

# WIT

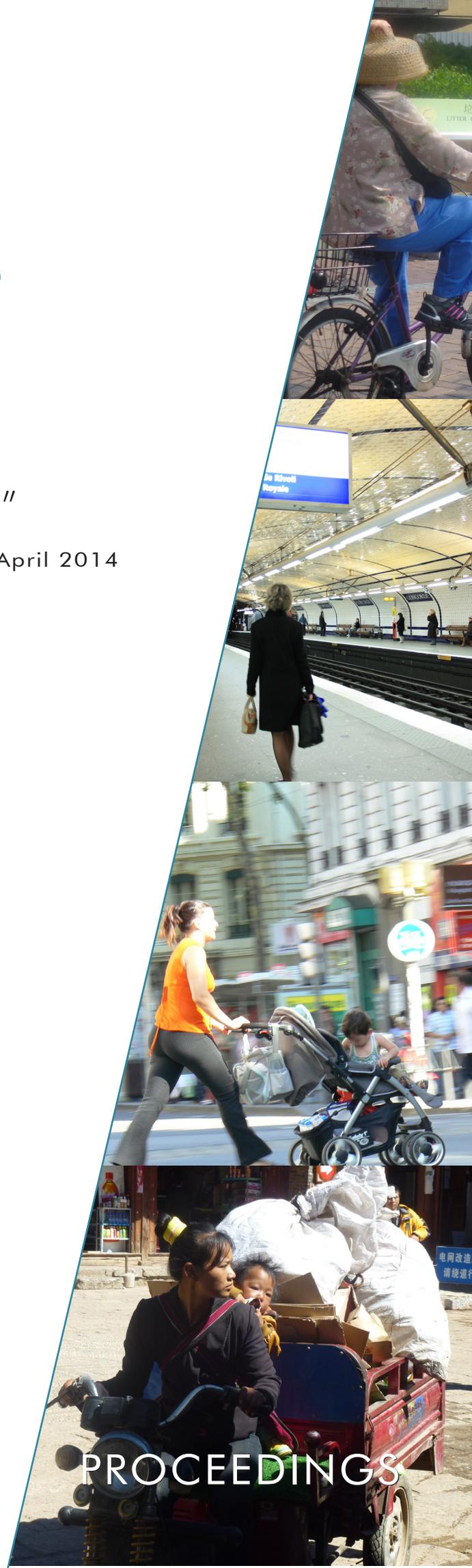
Women's Issues in Transportation

## "Bridging the Gap"

5th International Conference - Paris 14-16 April 2014



PROCEEDINGS





## “Bridging the Gap”

5th International Conference – Paris 14-16 April 2014



# Foreword



*Founded in 1904, with headquarters on the Place de la Concorde in Paris, the Fédération Internationale de l'Automobile (FIA) is a non-profit making association which brings together 236 national organizations from 141 countries on five continents. Its member clubs represent millions of motorists and their families.*

*The FIA defends the rights of motorists and road users through advocacy, educational campaigns and activities on issues involving safety, sustainability, and access to transportation. These issues naturally affect women. But, it has become increasingly clear that additional research is needed to more precisely understand the particular needs of women so that transportation policy and implementation can facilitate their full participation in societal and economic development.*

*The FIA was therefore honored to have been invited to support the 5th International Conference on Women's Issues in Transportation which took place in Paris on 14 to 16 April 2014. As a platinum sponsor, we are pleased to present the Proceedings of the event.*

*Jean Todt, President of the FIA*





# Acknowledgements

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*Please note that the research papers as presented in these Proceedings have been printed as submitted by the authors, and have been only lightly edited.*



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# Conference Description and Objectives

Ariane Dupont-Kieffer (project manager and head of the scientific committee of the 5th International Conference on Women's Issues in Transportation-WIIT -<http://wiit-paris2014.sciencesconf.org/>).

In 1903, Aida DeAcosta drew media attention when she landed her flying dirigible in the middle of a polo match being covered by the press. Fascinated and horrified that it was a woman "behind the wheel", she was a subject of great interest as the first woman to pilot a motorized airship. More than 100 years later, in 2008, Françoise Thébaud and Rebecca Rogers examined women in travel history. They drew attention to the fact that, although the number of historical studies on travel increases, few focus on the place and the role of women travelers in history. The lack of women in travel history is not because women did not travel. Ordinary women travelled for familial reasons, nuns travelled on pilgrimages, and women were parts of expeditions that travelled the world for scientific discovery, journalistic investigation, and war coverage. History tells us that, despite the notions largely presented in 19th century literature, women relied on their own mobility for reasons of family, religion, politics, and economics. This historical investigation of women as travelers is still relatively nascent and has focused even less on women's daily mobility. Sandra Rosenbloom was one of the first to point out that "men and women have long had different travel patterns". For example, women, for generations, "travelled fewer miles" or more locally and "were less dependent on the private car for their travel than men" (2004, p. 7-8). However, the gap between men and women is decreasing.

Thus, the 5th Conference on Women's Issues in Transportation promoted continued efforts to ensure that women have access to safe, secure transportation that meets their needs, and that they have the resources and support they need to be successful transportation professionals. Convening researchers, practitioners, and policymakers to share information and identify continuing needs allowed conference participants to identify opportunities to move research findings to the practitioners and policymakers who have the opportunity to implement those findings, in a cyclical nature, to identify additional research needed to develop effective programs and policies.

## **BRIEF HISTORY OF THE CONFERENCES ON WOMEN'S ISSUES IN TRANSPORTATION**

The first conference on Research on Women's Issues in Transportation was held in 1978, predominantly attended by researchers and scholars. The following conferences on women's issues in transportation took place in 1996 (Baltimore), 2004 (Chicago) and 2009 (Irvine) and aimed to expand the audience beyond the research community. While they continued to focus on the latest research in many of the same areas addressed in 1978, they moved towards the introduction of gender issues in the domain of transport policy, planning and engineering.

The fourth conference, held in Irvine, CA, focused on several themes that paved the way for the 5th conference held in Paris. Themes for the fourth conference included the following key areas and examples of topics discussed within each:

### Mobility and travel patterns

- Demographic changes, specifically aging populations.
- Recognizing that women are not homogeneous and that there are substantial differences among subgroups of women who are distinct in the social class, race, age, ethnicity, household size, etc.
- Exploring the relationship between land use patterns and how women travel

### Safety and Security

- Injury prevention and ergonomics.
- Personal security.
- Extreme (climatic) events and the differences in how they impact men's and women's ability to find transportation in times of crisis.

### Policy Design and Implementation

- Implications of women's trip behavior for planning practices.
- Implications of women's transportation issues for policy development.
- International experience with respect to women's travel.

The full proceedings of this conference can be found online at:

- Plenary Sessions: <http://onlinepubs.trb.org/onlinepubs/conf/cp46.pdf>
- Technical Papers: <http://onlinepubs.trb.org/onlinepubs/conf/cp46v2.pdf>

In addition to building on continued research themes and identifying new ones, the fourth conference expanded the scope to include a much larger international perspective. This international theme carried heavily into the 5th conference that explored the differences among women around the world in order to understand the role of institutional, economical, and cultural patterns on the mobility of women.

## **5TH CONFERENCE ON WOMEN'S ISSUES IN TRANSPORTATION**

The 5th International Conference on Women's Issues in Transportation (WIIT) was hosted by the French Institute of Science and Technologies for Transport, Development and Networks (IFSTTAR). **Under the theme “bridging the gap,”** the conference explored and addressed the gender differences in access to transportation and mobility, responsiveness of transport systems to needs and preferences of women, transportation safety, personal security, and participation of women in decision making and wealth creation in the transportation sector.

The 5th WIIT Conference was organized in conjunction and concurrent with the Transport Research Arena Conference (TRA). Both events occurred from April 14-16, 2014, in France at the Conference Center on New Industries and Technologies (CNIT) located in Paris-La Défense. The conference provided an international forum for debate by gathering a diverse audience of more than 200 attendees from the world of transportation (international leaders, elected public officials, researchers and academics, students, public policy experts, and transport providers and operators) to share recent research findings, best practices and innovations, and public policy analyses.

The conference was formatted to maximize the opportunities for dialogue and included the following:

- Plenary sessions that focused on cross-cutting, complementary topics and break-out sessions that reflect the conference's four research themes. These sessions included presentations as well as significant time for discussion and debate.
- Evening events, especially the gala dinner sponsored by the FIA, lunch, and program breaks that encouraged networking among the WIIT conference attendees as well as with the TRA Conference attendees.
- Special sessions (“Master Class”) for doctoral students to give them methodological and theoretical tools to include the gender perspective in their research agenda. The topics of the 3 master classes relate to the understanding of concepts such as gender and sex (Maxime Forest, IEP de Paris, OFCE), to women's in transportation issues in the developing world (Julie Babinard, World Bank) and the development of studies and a research agenda on women's issues in transportation over the last three decades (Sandra Rosenbloom, University of Texas at Austin).

## **PLENARY SESSIONS**

Cross-cutting themes were addressed through plenary sessions on the following topics:

- Addressing gender in research;
- Translating research results into actions and public transportation policy;
- Reducing the gap between developed and developing countries as to whether and to what extent women's issues in transportation are being addressed;
- Equity in transportation; and
- Careers in transportation.

The **opening plenary session** chaired by Therese Mc Millan (Federal Transit Administration, US Department of Transportation) set the stage for the conference themes of “Bridging the Gap”—in particular the cross-cutting topics of addressing gender in transportation research; reducing the mobility gap between developed and developing countries; and translating research results into meaningful, transportation policy, and implementing actions. This plenary session started by reflections on research on gender and how the introduction of women in historical research can change the work in terms of analysis and methodology. The debate then moved to the challenge of incorporating gender in public policy (designing sustainable and health policies). Based on these two questions, the audience addressed the overarching question: how much do women’s cultural and societal roles of the past drive our ability to advance our future. The session concluded with a discussion on the commonalities of many challenges, but the need to better understand the differences between research and political agendas, between developed and developing countries, and across cultural, sociological, and institutional patterns.

The **first cross-cutting plenary session** on bridging the gap between women and men chaired by Mary Crass (ITF/OECD) and Ariane Dupont-Kieffer (IFSTTAR) addressed the concept of “gender” as both a key determinant of social relationships and as a key factor to improve knowledge, and policy making. After identifying the definition of gender and how gender analysis can contribute to research in different disciplines, the discussion investigated how conscious and unconscious gendered representations build social relationships and the role of women for activities both in and outside the home. This is done to better understand the challenges faced by women as professionals in the transport sector as well as users of the transportation system. This understanding can then be applied to planning and development policies to promote increased participation of women in social and economic activities.

As a follow up to the first cross-cutting plenary session, the Cost Action: Transport Equity and Accessibility (TEA) organized a specific plenary session on women’s issues and equity issues in the transport sector. The TEA Action, analyzing how transport policy differently affects users by using both vertical and horizontal equity perspectives, paid special attention to gender issues. The TEA Action roundtable contributed on consolidating transport equity approach and on giving clues to develop gender equity indicators. The theme of equity was taken over broadly in the break-out sessions, both at the theoretical level and at the applied level.

The **second cross-cutting plenary session** on bridging the gap between research and policy making and implementation was chaired by Janet Oakley (American Association of State Highway Transportation Officials) and focused on the challenges and opportunities that could hinder or advance the state of the practice. Gender equality and mainstreaming as it relates to transport has been on the world social policy research agenda for decades, but research is being translated into policy development and actual practice to a much lesser extent. The objective of this plenary session was to explore how research findings are being translated into innovations and advances in policy, governance, service delivery and business practices, and how information to support policy, governance, service delivery and business practices can influence the research agenda. The panelists engaged with the audience to attempt to define strategies to aid in transforming decades of research into action. The debate also addressed ways policy obligations can translate back into a supporting research agenda and more broadly on the conditions for setting up and developing a more efficient and systematic interaction between the research communities, private stakeholders and policy makers at the local and national levels, especially on topics such as access to transport choices, affordability, safety and personal security, access to education and health care.

The relationships between the commonalities and differences of women's issues in transportation identified during the opening plenary session were addressed again during the **third cross-cutting plenary session** on bridging the gap between countries chaired by Stephen Perkins (ITF/OECD), with a focus on safety and security. The session brought perspectives from contrasting economies on core gender issues of access to transport services under safe and secure conditions. This session also emphasized data requirements for evidence-based policy making.

In this process of bridging research findings and policies, it becomes evident that women have a key role to play as transportation professionals. This was the topic of the **plenary session** chaired by Marsha Anderson Bomar (Stantec), careers in transportation. The panel brought together high-level American and European representatives from the public sector, the private sector, academia. The panellists provided rich information on how they made professional decisions over the course of their careers, challenges they have faced and tools they have used to move forward. This resulted in key needs for the inclusion of women in leadership roles throughout the industry and the importance of women in leadership positions to raise issues related to women

in transportation and promote solutions that address challenges to women in terms of mobility, safety, security and business.

## BREAKOUT SESSION

Additional breakout sessions were organized around four pillars:

- **Transportation Policy, Transportation Modes, and Mobility:** This Pillar refers to the gender impact of transport policies and regulatory frameworks, as they frame the sector research, investment and service delivery. Understanding transport patterns and mobility is fundamental to the creation of evidence-based, gender-sensitive policies. Women's socio economic conditions, mobility patterns and special needs vary widely across and within countries. Appropriate knowledge, monitoring and evaluation, incentives, regulations, and remedies are core elements of gender-sensitive transport policies, equally serving women and men. Ideally, policies should be designed to provide an enabling environment for a fair share of the mobility benefit and of the sector wealth participation between women and men. The design and implementation of successful policies would benefit greatly from sharing the experiences of countries across the globe.
- **Health, Personal Security and Safety:** This pillar focused on gendering of transport safety, health and security issues. Manuscripts focusing on policy making and gaps between low, medium and high income countries were presented. Papers focused on how gender influences the type of crashes women are involved in (specific type of injury and of severity), transport-related consequences on health and well-being, as well as attitudes and behaviours concerning transport safety and security. On these different topics, papers also analyzed if and how policies concerning safety, security, and health could take gender differences and specificities into account. Furthermore, some papers examined cultural, economic and geographical effects on gender safety, security and health on transportation. In particular, papers dealing with transfer possibilities and issues of best practices concerning gender equalities in safety, security and health in transportation from one country to another are needed.
- **Sustainable Mobility:** This pillar focused on sustainable mobility and economic, societal, and environmental considerations. Furthermore, while one country may be working to make transportation more environmentally sustainable, another may need to prioritize economic or social sustainability. In addition changes to the built environment (land-use and transportation infrastructure) to improve one aspect may negatively affect another. Within those three areas is an enormous set of issues that could affect the genders differently; this research focus area requests work on such important topics.
- **Impacts of Mobility on Women's Professional and Personal Lives:** This pillar focused on how mobility and professional activities interact at different scales, classified as 1) Workers who need mobility to reach their workplace, 2) Mobile professionals, meaning that their work activity occurs in variable locations, and 3) Transport professionals who work in itinerant or sedentary jobs providing mobility to people or transporting goods. In the field of gender studies, women's participation in transport policy development and oversight, women's share of transport business opportunities and wealth creation have been less researched. Relevant to this area is research on professional activities (or any wealth-creating activity) in relationship with transport and mobility in a world in which jobs are overwhelmingly dominated by men. Finally, women's participation in transportation research still needs to be considered.

## CLOSING SESSION AND RESEARCH NEEDS

An important outcome of the conference was the identification of research needs for future study, presented in the next chapter. The closing session, chaired by Therese Mc Millan, focused on the identification of research needs by reframing the question to focus on challenges going forward to advance women's roles and influence in transportation policy. This closing panel consisted of representatives from research, academia, elected officials, government/policy officials, and the private sector. The session included two PhD students presenting at the conference to highlight the younger generation's needs and points of view.

A conference organizing group, consisting of a planning committee, an international scientific committee and a local planning committee led by IFSTTAR, was responsible for all aspects of the conference planning, including the selection of technical papers and presentations.

Special thanks due to Ariane Dupont-Kieffer, Fathia Badin, Marsha Bomar Anderson, Cécile Coquelet, Laura Costa, Julien Dupont, Thierry Fragnet, Virginie Gouverneur, Marie-Axelle Granié, Susan Herbel, Maria-Cristina Marolda, Therese McMillan, Martine Micozzi, Elaine Murakami, Janet Oakley, Christine Panadour, Stephen Perkins, Susan Pikrallidas, Maryvonne Plessis-Fraissard, Paulina Potemski, Sandra Rosenbloom, Heather Rothenberg, Jennifer Sabin, Julien Saunier, Dawn Spanhake, Asa Vagland, Owen Waygood.



# Committees

## PLANNING COMMITTEE

**IFSTTAR:** H el ene Jacquot-Guimbal, Jean-Pierre M edevielle, Ariane Dupont-Kieffer, C ecile Coquelet, Hubert du Mesnil (RFF, Chairman of the Board of Directors).

**TRB and TRB ABE 70 Committee:** Sandra Rosenbloom (Urban Institute), Martine Micozzi (TRB), Marsha Anderson (AB70 Committee's President/Senior Principal at Stantec), Heather Rothenberg (AB70 Committee's co-President/FHWA), Dawn Spanhake (AB70 Committee's Secretary/University of Minnesota), Asa Vagland (Vinnova, Ministry of Transport, Sweden), Anu Siren (DTF, Denmark), Cristina Pronello (Polito/LET), Maryvonne Plessis-Fraissard (MPF Consult, ex-World Bank), Karel Martens (Transport Planning Radboud University Nijmegen), Susan Herbel (Cambridge Systematics).

**Externals:** Stephen Perkins (ITF-OECD), Hirohisa Tsuruta (MLIT, Ministry of Transport and Tourism, Japan), Neil Paulley (TRL and ECTRI), Suzanne de Cheveign e (CNRS and Aix-Marseille University), Christian Piehler (DLR).

**Local planning committee IFSTTAR:** Fathia Badin, Nassera Belarbi, C ecile Coquelet, Carlos De Melo, Ariane Dupont-Kieffer, Laurence Duverly, Christelle Fongue, Thierry Fragnet, Bernard Jacob, Patrick Mall ejacq, Christine Panadour, Paulina Potemski, Fran oise Potier, Isabelle Saint-Saens, Julien Saunier, Emilie Vidal.

## SCIENTIFIC COMMITTEE

### PILLAR 1: TRANSPORT POLICY, TRANSPORT PATTERNS AND MOBILITY

*Chair: Maryvonne Plessis-Fraissard (MPF Consult)*

Asha Agrawal Weinstein (San Jos e State University), Angel Aparicio (Universidad Polit cnica de Madrid), Julie Babinard (The World Bank Group), Susan Hanson (Clark University), Reza Jafari (RSTS Inc), Sigal Kaplan (DTU Transport), Rosario Macario (University of Lisbon), Jean-Loup Madre (IFSTTAR), Karel Martens (Radboud University Nijmegen), Neil Paulley (TRL), Laurie Pickup (Vectos), Carlo Giacomo Prato (DTU Transport), Cristina Pronello (POLITO/LET), Michael Replogle (ITDP), Eduardo Romano (IFRTD), Athena Roumboutsos (Aegean University), Erika Sandow (Umea University), Andrzej Urbanik (IBDIM),  asa Vagland (VINNOVA), Kerstin Westin (Umea University).

### PILLAR 2: HEALTH, SAFETY AND PERSONAL SECURITY

*Chair: Marie-Axelle Grani e (IFSTTAR)*

C ecile Coquelet (IFSTTAR and Aix-Marseille University), Marie-Antoinette Dekkers (IFSTTAR), Susan L. Handy (University of California Davis), Susan Herbel (Cambridge Systematics), Lidia Kostyniak (University of Michigan), Lucie Laflamme (Karolinska Institute), Anastasia Loukaitou-Sideris (UCLA), Maria Cristina Marolda (European Commission), Jennifer Anne Oxley (Monash University Associate Director, MUARC Malaysia), T urker  zkan (Middle East Technical University), Eduardo O. Romano (PIRE-Pacific Institute for Research and Evaluation), Bisakha Sen (University of Alabama Health Sciences Center), Anu Siren (Technical University of Denmark).

### PILLAR 3: SUSTAINABILITY

*Chair: E. Owen D. Waygood (Universit  de Laval)*

Jennifer Dill (Portland State University), Ariane Dupont-Kieffer (IFSTTAR), Yingling Fan (CTS), Jean-Loup Madre (IFSTTAR), Maria Nadia Postorino (University of Reggio Calabria in Transport field), Yoram Shiftan (Faculty of Civil and Environmental, Israel).

### PILLAR 4: IMPACTS OF TRANSPORTATION ON CAREERS AND CAREERS IMPACTS ON TRANSPORTATION

*Chair: Elaine R. Murakami (FHWA)*

Maya About Zeid, Sibel Bulay-Koyluoglu (EMBARQ), Chantal Duch ene (GART), Anne Goodchild (University of Washington), Reinhard Gressel (IFSTTAR), Susan Liss (FHWA), Mary Lupa (Wilbur Smith Associates), Nancy McGuckin (Travel Behavior Associates), Fran oise Potier (IFSTTAR), Elke Schneider (EU-OSHA), Gian-Claudia Sciara (University of California), Dawn Spanhake (CTS, University of Minnesota), Charlene Rohr (RAND Corporation), Roma Thomas (FRTD), Christine Wolf (Port of Seattle), Johanna Zmud (RAND Corporation).

### PHD TRAINING SPECIAL PROGRAM

Sandra Rosenbloom (Urban Institute).



# Cocktail Reception and Gala Dinner

It was a special way to get the 5th International Conference on Women's Issues in Transportation off to a great start: participants enjoyed a Cocktail Reception and Gala Dinner on the first evening of the conference in the exquisite salons of the Automobile Club de France (ACF). Hosted by the Fédération Internationale de l'Automobile (FIA), the evening provided guests with the chance to celebrate a number of women who have enjoyed exceptional careers in fields where they have had to "bridge the gap" to succeed. It also gave guests the chance to mingle and to enjoy an exceptional view overlooking one of the most beautiful places in Paris, the *Place de la Concorde*.

After a brief welcome from FIA Secretary-General Susan Pikrallidas, the floor was given to Moderator Mary Crass, Head of Policy and Summit Preparation for the Paris-based International Transport Forum. Mary led guests through the special evening, which included some work to identify research needs, as well as homage to many pioneering women in the transport world. She also introduced three very distinguished speakers: Michèle Mouton (former rally driver and President of the FIA's Women in Motorsport Commission since 2010); Marie-Claude Heys-Kieffer (professional navigator and yacht-racer); and Roselyne Bachelot-Narquin (politician, former French Minister), all accomplished women who told their stories about climbing the ranks in their respective, male-dominated fields.

FIA President Jean Todt was on hand to speak about the many challenges which remain to achieve greater personal mobility for all. Putting particular emphasis on the battle to improve road safety around the world, he underlined the need to invest in safe transport systems, to invest in life, to invest in the future.

After addressing guests, he then presented Special Achievement Awards to three very deserving women: Dr Susan Herbel (transportation safety specialist); Dr Sandra Rosenbloom (travel behavior specialist); and Dr Maryvonne Plessis-Fraissard (sustainable development specialist).

Finally, he noted that the FIA's 10 Golden Rules had been distributed in the conference bags. They were simple rules which everyone knew intuitively. But, he stressed, if everyone actually followed them, the world would indeed be safer for all.

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# Summary of Research Needs

**Susan Herbel**

Cambridge Systematics

On April 14, 2014, IFSTTAR hosted the 5th International Conference on Women's Issues in Transportation (WiiT) in Paris, France. The conference marked the first time the conference was held outside of the United States. As with previous conferences, interest and attendance in the issues continued to grow, and IFSTTAR's impressive hosting skills, together with the setting in Paris, added additional lustre. By all accounts, the conference was a spectacular success.

## INTRODUCTION

The 5th WiiT Conference serves a number of purposes; one of which is to stimulate original research on gender issues in transportation. That purpose was successfully accomplished in Paris. The conference brings scholars, academicians, policy-level managers, practitioners, and others together to discuss new research, identify implementation methods and resources, and ascertain additional research needs. This White Paper serves the purpose of documenting continuing research questions to address women's transportation needs, issues, and priorities.

The overall conference theme was *Bridging the Gap between Women and Men*, and the agenda addressed four pillars:

- Transportation Policy, Modes, and Mobility;
- Health, Personal Security, and Safety;
- Sustainable Mobility; and
- The Impact of Mobility on Women's Professional and Personal Lives.

In addition, the program sessions incorporated three cross-cutting, corresponding topics:

- Addressing gender in research;
- Translating research results into actions and transportation policy;
- Reducing the gap between developed and developing countries in terms of addressing women's issues in transportation.

The pillars and the cross-cutting issues serve as an outline for cataloguing the research needs suggested by the conference participants.

## TRANSPORTATION POLICY, MODES, AND MOBILITY

Research related to gender issues in transportation has produced important results in areas, such as: women's concerns for personal safety and security, e.g., on public transit systems; differences between women's and men's driving behavior and safety outcomes; differences between women's and men's travel behaviors, e.g., mode choice, trip chaining, etc.; and vehicle design and safety features as they relate to women, such as the ergonomics of bus and truck driver seats.

Evidence shows women continue to be underutilized in policy and decision making positions throughout the transportation sector. The tradition has been to overvalue men's strength in management and leadership roles, which has the effect of limiting and intimidating women's participation. One speaker cautioned against placing too much weight on technological solutions for promoting women's participation. For example, simply increasing the availability of tele-working opportunities may lead society to expect women to work at home and continue their roles as fulltime homemakers. Such solutions denigrate women's opportunities for full participation because tele-working tends to reduce the chances for networking, promotion, and participation in

decision making. Research is needed to identify effective methods for organizing a marriage or partnership so both women and men can equitably meet their work and home responsibilities.

### ***The Millennial Generation***

The research suggests a potentially significant change in travel behavior within the generation known as the Millennials. They move more with less baggage, longer distances, and for shorter time periods. Furthermore, they are moving from vehicle ownership to car sharing practices; are more likely to travel by bicycle, walking, and other modes; and appear to be more focused on service than product. These factors lead to reductions in car ownership, driver licensure, and other impacts. Furthermore, it appears men are more likely than women to change travel behaviors. Research is needed to identify the cause of this gap, as well as the factors that may be preventing women from following the same patterns.

### ***Bicycle Travel***

Women cycle less than men throughout most of the world. Studies, carried out in Davis, California, between 2006 and 2012, aimed to identify key factors influencing bicycling as a mode of transportation. Results showed comfort and liking bicycling as more important factors than convenience for women. Differences between men and women appear to begin early in life.

A sustained growth in bicycling in London during the 2000s showed policy interventions and physical and operational changes to the network encourage cycling. The current policy ambition is for cycling to continue growing. Although men are still more numerous as cyclists, women are disproportionately responsible for the cycling boom.

Training programs, especially for immigrant women, produce varying impacts depending on the purpose for using a bicycle, but training substantially improves women's feelings of self-esteem and self-confidence.

### ***Research needs***

- Document effective strategies that women use to achieve policy making positions in the transportation sector.
- Characterize the role of unions in promoting women's full participation in the transportation workforce.
- Evaluate whether reduced vehicle ownership, licensure, and dependence on the personal vehicle is a long term trend or is due to the weak economy over the past few years.
- Document the differential impact (or not) of information communication technologies and online social networks on trip making behavior between women and men for social trips.
- Evaluate if women's lower use of autos and higher use of public transport and walking leads to unequal mobility outcomes.
- Research the relationship between bicycling and socio-economic class and document the policy, training, and public information programs lessons to be learned.
- Identify and document noteworthy practices for policies, methods, and processes that result in populations adopting cycling as a function of societal norms, as seen in The Netherlands and the Scandinavian countries.
- Develop rail industry standards that afford comfortable, convenient, efficient travel perceived as safe by women.
- Identify the relationship between mode choice and human interaction, e.g., are the social aspects of travel gender-based, age-based, or income based?

## **HEALTH, PERSONAL SECURITY, AND SAFETY**

Public health as a transportation policy and planning consideration is a relatively recent phenomenon. Research indicates transportation decisions have a large impact on public health, and the gender difference in health outcomes may be substantial. The area provides a rich opportunity for future research. In contrast, personal security (crime, harassment) has been a significant transportation issue for decades, but it still requires additional analyses.

Conference presentations explored the issues and presented evidence that some countries are developing and implementing effective programs to address multiple types of harassment to which women are exposed. It has also been known for decades that gender differences exist in traveler safety (crashes and falls), but careful examination of the background, sources, causes, etc. has been scant. As women's travel increases for a variety of reasons, their road risks are known to be different than comparable males, as both pedestrians and drivers.

### ***Research needs***

- Determine the true impact on safety, security, mobility, and health of women-only public transport vehicles. Analyse if men's behaviors in public transit systems change in the absence of women travelers.
- Document and evaluate best practices for protecting women's health, safety, and security on public transport.
- Identify research methods and strategies that can be utilized to solve the puzzle of combining mobility management, traffic safety, and equity.
- Evaluate, synthesize, and address gender issues in road safety.
- Describe and monitor the mobility needs associated with lifestyle changes due to aging and other factors.
- Assess the economic consequences, (and the related issues in terms of organization of the daily life), of improving safety, security, mobility, and health of women transportation users.

## **SUSTAINABLE MOBILITY**

Several studies and presentations included attention to technologies designed to improve the environmental impacts of vehicle travel. For example, one study examined the characteristics of early drivers of plug-in electric vehicles (PEV) from a gender perspective. The study found that men tend to think about the impacts of gasoline on pollution, but women are more likely to act on their ideals. One lesson from the study is the knowledge that better message targeting may result in increased use of PEVs. Another study raised questions whether the placement and costs of away-from-home chargers was particularly disadvantageous to women, given their different travel patterns.

Another study also discussed connected vehicle (CV) technology, the primary benefit of which is enhanced traffic safety; however the technology has additional benefits, such as reducing vehicle emissions and congestion, increasing mobility, etc. The study reached several conclusions:

- Mature women and young men appear less enamored of CV.
- Women are more concerned about automobile safety, fuel consumption, and environmental impacts than men, but both women and men consider the vehicle's ability to protect the occupants in a crash, e.g., the crush zone, the most important aspect of technology.
- Women have significantly less prior knowledge of CV than men.
- Women's budgets for vehicle purchases are lower than men's, but women are willing to pay as much as men for CV technologies; however, price is a serious barrier to diffusion.

### ***Research needs***

- Detect and document the necessary conditions for women to consider PEVs.
- Identify and classify best practices for locating and pricing automobile battery chargers to encourage greater use by women.
- Determine if connected vehicle technologies can be made available and affordable to women travelers.
- Ascertain methods to more effectively market CV technology especially to mature women.
- Develop creative marketing techniques for informing the public, especially women, about CV technology focusing on safety impacts.

## **THE IMPACT OF MOBILITY ON WOMEN'S PROFESSIONAL AND PERSONAL LIVES**

Integrated transport and land-use planning is critical for promoting safe access to work and services as well as mixed land uses and affordable housing in proximity to employment centers. Most industrial societies are aging rapidly, while the majority of women with children are in the paid labor force. Ensuring integrated land use and transport planning will assist both working mothers and older women to maintain their mobility at all stages of life. For example, providing more strategically located day care centers helps salaried women; while better co-locating services for older people makes it possible for elderly women to meet their needs with fewer taxing trips.

Several papers and discussions explored the impact of household role on mobility. The discussion raised questions about the important barriers in transport. The participants concluded that gender needs in transportation planning and modelling should be based on time minimization, safety, and personal security, as well as the diverse social and cultural characteristics and environmental objectives associated with transportation modes rather than giving priority simply to minimizing monetary costs.

### ***Research needs***

- Clarify and classify the environmental and cultural aspects that influence gender mobility needs and roles in diverse societies.
- Document noteworthy practices for engaging government in thinking and talking about changes to increase women's mobility to reduce the lag time between recognizing changing conditions and implementing needed policies.
- Develop research, especially qualitative surveys for examining the gender impact of transportation technologies.
- Develop the data necessary to conduct more comprehensive research on the gender dimension in mobility planning.
- Ascertain effective methods for recruiting women into transportation careers.
- Examine the relationship of women's involvement in transportation decision making to policy and planning outcomes. Identify if plans and policies become more holistic and integrated and reflect key policy principles and concepts when examined in the light of women's needs.

## **ADDRESSING GENDER IN RESEARCH**

Many new research ideas were generated during the conference; central to all of them is the need for improved data on travel patterns, trends, technology, vehicle design, urban design, and many other issues. High quality data are vital to developing priorities for addressing gender issues and for generating the political attention needed to address gender equity, safety, and personal security. Good data are integral to sound policy, decision making, planning, and design and should be considered a priority investment.

### ***Research needs***

- Identify the basic and unique data sets available for conducting research on gender and transportation issues.
- Incorporate social scientists (e.g., sociologists, historians, psychologists, political scientists), as well as communications and marketing researchers into transportation research practice at the beginning rather than the end of the research process.
- Document successful methods for mainstreaming gender into basic curricula in many disciplines, as well as research practice.
- Develop methods for better incorporating a range of gender issues into transportation modeling and planning research and practice.

## TRANSLATING RESEARCH RESULTS INTO ACTIONS AND TRANSPORTATION PUBLIC POLICY

There was substantial discussion in many conference activities of the need to understand methods for translating research findings into policy advances and innovations, governance, service delivery, and business practices. There also was interest in translating the findings into the research agenda.

Gender equality and mainstreaming in transport has been on the world social policy research agenda for decades. Presentations from a variety of perspectives (e.g., public, private, academic sectors, and transportation research and operations) examined how to move from research findings to practice. The questions examined included:

- To what extent are the findings from the research on women’s travel issues and needs being translated into policy development and actual practice?
- What opportunities advance the state of the practice? What challenges hinder improvements in the state of practice? What strategies are needed to aid in transforming decades of research into action?

Moving from research to policy and practice is challenging for at least the following reasons:

- Policy contexts can differ in important ways from the conditions under which the research was conducted; hence, research needs to be augmented with on-the-ground context-specific knowledge. Implementation of gender-related research results may entail changing institutional and public attitudes and practices, which can be significantly more difficult and time-consuming than implementing a discrete technology. When researchers understand the context in which policy makers must operate, they can grasp and articulate the problem (i.e., decreasing discrimination and building a gender balanced transportation system) in researchable terms and make research more relevant, which leads to a more implementable result. The relationship between research and policy should be an integrated and iterative process.
- Research sometimes raises more questions than it answers, e.g., more knowledge does not always lead obviously or easily to implementable solutions. For example, a study in the U.S. found women are more likely than men to use handheld devices while driving; however, we need additional work to understand why this is the case, what the safety effects are, and how to address the behavior.
- The nature of the transportation research endeavor also stymies the transition from findings to practice. The transportation field does not produce a large amount of “basic” research and is often focused on narrow disciplines, populations, and contexts. Almost by definition basic research does not quickly translate into practice. Policymakers may not perceive the need to focus on basic research because it takes funds from addressing short term problems, such as women who can’t get a job because they lack mobility options.
- Transportation research needs to be more multidisciplinary, collaborative, and closely connected with the world of practice. Typically, men are more likely to pursue engineering degrees, while women lean toward the social sciences. A more recent focus on multimodalism, mobility, and livability may attract more women researchers and practitioners to the enterprise. If we involve more women in technical fields and encourage more women in the social sciences to engage in transportation research we may incorporate more social science topics into the transportation research agenda to encourage research aimed at understanding gender differences. For example, some research shows that men adopt new concepts and technologies more quickly than women. It seems that men focus more on the technology itself, being interested in the newness or cleverness of the innovation as a value in itself. On the other hand, women are often more focused on achieving their particular goals and meeting their needs; the presence or absence of “innovation” in the methods they use is a secondary concern.

Human connections are key to increasing participation of women in transportation careers and research and to bridging the gap between research and policy. Women are needed in leadership positions, not only to bring their perspectives but also to interact with younger women as mentors. Researchers and implementers need to interact more to strategically focus research on results more readily put into practice. The transportation industry is primarily focused on safe and efficient movement from one point to another. Research should move to a model in which transportation sees itself as a provider of an array of services that support and improve the travel experience. These actions and resulting innovations require adequate investment.

At the same time, we do have a growing body of knowledge of solutions and strategies that address some of the barriers and challenges that women professionals in transportation and women as travelers face. For example: a significant amount of design and construction activities is carried out by male-dominated contracting and consulting firms, leaving women-owned businesses underutilized and unable to compete. Strategies for addressing the imbalance include: pairing small, women-owned businesses with more experienced prime contractors, so they can learn the processes associated with transportation agency-sponsored projects; developing a loan program focused on the needs of women-owned businesses; and encouraging contractors and consultants to hire women and minorities.

### ***Research needs***

- Identify resources and generate the demand to conduct more research on women’s transportation issues and needs.
- Identify the challenges associated with implementing research results concerning women’s issues and needs in transportation.
- Describe the tools useful for implementing results from research on women’s issues in transportation.
- Focus on best practices for increasing women’s participation in the transportation-related work force and research community.

## **REDUCING THE GAP BETWEEN DEVELOPED AND DEVELOPING COUNTRIES**

The Conference also explored perspectives from contrasting economies on the core gender issues of access to transport services under safe and secure conditions. While many expected major structural differences in safety, security, choice, and empowerment among regions and particularly between developing and more developed countries, happy surprises were identified. Much of the discussion showed commonality and more of a continuum, with the more extreme cases of the general trends seen in developing countries.

The gender gap between developed and developing countries requires an acceleration of knowledge transfers between the two spheres. Solutions include: promote dialogue on constraints to women; provide technical assistance to governmental teams in designing and implementing policies; and strengthen and coordinate the institutional capacity of transport agencies in developing economies.

The focus for safety in the developing countries must be on walking, cycling, and motorized two wheelers. Thirty to fifty percent of deaths on the road in these countries are pedestrians, where women are represented disproportionately. Particular attention should be paid to motorcycle and moped passengers in these countries, because helmet use is particularly low for passengers.

Security and freedom from sexual crime in public transport depends upon building a culture that refuses to tolerate harassment of women. This requires intensive public relations outreach by the police and transport authorities, including social media targeted at cautioning vulnerable groups, such as teenage girls on buses and young professional women on rail systems, and providing them with effective countermeasures. Public outreach and media should encourage people to report aggression and harassment so enforcement and judicial systems can respond quickly and aggressively.

### ***Research needs***

- Identify policies and practices that result in close to work housing and supporting commerce for women, as well as safe, affordable, and convenient transport, both motorized and non-motorized.
- Document best practices for providing day care centers and other solutions in locations accessible to employment opportunities.
- Classify and document technology advancements that enable and encourage everyone to report incidents of sexual harassment and worse.
- Summarize law enforcement structures, policies, and tactics that lead to safer public transport.

## SUMMARY CONCLUSIONS

The presentations and discussions during the 5th International Conference on Women's Issues in Transportation focused more on implementing research results than generating research. This is perhaps not surprising; it suggests that the previous four conferences achieved their purpose to support and encourage researchers to conduct original research on gender issues. However, much of the research has not been implemented and a general attitude emphasizing implementation was clear throughout the conference. However, this White Paper documents continuing and additional research needs. The task is clear:

- Encourage students and researchers to continue a focus on gender issues in creating gender neutral transportation industries and systems.
- Create opportunities to support women's professional development to strengthen a focused approach on a transformative, gender neutral transportation enterprise.
- Continue to organize periodic conferences to present new research results and encourage continuing attention to gender-related transportation issues.
- Identify and report noteworthy examples of the successful implementation of research on women's travel issues and challenges.
- Utilize effective methods and resources to implement research results that promote and sustain a gender neutral transportation system.



# Prizes

## **Certificate of best paper in pillar 1: Transport Policy, Transport Patterns and Mobility**

Adeel Muhammad, Yeh Anthony & Feng Zhang

*Gender, mobility and travel behavior in Pakistan: Analysis of Time Use Survey 2007.*

## **Certificate of best paper in pillar 2: Health, Safety & Personal Security**

Thomas G. Brown, Jens Pruessner, Martin Lepage, Jacques Tremblay, Louise Nadeau, Marie-Claude Ouimet, Katarina Dedovic, Stephanie Dimitroff, Queenie Wong

*Sex differences in cortical thickness in first-time DWI offenders: A preliminary MRI study.*

## **Certificate of best paper in pillar 3: Sustainability**

Annika Kronsell, Lena Hiselius, Lena Smidfelt Rosqvist

*Sustainability transitions and gender in transport sector decisions.*

## **Certificate of best paper in pillar 4: Transportation Impacts on Careers and Careers Impacts on Transportation**

Christine Hudson

*Left holding the baby or increased career opportunities? The gendered consequences of regional enlargement and increased commuting.*



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# MOBILITY AND POLICY

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# Gender, mobility and travel behavior in Pakistan: Analysis of 2007 time use survey

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## ABSTRACT

Pakistan's national economic growth framework views connectivity between people and settlements as an engine of economic development. However, little is known about the patterns of mobility across socioeconomic segments of the country. The study aims to explore gender differences in travel behavior across urban and rural areas that remain unexplored due to the non-availability of suitable data. The paper employs national dataset of 2007 Time Use Survey (TUS) carried out to measure gendered time use in paid and unpaid work activities. In TUS, a national sample of 37,830 respondents living in 19,380 households, aged 11 and above, was selected for household and time diary surveys during the whole year 2007. Time use diary recorded various activities carried out by respondents in forty eight 30-minute long episodes of the past day, their context locations and simultaneity, according to 125 activity codes based on UN designed International Classification of Activities for Time Use Surveys. Preprocessed TUS, that is publically available from Pakistan Strategy Support Program, was analyzed using longitudinal data analysis techniques. According to the results, large gender differences are found in travel behavior related to trip rate, travel mode, duration and purpose of travel. Females are more likely to be immobile, as 55 percent of female respondents did not report any trip in the diary day as compared to just 4 percent of male respondents. Women make fewer daily trips (2.8) than men (5.4) and the greatest differences exist for leisure and sociocultural trips. Women are more automobile dependent, as their share of automobile trips (13%) is greater than men's share (10%). The period of adulthood and marriage seems to restrict female mobility and leisure travel strongly. Female travel behavior is largely shaped by the sociocultural, economical and built environment of the country. The findings point out the need for gender sensitive transport and land use policies in the country, as women are more likely to be immobile or travel less due to their concerns related to safety, security and quality of transportation. Potential sources of bias and research directions are pointed out at the end.

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**KEYWORDS:** Travel behavior; Immobility; Time Use; Pakistan.

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## 1. INTRODUCTION

The desire to travel is intrinsic to human beings and mobility is considered a basic right of all individuals [1]. A growing literature on travel behavior highlights significant gender differences in mobility and travel patterns [2]. In the developed world and in many developing countries, women make more trips than men, and in less developed countries, women travel longer and carry loads on their heads [3, 4]. However, in some developing countries, women may be less mobile than men, and as a whole, their travel patterns are more complicated and often include short distance travelling, trip chaining and time-crunched household serving trips [5, 6]. Women's mobility needs are also significantly different from men's and the literature shows that women are more concerned about personal safety, security and quality of service [7-12]. These differences in attitudes and needs are rooted in gender differences in activity participation, roles and responsibilities in daily lives and sociocultural norms of the society [13]. Understanding gender differences in travel behavior is important to identify women's transportation needs and mobility requirements [10, 14, 15]. Our transport systems may not recognize these important differences and thus become less responsive to women's needs and requirements. While gender differences in travel behavior are relatively well known in developed countries, this phenomenon has received far less attention in the developing world, where it is believed that the differences might be wider and even unique in some aspects [16-19]. Porter [20] noted that *"transport remains a surprisingly neglected area among gender specialists and transport specialists are still reluctant to take on gender issues"*. Therefore, this paper seeks to extend current research on travel behavior in developing countries by examining gender disaggregated travel patterns in Pakistan using activity time use data. Time use data is considered a key set of information for activity based travel behavior modeling [21, 22]. While household travel surveys form the

primary source of information for it, they often provide an ‘incomplete’ set of information on daily activity patterns due to their ‘travel only’ nature of enquiry [23, 24]. Time use data provides a more complete spectrum of human activity participation including travel, in-home and out of home activities [22, 25-27]. Many travel behavior researchers advocate combining data from household travel surveys and time use surveys in travel behavior analysis due to the unique set of information provided by the time use surveys [28, 29]. The fact that time use datasets are ‘harmonized’ for inter-country comparisons [25, 30, 31] makes them more useful for modeling travel behavior across geographies. Pakistan’s Time Use Survey provides a good starting point for measuring patterns of mobility and activity participation in the country, and this study aims to do so. The specific questions this paper addresses are:

1. Do women and men have different mobility and travel patterns across urban and rural areas of the country?
2. How do travel patterns (trip rate, mode choice, travel purpose and duration) vary by age, marital status and main role across gender?
3. What are the implications of these differences for the country’s growth and transport policy?

Section 2 ‘Study Area’ provides the socio-economic background for transport and mobility in Pakistan, to give the reader an opportunity to grasp the contextual base of the study. Section 3 ‘Data and Methods’ describes the design, collection and processing of data, and the methodology to extract travel behavior information from the time use diaries. Section 4 ‘Gender, Mobility and Travel Behavior’ explores patterns of travel behavior in detail and how do they vary across geography and demographic groups defined by age, marital status and income level of the respondents. Finally, Section 5 ‘Conclusions and Recommendations’ summarizes the new findings of the study, the implications of results for the country’s transport-related policy of economic growth, further research directions and potential sources of biases in the study.

## 2. STUDY AREA

Pakistan houses nearly 180 million people, with 37% of them living in urban areas [32]. Aided by high population growth rate and constant rural to urban migration, its cities are constantly increasing in size and numbers [33]. From 1951 to 2005, the number of cities of small population below 100,000, increased from 238 to 515, medium cities with a population up to 500,000 increased from 10 to 59, whereas the number of large cities, housing more than 500,000 people, increased from 2 to 12 [34]. Consistent increases in population, the size of cities and the decrease in rail-based transportation has put extra pressure on the demand for road-based transportation in the country [35-39]. Since the early 1960s, road-based transport has taken a central role in country’s transport strategy as it carried, in year 2010, more than 92 percent of passenger transport and 95 percent of cargo movement in the country [40]. A study estimated that the country’s current transport demand will triple by 2025 [41]. With every passing year, transportation is considered an even more important factor in the country’s economic growth policy that emphasises connectivity between people, cities and places of production [42, 43]. The work by international donor organizations such as the World Bank indicated that nearly 85% of villages and nearly all cities are connected with a major road network [44]. The government of Pakistan also aims to double the current road density of 0.31 to 0.62 km/km<sup>2</sup> until 2018 [40]. However, due to lower automobile ownership, the majority of its population is dependent on public transport for personal mobility. In the strategy of road, urban flyovers and highway construction, the goal of providing adequate public transport-based mobility is somehow not reached. Transport authorities of the country are unable to cater to the transportation needs of its growing population. The quality of road network and the non-availability of adequate mobility options consistently obstruct the mobility and connectivity in the country’s ever expanding urban and rural areas [45-47]. A panel study by International Food and Policy Research Institute (IFPRI) and Pakistan Strategy Support Paper (PSSP) found that commuting behavior in the country is moving towards ‘personal automobile’-based mobility [48]. Motorcycles are replacing bicycles and the usage of 4 wheelers-vehicles like Bus/Van has also decreased since 2007 [49]. Ownership of motorcycles has rocketed in the dominant middle class, being a ‘quicker and reliable’ means of transport than busses and vans [50].

While the country’s booming urban population has started to create a mark on the political and cultural stage of the country (see Kugelman [51] for brief discussion), its mobility issues are also becoming increasingly persistent and chronic in nature [52, 53]. Many cities are unable to provide a better quality public transport network for their residents. Available means of public transport are generally categorized as ‘inadequate’ due to major issues with service quality, coverage, fleet shortage and poor enforcement [52]. The users of public

transportation are often left at the mercy of private bus operators [54]. However, female travelers are more severely affected than males due to their special mobility needs in the conservative sociocultural settings of the state. Women are considered 'family honor' and often require permission to travel from the head of household [55]. While travelling without males, women are sometimes charged an extra fare or sometimes taken to wrong bus stops. They often face harassment, stalking and, poor travel environment in public transport and when walking on urban roads [56-60]. Knowing these hostile travel conditions, families do not allow women to travel without males especially young adults. Urban females may be the most affected intersection of gender and geography as urban areas are considered more conservative in their social settings. In this way, women's travel horizons are spatially and temporally restricted and require attention from policy makers [61]. In the ongoing attempt to realize a road-based transportation system for economic growth and connectivity in the country, a study of gender differences in travel behavior and mobility requirements has received little attention. Assessments of travel and issues of mobility are few and area-specific, mostly for big cities [62]. Such studies are not a statistical and theoretical representation of the entire country due to their area-specific nature and scope of data collection. While Pakistan, as in many developing countries, does not conduct national level transport surveys like the National Household Travel Surveys in many developed nations, there is a need to utilize alternative sources of data which can provide a reliable description of travel behavior and mobility levels. Such studies, like time use surveys, can provide a sound basis for gender sensitive policy intervention in mobility and transportation issues [63].

### 3. DATA AND METHODS

The study is based on time use diary data collected through Pakistan's first ever national Time Use Survey 2007 (TUS), carried out by the Pakistan Bureau of Statistics, with funding from UNDP. The purpose of carrying out TUS was to measure the role of women in the labor force, paid and unpaid work activities, in order to develop women-friendly welfare programs and budgeting [64]. The data has been collected from a nationally representative sample of 19,600 households surveyed during all of 2007 by a door to door questionnaire survey. TUS questionnaire has two parts, a household part and a time diary part. The household part of the questionnaire enquired into the household's socioeconomic status: household size, type of housing, income and access to various facilities. The time diary part solicited demographic information of the respondent and activities carried out by him or her in the past day. Respondents were asked to recall and mention up to three activities for each of 48 pre-defined episodes of half hour duration from 4:00 a.m to 4:00 p.m. Recalled activities were classified according to the UN recommended ICATUS (International Classification of Activities for Time Use Surveys) scheme, detailed in the United Nations [65], that was first proposed by Harvey and Niemi [66]. Based on the guidelines, a maximum of 144 activities were recorded per respondent along with their context, location and simultaneity in each episode. Context location for each activity was recorded in two variables; 'Location Code 1' that identified activity location by broad land use type (own residence, other's residence, agricultural workplace, public place, travelling or waiting and other places), whereas 'Location Code 2' described the general location 'inside' or 'outside' of the building or the type of mode used (walking, personal automobile, taxi, train, bus, bicycle and other modes), if travelling.

TUS represents the country's urban and rural population in each of the four provinces. For this purpose, the entire stratum of the country's urban areas published in the 2005 Economic Census [67] and rural areas published in the 1998 Population Census, was taken as the sampling frame. As nearly 40 percent of the population is urban, 40 percent of the sample size was surveyed from urban areas and the remaining 60 percent was surveyed from rural areas. A three-stage stratified random sampling procedure was applied for sample selection similar to other national surveys. At the first stage, 652 urban and 736 rural Primary Sampling Units (PSU) were selected from the sampling frame by probability proportional to size method where a larger PSU had higher chances of selection. PSUs are the entire Enumeration Blocks (each consists of 200-250 households) in urban areas and village/mouza in rural areas. At the second stage, sample households were selected from the PSUs through systematic sampling using a published list of houses and every 16th urban and 12th rural household was selected for survey with a random start. At the third stage, two respondents were selected from each selected household for time use diary by Kish grid selection. This method, developed by Kish [68], is a probability sampling technique used to select individuals from multiple potential respondents [69]. Using this method, a table of household size and member's rank enabled selection of respondents systematically for the time use diary survey. The household questionnaire was given to the adult member of the household whereas the time use diary surveyed two respondents above 10 years of age from each

household. The TUS sample was distributed evenly over four quarters to account seasonal variation in time use.

The sample excluded a few administrative areas, like Federally Administered Tribal Areas (FATA) and some districts of Khyber Pakhtunkhwa (then called North West Frontier Province) that were mostly located in difficult terrain or in places with security vulnerabilities. Homeless populations and those who cannot be categorized as a household, for example day-time household workers and children living away from home, were also excluded from the sample. The entire excluded population forms nearly 3 percent of the sampling universe. The survey was carried out by hiring local female surveyors with facilitation from local political leaders, and multiple visits to the household increased the response rate of the survey up to 98.9 percent. A total of 19,380 household questionnaires and 37,830 time use diaries were filled completely and data was digitized and processed in STATA. The Pakistan Strategy Support Program provided TUS data free of cost on their website for research purposes. Key demographic characteristics of the sample are given in Table 1 below, showing the distribution of respondents by area, province, age group, education, main activity and source of income, feelings about diary day and availability of transport mode in the household across genders.

**TABLE 1. Sample characteristics**

Socioeconomic Characteristics	Male		Female		Overall	
	n	%	n	%	n	%
Sample size	18,321	48.4	19,509	51.6	37,830	100.0
Urban	7,422	40.5	7,495	38.4	14,917	39.4
Rural	10,899	59.5	12,014	61.6	22,913	60.6
Province						
Punjab	8,092	44.17	9,000	46.13	17,092	45.18
Sindh	4,615	25.19	4,424	22.68	9,039	23.89
NWFP (Khyber Pakhtunkhwa)	2,986	16.3	3,828	19.62	6,814	18.01
Baluchistan	2,628	14.34	2,257	11.57	4,885	12.91
Age group						
10 to 19	5,860	32.0	5,636	28.9	11,496	30.4
20 to 29	3,593	19.6	5,045	25.9	8,638	22.8
30 to 39	3,359	18.3	3,812	19.5	7,171	19.0
40 to 49	2,415	13.2	2,316	11.9	4,731	12.5
50 to 59	1,446	7.9	1,346	6.9	2,792	7.4
60 to 69	1,008	5.5	868	4.5	1,876	5.0
70 to 79	462	2.5	342	1.8	804	2.1
80 to 89	139	0.8	116	0.6	255	0.7
90 & Above	39	0.2	28	0.1	67	0.2
Education level						
No formal education	5,762	31.5	11,252	57.7	17,014	45.0
K.G. but below primary	2,181	11.9	1,669	8.6	3,850	10.2
Primary but below middle	3,548	19.4	2,489	12.8	6,037	16.0
Middle but below matric	2,359	12.9	1,371	7.0	3,730	9.9
Matric but below intermediate	2,210	12.1	1,363	7.0	3,573	9.4
Inter. but below degree	1,093	6.0	749	3.8	1,842	4.9
Degree and above	1,168	6.4	616	3.2	1,784	4.7
Marital status						
Never married	8,084	44.1	6,736	34.5	14,820	39.2
Currently married	9,775	53.4	11,648	59.7	21,423	56.6
Widow/widower	413	2.3	1,058	5.4	1,471	3.9
Divorced	49	0.3	67	0.3	116	0.3
Main Role						
Employed	12,691	69.3	3,270	16.8	15,961	42.2
Student	3,726	20.3	2,789	14.3	6,515	17.2
Unpaid worker	123	0.7	11,483	58.9	11,606	30.7
Doing nothing	1,781	9.7	1,967	10.1	3,748	9.9

**TABLE 1 (continued). Sample characteristics**

Socioeconomic Characteristics	Male		Female		Overall	
	n	%	n	%	n	%
Main source of income						
Wage/salary	5,781	31.6	1,270	6.5	7,051	18.6
Own business	5,504	30.0	435	2.2	5,939	15.7
Government grant	167	0.9	39	0.2	206	0.5
Investment	34	0.2	13	0.1	47	0.1
Other household member	1,027	5.6	2,456	12.6	3,483	9.2
Remittance	88	0.5	268	1.4	356	0.9
Compensation	27	0.2	21	0.1	48	0.1
Other	256	1.4	64	0.3	320	0.9
No personal income	5,437	29.7	14,943	76.6	20,380	53.9
Diary day						
Monday	2,929	16.0	3,120	16.0	6,049	16.0
Tuesday	3,060	16.7	3,167	16.2	6,227	16.5
Wednesday	3,021	16.5	3,157	16.2	6,178	16.3
Thursday	2,738	14.9	2,868	14.7	5,606	14.8
Friday	2,403	13.1	2,716	13.9	5,119	13.5
Saturday	1,744	9.5	1,675	8.6	3,419	9.0
Sunday	2,426	13.2	2,806	14.4	5,232	13.8
Feeling about diary day						
Busy	5,641	30.8	4,550	23.3	10,191	26.9
Comfortable	6,785	37.0	7,743	39.7	14,528	38.4
Not too busy	5,895	32.2	7,216	37.0	13,111	34.7
Transport mode in household						
Car	1,265	6.9	1,241	6.4	2,506	6.6
Motorcycle	3,592	19.6	3,449	17.7	7,041	18.6
Cycle	6,531	35.7	6,543	33.5	13,074	34.6

Source: Author's calculations using Time Use Survey (2007)

Sample characteristics show that the urban population is 40.5%, the female subsample is 51.6%, young adults from 10 to 29 years of age make 53.2% while elderly aged 60 or above form 9% of the total surveyed population. Being the largest province in the country, Punjab province covered 45.18% and the combined share of Baluchistan and KPK was 30.9% of the total sample. On marital status, 39.2% reported being unmarried, 56.6% reported being currently married while 4.2% reported being divorced or widowed. On main source of income, 60.6% of respondents reported having a job or personal business, 29.7% expressed no personal source of income; 5.6% reported receiving income from other household members and the remaining 3.2% reported income from government grants and other sources. On vehicle type ownership, 6.6 percent of respondents reported having a car, 18.6 % reported motorcycles while 34.6% of the sample reported having a cycle in their house. 60.3% of the sample reported being employed; from the rest not having employment, 20.3 % reported being a student, 9.7% people reported 'doing nothing' and 0.7% reported doing unpaid household work. The main role of the respondent other than employment was extracted from the questions '5.21: if not available for work, then why?' And the expressed reason behind not working was taken as the main role of respondent. Time diaries were prepared for the whole week period with least respondent share of 9.7% for Saturdays, nearly 13% for Fridays and Sundays and 15 to 16% for rest of the days. Least diaries were reported for Saturdays due to the general holiday on next survey day. TUS sample characteristics show that, as compared to male respondents, a larger proportion of female interviewees reported being in an adult age group, having lower education levels, currently married or divorced, doing unpaid work, dependent on others for income, and feeling 'not enough busy' on the diary day. As the analysis section highlights, these demographic factors play an important role in women's travel decisions in the country.

### ***Measuring Travel Behavior***

The paper measures four characteristics of activity travel behavior in the country: trip rate, mode choice, duration and purpose of travel. TUS recorded time use of respondents in 125 detailed 3-digit activity codes

that, when combined, form 10 broad activity categories defined by ICATUS. Each of 10 broad activity categories describes 'travel' activity with at least one distinct 3-digit activity code, usually ending with '80'. These travel-related activity codes were identified, and the ten broad activity categories were divided into 20 broad groups, 10 representing the activity and 10 representing travel for that activity. The data was recoded to separate 'activity' and 'travel' time use and summarized for travel duration, number of trips, mode choice and trip purpose for each respondent by longitudinal analysis techniques described in Singer and Willett [70] and Michelson [29]. For simultaneous activities, a 30-minute episode time was allotted to each of the activities while, in case of non-simultaneous activities, episode duration was divided equally among them. As a result, activity time for the diary day was 1,440 minutes or higher. This method helped preserve actual time spent by each activity as if a person was sleeping during travel in an episode, both travel and sleep activities were given 30 minutes each. Detailed ICATUS activities are often reduced to small number of activities in activity behavior modeling [27, 71]. For travel behavior analysis, this study converted ICATUS activity classification into 3 activities of Reichman classification, developed by Reichman [72], namely subsistence, maintenance and leisure activities. As the official report does not provide a detailed description of the travel activity, due to its focus on work duration assessment, the overall figures reported in this work may differ from the official summary of travel patterns due to methodological differences in data analysis. For example, in the official report, activity time has been equally divided between simultaneous activities which may under represent travel time, whereas in this reported research, simultaneous activities have been treated differently to preserve travel activity time. Similarly this paper carries detailed analysis of travel activity which has not been provided in official final reports, [64], due to their limited scope of work.

## 4. GENDER, MOBILITY AND TRAVEL BEHAVIOR

Out of a total 37,830 respondents, 26,441 (69.89%) reported travelling during the diary day, while 11,389 (30.11%) did not report any trip. A total of 120,173 trips were recorded from the survey, including 103,999 (86.5%) by walking, 7,626 (6.4%) by automobile, 2,905 (2.4%) by cycle, 2,500 (2.1%) by bus, 2,175 (1.8%) by taxi including rickshaw, 912 (0.8%) trips by other modes (e.g. animal driven carts) and just 56 trips by train. While rural dwellers reported more trips by walking (67,389 or 90.6%) than urban residents (36,610 or 79.9%), their share of motorized trips was smaller (6.3%) than urban areas (16.7%). Table 2 below details total trips by mode of transportation used across respondents in urban/rural and gender categories.

**TABLE 2. Total trips by mode across geography and gender reported in Pakistan Time Use Survey 2007**

Mode	Overall		Urban		Rural		Male		Female	
	n	%	n	%	n	%	n	%	n	%
Walking	103999	86.5	36610	79.9	67389	90.6	82696	86	21303	88.6
Personal automobile	7626	6.4	5032	11	2594	3.5	6099	6.4	1527	6.3
Taxi	2175	1.8	1109	2.4	1066	1.4	1551	1.6	624	2.6
Train	56	0	31	0.1	25	0	47	0	9	0
Bus	2500	2.1	1465	3.2	1035	1.4	2038	2.1	462	1.9
Bicycle	2905	2.4	1306	2.9	1599	2.2	2838	3	67	0.3
Other	912	0.8	257	0.5	655	0.9	842	0.9	70	0.3
Total	120173	100	45810	100	74363	100	96111	100	24062	100

Source: Author's calculations using Time Use Survey (2007)

### *Gender and Mobility Decisions*

On average, 30% of respondents (11,389) did not report travel in any of their 144 activity episodes. However, the mobility decisions and the number of trips vary considerably across gender. A large number of female respondents (10,722) did not report travel activity as compared to relatively small (667) male respondents. Females were one third (8,787) of the total travelers (26,441) and their immobility rate was nearly 55.4% as compared to 3.64% for men. Other than higher immobility rates, females are less likely to make more than 2 trips per day as compared to the male population (Table 3). 29.7% of female respondents (i.e. 66 percent of mobile women) reported one to two trips in the diary day, 11.1% (or 24.5 percent of mobile women) reported making three to four trips whereas only 4.2% of females (9.1 percent of mobile women) reported more than 4 trips in the diary day. From male sample, 25.5% respondents (i.e. 21.8 percent of mobile men) reported one to two trips, 20.3% (31.3 percent of mobile men) reported three to four trips, 10.3% (i.e.

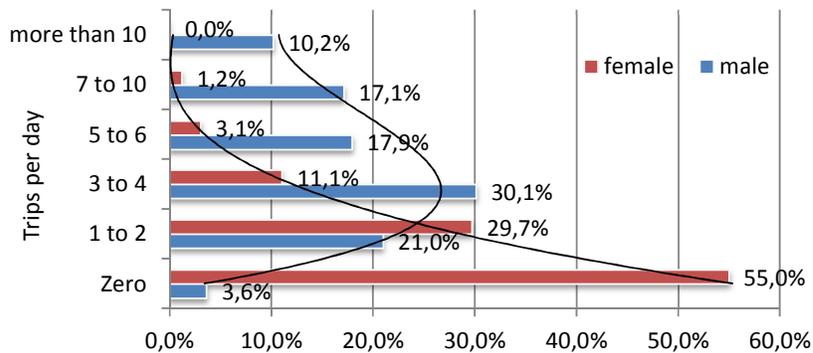
18.6 percent of mobile men) reported making five to six trips, whereas 13.8% respondents (i.e. 28.3 percent of mobile men) reported 7 or more trips in their diary day.

**TABLE 3. Total daily trips across gender**

Total daily trips	Overall		Male		Female	
	N	%	N	%	N	%
Zero	11,389	30.1	667	3.6	10,722	55.0
1 to 2	9,641	25.5	3,845	21.0	5,796	29.7
3 to 4	7,673	20.3	5,517	30.1	2,156	11.1
5 to 6	3,881	10.3	3,285	17.9	596	3.1
7 to 10	3,373	8.9	3,139	17.2	234	1.1
More than 10	1,873	4.9	1,868	10.2	5	0.0
Total	37,830	100	18,321	100.0	19,509	100

Source: Author's calculations using Time Use Survey (2007)

More than half of the women reported immobility, which is almost double the previously known immobility levels in the developing world. Similar levels of immobility have been reported in Shefali [73] in their Dhaka metropolitan area sample. The time use data highlights that nearly 79% of the male population made more than two trips per day while approximately 85% of the total female respondents reported making less than two trips in the time use diary. Nearly half of the male respondents made more than 5 trips as compared to less than 5% female respondents as detailed in Figure 1 below.



**FIGURE 1. Percent of respondents by mean daily trip across men and women in Pakistan**

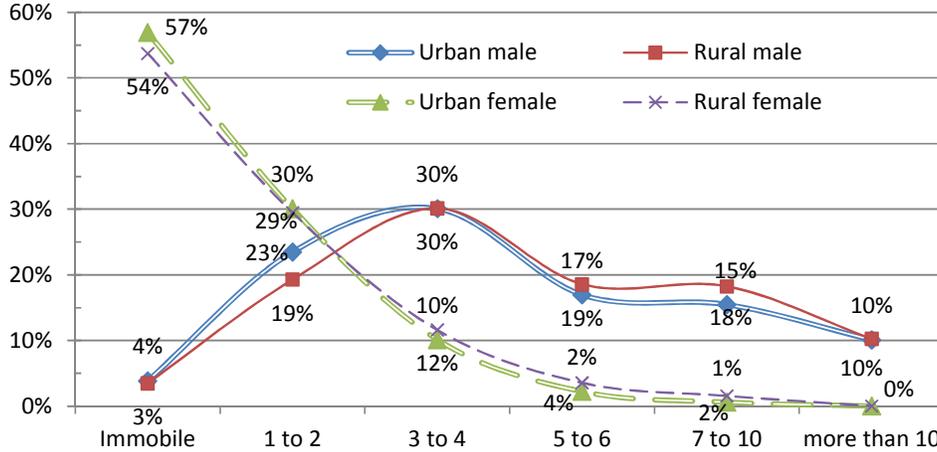
One-way ANOVA results verify significant gender differences in trip rates (at  $Pr > Chi^2 = 0.0$  and  $F Stat = 5621$ ) with mean trips per day of 5.5 and 2.8 for male and female respectively. While immobility is concentrated on the female side of gender, urban areas seem to carry a larger immobility burden than rural areas. Urban females were more immobile (56.9%) than rural females (53.7%) and urban males were slightly more immobile (3.9%) than rural males (3.5%) as shown in Table 4.

**TABLE 4. Mean daily trip distribution by men and women**

Mean Daily trips	Overall		Urban male		Rural male		Urban female		Rural female	
	N	%	N	%	N	%	N	%	N	%
Zero	11,389	30.1	286	3.9	381	3.5	4,266	56.9	6,456	53.7
1 to 2	9,641	25.5	1,744	23.5	2,101	19.2	2,254	30.1	3,542	29.5
3 to 4	7,673	20.3	2,233	30.0	3,284	30.1	760	10.1	1,396	11.6
5 to 6	3,881	10.3	1,260	17.0	2,025	18.6	168	2.3	428	3.6
7 to 10	3,373	8.9	1,149	15.5	1,990	18.3	46	0.6	188	1.6
More than 10	1,873	4.9	750	10.1	1,118	10.3	1	0	4	0
Total	37,830	100	7,422	100	10,899	100	7,495	100	12,014	100

Source: Author's calculations using Time Use Survey (2007)

Other than higher immobility in urban areas, a larger share of urban men and women make 1 to 2 trips per day (23.5% and 30.1% respectively) as compared to rural men and women (19.2% and 29.5%). For the respondents reporting more than 2 trips per day, rural men and women reported greater trip frequencies than their urban counterparts. The results show that rural people are more out-going than urban residents and that there may be various socioeconomic and accessibility factors associated with these mobility differences across urban and rural areas.



**FIGURE 2. Percent respondents by mean daily trips across urban and rural areas**

One-way ANOVA shows significant gender differences in trips across geography (F Stat = 2136.1). Bonferroni, Scheffe and Sidak multiple comparison tests show that the trip rate differences between the four groups are significant and that the male-female differences are larger (1.18 trips per day) than the rural-urban differences (0.12 trips per day) at 0.00 significant level.

**Gender, Geography and Mode Choice**

On average, the mobile population of the country makes 4.5 trips per day, out of which 3.9 (86.5%) trips are done by walking, 0.3 (6.3%) are done by private automobile like cars and motorcycles etc., 0.1 trips are done by bicycle, bus and taxi (2.4%, 2.1% and 1.8% respectively), and less than 1 percent of trips are done by other means of transportation, and train trips remain near to negligible. On average, public transport and bicycle/other modes trips were found to be 3.9% and 3.2% of the total trips.

**TABLE 5. Modal split for mean daily trips by gender and area**

Mode	Overall		Female		Male		Urban		Rural	
	n	%	n	%	n	%	n	%	n	%
By mode										
1. Walking	3.9	86.5	2.4	88.5	4.7	86.0	3.5	79.9	4.2	90.6
2. Private automobile (Car, Motorcycle)	0.3	6.3	0.2	6.4	0.3	6.4	0.5	11.0	0.2	3.5
3. Taxi	0.1	1.8	0.1	2.6	0.1	1.6	0.1	2.4	0.1	1.4
4. Train	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
5. Bus	0.1	2.1	0.1	1.9	0.1	2.1	0.1	3.2	0.1	1.4
6. Bicycle	0.1	2.4	0.0	0.3	0.2	3.0	0.1	2.9	0.1	2.2
7. Other	0.0	0.8	0.0	0.3	0.0	0.9	0.0	0.6	0.0	0.9
Total	4.5	100	2.7	100	5.4	100	4.4	100	4.6	100
By type of transport										
Walking (1)	3.9	86.5	2.4	88.5	4.7	86.0	3.5	79.9	4.2	90.6
Personal automobile (2)	0.3	6.3	0.2	6.4	0.3	6.4	0.5	11.0	0.2	3.5
Public transport (3, 4, 5)	0.2	3.9	0.1	4.7	0.2	3.7	0.3	5.7	0.1	2.9
Other Non-motorized (6, 7)	0.1	3.2	0.0	0.6	0.2	3.9	0.2	3.4	0.1	3.0
Total	4.5	100.0	2.7	100.0	5.4	100.0	4.4	100.0	4.6	100.0

Source: Author’s calculations using Time Use Survey (2007)

As Table 5 shows above, women make nearly half of the daily trips (2.7) as compared to men (5.4). This difference is mainly due to reduced walking trips by women (2.4) as compared to men (4.7). Women's trip characteristics vary significantly from men's by modal split as well. Their share of walking trips (88%) is higher than men's (86%) and their share of motorized trips (1%) is lower than men's (4%). This phenomenon is linked to their limited access to modes of transportation and ability to pay for motorized trips. Women's share of private automobile trips is similar to the men (6%) but they make a higher percentage of public transport trips (4.7%) than men (3.7%) showing their increased dependency on public transport. Similarly, women's share of non-motorized trips by 'Cycle and other modes' is also lower than men's (0.6% and 3.9% respectively) as women are not expected to ride bicycles or use other (less common) means of transportation e.g., intermediate modes of transportation (IMTs). While differences in trip rates are larger between men and women, mode choice differences are somehow greater between urban and rural areas of the country. Rural dwellers make more trips per day (4.6) as compared to urban residents (4.4) and their share of walking trips (4.2 or 91%) is also greater than urban residents, who make 3.5 or 80% trips by walk. Use of private automobiles is greater in urban areas (11%) as compared to rural areas (3%) and public transport-based trips are also higher in urban areas (6%) than rural areas (3%). Greater use of motorized means of transportation in urban areas is probably due to the fact that urban dwellers have higher income levels and greater access to public transport especially in large cities. The high percentage of walking trips is already known in Pakistan; however, this study finds a much lower share of public transport-based trips in the national sample as compared to the city specific studies like NESPAK [74] and Imran [45]. This is probably due to the fact that most of the previous studies have been undertaken in major cities like Karachi and Lahore which have large and dispersed urban areas, a higher level of private vehicle ownership and their vehicle-less population relies on public transport for long commuting distances. Such studies of metropolitan areas may over represent the travel behavior and use of automobiles in the country.

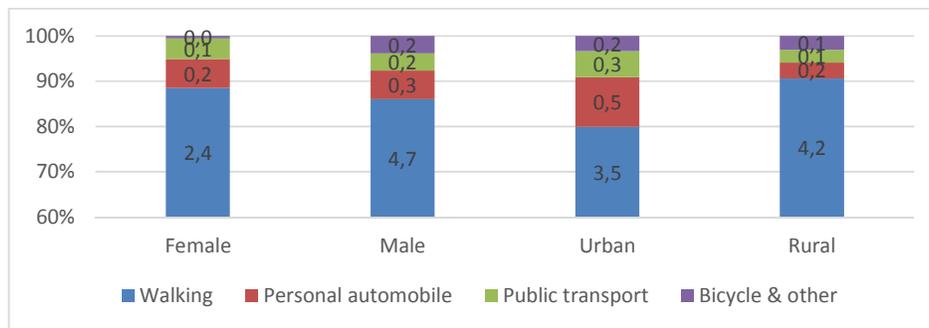


FIGURE 3. Mean daily trips by mode by gender and area in Pakistan

### **Gender and Travel Purpose**

While gender to a large extent, and geography to a small extent, seem to affect travel decisions and trip rates in Pakistan, socioeconomic status and personal characteristics of respondents also affect mode choice more and travel purpose. Automobile usage in Pakistan varies considerably by the main role of the respondents between genders which, to some extent, is linked with their age and access to resources. Overall, females reported a greater share of travel by automobile than male travelers. Within the female group, the share of automobile and public transport-based trips is highest for female students (10% and 5%), second highest for unpaid female workers (6% and 5%), and decreases for females doing nothings 5% and 4% respectively. Ironically, the share of automobile based trips was found lowest for employed women (4% each) among all females. It shows the challenge of travel for female students and house ladies doing household care work. Employed women also made the highest percentage of non-motorized and walking trips (93%) among all females. On the other hand, the situation is different among male travelers. Employed men experience the greatest share of private automobile and public transport, 7% and 4% respectively, and the least share of walking trips (84%) among all male travelers. Whereas, male unpaid workers and free timers reported the lowest automobile trips (3%) and highest walking trips (93%), that might be due to their reduced access to economic resources and personal means of transportation. However non-motorized trips are highest among employed males which shows their extra usage of bicycles and other modes of transportation for quicker mobility and reduction of transportation cost.

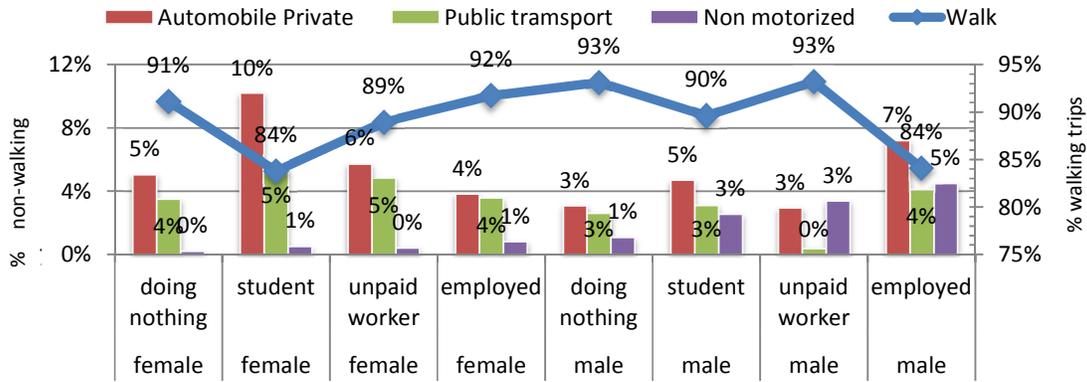


FIGURE 4. Modal split by role and gender of the travelers

One-way ANOVA and Bonferroni, Scheffe and Sidak multiple comparison tests verify mode choice difference across gender and geography with a few exceptions; that the gender differences in personal automobile and walking trips were only significant in rural areas and trips by other modes were statistically similar between the male travelers across urban and rural areas. Data shows that young female students are more dependent on personal automobiles, probably due to security issues and fear of crime. This issue might be more significant for ethnic minorities and communities facing social exclusion and violence in the country. Other than their lower walking trips and difficult travel conditions for women, the data shows that women travel less than men for leisure purpose as well. On average, females reported 0.8 trips per day as compared to 2.4 trips by male respondents in the diary day. It is expected that the patriarchal system in the households and concerns of security at public places like parks and bus stops play a significant role in female mobility to leisure activities. Leisure activity travel is largely affected by the marital status of women and men. Unmarried respondents made more trips per day than married respondents probably due to the fewer household and childcare activities. However female leisure travel is more affected than male members (Figure 5). While unmarried women reported more than 2 trips per day for leisure activities, married, divorced or widow female respondents reported on average 1 trip per day as compared to 3.5 and 2.9 trips per day respectively for male respondents.

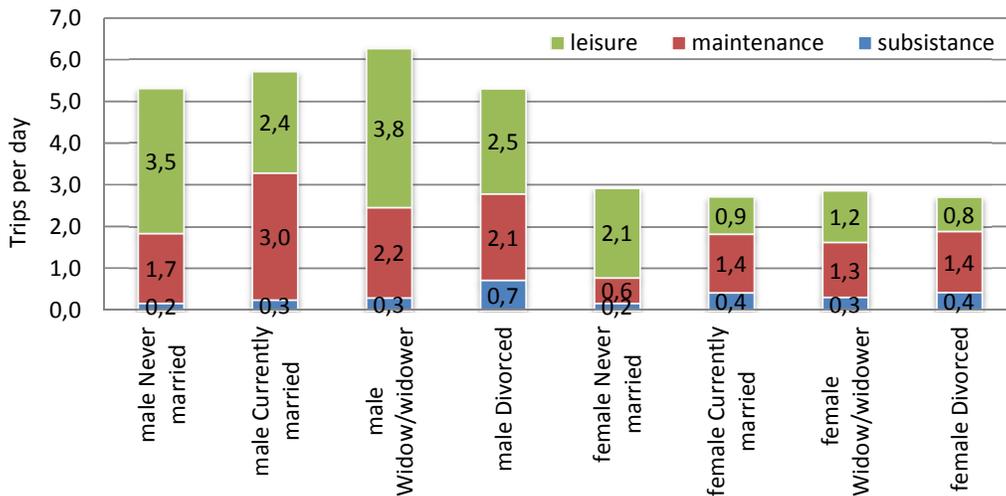


FIGURE 5. Mean trips across male and female by their marital status for different activities

Subsistence travel dominates the travel patterns of students and employed females (2.4 and 2.1 trips per day) that account for 70 to 80 percent of their daily travel budget. However they undertake fewer leisure trips per day (0.3 and 0.4 trips per day or nearly 10% of total trips) as compared to free timer and unpaid worker female respondents who reported 1.4 and 1.2 trips per day respectively that make 50% of their daily total trips (Figure 6). On the other hand, leisure trips dominate the daily travel purpose of male population in all roles and accounts 50 to 70 percent of their total daily trips. When we compare trip rates between gender, male

students and the employed make more maintenance trips per day (0.5 and 0.7) than their female counterparts (0.2 and 0.5); however, subsistence trips were found to be slightly greater for male than female respondents. For the male population, subsistence trips are statistically different for after-marriage and before-marriage stages.

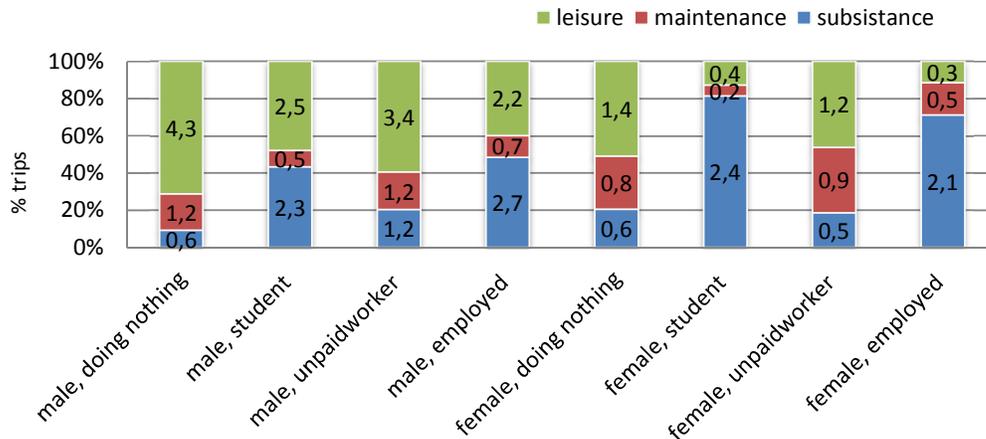


FIGURE 6. Mean trips across male and female by their main role

Among females, travel activity is considerably affected by age and marital status. Generally female leisure travel is reduced to half after marriage and eases with the age. However, they travel considerably less than men for leisure activities. Marriage seems to affect the leisure trips of females due to their increased household care and child bearing responsibilities, while their maintenance trips are doubled. In this way women try to combine maintenance trips with social activities and it is possible that women try to find leisure within their maintenance-purpose travel by visiting friends during the trip or out-of-home activity participation. However, the reduction is greater for females as compared to males who still make multiple leisure trips daily. It is possible that enhancing mobility needs especially the walking environment in urban and rural areas, might increase the leisure trips, like early morning walks for the female population.

### ***Trip Durations and Travel Time Budget***

While female trip rates are nearly half of the male travelers, their daily travel time budget is also less than men at the national level. On average, females travel daily for 65 minutes, as compared to 117 minutes travel time for male travelers representing that the female travel time budget is 44.4 percent less than men. There is evidence that in the villages of Balochistan, women travel for hours to fetch water and firewood, but the data shows that more than 90 percent of country’s households have water, electricity and natural gas inside their house. At the national level, female daily travel duration is not much affected by these extremes and their mean daily travel duration is less than men, confirming the hypothesis that female travels less and nearer to their residential places than male travelers.

ANOVA results show that mean trip duration is slightly higher for females (24.4 minutes) as compared to males (23.5 minutes), but differences are significant in urban areas only. Mean daily travel duration by men and women for ten broad activities is given in Figure 7 below. It shows that, as compared to men, female travel duration is 19 to 20 percent shorter for work and community services, 4 to 6 percent shorter for education and household care whereas 28.3 percent shorter for sociocultural activities. However, female travel duration was found longer than men for personal care travel by 21.4 percent, for maintenance travel by 51 percent.

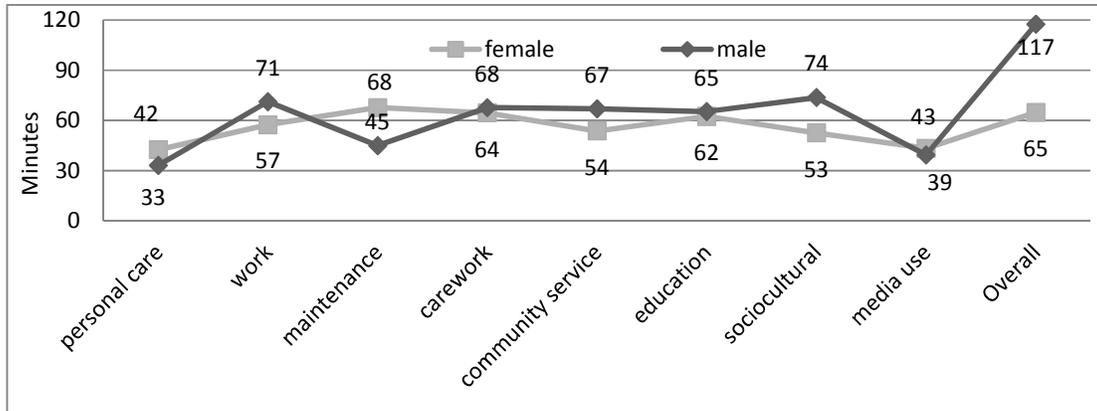


FIGURE 7. Mean daily travel duration by purpose across men and women

Results highlight that the majority of Pakistani women carry responsibilities for household maintenance related tasks outside home. Other than personal care travel, women face a restricted mobility environment for work and sociocultural travel. It seems that the poor condition of public transport and lack of affordability for personal automobiles has restricted women’s mobility for work more significantly than for access to education. Female students sometimes travel by escort or in groups to the nearby school, whereas the adult female’s mobility to the workplace is restricted due to the non-availability of suitable travel conditions. Female mean trip duration is also shorter than males by bus (41 versus 49 minutes per trip), by bicycle (28.8 versus 26.4 minutes per trip) and other means (24.9 versus 34.3 minutes per day of transportation). However, female trip duration was found greater than males for train, personal automobile and walking trips. Increased mean trip duration by personal automobile shows the increased reliance of women on personal means of transportation for mobility.

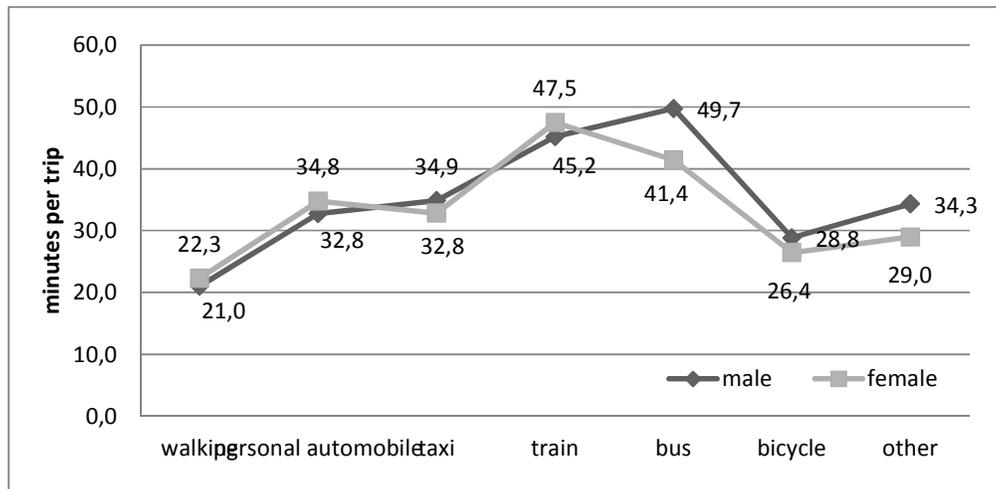


FIGURE 8. Mean trip duration by mode across gender

Keeping in view that women do not drive motorcycles and mostly travel as passengers, increased trip duration by personal automobile might be due to the fact that the number of women car passengers might be more than men. Increased walking trip duration in women may represent a number of reasons, including their short period of socialization with other females during walks and the time spent in shopping food and other necessities from street hawkers and open air stalls on the road. The fact that rural females tend to spend more time walking for buying household goods from urban areas and due to their longer travel duration as compared to urban residents, may also increase their mean walking trip duration. One-way ANOVA, Bonferroni, Scheffe and Sidak multiple comparison tests find that mean travel duration for train and taxi is statistically not different across gender; and for the other modes, differences are statistically significant. The lack of difference can be attributed to low demand for travel by train and taxi due to availability and cost issues with these modes of transportations.

## 5. CONCLUSIONS AND RECOMMENDATIONS

This paper quantifies the differences in mobility and travel behavior across male and female populations of the country. While the study reaffirms previously known facts about travel behavior, it also contributes unique information to the existing literature on travel behavior in Pakistan specifically and in developing countries in general. Most of the previous studies on the subject focused on urban travel behavior of major cities; rural travel patterns were somehow overlooked and the existing literature needed fresh evidence for understanding current travel behavior differences across urban and rural areas. Similarly, few previous studies have explored gender differences in travel behavior and activity participation, and the current paper fills that gap too. The results highlight wide mobility gaps between men and women across the country, and it appears that gender mobility differences are much greater than the urban/rural differences. While rural people appeared more mobile than urban residents, female freedom of mobility is somehow restricted in the country. Nearly 55 percent of women were immobile in the diary day as compared to less than 4 percent men, and the instances of immobility were higher in urban women (57%) than in rural women (54%). Overall, females made half of the trips (2.7) as compared to male respondents (5.4), and the differences were mainly due to walking trips (men made 2.3 more trips). Similarly, men performed more leisure trips (2.4) than women (0.8). Female daily travel time budget is 44 percent shorter than that for males and their travel time for subsistence and leisure activities is also shorter. Female mean trip duration is slightly higher for walking and personal automobile trips whereas considerably lower for travel by bus, bicycle and other means of travel. Female students reported the highest dependence on personal automobile and public transport, while male students reported the lowest. Female mean travel duration by bus and bicycle is much shorter than male due to the potential issues with public transport and bicycle-based travel in the country. Risk of security and interaction with unwanted men seems to affect female trips and mode choice the most. Socioeconomic variables like age, marital status and main role of respondents seem to affect the trip characteristics of women more than men.

A number of research directions can be drawn from this work. Firstly, there is a need to explore the widespread phenomenon of female immobility in detail. What is the female opinion about immobility? Does it represent a form of 'transportation disadvantage' which reduces female access to various services and opportunities? How do the current mobility and travel patterns affect female access to economic resources, personal wellbeing and social inclusion in the city? Is there a 'latent demand' for women's mobility? If yes, then to what extent? How can transport and land use policy can help facilitate women's mobility, reduce their automobile dependency and promote leisure trips? And what cost-effective interventions are needed? Land use policy, probably, has a more important role for facilitating the active transportation and leisure travel of women because of the nature of spatial growth and cultural norms of the society. Gender-aware land use policy is needed to provide women friendly streets and land use in newly planned housing estates in the country. For the areas already developed, like inner city areas, transport policy should also facilitate mobility and accessibility for non-motorized travelers as, 80 to 90 percent of travel is done by walking. For enhancing the physical connectivity of people and destinations, there is a need to consider the walking environment to be as important as the construction of roads and flyovers in the urban areas. Females tend to travel less due to various issues of accessibility and mobility, and increasing walkability is expected to favor women more than men. Increasing walkability can help reduce female immobility and automobile dependence and may increase their leisure travel as well. Walkable streets should be encouraged within the social norms for better social acceptance. This can be done, for example, through segregating pedestrian walkways by gender. If a road has dual walkways on both sides, female security might be improved by promoting one walkway as a female and children – priority walkway. Gender segregation at public places is a common phenomenon in the country. However, the degree of gender sensitivity in the transportation environment seems the less as compared to the other built environments like schools, offices and even public parks. Gender sensitive interventions will help create safer streets which is also a common desire for mobility in the country's religious culture. Similarly, there is a need to bring rural areas into the transport policy and connectivity framework. Rural people are in clear majority and so is their travel demand; however, they lack access to public transport and important services like healthcare, educational centers and good shopping places. The wide geographical differences in accessibility have been rarely pointed out in terms of travel demand in rural areas and their actual level of access to public transport. The authors aim to discuss it in their ongoing research on transportation disadvantage in Pakistan. The country's development policies should also utilize national level datasets to their full potential for well informed decisions in urban planning and transportation projects.

The study attempts to quantify travel behavior of Pakistanis for the first time in the country's known history of transport planning. The quality of results might be affected somehow, if not greatly, by the quality of dataset

used. TUS was designed to calculate gender-based working hours, and travel information was not the focus point of this data collection strategy. Travel activities were noted to get a more complete picture of activity time use and thus the study design can generate a potential source of bias in the results. At first, the data collection might omit some of the travel activity on the diary day. TUS collected 3 activities per half hour episode; however, there is a possibility of the existence of more than three activities in an episode (unreported activity). Secondly, there may be other instances of unreported travel where respondents might change their location without specifying a travel activity or the respondent might not even mention the change of location at all (unreported travel and activity both). Similarly the time use might be upward biased as all activities of an episode were given equal time. Measurement of the nature of bias and its impact on travel behavior data needs further analysis. However, the results are expected to be sufficiently reliable in their level of detail and convey a meaningful picture of the travel behavior patterns. By quantifying the travel behavior through a nationally representative dataset, the results provide a comprehensive set of information as a first step on the long road of travel behavior analysis in the country. Similar efforts can be carried out in other countries using their time use survey datasets. Because of the ability of time use surveys to be 'harmonized' across countries and regions, it is possible to compare patterns of activity travel across space and time. Studying travel behavior through time use data can provide a useful bench mark for measuring travel behavior in developing countries, and it can enhance the utility of expensive time use surveys well beyond the calculation of time use in paid and unpaid work activities.

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# Gender differences in travel behavior in the Arab World: Comparison of case studies from Jordan and Israel

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## ABSTRACT

This paper extends the research on gendered differences in travel patterns in the Arab world by studying similarities and differences between Israeli Arab and Jordanian Arab communities in relation to travel behavior. We try to explore differences in travel behavior between women and men in the two communities and their potential causes. Although this work focuses on two countries, it serves as an important early study of travel behaviors in general in the Arab world, a topic deserving of more research.

The similarity of factors characterizing the Israeli Arab minority and Jordanian society— culture, language, religions and sets of beliefs—makes their comparison interesting. The study is based on a survey of 300 households in Israel and 200 households in Jordan. A descriptive statistical analysis was employed to understand the differences in travel behavior between the sexes in each country, and a daily activity pattern model was developed using a multinomial logit model.

The results of this study show significant differences in travel behavior between women and men in both countries but there are also differences between the two countries. Men make more trips, use the car as a driver more, spend more time travelling, and participate more in the workforce than women do. One of the principal findings of the analyses of the two communities is that demographic and socio-economic factors have a significant effect on the diversity of daily activity patterns; nonetheless, these variables are not sufficient to explain these gender disparities.

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**KEYWORDS:** Travel behaviour; Daily activity pattern; Gender; Arab; Israel; Jordan.

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## INTRODUCTION

In recent years, a great deal has been learned about gender differences in travel patterns in developed urban societies. However, little is known regarding this aspect in the developing world, and there are insufficient studies that look at the complexity of women's daily travel patterns in developing countries. This dearth of knowledge impairs the effective design and implementation of transportation policies.

One vast understudied population is the Arab community of the Middle East and North Africa, whose roughly 325 million people compose the vast majority of citizens in a swath of nations extending from the Atlantic Ocean in the west to the Persian Gulf in the East. In Israel, Arabs constitute a substantial minority population.

General questions can be raised in regard to women's daily activity pattern. In which activities are women engaged, and how do they get to these activities? Are socio-economic characteristics sufficient to explain gender differences in travel behavior, or do differences in accessibility and culture contribute the most to gendered disparity?

The purpose of this research is to extend the research on gendered differences in travel patterns in the Arab world by studying similarities and differences between Israeli Arab and Jordanian Arab communities. We try to explore differences in travel behavior between women and men in the two communities and their potential causes. This paper focuses on Israel and Jordan, but it serves as an important early study of travel behaviors in general in the Arab world, a topic deserving of more research.

The study is based on a unique data set that includes activity and travel diaries collected by personal interviews in three Arab communities in the Galilee region in northern Israel— Majd-al-Krum, Rami, and

Shefaram—and in the town of Al-Husn in Jordan. Similar factors characterizing the Israeli Arab minority and Jordanian society— culture, language, religions and sets of beliefs—make this comparison interesting.

The paper is organized as follows: Section 2 reviews the literature regarding gender differences in travel behavior and factors affecting this behavior in developing countries, with a focus on the Arab countries. Section 3 presents some background about the Israeli and Jordanian communities. Section 4 discusses the methodology, including the case-study towns, the survey and the main characteristics of the sample. Section 5 analyzes the data collected from the two surveys (Israel and Jordan) and estimates the results of the daily activity model. The final section offers conclusions.

## LITERATURE REVIEW

There have been relatively few studies about gendered differences in travel behavior in developing countries. Turner and Fouracre (1) note that “the roles that women have in society must inevitably have a powerful influence on their travel patterns, though there is little documented evidence which clearly demonstrates this [in developing countries].” These authors do cite earlier research in Brazil, which revealed that women make only a third of the work trips, but half of non-work trips. They also cite earlier research in Kenya, which revealed that women’s travel is mostly local and on foot. In both of these studies, women reported a higher transit-mode share than did men.

Srinivasan (2) finds that in Chennai (formerly Madras), India, men spend more time and money on travel than do women although women walk more, make more trips, and complete more shopping tours than do men. The researcher advocates improved transit to reduce travel times and improve access to opportunities. Peters (3), who reviewed case studies from cities in India, Mali, Bangladesh, Turkmenistan and Peru, concluded that women had less access than did men to individual mechanized modes, ranging from bicycles to automobiles, and that women who did have access to public transport were more dependent on it than were men with similar access.

In the Arab world, Abuhamoud et al. (4) show that males in Libya are more likely to use public transport than to drive. In Jordan, Hamed and Olaywah (5) studied the use of buses, service taxis and private cars in Amman, but did not examine gendered differences; they found that bus commuters were less likely to pursue social activities than were private vehicle commuters.

Few studies focus on Israel. Blumen and Kellerman (6) find that women in Haifa commute shorter distances than do men. Both of these studies include data from Israeli Arabs, but only as a small part of a larger sample. Mansfeld and Ya’acoub (7) focus exclusively on the Arab community of Northern Israel and find that tradition and cultural affiliation are more influential factors than are socio-economic characteristics in affecting tourism travel. However, their study did not consider either gender or daily travel behaviors. Elias et al. (8) find that women in Israel make fewer trips, travel less time and walk more than do men.

The literature provides some debate on the role of a variety of factors influencing gendered differences in travel behavior. These studies reveal that most influential of the demographic and socio-economic characteristics are age, household size, education, driving license, income and car ownership (9, 10).

Abuhamoud et al. (4) find that in Libya as one becomes older, he or she is more likely to drive than take a bus. They also found that driving license and access to a car had traditionally been among the most significant determinants of mode choice. Elias et al. (8) found that demographic and socio-economic factors affected gendered differences in travel behavior in Arab communities.

In the past few decades, cities have expanded tremendously owing to fast-paced economic growth and urbanization. Currently shopping centers, residential areas, schools and even job opportunities are spread all over a city. This change in urban form and in the geographical distribution of activities generated significant effects on people’s travel behavior (11), especially that of women, who normally take more responsibility for child-serving stops, such as picking up their children from schools/daycare centers and bringing them to/collecting them from other social and leisure activities (12). These findings demonstrate the need for a better understanding of the entire daily activity pattern and its complexity, including trip-chaining decision-making, which is necessary for transportation researchers and policy-makers alike. Both Turner and Fouracre (1) and Peters (3) call for improved surveying and a more holistic understanding of travel behavior that considered the interplay of activities within the household.

Rosenbloom and Burns (13) pointed out that women's travel patterns differed from those of men both because of the former's household and child-care roles and because of their norms regarding appropriate travel behavior.

Several studies have examined commuting patterns, which are becoming more complex because of an increasing tendency to make non-work stops during the commute to work, especially in the evening (14). Some research results show differences in commuting trip-chaining behavior between men and women and among different household structures (15). Women are more likely than men to trip-chain on the way to and from work, and they make more trip chains with stops to serve passengers (12, 16). Strathman and Dueker (15) determined that the more school-age children there were in a household, the more trip-chaining would be performed. Working mothers are more likely than working fathers to link trips, especially when there are younger children in the household (15). McGuckin and Murakami (16) determined that trip-chaining was predominantly the domain of women, even when women entered the workforce. These chaining trips have been found to structure women's travel patterns and to have significantly impacted commuters' in-vehicle travel time and route choice (distance) (17). Nevertheless, there are insufficient in-depth studies of these issues in developing countries in general, as well as among the Arab minority in Israel.

Elias et al. (8), using a tour-based approach to analyze travel behavior in Arab-Israeli villages, found that gender constituted a significant predictor of travel. Men were found to make more tours.

Subbarao and Krishna Rao (18) examined the effect of household and individual socio-economic characteristics and travel choice on individual trip-chaining in India's Mumbai Metropolitan Region. Their study recognizes that decision-making on trip-chaining varies significantly by age group. It was found that drivers in the 36 to 50-year-old age group made more trip chains than did other age groups and that people in the age group of 21 to 35 years did not show interest in making complex, non-work-related trip chains. People age 50 and older create fewer work trip chains, and more trip-chaining is associated with maintenance and leisure activities. It was observed that men tended to make more work-related trip-chains, whereas women undertook more trip chains involving maintenance or leisure activities. This last finding supports the notion of gender division of household in developing countries.

Many researchers have turned to activity-based analysis, whereby travel is a derived demand from the desire for personal activity. Travel decisions, therefore, form part of a broader activity-scheduling process. The basic travel unit is a tour, which is defined as a sequence of trip segments that start at home, proceed on time to activities and end back at home. Activity-based research emphasizes that activities may change on a daily basis, thus influencing travel choices. Copperman and Bhat (19) showed that explicitly considering children's activity patterns was important when accounting for the linkage between children's and adults' activity-travel patterns and for accurately forecasting activity-travel patterns in general.

## BACKGROUND

Table 1 presents the main demographic and socio-economic characteristics of Israel and Jordan. The State of Israel had a population of 7,374,000 in 2008 (CBS, 2010). The state is populated primarily by Jews, with a sizable Arab minority, both groups being non-assimilating (20). The Arab community contained 1,487,000 million people or 20.2 percent of the Israeli population in 2008. This community is primarily Muslim (82.9 percent), but includes prominent Christian (8.6 percent) and Druze (8.3 percent) minorities (Statistical Abstract of Israel, 2007). The Druze are a religious sect numbering between a half million and a million adherents and, in addition to living in Israel, reside in Syria, Lebanon and Jordan. They trace the origins of their beliefs to Islam, but have been a distinct community for almost a millennium.

These three religious communities have distinct socio-economic characteristics. Christians most resemble Jewish Israelis in terms of levels of education and household size, and they form the highest-earning Arab group; however, on average, the wage rates of Israeli Arab Christians are only 86.3 percent of those of Jewish Israelis. In contrast, Muslims and Druze have lower levels of education and larger household sizes than do Christians. Interestingly, despite very similar levels of education between Muslims and Druze, the latter earn far larger salaries (CBS, 2008). Arab Israelis account for the majority of the population in the Galilee region of the country, which contains the three surveyed communities: Shefaram, Majd-al-Krumand Rami. Yiftachel (20) noted that Israeli planning policy has viewed this area as an "internal frontier" and sought to constrain the spatial and economic growth of the Arab towns located in the region. As a result, Arab towns do not enjoy the

same level of development as do other Israeli towns as a whole. One example is the virtual absence of public transit service in Arab towns (8).

Jordan has a population of about 5,800,000 people, more than 92 percent of whom are Sunni Muslim. Official government figures estimate that Christians make up 6 percent of the population; there are between 12,000 and 14,000 thousand Druze, a small number of Shi'a Muslims and approximately one thousand Bahá'ís.

The population distribution in Jordan is affected by a variety of factors, among which are reciprocal migration streams and regional disparities in socio-economic development. Almost two fifths of the total population (37 percent) lives in the Amman Governorate alone, followed by the Irbid and Zarqa governorates (18.4 percent and 14.8 percent, respectively). The surveyed city, Husn, is in Irbid.

Table 1 shows that in both communities, Israel and Jordan, the young population, those 18 years old and younger, comprises more than 40 percent of the total population; however, the share of young population is higher in Jordan. Both communities have a high growth rate and a relatively large household size.

The annual household income in Israel is about three times that of the Jordanian. Jordan, like most other countries and like the Arab population in Israel, records a lower average wage for women than for men. On average, women in Jordan earn 379 JD, 11 percent less than Jordanian men, while Arab women in Israel earn 23 percent less than Israeli Arab men (CBS, 2010). The participation rate of the women in the workforce in Jordan and Israel is very similar: 23% and 24.9%, respectively. Table 1 also shows a considerable difference in the motorization rate between Jordan and Israel.

**TABLE 1. Demographic Comparison between Jordanian and Israeli Arabs (2008 Census)**

Feature	Jordan	Israeli Arabs
Population size	5,850,000	1,487,600
Religion		
Muslims	92%	82.9
Christians	6%	8.6
Druze	0.3%	8.3
Population Growth Rate	2.2	Muslims = 2.8 Christians = 1.3
Household size	6.1	5.04
Percentage of population under 18	47.0%	44.4%
Annual household income	572 Dinar (1 dinar = \$1.14)	8,578 (1 shekel = \$0.277)
Average Monthly Wage (paid employees)		
Women	379 JD (2010)	4395 Shekel
Men	429 JD	5756 Shekel
Rate of Participation in the Workforce		
Women	23.0% (2011)	24.9%
Motorization Rate*	147 per 1,000 vehicles	187 per 1,000 vehicles

## METHODOLOGY

This study is based on a unique data set that includes activity and travel diaries collected following personal interviews in three Arab communities in the Galilee region in northern Israel and in Al Husn, a town in northern Jordan. The database includes 300 completed questionnaires from Israeli households and 200 from Jordanian households.

The samples were randomly selected from a set of spatially distributed zones within each surveyed community. The spatial distribution is critical to ensuring the inclusion of clans, which have specific living standards and which reside in specific areas based on historical land ownership. The interviewers telephoned each household in advance to set up an interview time and then visited the home to personally record demographic information and to complete travel diaries for the preceding day for each member of the household over age six. A typical surveying session took an hour and a half per household.

A descriptive statistical analysis was employed to understand the differences in travel behavior between the Israeli and Jordanian Arab communities, as well as gendered differences. In addition, a daily-activity-pattern model was developed by using a multinomial logit model. The structure of the daily-activity-pattern model, shown in Figure 1, includes two choices: the highest level estimates the choice of the main activity of the day. There are three activity alternatives: Work (W), Education (E) and Other (O), the last representing such activities as shopping, leisure, dropping off a child or staying at home.

For days in which the main activity is work, another model estimates the probability of the daily-activity pattern (DAP). This choice consists of three alternatives: simple daily activity pattern, meaning only one trip to and from work; a stop on the way back from work for non-work activity (HWH, HWOH); and a complex daily activity pattern, which includes more than one more trip in addition to the trip to work.

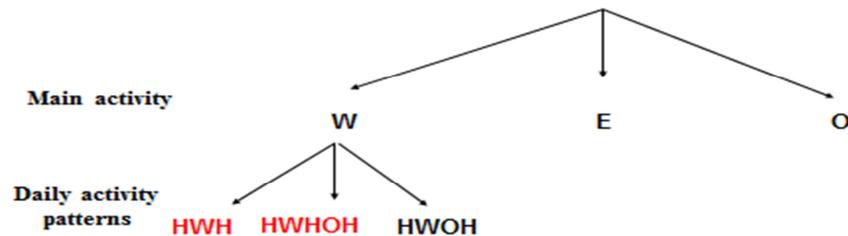


FIGURE 1. Structure of the daily- activity-pattern model

### ***The Case Study Sites***

Shefaram and Husn are medium-size cities, whose populations are 33,600 and 20,000, respectively, while Majd-Alcrum and Rami are small towns, whose populations are 12,700 and 7,800, respectively. Majd-Alcrum is entirely Muslim while Shefaram is mixed, with a Muslim majority (58.8%), a significant Christian community (27.0%) and a Druze minority (14.4%) (2). Rami is mixed, with a 51.5% Christian majority, 30.3% Druze and 18.3% Muslims.

Al Husn, located 65 km (40 miles) north of Amman and about 7 km (4 mi) South of Irbid, has a mixed population of Muslims and Christians, with a higher percentage of Christians.

### ***Main Socio-Economic Characteristics of the Samples***

Table 2 presents the main demographic and socio-economic characteristics of the samples, which consisted of 753 and 1,164 individuals in Jordan and Israel, respectively; 52% of the Jordanian sample and 49% of the Israeli sample are males, the average age being 30.9 (S.D = 16.22) and 33.0 (S.D = 18.9) in the Jordanian and Israeli samples, respectively. Table 2 shows that the income level among the Israeli Arab communities is higher than that of Jordan. Among the Israeli communities, 56.0% of the households had an income above the average, whereas only 22% of the households in Husn have incomes above the average. In contrast, more than half of the households in the Jordanian town have an income below the average, compared with 30.6% among the three Arab communities in Israel. In addition, the average number of cars among the Israeli Arab communities is 1.12, compared with 0.82 in Al Husn.

Most of the men in Israel have a driving license (90.0%), whereas only 50.4% of the women do. In Jordan, about half of the men have a driving license, while only 20% of the women do. In other words, the percentage of Arab Israelis who have driving licenses is about twice that of the Jordanians.

In contrast, the percentage of women and men with university degrees in Jordan is higher than that among the Israeli Arab communities. As Table 2 shows, most of the women in both Jordan and Israel work within their towns of residence, while most of the men work outside their home town; however, the percentage of Jordanians who work outside their towns is higher than of the Arab Israeli men.

**TABLE 2. Demographic and Socio-Economic Comparisons of Jordanian and Israeli Arabs**

Demographic Characteristic	Gender	Jordan	Israel
N	Women	358	593
N	Men	394	571
Age (mean)		30.95	33.02
S.D.		16.228	18.968
Participants Age 18 and older	Women	263	418
	Men	272	408
Income			
		54.0%	30.6%
		24%	13.4%
		22.0%	56.0%
Percentage of population with a driver's license (age 18 and older)	Women	20.9	50.4
	Men	59.6	90.0
Percentage of population with a university degree	Women	47.9	34.9
	Men	44.5	36.8
Work status (entire sample)			
		N = 746	N = 1164
Salaried		22.1	35.9
Self-employed		8.7	2.7
Unemployed		4.5	4.4
Pensioner		9.5	6.8
Housewife		18.6	17.9
Student		36.6	32.3
Work location (of those 18 and older) within the town	Men	32.2	47.9
	Women	60.3	57.1
Average number of cars in the household		0.82	1.12

## RESULTS OF THE ANALYSIS

We first examined the variation in travel behavior by gender of all survey respondents in the two communities who were at least 18 years old. We found a significant variation in travel behavior by gender and by community.

Table 3 summarizes the main differences between men and women in activity participation and in the amount of travel. Men in both countries make more trips and more tours than do women; and Israelis, both men and women, make more trips than do Jordanians. Despite the fact that Jordanians make fewer trips, they spend more time travelling; they also spend more time travelling both by motorized mode and on foot than the Israelis. Furthermore, men and women in Jordan spend more time travelling outside their towns than Israeli Arab women and men.

**TABLE 3. Summary Comparisons of Trips Made**

Variable	Gender	Jordan	Israel
Per Individual (Daily Mean)		N = 529	N = 1,043
Trips	Women	2.4	3.9
	Men	3.1	5.3
Tours	Women	1.2	1.6
	Men	1.3	2.0
Travel time (hours)	Women	01:11	00:53
	Men	01:47	01:31
Time Away from home (hours)	Women	05:23	05:22
	Men	06:40	07:54
Travel time by motorized means (minutes)	Women	55.6	43.1
	Men	97.4	79.3
Travel time on foot (minutes)	Women	16.3	9.8
	Men	11.0	8.4
Trips outside the town (Minutes)	Women	30.9	21.3
	Men	39.4	24.7

Table 4 presents the main daily activity for the sample participants. Six activities are considered: working, shopping, school/study, errands, social activities/leisure, and staying at home. The identification of the main daily activity is based on a combination of the hierarchy of activities (work being the most important) and duration.

The table shows a significant variation in the main activity by gender and community. In both countries, work is the main activity more for men than for women. The percentage of Arab women in Israel who work is twice that of Jordanian women. This means that education level cannot explain the participation of the women in the workforce without taking into consideration additional factors, as Jordanian women are more educated than Arab Israeli women.

It is interesting to see that men in Jordan are more used to going shopping than are women; in Israel, in contrast, women do more shopping than do men. The percentage of men and women in Jordan whose main trip is for study is higher than of women and men in Israel. Women in Israel make more trips for self-arrangement purposes than do men in Israel and than do women in Jordan. Overall, there are much fewer self-arrangement activities in Jordan, and these are hardly made by women. Participation in social activities is also very much lower for Jordanian women and men than for Israelis.

This lower participation in activities by the Jordanians compared to the Israelis means the former stay at home more. Table 4 shows that more than half of the women in Jordan stay at home and do not participate in any activities, whereas 19.1% of the Jordanian men stay at home. In Israel, more than one fifth of the women stay at home, whereas only 5.4% of the men do.

**TABLE 4. Main Daily Activity (over age 17)**

Trip Purpose	Men		Women	
	Israel (%)	Jordan (%)	Israel (%)	Jordan (%)
Work	63.9	55.1	38.2	19.4
Shopping	4.7	8.8	6.7	4.2
School/Study	6.4	10.3	7.6	12.5
Self-arrangements	4.9	1.5	7.4	0.4
Social activities/Leisure	14.7	5.2	18.8	8.0
Stay at home	5.4	19.1	21.2	55.5

### ***Mode Shares***

Figures 2 and 3 present the mode shares for commuter trips, Figure 2 for men and Figure 3 for women. As can be seen, there are significant differences in mode share between Israeli Arabs and Jordanians and between men and women. The bus is a significant transport mode among Jordanians, men and women, but it is hardly used by Israeli men and only marginally used by Israeli women. Taxis are also much more common in Jordan than in Israel, and they are used more by Israeli women than by Israeli men. On the other hand, Israelis, both men and women, use employer-provided transportation, which is unavailable in Jordan. There are significant gender differences in car use, men being car drivers significantly more so than women; this difference is much stronger in Jordan, as the proportion of car drivers among Jordanian women is very low. On the other hand, Jordanian women travel more as car passengers than Israeli women do, while women in both countries travel more as car passengers than men do. Women in both countries commute by walking more than men do. A similar analysis for all trips to all activities (not shown here to save space) shows very similar trends.

Various factors account for the foregoing differences that were found. First, of the four groups being compared, women in Jordan have the lowest share of driver-license holding. Car ownership in Jordan is lower than in Israel, which explains the overall lower share of car drivers in Jordan. Public transport in Jordan in general and in Al Husn in particular is well developed compared to that in the Galilee region of Israel; on the other hand, employer-provided transportation is common in Israel but completely lacking in Jordan. In both communities women are more likely to work close to home, and therefore walking is more popular among them than among men. Differences in occupational structure between men and women in both countries make men more dependent on the car for their job.

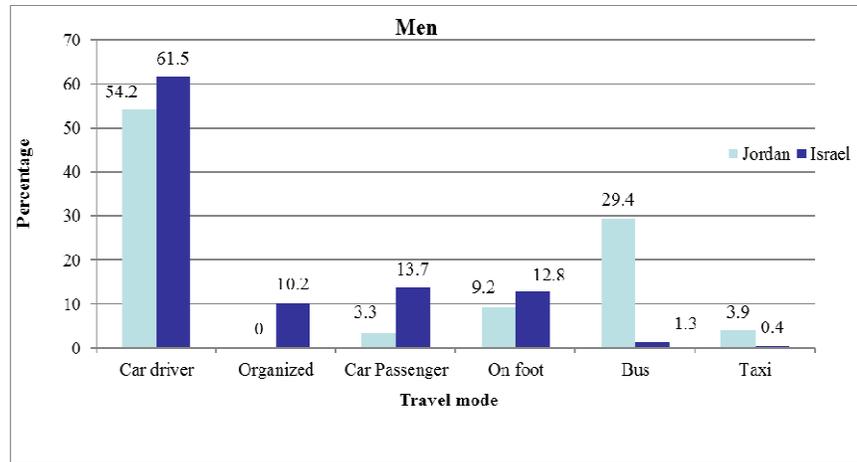


FIGURE 2. Commuting Mode for Men in Jordan and Israel

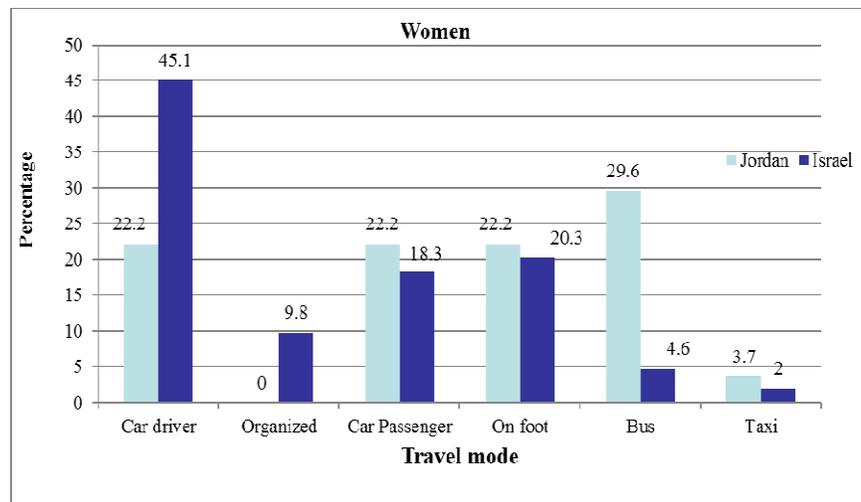


FIGURE 3. Commuting Mode for Women in Jordan and Israel

Table 5 shows the average number of all activities participation by purpose for Israeli and Jordanian men and women. Although, as mentioned above, men in both countries engage in work outside the home more than women do, the two communities reveal significant differences in regard to the travel behavior of men and women. Women in Israel are more used to going shopping than are men, whereas shopping is the man’s responsibility in Jordan. Differences in the amount of serving activities (Drop Off/Pick Up) between Arab Israelis and Jordanians are explained by the fact that the latter are rarely engaged in this type of activity. In Israel, the amount of serving stops is relatively high and, on average, men make more serving stops than do women, but the difference is not significant. It should be noted that usually men’s serving trips are for work-related purposes; e.g., giving an employee a ride, whereas women’s serving trips are mostly for dropping off and picking up children.

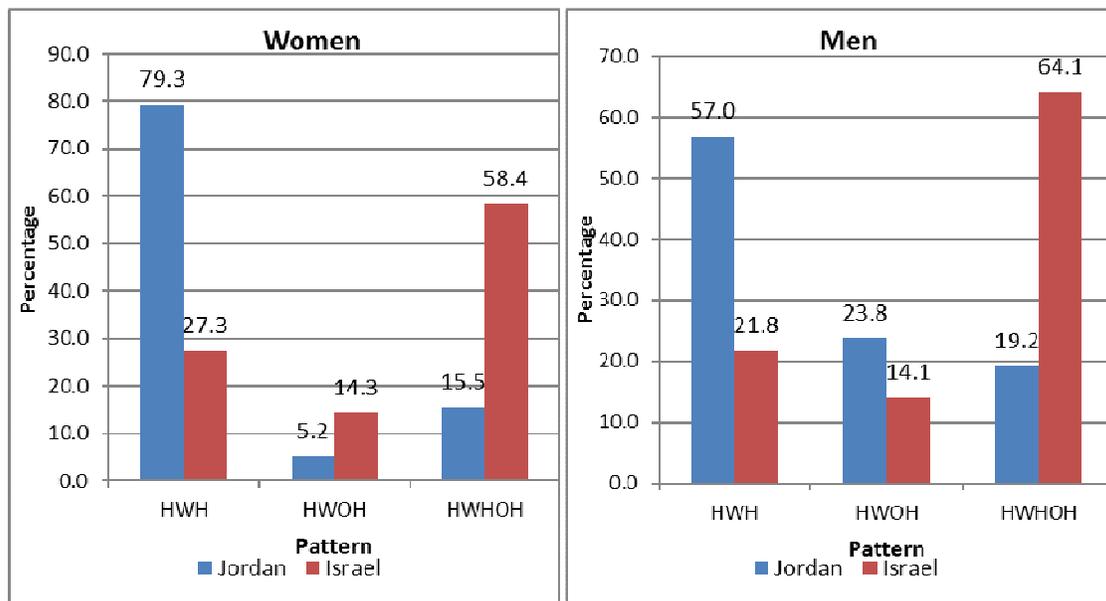
The findings show that Jordanians participate much less in social activities than do Israelis. In both countries, men’s participation in social activities is about 1.5 times that of women. The differences in the various activities may be explained by the differences between Jordan and Israel in socio-economic characteristics, including income level, car ownership, driving licenses, and the household size. These differences may also reflect differences in norms despite the fact that both communities have similar religions and, as a result, a similar culture. It is possible that the exposure of the Israeli Arabs, especially women, to the Jewish culture has affected the society norms of the Arab community, including their daily activity patterns and travel behavior.

**TABLE 5. Differences between Men and Women in Jordan and Israel in the Amount of Daily Activity**

Trip Purpose	Gender	Country	
		Jordan	Israel
Commuting to Work	Men	0.63	0.91
	Women	0.14	0.35
Shopping	Men	0.12	0.14
	Women	0.04	0.18
Drop Off/Pick Up	Men	0.05	0.28
	Women	0.01	0.21
School/Study	Men	0.07	0.04
	Women	0.07	0.05
Social Activities/Leisure	Men	0.13	0.82
	Women	0.09	0.50

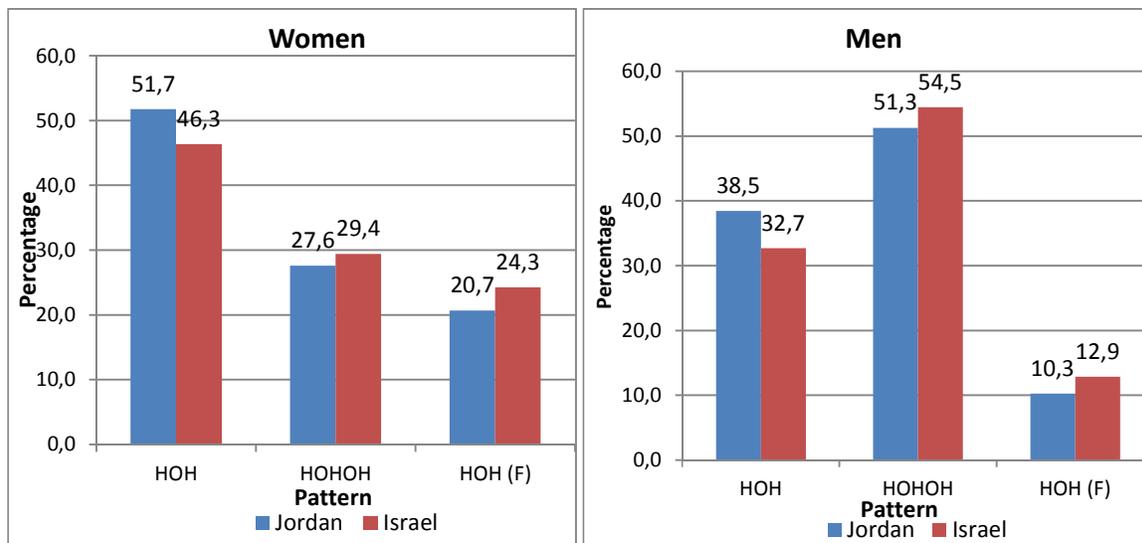
There are also gender differences in how people arrange their travel patterns. Figures 4 and 5 present the complexity of the daily activity patterns for women and men, respectively. The daily activity patterns were divided into two categories, the first when the main activity is work, and the second when the main activity is non-work.

In regard to commuter trips, Jordanians make significantly more simple tours from home to work and back compared to Israelis; and Jordanian women make more simple tours than Israeli women do. Finally the rate of simple tours among Israeli men and women is quite similar.



**FIGURE 4. The complexity of the daily activity pattern, by gender and country, when the main purpose is work**

In regard to daily activity patterns that do not include work trips, Figure 5 shows that women in both Jordan and Israel make significantly more simple tours from home to non-work purpose and back home, and this is true both by motorized mode HOH and on foot HOH (F), compared to men, who make more complex tours. In sum, the daily activity pattern for men is more complex even when they do not work. Women are more likely to have a simple daily activity pattern that, in many cases, includes a walking trip for a non-work purpose.



**FIGURE 5. Complexity of the daily activity pattern, by gender and country, when the main purpose is other than work**

#### Estimation Results for the Daily Activity Model

Table 6 shows the estimation results for the main activity model. This model estimates the probabilities of the main activity being one of three: work, education, or other. The work alternative is the reference.

The results show that people older than 65 are less likely to work than are younger people, and that people older than 35 are less likely to study. Men are more likely than women to work, but women are more likely than men to study. Married people are more likely to work and less likely to study. Education is an important factor for work participation, and people with an academic degree are much more likely to work than are people without an academic degree, an effect that is stronger in Jordan. Similarly, holding a driver's license is important, and those who do are more likely to work. Number of cars in the household is an important factor for work participation in Israel, but not in Jordan.

**TABLE 6. Estimation Results of the Main Daily Activity Pattern Model**

Variable description	Other		Study	
	$\beta$	t-statistics	$\beta$	t-statistics
Constant	1.933	8.05	1.149	3.18
Age 36-55, 55-65	-	-	-1.994	-3.22
Age 55-65	2.409	7.74	-	-
Age 66+	4.101	7.35	-	-
Gender (male)	-1.287	-8.14	-	-
Gender (male), Jordan	-	-	-0.750	-1.89
Gender (male), Israel	-	-	-0.471	-1.36
Status (married)	-0.382	-1.27	-1.819	-5.32
Education (at least a BA), Jordan	-1.233	-4.83	-	-
Education (at least a BA), Israel	-1.455	-2.79	-	-
Driver's License	-1.439	-8.46	-1.560	-5.49
Number of cars (Jordan)	-	-	-	-
Number of cars (Israel)	-0.260	-2.0	-	-

Likelihood with constants only = -1705.155  
 Final value of Likelihood = -970.440  
 $\rho^2 = 0.505$   
 N =

Table 7 shows the estimation results for the daily activity pattern model when the main activity is work. This model estimates the probabilities of the daily activity being either a complex or a simple pattern. The simple alternative is the reference.

The results show that people age 36 to 55 are more likely to make complex daily activity patterns than are other population groups. Men are more likely to have complex daily activity patterns than are women. People with a driving license are more likely to have a complex daily activity patterns. Working place affects the complexity of the daily pattern, and people who work outside their city of residence are less likely to have a complex daily pattern. This last result can be explained by the occupation type and by the commuting travel time.

Unsurprisingly, the more cars in a household, the more likely its members will have a complex pattern. Income also affects people's daily activity patterns: the higher the income, the more likely it is that the individual will have a complex travel pattern. The results show that Israelis are more likely to have a complex pattern than are Jordanians.

**TABLE 7. Estimation Results of the Daily Activity Pattern When the Main Trip Is for Work**

Variable description	Complex Pattern (HWHOH, HOHOH)	
	$\beta$	t-statistics
Constant	2.35	6.32
Age 36-55	0.79	3.57
Status (married)	-	-
Gender (male)	0.57	2.45
Under18 (study)	-	-
Driver's License	0.96	2.10
Work place (outside the town)	-0.7	-3.25
Number of cars in household	0.54	3.20
Income	0.149	1.86
Nationality (Israeli Arabs)	2.27	8.88
Likelihood with constants only = -538.237		
Final value of Likelihood = -364.170		
$\rho^2 = 0.301$		
N =		

## CONCLUSION

This research addresses the critical, but understudied issue of gender differences in travel behaviors in developing countries, in general, and in the Arab world, in particular. A rich data set of activity and travel diary surveys from both Israel and Jordan was analyzed by a variety of statistical means to reveal stark gender differences in travel behavior.

On the whole, men in both Israel and Jordan are more mobile than women: they make more trips and travel to work more frequently. Women exhibit a more simple daily activity pattern than men. Men disproportionately travel by private vehicle while women disproportionately travel as car passengers or walk.

The results also show significant differences in travel behavior between Israelis and Jordanians. Israeli Arabs make more trips, spend more time traveling, and spend more time at activities than do Jordanians. Israeli Arab women are more mobile than Jordanian women: they travel to work more frequently, spend more time in shopping, and make more child-serving trips. A considerable percentage of Jordanian women stay at home and do not participate in out-of-home activities. Transit provision in all the Israeli Arab communities is very low and, accordingly, has a low mode share. For Jordanians, in contrast, public transit is one of the major modes.

One of the principal findings of this study is that demographic and socio-economic factors have a significant effect on the diversity of participation in various activities. However, demographic and socio-economic characteristics cannot solely explain gendered disparities. The study results show that despite the fact that women in Jordan are more educated than Arab women in Israel, their participation in the workforce and other social activities is lower.

Therefore, the locational accessibility of employment and the availability of a car, as well, are critical. It may also be that the assimilation of Israeli Arabs within the Jewish population since the establishment of the State of Israel in 1948 has affected the Arab women's lifestyle, activity, and travel behavior, but this is a question requiring further research.

In sum, effective policy interventions must consider these distinctions in order to best address the development needs of the Arab world.

This paper tries to contribute to a better understanding of the various factors affecting differences in activity and travel behavior in the Arab world by investigating differences between men and women in two populations that share some commonality but are still quite different. Much further research is needed to better understand the weight of different factors: socio economic/demographic characteristics, culture and norms, land-use patterns, and the transportation system. To this end, larger samples from more diverse communities within the Arab world are needed as are more detailed studies of the various communities' characteristics, culture, and norms. More detailed surveys will enable the development of various latent variables representing culture, land use, and transportation supply.

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# Does the city's pulse beat at the same rate for men and women? Gender time-geography

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## ABSTRACT

Since the mid-70s, Household Travel Surveys (HTS) in France have been a major source of knowledge of the mobility of inhabitants within a territory. Since 2010, an "Urban Pulse" tool, developed by CETE de Lyon, has offered new perspectives for the use of travel survey data. Like the work based on gender time-geography, the tool enables an accurate understanding of the daily schedules of each individual within a territory, and focuses not only on trips, but also on what happens between two trips: who is where? For what type of activity? Thus, this paper focuses on gender-based spatio-temporal analyses of daily mobility in urban areas of the Rhône-Alpes region. What are the patterns/specificities in the spatial and temporal location of men and women in the cities of Lyon, Grenoble and Saint-Etienne? The "Urban Pulse" tool offers a new perspective on the diversity of urban areas, in the true sense of the term. Finally, these analyses highlight public policy issues that are raised when gender-based mobility is taken into account.

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**KEYWORDS:** Mobility; Gender time-geography; Household Travel Surveys (HTS); Schedule.

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## 1. OBSERVING THE PACE OF LIFE OF URBAN MEN AND WOMEN

Society evolves, leading to changes in the pace of life of each citizen. Travel behaviour is more or less shaped by factors such as population ageing, reduced work time, family composition, transport costs etc. Public policy-makers need to take into account the reality of the paces of life in order to make informed planning decisions within a territory. The "pulsations" that regulate the daily tempo of the urban frenzy are, among other things, the reflection of the person's occupational status (employee, student, retiree...), family situation (single or in a couple, with or without children...) but also gender.

Gender has proved to be a major factor explaining travel behaviour. The significant differences between men and women are particularly pronounced when it comes to commuting between home and work. Women's commutes are generally shorter than men's (Madden 1981, Hanson and Pratt, 1988; McLafferty and Preston, 1991; Lee & McDonald, 2003) and closer to home (Carron, 2007). This is particularly true for suburban households, where women have strong local anchoring, which contrasts with longer commutes of men, who tend to work further from home (Cailly and Dodier, 2007). The cross-analysis of consistencies/specificities in men's and women's behaviour helps to understand how the city moves.

Beyond the single issue of access to employment, we propose to go further into men's and women's pace of daily travel, by analysing their activities during the day. We have chosen to relate this analysis to "time-geography" research work. This approach, developed by the Swedish geographer Torsten Hägerstrand (1970), provides an analysis of the interactions between temporal and spatial constraints and experiences of individuals during their daily activities. This theory is based on a representation of the accessible space for an individual's activities at a given time of day, the potential access to urban resources and facilities and the individual's personal constraints, (Chardonnel, 2001). Other contributions (Bondi and Domosh, 1998; Scholten, Friberg, Sandén, 2012), show that time-geography provides a useful set of analytical tools which work successfully with the theory of social sciences, such as gender studies: "time-geography" shares the feminist interest in the quotidian paths traced by people, and again like feminism, links such paths, by thinking about

constraints, to the larger structures of society” (Rose, 1993). It therefore seems pertinent to observe daily travel behaviour differences between men and women, using time-geography principles mentioned in recent work (Kwan, 2007; McQuoid, Dijst, 2012; Scholten, Friberg, Sanden, 2012).

This article therefore focuses on spatial-temporal analyses of daily travel in urban areas according to gender. What are the major temporal and spatial differences of men’s and women’ daily trips? The aim of this analysis is to identify common factors and differences in men’s and women’s daily programmes, and then to identify their spatial distribution throughout the city. The analysis is based on a travel-pulse modelling tool, which draws on data from household travel surveys. Since 2010, the Urban Pulse tool, which has been developed by CETE de Lyon, has helped provide a detailed understanding of the daily schedule of individuals in a given territory. It also enables us to go one step further and provides an analysis of what happens between two trips. In other words, the analysis allows us to know who is present in the city, where, at what time and for which activity. It is a spatial and temporal analysis, also known as "urban pulse", which provides a visualization tool for observing the evolution of a population present in the city. This spatial and temporal analysis consists in identifying the schedule and the location of each interviewee, based on HTS (Household Travel Survey) data.

The raw material of the urban pulse tool is provided by the data from household travel surveys (HTS), carried out in French cities. The data from these surveys provides a picture of trips made by the interviewees on the day before the interview (all kinds of trips for all reasons). The survey therefore provides a reliable description of the travel behaviour of the inhabitants of a given area. Interviewees must accurately describe their travel behaviour, so as to provide representative information of daily mobility. With a sampling rate of 1 to 2%, we know the exact schedule and gender of the interviewees over 5 years old (declarative information). With over 150 HTS interviews, conducted in French cities since 1976, it is an important source of mobility information and highlights differences based on multiple criteria, such as gender.

The geographic areas concerned are the metropolitan areas of the Rhône-Alpes region: the cities of Lyon, Grenoble and Saint-Etienne, which have recent HTS data<sup>1</sup>. There are two main arguments to justify the choice of these urban areas: the first arises from the need to compare these neighbouring, but different cities: Lyon, capital of the Rhône-Alpes region, is a European metropolis; Grenoble is a dynamic regional centre, focused on research and innovation; while Saint-Etienne, which has a population equivalent to Grenoble, is marked by an industrial past and has more disadvantaged populations in comparison with the two other cities. The second reason consists in mitigating local specificities. By comparing the three cities’ data, we can identify consistencies and local specificities. Given the contrasted nature of the cities’ population, we can easily determine the importance of gender in daily travel behaviour analysis. Could it be used occasionally or systematically to understand the city’s pace?

This analysis is carried out in three stages. First, it is important to present the main social demographic data of the analysed territories. This information should be put into perspective with the knowledge of men’s and women’s travel behaviour at the national level. Once that is done, we can apply the urban pulse tool to examine the similarities and differences in men’s and women’s schedules in three Rhône-Alpes urban areas. Finally, the analysis of daily activities is completed with a spatial dimension that provides a more detailed view of the daily processes of “feminization” or “masculinization” of the three urban areas, depending on the time of the day. Can we identify a city of men and a city of women? Finally, the “urban pulse” tool provides a new look into the diversity of urban territories. These analyses highlight public policy issues that could take gender into account in their approach to mobility.

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<sup>1</sup> Unless otherwise stated all data used in this article are:

- Source: the standard CERTU household travel survey of the Lyon metropolitan area conducted in 2006 in Greater Lyon (1,100,000 inhabitants);
- Source: the standard CERTU household travel survey of the greater Grenoble region conducted in 2010 (370,000 inhabitants);
- Source: the standard CERTU household travel survey of the Saint-Etienne area realized in 2010 (350,000 inhabitants).

To avoid overloading the text, we use shorter references to data sources: “HTS Lyon 2006”, “HTS Grenoble 2010” and “HTS St-Etienne 2010”.

## **2. ACTIVITY AND MOBILITY ACCORDING TO GENDER: SITUATION IN THE RHONE-ALPES METROPOLITAN AREA**

### ***2.1 Main occupation by gender: a lower rate of activity for women***

The last household travel survey showed that there are generally few differences between Lyon, Grenoble and Saint-Etienne when it comes to occupation: about 40% of the population works (full-time or part-time), 25% is retired and 25% is made up of students, apprentices or school pupils. Only Saint-Etienne differs slightly from Lyon and Grenoble with a lower rate of workers and a stronger rate of retirees, unemployed and women remaining at home. In the three cities studied, the differences between men's and women's occupation rates are similar. The share of active men is higher than that of women, but the contrast is especially marked in terms of the type of employment: full-time workers are mostly men (in Lyon 44% for men, 30% for women), whilst part-time workers are mostly women (in Lyon 3% for men, 11% for women). In addition, those declaring that they stay at home are only women, reaching 12% in Saint-Etienne. The other main occupations are relatively balanced even though there are slightly more male students, apprentices, or school pupils and more women who are retired. These contrasts are homogeneous between Lyon, Grenoble and Saint-Etienne, which tends to prove that gender differences are little dependent on local contexts.

### ***2.2 Daily travel behaviour: women are as mobile as men but less motorized***

Mobility, described as the number of trips per day and per person, is quite similar between men and women in all three cities: around 3.65 in Lyon, 3.9 in Grenoble and 3.8 in Saint-Etienne. Women are slightly more mobile than men in Grenoble and slightly less so in Saint-Etienne. The differences between men and women are more visible if we observe mobility based on the main occupation. Women working part-time are those who on average make the most trips in a given day of the week (4.88 for the Grenoble area). They are substantially more active than men (4.44 for the Grenoble area) while overall, an inhabitant of the Grenoble area makes 3.9 trips per day on average. In the "students" and "retiree" categories, men appear to be slightly more mobile.

In terms of modal share, men figure as the largest users of private cars (in the Lyon area 52% for men, 46% for women), while women are more inclined to walk (29% for men, 36% for women). Public transport users are mostly females, while cyclists and motorised two-wheelers are mostly men. The three urban areas have similar trends although the volumes of each mode vary: in Saint-Etienne, the use of the car is higher while the share of public transport is higher in Grenoble and in Lyon. The modal share for cyclists is also higher in Grenoble.

These observations are consistent with national trends that reflect increasing use of the car for commuting (almost 41% in 1973 and a little more than 72% in 2007). According to the national HTS, more men than women travel to work by car, although women are starting to catch up (Roux, 2012). Women, who on average live closer to their workplace, use more public transport and walk more in comparison to men. Motorized two-wheelers are used marginally by women (Roux, 2012). The same observation can be made with commuting data from INSEE (French national statistics institute): whatever the French region, fewer employed women than men leave their hometown to get to their workplace (Houillon, 2004). However, a more specific analysis of the Lyon HTS (CERTU & Grand-Lyon, 2005) or the Savoie metropolitan area HTS (CETE de Lyon & Métropole Savoie, 2010) have shown that differences in the use of transport modes is not significantly linked to gender or to professional activity.

The difference between men and women in modal share is mainly linked to a smaller number of driving licences among women, whatever their age. In total, in the Grenoble area, 23% of women of driving age do not have a licence, compared to 10% of men. Analysis by age group reveals two categories for which licence possession is lower: over 65 years old and under 24 years old, where more than 35% of women do not have the opportunity to drive a car. Even if this difference between men and women is gradually decreasing, and the number of women with a driving licence is on the increase<sup>2</sup>, the contrast is still an explanatory factor of

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<sup>2</sup> Although one woman out of three did not have a driving licence in France in 1974, 76% of women had a driving licence in the first years following 2000 (INRETS-DEST, 2001). Robin (2010) shows from the national transportation survey (ENTD) that 76% of women over 55 years old possessed a license, compared to 64% in 1994 and 47% in 1982. This catching up phenomenon is also reflected in the frequency of car use, since 80% of women with a license drove regularly (every week) in 2008, compared to 77% in 1994 (+ 3 points).

mobility differences. In summary, we can say that women travel as much as men (sometimes more: part-time workers) but differently: more by foot or by public transport and less often by car, which is explained by a lower driving licence rate.

### **2.3 Daily activities: a deeper analysis of differences highlighted by the “urban pulse” tool**

The analysis of daily activities offers a more accurate reading of the pace of life for men and women. On their way from home (or on their way back home), activities conducted by women mainly concern purchases (16%), drop-offs or pick-ups (14%) and work (13%). When men leave their home, it is directly to go to work (19%) or to school (14%). Women tend to drop off or pick up others and take care of purchases.

Other studies provide a deeper insight into the differences between men’s and women’s daily activities. In particular a daily schedule survey conducted by INSEE in 2009-2010 shows that, in the “private” sphere, there remain major differences between the sexes when it comes to the management of daily activities linked to the family, leisure and children. Although today women are catching up with men in terms of driving licence rates, differences still exist in the use of modes of transport<sup>3</sup> or the use of their time.

To go further than a simple cumulative estimate of activities and trips, it is interesting to use the “urban pulse” tool to differentiate daily behaviour in terms of time and space. The analysis of the urban pace of life provides an insight into the activities of the residents of the three urban areas, throughout the day. Unlike the 2010 INSEE “schedule survey”, the “urban pulse” tool, based on HTS data, does not provide precise knowledge of the activities undertaken within the home. However, they help provide a more spatial vision than the national survey, even if it remains on major types of activities within a personal schedule.

## **3. TIME DISTRIBUTION OF MEN AND WOMEN: WHO DOES WHAT?**

### **3.1 Time spent per activity: differences between active males and females**

To refine the programme of activities throughout a day, we calculated the time spent per activity. Thanks to HTS data, we know that Mrs X left her home at 8:00 a.m to arrive at her workplace at 8:20 a.m, etc. We can deduce that, between 4:00 a.m and 8:00 a.m she was at her home, that she was travelling between 8:00 a.m and 8:20 a.m and that from 8:20 a.m she was at work, etc. Nine categories of daily activities were cross-analysed with the main occupation, retaining only the people who travelled at least once during a day. For example, according to the Lyon HTS conducted in 2006, a woman working full-time spends 6h32 at work and 46 minutes travelling in her day.

The following table presents only an excerpt of the analysis of this data, which provides a deeper insight into the differences between men’s and women’s daily schedules. First, we observe that both men and women spend most of their time at home, about 16 hours a day on average. However, working women spend more time at home than working men (30 minutes to 1 hour 20 minutes difference), equivalent to the students/pupils and retirees. In Saint-Etienne, women spend on average 30 minutes more at home than their counterparts in Lyon or Grenoble. This is probably due to the nature of the population, since the Saint-Etienne area has proportionately more retired women and women who stay at home than the two other urban areas.

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<sup>3</sup> Some authors suggest discrimination in terms of car access within the household (Paulo, 2007).

Greater Lyon 2006	Full-time workers			Part-time workers		
	Women	Men	Diff. women-men	Women	Men	Diff. women-men
1- Home	14h 57	13h 46	+ 71 min	17h 06	16h 13	+ 53 min
2- Work	6h 32	7h 12	- 40 min	4h 09	4h 11	- 2 min
3- Study	0h 01	0h 00	+ 1 min	0h 00	0h 05	- 5 min
4- Purchases	0h 20	0h 12	+ 8 min	0h 28	0h 13	+ 15 min
5- Drop-offs or pick-ups	0h 09	0h 05	+ 4 min	0h 11	0h 03	+ 8 min
6- Leisure	0h 14	0h 15	- 1 min	0h 15	0h 19	- 4 min
7- Others	0h 35	0h 35	0	0h 41	0h 58	- 17 min
8- Travelling	0h 46	0h 55	- 9 min	0h 46	1h 01	- 15 min
9- Outside investigation area	0h 22	0h 56	- 34 min	0h19	0h 54	- 35 min

**FIGURE 1. Average time spent per activity by the inhabitants of Greater Lyon who travelled**

(Source: Standard HTS Certu, Cete de Lyon)

The time spent at work, about 6 hours for full-time workers and 4 hours for part-time workers, is practically equivalent for men and women but situations may vary: a man working full time will tend to work longer hours than women (especially in the Lyon area where men remain 40 minutes more at work than women). On the other hand, women part-time workers spend either the same or significantly more time at work than men part-time workers: in Grenoble they spend 1 hour more at work than men. There is less contrast in the time spent in studies for students/pupils (about 6 hours), with a slightly longer time for males than females.

In the three urban areas, the time spent on purchases is systematically more significant for women when they work, but equivalent to students/school pupils and retirees. The same observation can be made for the time spent on drop-offs and pick-ups, with women working full-time or part-time spending twice as much time on this activity than men, whereas the difference does not appear for the other categories. On the other hand, women spend less time on leisure activities than men. The difference between men and woman is especially marked for leisure activities for students/pupils and part-time workers. For example, a female part-time worker in the Grenoble area spends on average 15 minutes per day on leisure activities, compared to 24 minutes for men in the same situation.

The time spent travelling is generally less for women. Once again, this difference concerns the employed while there are fewer contrasts for other categories. We can assume that men, who are more motorized, spend more time travelling because they work further away from home. The study showed that, for women, juggling domestic obligations, work and other daily activities creates a need for their workplace to be near home (Nelson, 1986). Finally, the time spent outside the geographic area of investigation is also significantly less for women who work. An employed man spends 30 minutes to 1 hour more outside the investigation area than women. The opposite is true for students/pupils where it is women who spend more time outside the investigation area than their male counterparts. It can be noted that in Saint-Etienne, active men working full-time spend more than 2 hours per day outside the perimeter of the HTS. That is twice the time spent by their counterparts in Grenoble or Lyon and probably a sign of a more difficult access to local employment.

Time spent	Home	Work	Purchases	Drop-offs-pick ups	Leisure	Others	Travelling	Outside investigation area
Female full-time workers	15 h	6 h	18 min	9 min	14 min	38 min	44 min	31 min
Female part-time workers	17 h	4 h	26 min	12 min	15 min	42 min	46 min	19 min
Difference in comparison with men	1 h less for men	= / more time for male full-time workers; time is less for male part-time workers	10 min less for men	5 min less for men	10 min more for men	=	15 min more for men	45 min more for men

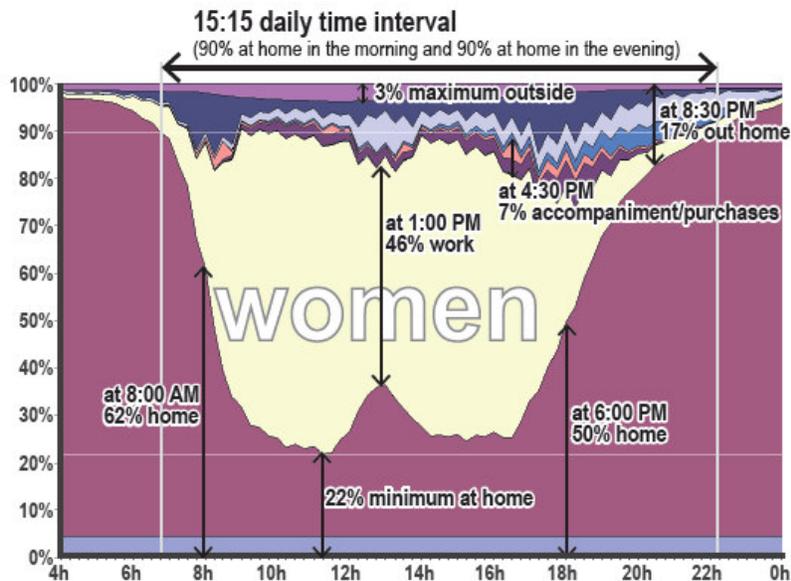
**FIGURE 2. Average time spent on activities by the inhabitants of the Lyon, Grenoble and Saint-Etienne urban areas who travelled**

(Source: standard HTS Certu, Cete de Lyon)

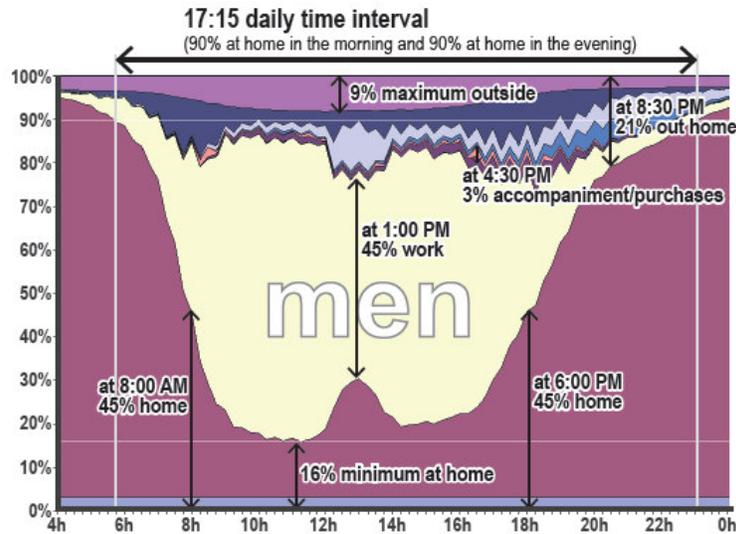
Thus, for a broadly equivalent time spent at work, a woman spends more time at home. The active woman whether a full-time or part-time worker spends more time on purchases and drop-offs/pick-ups than an active man and less time on leisure activities and travelling. On the other hand, men are more likely to travel outside the HTS investigation area, generally to attain more qualified jobs. Working years coincide with the period in family life when one raises children. Women still tend to take care of the daily management of the family. The distribution of the daily activities of women and men confirm that even when they work, it is women who manage the activities or the tasks of the household. Spare time for part-time workers tends to be used to look after children in the case of women and for leisure activities in the case of the men<sup>4</sup>.

### 3.2 Daily activities: a more intense programme for women who work

It is possible to refine the analysis of the time spent on daily activities by offering a two-dimensional reading. On a graph, we crossed the rate of presence of men or women with one of the 9 categories of activities within daily schedules. The form of the graph highlights the share of men and women that carry out a given activity. The students/pupils and retiree categories present few gender differences in the schedule. For students/pupils, we can note a similar share between men and women. The peak in travelling at around 8:00 a.m is very pronounced with male or female students/pupils, while presence at home is rather similar: at least 13% of men, at least 15% of women. For retirees, the pace of life of men and women is also rather similar. Once at retirement age, the pace of life of couples tends to resynchronise. Thus, men's and women's schedules are relatively similar for categories that do not have children or no longer look after children. On the other hand, among the employed, contrasts appear in the sequence of daily activities that we have sought to analyse more deeply.



<sup>4</sup> The daily schedule survey conducted by INSEE in 2010 tends to confirm this, since employed men spend 2h06 every day on household activities compared to 3h27 for women. In contrast, men spend 3h28 on leisure activities, compared to 2h48 for women.



**FIGURE 3. Diagram of the daily share of activities for women/men working full-time in the Lyon, Grenoble and Saint-Etienne urban areas** (Source: standard HTS, Certu, Cete Lyon)

*Reading: at 7:00 a.m, 90% of women are at home, 4% will not leave their home while the remaining 86% will conduct (or have already conducted) at least one activity during the day.*

The first differentiating criterion between employed men and women concerns time spent at home. We already found that on the whole, women spend 1 hour more at home than men. We can find this trend in the sequence of daily activities, as at any given time of the day at least 20% of full-time women workers are at home, compared to 16% of men. The same finding is made for the lunch break of the employed, where women are more numerous at home: 38% of women compared to 31% of men. These rates of presence at home are close to average within the Lyon and Grenoble areas, while they are systematically higher for the inhabitants of the Saint-Etienne area.

Outside the home, accompaniment (pick ups or drop offs to the nanny, to nursery, to school...), are more frequent for women and tend to be concentrated around 4 school time slots: 8:30 a.m, 11:30 a.m, 1:30 p.m and 4:30 p.m. Similarly, purchases are clearly visible among women from 10 am onwards, but are mainly found late afternoon, between 5 p.m and 7 p.m. Leisure activities mainly take place at the end of the day and are more marked for men. Other activities (administrative tasks, looking for a job, eating outside the home, visits...) are generally concentrated during the lunch break and the evening for men, while they are more evenly spread throughout the day among women. The explanation for this phenomenon relates back to the nature of the activities that fall within the category referred to as "others" and which we can assume are different for men and for women. Men are more likely to spend their lunch breaks outside the home, which explains the concentration of activities in the "others" category during this period. Women tend to conduct these other activities (administrative tasks for example...) in the morning and during the afternoon. The distribution of these activities in a day tends to confirm that the chores of women (e.g. picking up children from school and meal preparation) are more numerous and more sensitive to time constraints than those undertaken by men (e.g. DIY activities) (Mac Donald et al., 2005).

The sequence of the "work" activity presents the same form for men and women. Presence at work is therefore approximately the same with one difference: time of arrival at work, which is earlier for men. In the Grenoble area, 32% of men working full-time are at work at 8:00 a.m, compared to 22% of women. Women make up for this later start at work during their lunch break: at 1:00 p.m, about 45% of men remain in their workplace, compared to 48% of women. We can equally note that the "outside" category, which generally corresponds to a professional activity outside the investigation area, varies from 4 to 8% for men (implying that at least 4% of men are outside the investigation area all day) and from 2 to 4% for women, with a peak in the middle of the day. Finally, trips are much more marked for men, and are primarily made earlier in the day during peak hours and during the lunchtime period. For women, the time spent travelling is quite similar to men, although trips are spread more throughout the day. Indeed, they visibly travel more in off peak periods.

The main piece of information on daily schedules provided by the graphs concerns the overall duration of men’s and women’s daily activities. For this, we can observe the period of the day at which less than 90% of the employed are at their home (in others words, the time that they begin to leave the home and the time at which they are almost all returned). On average, for men, this period spreads from 5:45 a.m to 11:10 p.m and for women from 6:45 a.m to 10:15 p.m. In all the urban areas analysed, the duration is shorter for the women. The overall period during which women conduct their activities outside the home is at least 2 hours less than that of men! In others words, women carry out as many, or even more activities, but within a shorter period of time!

#### 4. SPATIAL DISTRIBUTION BETWEEN MEN AND WOMEN: WHO IS WHERE?

##### 4.1 Location throughout the day: are some areas more feminine than others?

Territorial analyses based on urban or peri-urban residence, show that travel behaviour remains relatively homogeneous<sup>5</sup>. Peri-urban residents use their cars more and travel further, but the daily activities of households in cities and peri-urban areas are quite similar. One of the explanations concerns the double territorial status of the household; in other words, the travel behaviour differences between men and women level out spatial urban/peri-urban residential differences. It remains to be understood how this “double status” of men and women is translated from a spatial point view? In addition to temporal differences in the daily activities of the men and women, are there also differences in spatial presence within territories (and not only from a residential point of view)? At a given time of day, do territories “have a gender” to resume the expression of Bard (2004)?

Today, urban planning strategies are essentially based on analyses of the resident population in a city. The “urban pulse” tool allows an observation of the population that is physically present at a given time and shows if between two periods of one day, certain areas have a stronger female presence than others, or on the contrary if some areas have a stronger masculine presence. Thanks to HTS information, we know that Miss X left place A at 8:00 a.m and arrived at place B at 8:20 a.m, etc. We can deduce that between 4:00 a.m and 8:00 a.m she was at place A, that between 8:00 a.m and 8:20 a.m she was travelling and that from 8:20 a.m she was at place B, etc. The analysis proposes to observe the share of women present per sector at two moments of a given day. The comparison is made between 4:00 a.m, time at which the great majority of inhabitants are still at their home and 10:30 a.m, time at which most daily activities have begun (school, work, purchases...). If we observe the densities of inhabitants at 4:00 a.m and the densities present later in the morning, the gender of the territories obeys a daily rhythm. Certain areas that have a stronger masculine presence at night have a stronger feminine presence in the morning and vice-versa. We can identify if a district or a town is “feminized” (this implies that the ratio of women present has increased) or if it is “masculinized” (this means that the ratio of women present decreased).

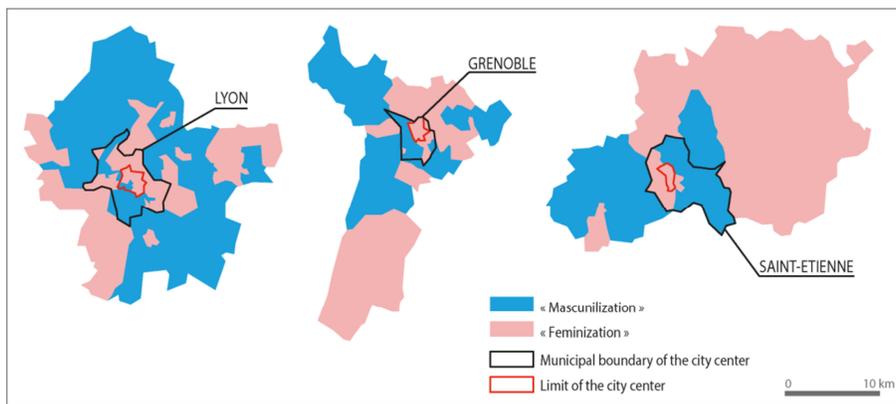


FIGURE 4. “Feminization” or “Mascunilization” of the Lyon, Saint-Etienne and Grenoble urban areas

(Source: standard HTS Certu, Cete Lyon)

<sup>5</sup> Refer to the thesis by Clotilde Minster (IFSTTAR) “Mobility analysis of inhabitants of rural locations as a contribution to comprehension of the demographic revival and sustainability of these spaces”.

Overall, we can note common trends for the three urban areas studied: the densest central areas tend to become more feminized while the suburbs see the share of men grow. As confirmed by INSEE data, the nature of employment in each geographic area seems to explain why an area becomes feminized or masculinized. However, although jobs have an impact on the travel behaviour of the population, this is not the only reason for the daily movements of men and women. Indeed, the location of shops and other facilities, especially those related to children, (nurseries schools...) can also account for the masculinization or feminization of certain areas.

#### 4.2 “Masculinization” or “feminization” of a city: towards a typology of urban areas

In addition to identifying general trends, we can conduct a deeper analysis by identifying the intensity of daily movements: does the area become more feminized due to the arrival of more women or due to the exodus of men?

An analysis of the spatial nature of men’s and women’s movements in the Lyon urban area, shows that the areas near the city centre feminize or masculinize due to an increase in population in favour of one gender or the other. These areas provide a large number of jobs and are characterized by contrasting economic activities. In certain cases, men and women literally switch areas: some come whilst others leave. For example, the eastern part of Lyon (an area with hospitals) is marked by an arrival of women and a loss of men, while in the suburban towns of Chassieu or St-Fons (with numerous industrial jobs) the opposite occurs. Suburban areas, which are not very attractive in terms of job offers, essentially explain the difference between the departures of men and the departures of women. The northern and southern suburbs of Lyon are faced with a greater departure of women than men, while in the eastern and western suburbs there is a more significant departure of men. This tendency can also be found in the urban area of Saint-Etienne where the sectors to the east near the towns of Rive-de-Gier and Saint-Chamond are feminized mainly due to the departure of more men than women; men leaving their home to work in Lyon area.

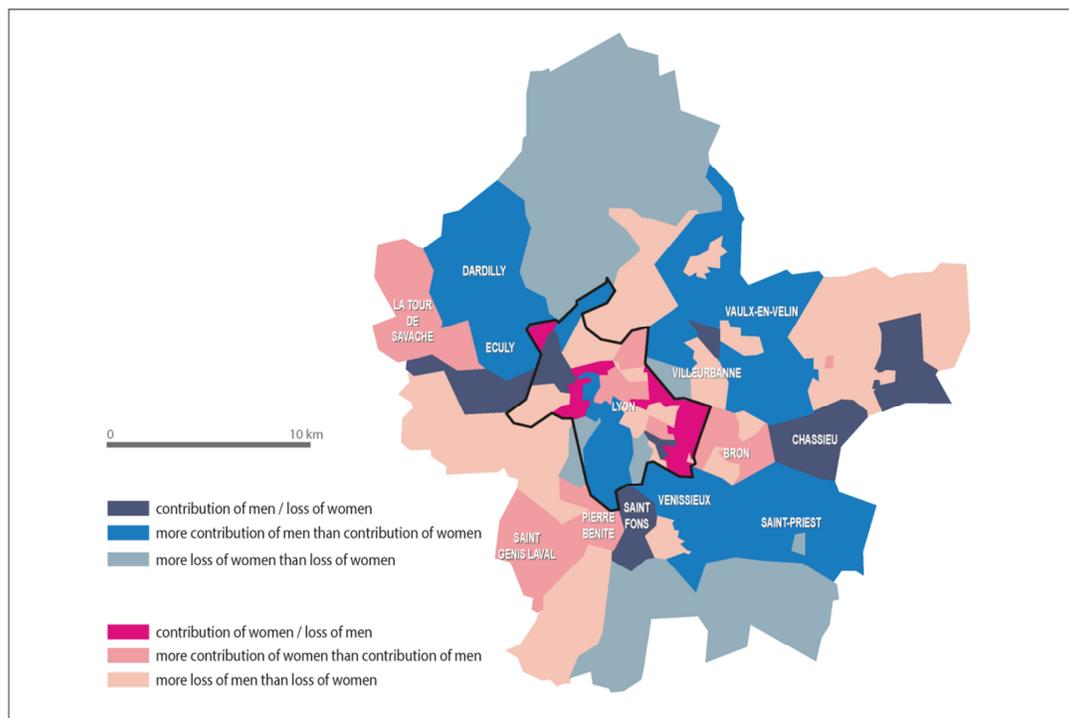


FIGURE 5. “Feminization” or “Masculinization” within the Lyon urban area

(Source: Standard HTS Certu, Cete Lyon)

The pace of daily activities and the travel behaviour of women have an impact on the household’s place of residence. Central locations appear to be important to women, due to their varied activities. The best compromise, taking into account the different types of activity within households would be to live in both dense and mixed environments, with all types of services easily reachable for each individual (Carron, 2007). Central and more “women friendly” locations would help women to juggle both their private and professional

life and facilitate daily routines (Butler and Hammett, 1994). On the contrary, living in suburban areas makes daily activities more difficult, especially for women, and will often explain the need for a part-time job, more frequent in these territories (Carron, 2007). The work identified the risk of “spatial entrapment” of women in suburban areas (Nelson, 1986; England, 1993): women are willing to accept lower-paid jobs near their home in order to facilitate their work-home balance.

## 5. CONCLUSION: A GENDER TIME-GEOGRAPHY

This article aims to provide a deeper insight into the spatial-temporal dynamics of the daily mobility of men and women through an innovative “urban pulse”, tool developed by the CETE de Lyon. Modelling of the daily pace of life in urban areas in the Rhône-Alpes region (Lyon, Grenoble and Saint-Etienne), provides more precise knowledge of the differences in the behaviour of men and women.

The analysis first shows that there are differences in the pace of life of men and women for the employed, but not for students and retirees. We can question if the differences observed between employed men and women are related to the presence or not of a child as the period of employment corresponds to the period in life during which one raises children. It would therefore be useful to conduct further investigations for the employed category of the population, by integrating the composition of the household: couples with or without children, single parent families, single employees...

This analysis also shows that the location of men and women in time and space is a reflection of a territory’s characteristics. It is closely linked to the nature and the location of economic activities, but undoubtedly also to the availability of facilities and services. Public decision-makers must therefore bear in mind that men and women do not have the same activities and that their geographic dispersal is different. Facilities and services must be adapted to the different requirements of men and women and take into account whether territories are more feminine or more masculine.

In particular, this work provides a gender “time-geography” which may be characterized by certain clichés: the daily schedule of active women is shorter than that of active men, with more time-related constraints and is therefore differently paced. Travel distances are shorter and less dependent on the car while destinations tend to be closer to the city centre than for men, due to the type of jobs and other facilities. The space-time prism of men and women drawn by this analysis indicates that daily behaviour is still significantly different.

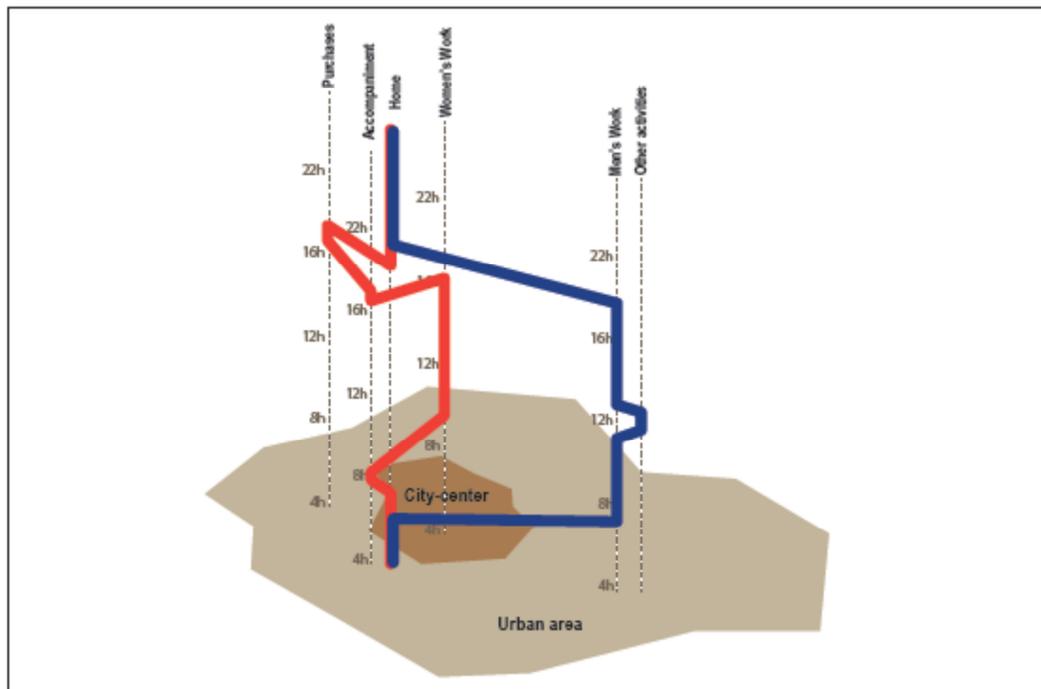


FIGURE 6. Simplification of space – time behaviour of men and women (CETE Nord-Picardie)

## ACKNOWLEDGEMENTS

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# Travel behavior of working mothers in Tokyo metropolitan area, particularly addressing those with small children and their residential areas

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## ABSTRACT

In Japan, although the women's employment rate has improved, child-rearing mothers' burdens remain heavy. A preschooler would have to be attended by an adult, whose physical burden would certainly increase. Those physical burdens might be reduced through policy measures to improve transportation systems or the built environment. This study was undertaken to ascertain how different the travel behaviors of working mothers of nuclear families in Tokyo metropolitan area are from other attributes, especially the actual conditions of taking their children to day-care on the way to work. The characteristics were clarified by comparing 20–39-year-old employed women with preschoolers and women with different household compositions and resident area attributes. The study uses results of the Tokyo Metropolitan Area Person-Trip Survey, conducted in 2008. Looking at households with children, households with children under 5 show large numbers of daily trips that aimed to drop off and pick up. It also shows high portions of on-foot and public transportation, and long daily travel time. From the point of view of the time required from home to workplace, there was a time difference of about 10–20 min depending on whether there was day-care related travel while commuting from home to the workplace. Particularly, results show that women living in the suburbs and working in central Tokyo, took a train for commuting after taking their children to day-care by bike or on foot. Therefore, they spent as many as 70–80 min, on average, going from home to work.

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**KEYWORDS:** Travel behavior; Working mother.

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## INTRODUCTION

The aim of this study is to clarify the actual condition of working mothers' travel behavior in the Tokyo metropolitan area the presence or absence of preschooler and regional features point of view.

Creating a social environment that is friendly to women, which enables them to work while child rearing, is an important policy issue in Japan. This is because the declining birth rate and an aging population which is causing a decline in force population, could be supplemented by increasing women's employment rate. According to the survey conducted by the Ministry of Health, Labor and Welfare, force population has been gradually declining every year. There were around 68 million in 2000; however, the number had decreased to around 66 million in 2012 (1). It can be estimated that force population would continually decrease in the future, based on the population projection that population between age of 15~65 is going to decrease from 8.2 million in 2010, to 6.8 million in 2013 (2). The employment rate of 30–34-year-old women increased from 50% in 1990 to 64% in 2010 (1). However, 25% of employed women aged 30–34 are non-regularly employed (1). The women's employment rate has increased during the past twenty years not only because of an increased percentage of unmarried working women, but mainly because of the increased percentage of employed married women.

Although the women's employment rate has improved, the fact that mothers' heavy burdens remain, caused by child-rearing, has been indicated. The burden of mothers with children under six (preschooler) is specifically regarded as a problem. The increasing pattern of residing in nuclear families has made it difficult for mothers to return to work after child-rearing leave. Day-care centers for children (including preschool and kindergarten) are invariably too few, so households have difficulty arranging for their children to attend day-care. Even if they can, they must take their children to day-care in addition to work, housekeeping, and child rearing. Transporting children to day-care might be a heavy burden because it must be done in busy commuting times and within a tight time constraint. However, no quantitative research has been done to assess it.

Different from cases in which children attend elementary or junior high schools, it is difficult to reduce the time necessary for transporting children to day-care. Even if lower crime rates and public transportation improved to the degree that children can travel by themselves, it is still difficult to have preschoolers act unattended. A preschooler would have to be attended by an adult, whose physical burden would certainly increase. Although it is almost impossible to stop transporting their children to day-care completely, physical burdens might be reduced through policy measures to improve transportation systems or the built environment. However, travel behaviors depend strongly on conditions of public transport and vehicle ownership, so working mothers' travel behaviors and burdens of transporting their children to day-care might vary depending on whether they live in urban areas or in the suburbs and whether they live near railways or not. Consequently, to improve the environment so they can work easily while rearing their children, it might be important to clarify quantitatively the actual traveling conditions and the level of burdens attributable to child rearing of mothers with preschoolers' according to the characteristics of residential areas.

Therefore, this study was undertaken to ascertain how different the travel behaviors of working mothers of nuclear families with preschooler in Tokyo metropolitan area from other attributes, especially the actual conditions of taking their children to day-care on the way to work.

## PREVIOUS STUDIES

This chapter presents a review of studies examining the difference of women's travel behaviors according to the built environment, especially mothers' burdens attributable to transporting their children.

Recent studies particularly address the putative relationship between the difference of built environment and children's travel behaviors (3-6). They are based on the ideas that the more easily children can travel alone, the lower the burden on parents in transporting their children. Using the National Household Travel Survey (NHTS) conducted by United States Department of Transportation, McDonald (3) sought to verify in his hypothesis that because children can travel alone in highly populated urban areas, their mothers' burden of transporting children should be reduced, which could not be confirmed. Children turned out to be able to travel alone in both conditions: in highly populated urban areas, they were able to travel alone on foot; they were able to use school buses or drive vehicles themselves in thinly populated suburban areas. In 2001, Weston (4) analyzed the travel behaviors of 13–15-year-old children by gender with NHTS, suggesting that their travel behaviors differed between sexes. They were affected by the built environment. He pointed out that young women, who are subjected to greater danger of being kidnapped, avoided commuting on foot, by cycle and bus without being attended by their parents, which might explain gender differences of travel by young people. Waygood et al. (5) (6) compared the travel behaviors of 10–11-year-old children in the Kyoto–Osaka–Kobe area in Japan to those of children in the United States, based on their hypothesis that children can transport themselves in more advanced transit oriented development (TOD) and that the burden of parents for transporting their children should be reduced. Results show that the percentage of Japanese parents transporting their children was 15%, which was very low compared with 65% in the United States. Other results suggest that Japanese children should be remarkably more independent of their parents and go to school more by themselves.

This research also specifically assessed the relationship between the built environment and reduction of mothers' burdens attributable to transporting their children. However, unlike most previous studies, targeting elementary and junior high school students sufficiently old to commute independently, i.e., "children's self-reliant travel," this research specifically assessed "the burden of mothers with preschoolers", who have practical difficulties going out alone. Additionally, previous studies have compared built environments using indexes including urban/suburban environments, level of TOD, urban density, and ease of walking. Considering that mothers' travel behaviors and burdens of transporting their children should be affected by whether they

live near the railway or not, the present study categorized built environments into three: central Tokyo, suburbs along railways and suburbs distant from railways. The method of classification was unique to this research and different from those of previous studies.

## **ANALYTICAL METHODS**

### ***Methodology***

Analyzing built environments and quantitatively clarifying the characteristics of working mothers with children under five years old in terms of travel behaviors and behaviors of transporting their children to day-care, this study inspects two hypotheses. One is that households with juveniles travel more, for the purpose of dropping off and picking up, than households without. Their total hours spent on dropping off and picking up is a matter of great importance. Another is that the travel behavior of households with juveniles changes depending on residential region. To inspect these hypotheses, this study compares the travel behavior of 20–39 year old working women according to residential area and by household composition. The study uses results of the Tokyo Metropolitan Area Person-Trip Survey, conducted in 2008.

To be more specific, comparison of the total number of average daily trips and travel time which were classified by households with children under 5 and without, and also the residential region they live in. Furthermore, this study focuses on dropping off and picking up their children while commuting in the morning. Also, to clarify the time loss emerged by taking their children to day-care center, this study compares time to commute making detours to the day-care center and ones without.

### ***Data***

The Tokyo metropolitan Area Person-Trip Survey is a sample survey which assessed actual conditions of a person's daily travel and helped elicit transportation plans in urban areas in particular. The examinees were selected randomly from households who live in the Tokyo metropolitan area. The questionnaires were sent to the target households where they were completed and returned by mail or via the internet. It was a large-scale survey with a sampling rate of 2.12% and the sample number of 730,000. The survey consisted of two types: individual and household questionnaires. With the former, destination, time, purpose, and transportation were revealed; with the latter, sex, age, occupation, and possession situations of driver license and car of all the members of a household. It showed a person's individual travel behavior by composition of the household in which he or she resided.

Tokyo Metropolitan Area Person-Trip Survey data was aggregated into categorized sections which had been decided by Tokyo Metropolitan Transportation Planning Conference, the head of investigation practice, then announced officially. Although statistical tests are usually necessary to evaluate the significance of a difference, data of individual samples could not be used, so the comparison was made using aggregated values.

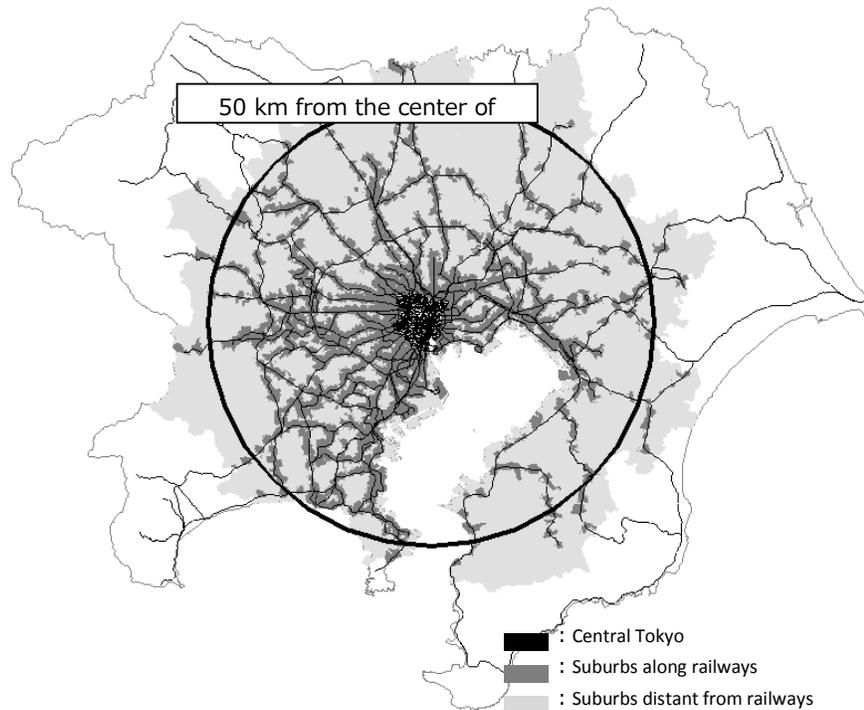
### ***Area Types***

The Tokyo metropolitan area has an urban structure in which workplaces are highly integrated in the city center. Residential areas are spread in the suburbs and are connected by railways. The railways are multiply networked in both radiating and circular directions in a highly complex network that is rare even when regarded on a world scale. The Tokyo metropolitan area Person-Trip survey (2008) showed that the Tokyo metropolitan area's modal share of railways and cars were 30% and 29%, respectively, with railways being used more than cars for the first time.

To conduct travel behavior analyses considering different area features as indexes of built environments as described in former chapter, this study categorized the circle area with a radius of 50 km from the center of the city into three parts: central Tokyo, suburbs along railways and suburbs distant from railways. Business functions concentrate in central Tokyo, with a high level of railway service. Suburbs along railways have a high level of railway service and integrated city functions near train stations. The suburbs that are distant from railways are mainly residential zones that are distant from any train station. Their bus service level is low. The concrete classification method is presented in Table 1.

**TABLE 1. Area Types and Area Features**

Area types	Area range	Mean population density	Service level of public transportation
Central Tokyo	8 wards in central Tokyo (about 10 km from the center)	137 people /ha	Both the station density and travel frequency are extremely high.
Suburbs along railways	Area from 1.5 km from the station (50 km from the center)	80 people /ha	Station density and travel frequency are high.
Suburbs distant from railways	Ather areas (50 km from the center)	21 people /ha	With long distance from a railway station.



**FIGURE 1. Area Types**

### ***Household Types***

The household questionnaires from the Tokyo Metropolitan Person-Trip Survey include the number of people appertaining to a household, their sex, and age but not their family relationship. Not being able to comprehend their relationship with family members precisely, an alternative rule was consequently established to assume the family relationship regarding their sex and age.

First, households with employed women aged 20–39 were selected. In a household, a man with an age difference within 20 years was regarded as the woman’s husband. Boys and girls under 16 with an age difference of greater than 20 years were regarded as children of the woman residing in the household. Under these conditions, the household types shown by Table 2 were defined. Whereas this study targeted households with preschoolers younger than 6, the person trip survey showed data for every five years. Therefore, the households with children were divided into households with children under five years old and households without children under five years old.

**TABLE 2. Household Types**

Household types	Population (thousands)				Total	Ratio
	Central Tokyo	Suburbs along railways	Suburbs distant from railways			
I Single-person households	77	480	101	658	22%	
II Men and women households	28	294	107	429	14%	
IIIA Men, women and children (under five) households	11	147	75	234	8%	
IIIB Men, women and children (five and older) households	5	99	74	177	6%	
IV Others	539	864	638	1,554	51%	
Total	173	1,884	994	3,052	100%	

(Source: Tokyo metropolitan Person-Trip survey, 2008)

To see the composition ratio of 20–39-year-old employed women according to household type, single-person households and households with men and women accounted for about 40%. Households with children under five years old and households without children under five years old or younger respectively accounted for 8% and 6% of the total. Others accounted for about 50%, most of whom were women living with their parents.

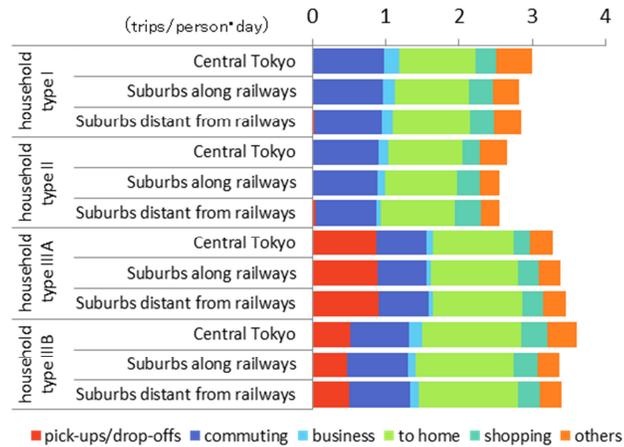
## FEATURES OF YOUNG WORKING WOMEN'S TRAVEL BEHAVIOR

As described above, to elucidate working mothers' travel behavior, addressing "presence or absence of children under five years old" and "differences of area types," this study used only aggregate results for groups I–III among the household types presented in Table 2.

### *Average Daily Trips*

The number of average daily trips of women with children (household type III) was larger than that of other household types. The difference among residential areas was not large. The difference was attributable to the trips related to dropping off and picking up. The average daily trips attributable to dropping off and picking up of household type IIIA was higher than that of household type IIIB. Although some trips were dedicated to the dropping off and picking up even in household type IIIB, they traveled more for commuting. Results suggest that when children are younger, the number of daily trips for picking up and dropping off should be larger and that when they become more independent, their mothers should return to work and the number of times commuting should become larger.

The number of trips for dropping off and picking up included all the trips for women taking their husbands to railway stations, their fathers or mothers living in their neighborhood to hospitals, and their children to day-care, elementary schools or cram schools. However, because households without children had few trips for dropping off and picking up, it might be inferred that most such trips are for transporting their children to or from someplace.



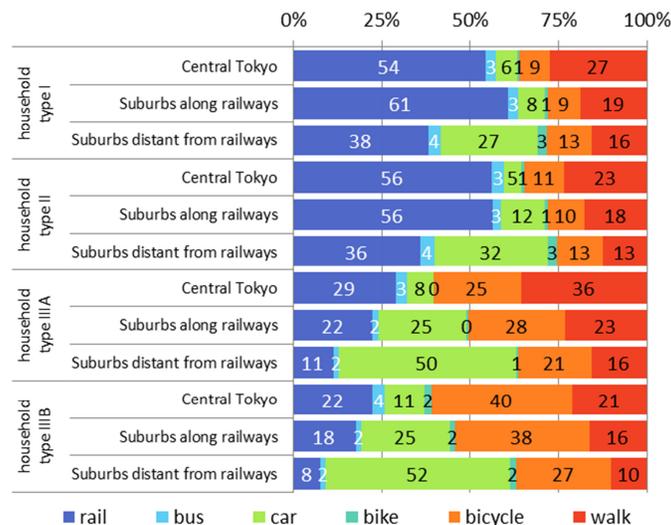
**FIGURE 2. Average Daily Trips Made by Women by Household and by Residential Area**  
(Source: Tokyo metropolitan Person-Trip survey, 2008)

### Modal Split

Although the percentages of trips by rail of the women in household types I and II were high, the percentages of trips by car, bicycle, and on foot were high in household type III. Analyzing them by residential areas, for women living in the suburbs distant from railways, the percentage of trips by car was higher in general.

Comparison of household types IIIA and IIIB reveals that the percentage of trips by rail and walking was higher in the former and the percentage of trips by bicycle, in the latter. When they traveled with their young children who are unable to move alone, they tended to use public transportation or walk. As their children became somewhat older, bicycle use increases. Certainly, mothers often carry their children in a stroller or with a front baby carrier, as demonstrated by these figures.

Looking at the regions individually, the share of automobile travel is high at suburbs distant from the railway. Car owner rates at the city center area show 4% from type I and 50% from type III. On the other hand, areas distant from the railway show 35% from type I and 90% from type III. The further they live from the city center, the higher the portion of automobile and possession of automobile can be seen, under the condition of presence or absence of children under 5.



**FIGURE 3. Modal Split of Women by Household and by Residential Area**  
(Source: Tokyo metropolitan Person-Trip survey, 2008)

### Average Daily Travel Time

The average daily travel time of women in household type III was shorter than in other household types. The total travel time of the women under less time pressure in household types I and II was longer. The women in household type III who were compelled to devote their time to child-rearing activities including picking up and dropping off at day-care might make efforts to reduce travel time by doing necessary tasks in their neighborhood.

Analyzing them by residential area revealed that, for women of household types I and II, the closer they lived to the city center, the shorter their travel time became. In the urban central areas on which various functions focus, it was suggested that they should be able to save their travel time. For the women in household type III, however, the total travel time in suburbs distant from railways was the shortest.

Based on the result that the number of daily trips and the daily travel time of the women in household type III were larger but less time, respectively, than in household types I and II, women in household type III are inferred to spend a shorter time traveling for their various purposes. Looking at households with children, households with children under 5 show large number of daily trips that aimed to drop off and pick up. It also shows high portions of on foot and public transportation, and long daily travel time. It can be estimated that households with juveniles spend a long time travelling in order to adjust their method of travel and traveling speed to their children.

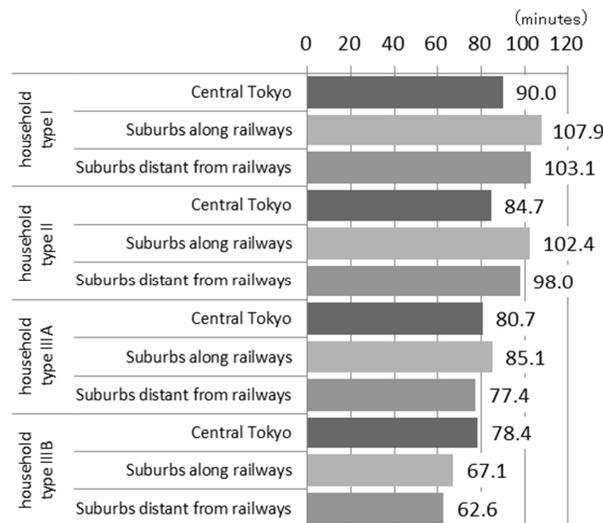


FIGURE 4. Women's Total Travel Time per Day by Household and by Residential Area

(Source: Tokyo metropolitan Person-Trip survey, 2008)

### ANALYSES PARTICULARLY ADDRESSING PICKING UP AND DROPPING OFF AT DAY-CARE

As the results of analyses above suggest, it was remarkable that women in households with children under five years old traveled frequently for dropping off and picking up compared with women from households with other compositions. Therefore this study conducts a comparison on transportation conditions of commuting with and without dropping off, which aims to visualize the burden on mothers with the duty of picking up and dropping off.

Concretely, the subjects of the comparison are, within household type III A, trips including dropping off children at schools, educational facilities, kindergartens and day-care facilities on the way to work and those without, both occurring between 6:00–11:00. This compares transportation modes to drop-off destination and to workplace and the required time spent for travel from home to the workplace.

Results depended on the relation between residential places and workplaces. Therefore, residential places were divided into two categories: suburbs along railways and suburbs distant from railways. Workplaces were divided into three categories for comparison: central Tokyo, suburbs along railways, and suburbs distant from

railways. The residential places were categorized into two categories because very few women living in the central city transported their children to day-care while commuting.

### Modal Split

Women who live in the suburbs along railways and work in central Tokyo or the suburbs along railways used bicycles or walking for day-care related travel and used railways and bicycles for commuting, in general. More than half of the women with workplaces in the suburbs distant from railways used bicycles for day-care related travel and cars for commuting. With their workplaces in the suburbs distant from railways, even if living in the suburbs along railways, the women generally used cars. Women living in the suburbs distant from railways and commuting to central Tokyo used bicycles for day-care related travel and railways for commuting. For women working in the suburbs along or distant from railways, the percentages of trips by cars were the highest for women transporting children to day-care, and commuting.

These showed the following: when they worked in central Tokyo, the women used bicycles or walked for transporting children to day-care and used railways to work; working in the suburbs distant from railways, they used cars both for day-care and day-care related travel and commuting. Working in the suburbs along railways, the ways they used cars depended on whether they lived along or distant from railways.

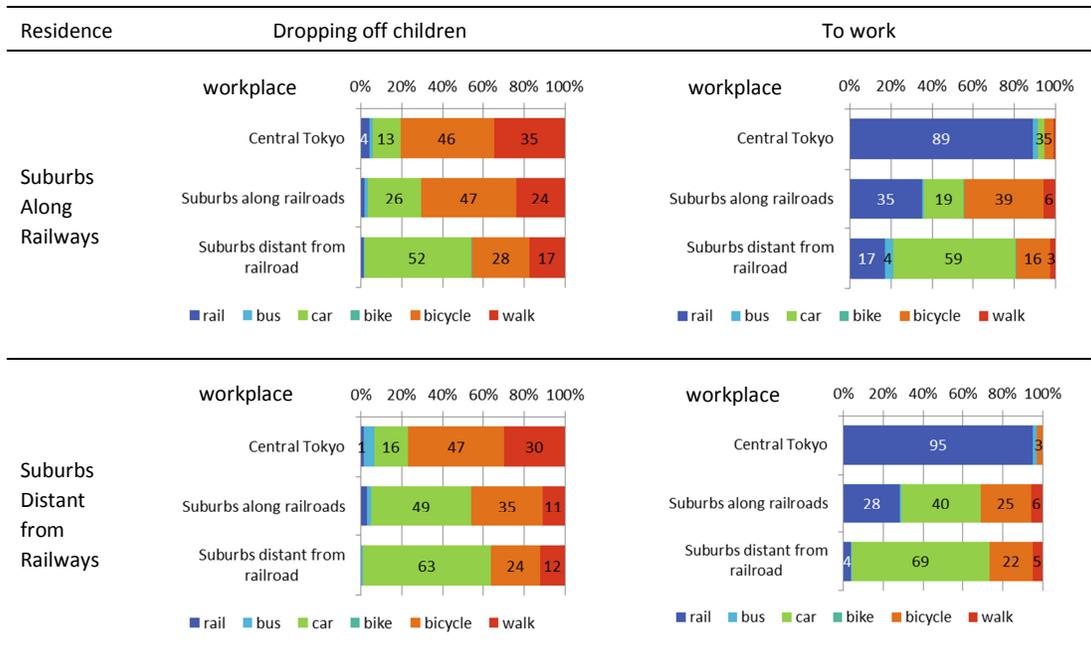
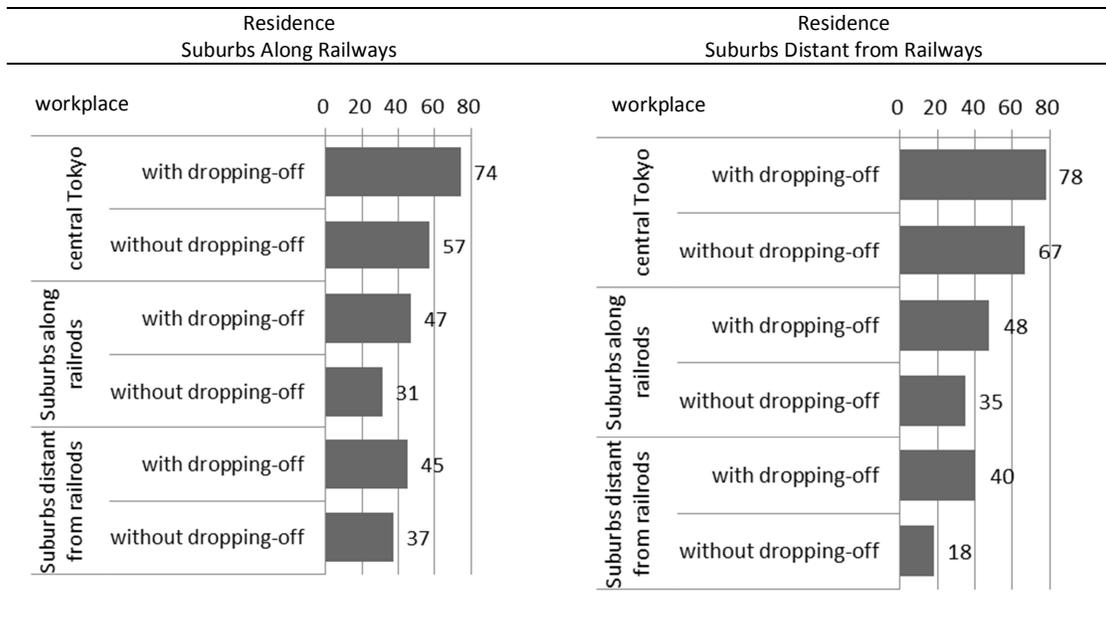


FIGURE 5. Modal Split (for Transporting Children to Day-care and Commuting) of Women by Household, Residential area, and Workplace (Source: Tokyo metropolitan Person-Trip survey, 2008)

### Time Required from Home to Workplace

In all cases, there was a time difference of about 10–20 min depending on whether there was day-care related travel while commuting from home to the workplace. The difference of 10–20 min was the physical burden on working women, which seemed to make little difference when compared by area.

The point to examine specifically was the total time necessary for commuting. When women living in the suburbs and working in central Tokyo had day-care related travel, it took 70–80 min on average to travel to the workplace. In the Tokyo metropolitan area, multiple and advanced business functions are integrated in central Tokyo. Women who hope to work in such businesses must look for their workplace there. However, when they choose to live in the suburbs and work in central Tokyo, they must spend as many as 70–80 min twice a day, every day, on traveling to and from the workplace in the morning and evening. Furthermore, the main transportation mode to central Tokyo is rail. Therefore, they must take a crowded train at peak rush hour. For this reason, physical burdens are imposed particularly on working women.



**FIGURE 6. Women’s Travel Time for Commuting (with and without Day-care-Related Travel) by Household**

(Source: Tokyo metropolitan Person-Trip survey, 2008)

## DISCUSSION AND CONCLUSIONS

The results of analyses conducted in this research showed that, in terms of the travel behaviors of working women with children under five years old, the number of trips was larger than those by other women. Additionally, transportation modes and travel time varied depending on the area type.

The quality of life (QOL) of working mothers might be affected by various factors, including the presence and absence of children and the mothers’ day-care related travel, and residential environments, to which might be added “quality of work.” That point might be true because the city center often has integrated populations and city functions and provides various and high-quality jobs for which more people live in the suburbs and work in the city center. When women look for challenging jobs, their wish can often and actually be fulfilled in the city center, so they might choose to work in the city center even if the commuting time is somewhat longer. Nevertheless, it is physically impossible for all people working in city center to live there in any city of the same scale as Tokyo. Furthermore, the city center is not necessarily appropriate as an environment in which to rear children. Consequently, it is reasonable to choose living in the suburbs after weighing and evaluating several factors. Which factor might improve the QOL for working women among living and working in the city center, living in the suburbs and working in city center, and living and working in the suburbs depends on at which stage of life they are and how important they consider their work to be. Certainly, households with children under five years old might have greater physical burdens but more of a sense of spiritual happiness by which they care for their children. The results of analyses presented herein might constitute objective assessments to consider when choosing among various lifestyles.

For the future, it will be desirable to design cities presenting various options, so that residents can enjoy a variety of jobs and balance work satisfaction, commute time, and day-care related travel. Concretely, political measures to advance the return of residents to the city center and to create hubs with integrated business functions along railways in the suburbs to prevent overconcentration in the city. To realize this, long-term and consistent political measures will be necessary. Ties and collaboration with private companies will also be necessary.

Analyses for this study used only travel behavior data. To evaluate the relationship between travel behavior and QOL of all people as well as working women in the future, it will be necessary to make more qualitative valuations and analyses, say, by introducing the QOL index as a policy variable into the Person-Trip survey.

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# Gender differences in escorting children among dual-earner families in the Paris region

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## ABSTRACT

The present article looks to pinpoint explanatory factors for the sharing of escorting children in dual-earner families. It proposes a detailed analysis of inequalities and interactions in dual-earner families when it comes to escorting children by taking into account the characteristics of trips to and from school for children, the characteristics of the parents' occupations, and the characteristics of the household. Compared with earlier research, the model considers more detailed data about the escorts' jobs, such as specific working hours, which provide a better understanding of the constraints on parents and insight into the choices made when both parents are in a position to escort their children. The findings depart somewhat from those of earlier work on the question because more specific data are considered. They show a marked gender inequality in escorting, because mothers in dual-earner families do more than two-thirds of the escorting. But the factors explaining the sharing of escorting act almost symmetrically for both parents, with the effect of work starting and finishing times being preponderant. These models confirm that the inequality kicks in ahead of this: mothers in dual-earner households are more often than fathers in jobs with shorter working hours and which are more compatible with escorting.

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**KEYWORDS:** Escorting; Chauffeuring Trips; Dual-earner Families; Parenting; Household Interactions; Household Travel Survey.

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## INTRODUCTION

Much research has been conducted in recent years into parents' escorting of children especially between home and school. This phenomenon lies at the junction of three areas of research into transport and mobility. The first of these areas relates to gender differences in mobility (1). It reveals that escorting is shared unequally between mothers and fathers (2). Even when both parents are earners, women do more of the chauffeuring (3) because they are considered to be the primary care-givers for the children (4). The second, more recent and very active area of research relates to factors prompting active modes of transport for children traveling to school and back. The challenge is the fight against overweight and obesity (5, 6). The effects of the built environment have been investigated and the findings show that local planning actions are decisive factors in children's travel choice between active modes (walking, cycling) and chauffeuring. But escorting remains primarily a question of the age of the children and the availability of parents, and especially mothers (7). The third area of research that has been developing in recent years concerns interactions among members of the same household and their effects upon demand for transport (8). Unlike the previous research, interaction models point to a difference in factors prompting parents to take their children to school in the mornings or to bring them home in the afternoons (9, 10). Apart from whether or not the parents work and their working hours, escorting may vary with the sharing of other activities between the parents (11).

The present article is part of this third area of research and looks to pinpoint explanatory factors for the sharing of escorting children in dual-earner families. It proposes a detailed analysis of inequalities and interactions in dual-earner families by taking into account the characteristics of trips to and from school for children, of the parents' occupations, and of the household, much as in the previous models (9, 10). Compared with earlier research, the model considers more detailed data about the escorts' jobs, such as specific working hours, which provide a better understanding of the constraints on parents and of the choices made when both parents are in a position to escort their children.

The findings depart somewhat from earlier works because more specific data are considered. They clearly show a marked gender inequality in escorting because mothers in dual-earner families do more than two-thirds of the escorting. But the factors explaining the sharing of escorting act almost symmetrically for both parents, with the effect of work starting and finishing times being preponderant. Mothers in dual-earner households are more often than fathers in jobs with shorting working hours and which are more compatible with escorting (12). Conversely, 'split-shift' practices remain rare in dual-earner families in Ile-de-France, the dominant practice being for the same parent to accompany the children morning and evening.

## **PREVIOUS RESULTS**

### ***Dual earners but not dual carers, women are the primary care-givers and chaperones***

Within couples, gender differences have been the subject of much research into the distribution and sharing of household activities, both domestic and parental. These activities are said to catalyze the continuation and re-production of considerable gender inequality (13). And yet, the growing participation of women in the labour market is indicative of a decline in the supposedly dominant model of the male breadwinner, where the man is the earner and the woman the homemaker and carer for the children (14, 15). This model would seem to have given way to a new, more equal ideal of sharing: the dual-earner/dual-carer model in which both men and women participate equally in household activities. However, in point of fact, the dominant model in western countries is rather that of dual-earner but not dual-carer because many inequalities remain. Apart from differences in earnings, careers or access to employment, the distribution of jobs related to the home remains a stumbling block. In France the division of both domestic and parental labour has changed little (16). Even within dual-earner families, the woman is often forced to take on a second service (17) doing both her job and domestic chores. Women then find it increasingly difficult to reconcile work and private life (18).

Although women do most of the escorting of children, men do contribute too. In the Netherlands, based on an ad hoc survey in Utrecht, men undertake 38.4% of school runs by dual-earner families (3). In the United States, men are less involved in escorting children according to the National Household Travel Survey (NHTS) making 30.5% of school trips whether the mother is in work or not (7). The Atlanta household activity-travel survey reports a similar level of participation by men in taking children to school (29.8%) and even lower participation in collecting them from school (23.3%) (9). Analysis of the Household Travel Survey (EGT) for Ile-de-France set out below shows that men do 32% of the escorting.

The unequal contribution of parents to escorting children is not merely the reflection of occupational inequality (level of activity, job characteristics, etc.). While more women work part time and close to home, all else being equal, female household members do more escorting than males (9). However, these findings are based on analyses that take account in part the characteristics of employment and of the working day of the parents. Yet the sector of activity, type of employment, and precise number of hours worked are all factors that affect the likelihood of escorting the children (3). Ignoring the interaction with child commuting, while women maintain a high level of escorting even when they have long working and commuting times, men seldom escort their children when the working and commuting time is above average. Short of a fair share-out of chores, fathers are more involved in escorting children when the mother works (3). Men in dual-earner families are more likely to do some of the escorting (10).

### ***Interactions between partners in escorting practices***

Although the characteristics of each of the parents are decisive, some research underscores the crucial role of interactions among household members over escorting the children. But the emphasis falls primarily on the crossed effects between parents and children (7, 9, 10) and not between the parents themselves. It is difficult to take account of interactions between parents insofar as the research primarily models children's travel to and from school and not escorting practices by either parent. In addition, two-parent and single-parent families are analyzed indiscriminately. At best, the research confirms the fact that women do more chaperoning than men, all else being equal.

A closer analysis of the interactions between parents has been proposed by considering dual-earner households and modeling the escorting practices of parents rather than children's commutes (3). The outcome is that women adapt their level of escorting to their partners' time constraints, and the partners offset to some

small degree the woman's long working day by moderately increasing their participation in escorting. Moreover, partners may interact intensely but in various different ways (11). They may share traveling by taking advantage of their complementarities (19). For example, faced with very busy schedules, one partner may take care of the shopping while the other escorts the children. This specialization in domestic activities would seem then to explain why women predominantly escort. However, by comparing the activity schedules of men and women, some couples seem to have an escorting strategy. The father takes the children in the morning before going to work and the mother picks them up in the evening after work (3). In this case, escorting is shared equally between the parents.

### ***Characteristics of children and of the area determining escorting practices***

Besides the characteristics of the parents and their interactions about escorting, factors related directly to the children are reported to influence the parents' escorting practices. The motivations and the levels of escorting vary greatly with the age of the children. While children under the age of six are almost systematically accompanied to school, the proportion declines rapidly with increasing age (20, 10). The number and age of siblings also affects the likelihood that parents will accompany them (3). Older siblings can accompany younger ones and parents are less concerned about safety when children go to school in groups (20, 21).

Insofar as children are essentially escorted by a motorised mode (7) for reasons of convenience and compatibility with the parents' own commute (21, 22), the built environment of the home and school is reported to influence the likelihood of parents escorting their children. Several studies have shown that the choice between active and motorized modes is related to the built environment (6), especially for children (23). For many researchers, the aim is to show that public policies can act against problems of overweight and obesity in children by encouraging them to use active modes of transport. Among the characteristics of the built environment, the main factors investigated include accessibility or proximity, mixed land use, density, aesthetics, sidewalks, street connectivity and safety. These factors are not to be considered in isolation but must be associated with other factors like the transport options available to parents and children, social/cultural norms, and socio-demographic characteristics. They have some effect on the mode of transport of children and indirectly on the probability of their being accompanied. All told, these factors mean that the locations of the home and children's school or parents' work and their characteristics affect the escorting of children.

## **HYPOTHESIS AND RESEARCH DESIGN**

With regard to the bibliographic framework and the factors highlighted, we shall examine the inequalities between parents of dual-earner households in escorting their children on the basis of data from the Household Travel Survey (HTS) of the Paris Region. The survey contains a fairly precise description of mobility for escorting and for commuting. It was conducted by face-to-face interviews and captures and information on all trips undertaken by household members aged six and over on a designated survey day as well as socio-demographic information (24). In all, 10,478 households were surveyed between 2001 and 2002. Of those households, about 1,400 were dual-earner families with at least one child. We aim at analyzing escorting by parents of these households. Given the relatively moderate sample size, we capture here only dual-earner couples of different sexes.

Our first hypothesis is that escorting practices are shared unequally between men and women, all else being equal. For a working day of equal length, with the same starting and finishing times, it is more likely women will do the escorting. The second hypothesis is that interaction occurs between parents and that despite male/female inequality, the escorting practices of one partner depend on their own occupational constraints and those of their partner and on the partner's escorting practices. Thus the probability that the father will escort the children home in the afternoon will be greater if the mother works late and takes the children to school in the morning. The third hypothesis postulates a spatial dimension to escorting. For families living in the city centre, fathers escort their children more often than when families live on the outskirts, especially for the morning trips (3).

To test the three hypotheses, we perform multivariate analysis based on HTS data for the Paris Region. The results set out here are based on multinomial logit models. The first two predict the likelihood of escorting in the morning, the afternoon or both, for men and for women. The next two look exclusively at households which escort their children and predict the likelihood of it being the father rather than the mother who does the escorting, one for the morning and one for the afternoon.

### ***Child escorting in the HTS***

The trips studied are the escorting of children by their parents. Parents must live as couples and have jobs. The Paris Region HTS indicates whether the person escorted is part of the household and, if so, whether it is a child of the couple. In this way, we can circumvent the restriction of the survey—which does not enquire into the mobility of children under six years old—by inferring it from the parents' escorting mobility. This study therefore covers the escorting of all children and not just those aged over six, as in recent research on children's travel. Moreover, all trips were taken into account and not just school runs. It is assumed here that interactions between parents over escorting are not confined to school and that escorting should be taken into account comprehensively so as to better analyze it.

Even so, school remains the main reason and probably the one that structures escorting. If taking the child involves a detour on the way to work, this will have a negative effect on the likelihood that parents will escort the child (9). For this reason, it is necessary to identify more specifically trips relating to school so as to deduce its location, especially for children under six years old. The HTS from the Paris Region indicates the reasons for the trip made by the person escorted. Yet, only 70% of children under six were escorted to school. To offset this, the detour for parents for other children in the family was applied to children under six for which the detour could not be determined. For children over six who were not escorted to school, information about the location of the school was obtained from analyzing the mobility of the children themselves. The school location was included in the models notably by calculating a level of effort, that is, the detour in terms of time involved in escorting to or from school on the commute to and from work.

### ***Characteristics of the partners' working days to understand parents' escorting practices***

Information on the mothers' and fathers' work status, occupation, education, transport mode and distance to work is recorded in the HTS for the Paris Region: these characteristics are known for all of the dual-earner households surveyed. It is also possible to infer the number of hours worked by each parent from the departure and arrival times for commutes, which is a variable used in many models about escorting or children's school journeys. But we also used the starting and finishing times at work to determine whether they were compatible with their children's school times and to check whether parents are in a position to take their children to and from school. In the French school system, which is very largely state-run, school times up to the age of 10 are fixed, starting at about 8.30 a.m (depending on the local area and schools) and ending at around 4.30 p.m. Moreover, in most schools, there are after-school arrangements for children to remain up to 6.00 p.m. This time extension means parents can more easily collect their children from school. Two variables indicating the compatibility of parents' working hours with morning and afternoon school times were used in the models presented. Above the age of 10, when children start middle school, school starting and finishing times may be more variable. However, up to the age of 15 at least, the school day from 8.30 a.m to 4.30 p.m remains the dominant model.

### ***Interactions between partners examined in two models with instrumental variables***

In order to introduce interactions into log models between escorting trips, a problem of endogeneity has to be overcome. If one tries to explain the likelihood that one of the parents escorts the children in the morning by the fact that they did or did not escort the children in the afternoon, it is obvious that the cause and effect may work in both directions. A parent who collects the children in the afternoon will be less likely to take them in the morning; but a parent who takes them in the morning will also be less likely to collect them in the afternoon.

We therefore construct four models with instrumental variables to predict the likelihood of escorting in the morning and the afternoon for each of the parents. These are standard logistic regression models. The instruments used are a set of socio-demographic variables similar to those presented below in the final models. These probabilities of escorting the children are then used as explanatory variables in the models to capture any interaction between escorting trips.

## RESULTS

### *Factors affecting escorting for dual-earner families: few differences between men and women*

Among the dual-earner households studied, 55% of parents escorted their children at least once on the survey day. This figure ranges from more than 70% for households with at least one child under the age of 6 to 31% when the household has at least one grown-up child. Escorting is usually done by women since almost half of mothers escort their children versus less than one-third of fathers (Table 1). Far more mothers than fathers escort both mornings and afternoons, and a few more mothers than fathers escort just in the mornings, which is consistent with observations in other countries. A relative balance is found between fathers and mothers for escorting in the afternoons alone. However, it can be observed that some characteristics of women's employment may be related to these gender differences. More women begin work after 8:30 a.m, giving them the opportunity to escort their children.

**TABLE 1. Descriptive variables of dual-earner households with one or more children**

Variables	Men		Women		
	N	%	N	%	
Escorting	None	922	72.0	709	55.4
	a.m and p.m	46	3.6	202	15.8
	a.m	156	12.2	208	16.2
	p.m	157	12.3	162	12.6
Employment	Public sector	316	24.7	456	35.6
	Private sector	827	64.6	746	58.2
	Liberal profession	138	10.8	79	6.2
Work starting time	> 08:30	676	52.8	479	37.4
	< 08:30	605	47.2	802	62.6
Work finishing time	> 18:00	657	51.3	490	38.2
	< 18:00	624	48.7	791	61.8
08:30 > working day > 18:00	233	18.2	109	8.5	
08:30 < working day > 18:00	424	33.1	381	29.7	
08:30 > working day < 18:00	443	34.6	370	28.9	
08:30 < working day < 18:00	181	14.1	421	32.9	
Urban commuting distance		11.5 km		8.1 km	
Outer suburban commuting distance		12.4 km		10.5 km	
Rural commuting distance		21.6 km		17.7 km	
		Household			
		N	%		
Number of children	1	580	45.3		
	2	554	43.3		
	3 and more	147	11.4		
Children aged under six	None	670	52.3		
	1 or more	611	47.7		
Adult children (over 18)	None	1074	83.8		
	1 or more	207	16.2		
Number of cars	None	83	6.5		
	1	530	41.3		
	2 or more	668	52.1		
Area of residence	Urban	1051	82.0		
	Outer suburbs	135	10.5		
	Rural	95	7.4		

**TABLE 2. Logistic Model: Probability the father escorts both mornings and afternoons, mornings only or afternoons only**

		Estimate	Std. Error	t-value	Pr(> t )	
a.m and p.m		-5.7	1.3	-4.525	6E-06	***
a.m		-5.8	0.97	-5.831	5E-09	***
p.m		-3.7	0.73	-5.039	5E-07	***
a.m and p.m	Mother escorts a.m	-0.44	0.3	-1.445	0.148	
a.m	Mother escorts a.m	-0.56	0.18	-2.930	0.003	**
p.m	Mother escorts a.m	0.51	0.2	2.530	0.011	*
a.m and p.m	Mother escorts p.m	-0.32	0.21	-1.522	0.128	
a.m	Mother escorts p.m	0.16	0.13	1.264	0.206	
p.m	Mother escorts p.m	-0.45	0.12	-3.562	0.000	***
a.m and p.m	Private sector employment	-0.18	0.35	-0.530	0.596	
a.m	Private sector employment	0.066	0.23	0.284	0.776	
p.m	Private sector employment	-0.59	0.21	-2.850	0.004	**
a.m and p.m	Liberal profession	-1.5	0.81	-1.857	0.063	.
a.m	Liberal profession	-0.3	0.36	-0.838	0.401	
p.m	Liberal profession	-1.3	0.45	-2.921	0.003	**
a.m and p.m	Start work > 08:30	0.1	0.34	2.960	0.003	**
a.m	Start work > 08:30	1.7	0.23	7.177	7E-13	***
p.m	Start work > 08:30	-0.15	0.22	-0.701	0.483	
a.m and p.m	Finish work < 18:00	1.2	0.36	3.381	0.001	***
a.m	Finish work < 18:00	-0.72	0.22	-3.213	0.001	**
p.m	Finish work < 18:00	1.9	0.26	7.730	1E-14	***
a.m and p.m	Commute (m)	-5.0E-05	1.8E-05	-2.677	0.007	**
a.m	Commute (m)	-4.9E-06	8.7E-06	-0.567	0.570	
p.m	Commute (m)	-1.2E-05	8.5E-06	-1.365	0.172	
a.m and p.m	2 children	0.38	0.37	1.029	0.303	
a.m	2 children	0.61	0.23	2.571	0.010	*
p.m	2 children	-0.19	0.23	-0.829	0.407	
a.m and p.m	3 or more children	0.045	0.51	0.087	0.930	
a.m	3 or more children	0.74	0.29	2.595	0.009	**
p.m	3 or more children	7.3E-03	0.32	0.023	0.981	
a.m and p.m	1 or more children under 6	0.98	0.44	2.228	0.026	*
a.m	1 or more children under 6	0.86	0.26	3.302	0.001	***
p.m	1 or more children under 6	0.93	0.28	3.393	0.001	***
a.m and p.m	1 or more adult children	-2.0	0.81	-2.448	0.013	*
a.m	1 or more adult children	-0.59	0.41	-1.449	0.147	
p.m	1 or more adult children	-0.44	0.44	-0.989	0.323	
a.m and p.m	1 car	0.99	0.95	1.053	0.292	
a.m	1 car	1.9	0.82	2.317	0.020	*
p.m	1 car	0.68	0.51	1.346	0.178	
a.m and p.m	2 or more cars	0.95	0.97	0.979	0.328	
a.m	2 or more cars	2.3	0.83	2.779	0.005	**
p.m	2 or more cars	0.84	0.52	1.615	0.106	
a.m and p.m	Home in outer suburbs	0.99	0.43	2.310	0.021	*
a.m	Home in outer suburbs	0.066	0.32	0.208	0.835	
p.m	Home in outer suburbs	0.19	0.29	0.654	0.513	
a.m and p.m	Home in rural area	1.1	0.55	2.030	0.042	*
a.m	Home in rural area	-0.13	0.37	-0.342	0.732	
p.m	Home in rural area	0.45	0.34	1.314	0.189	

**TABLE 3. Logistic Model: Probability the mother escorts both mornings and afternoons, mornings only or afternoons only**

		Estimate	Std. Error	t-value	Pr(> t )	
a.m and p.m		-5.2	0.86	-6.053	1E-09	***
a.m		-3.7	0.85	-4.359	1E-05	***
p.m		-3.2	0.92	-3.480	0.000	***
a.m and p.m	Father escorts a.m	-0.22	1.1	-2.002	0.045	*
a.m	Father escorts a.m	-0.29	0.11	-2.653	0.008	**
p.m	Father escorts a.m	0.27	0.12	2.363	0.018	*
a.m and p.m	Father escorts p.m	-0.29	0.1	-2.915	0.003	**
a.m	Father escorts p.m	0.21	0.099	2.086	0.037	*
p.m	Father escorts pm	-0.37	0.11	-3.506	0.000	***
a.m and p.m	Private sector employment	-0.15	0.19	-0.789	0.430	
a.m	Private sector employment	0.43	0.20	2.153	0.031	*
p.m	Private sector employment	-0.25	0.20	-1.250	0.211	
a.m and p.m	Liberal profession	-1.0	0.47	-2.215	0.027	*
a.m	Liberal profession	0.10	0.38	0.274	0.784	
p.m	Liberal profession	0.082	0.39	0.208	0.835	
a.m and p.m	Start work > 08:30	0.83	0.19	4.240	2E-05	***
a.m	Start work > 08:30	1.2	0.22	5.757	9E-09	***
p.m	Start work > 08:30	-0.48	0.19	-2.488	0.013	*
a.m and p.m	Finish work < 18:00	1.3	0.21	6.439	1E-10	***
a.m	Finish work < 18:00	-0.16	0.18	-0.897	0.369	
p.m	Finish work < 18:00	1.7	0.26	6.545	6E-11	***
a.m and p.m	Commute (m)	-4.6E-05	1.2E-05	-3.946	8E-05	***
a.m	Commute (m)	-3.4E-05	1.1E-05	-3.139	0.002	**
p.m	Commute (m)	4.5E-06	9.7E-06	0.470	0.638	
a.m and p.m	2 children	0.49	0.19	2.642	0.009	**
a.m	2 children	0.39	0.18	2.152	0.031	*
p.m	2 children	-0.065	0.21	-0.314	0.753	
a.m and p.m	3 or more children	0.18	0.31	0.581	0.560	
a.m	3 or more children	-0.022	0.31	-0.071	0.943	
p.m	3 or more children	0.26	0.29	0.903	0.367	
a.m and p.m	1 or more children under 6	1.5	0.22	6.646	3E-11	***
a.m	1 or more children under 6	0.72	0.22	3.272	0.001	**
p.m	1 or more children under 6	1.0	0.23	4.494	7E-06	***
a.m and p.m	1 or more adult children	-1.7	0.40	-4.255	2E-05	***
a.m	1 or more adult children	-1.2	0.32	-3.714	0.000	***
p.m	1 or more adult children	-0.29	0.32	-0.904	0.366	
a.m and p.m	1 car	0.77	0.53	1.468	0.142	
a.m	1 car	0.89	0.51	1.757	0.078	.
p.m	1 car	0.066	0.61	0.108	0.913	
a.m and p.m	2 or more cars	1.4	0.53	2.625	0.009	**
a.m	2 or more cars	1.3	0.52	2.554	0.010	*
p.m	2 or more cars	0.21	0.62	0.334	0.738	
a.m and p.m	Home in outer suburbs	0.23	0.30	0.806	0.420	
a.m	Home in outer suburbs	5.5E-03	0.28	0.018	0.984	
p.m	Home in outer suburbs	0.17	0.30	0.574	0.566	
a.m and p.m	Home in rural area	0.94	0.31	3.070	0.002	**
a.m	Home in rural area	-0.077	0.36	-0.213	0.831	
p.m	Home in rural area	0.23	0.34	0.687	0.492	

The first model (Table 2) predicts the likelihood that fathers will escort the children in the mornings or in the afternoons or both. The second model (Table 3) predicts the same probabilities for mothers. The main explanatory variables of the two models work in similar ways: the start and finish times of work for the parents and the presence of children under the age of 6 in the household. The presence of young children has a very positive effect on the probability of escorting in the mornings and/or afternoons for fathers and mothers. For working hours, a late start increases the probability of escorting in the mornings only or mornings and afternoons. Conversely, an early finish increases the likelihood of children being escorted in the afternoons only or mornings and afternoons. Apart from the main explanatory variables, two other factors have significant effects on the probability of parents escorting children. The likelihood of escorting in the mornings increases for parents in households with several children and for those with one or more cars. The likelihood of escorting mornings and afternoons is also greater for mothers in households with two children and/or two or more cars.

Concerning our hypotheses, the factors of gender inequality seem somewhat reduced in these first two models. The first relates to the type of occupation, the second to the presence of a third adult in the household. Thus men who are private sector employees or in the professions are less likely to escort children in the afternoons than are men who are public sector employees. For women in similar occupations, there is no significant reduction in the likelihood of them escorting their children according to type of occupation except for escorting them in the mornings for private sector workers and for double escorts (mornings and afternoons) for those in the professions. Conversely, the presence of an adult child (over 18 which is legal age of majority in France) significantly reduces the likelihood the mother will escort the children in the mornings or mornings and afternoons. For the partner, the presence of a third adult reduces only the probability of morning and afternoon escorts and barely significantly. For afternoon escorts, the presence of a third adult has no significant effect, even for mothers. It can be postulated that afternoon escorts are those which weigh somewhat less heavily on mothers (Table 3), even if they still perform them more often than fathers. The second hypothesis relates to forms of interaction between parents. In the first series of models, there are two types of interaction. First, if one parent escorts the children in the mornings or afternoons, the likelihood that the other parent escorts the children in the same time slot is very low. Just one parent seems to escort in a given time slot. Secondly, if one parent escorts in the mornings, it is much more likely that the other parent will escort the children in the afternoons. Parents are complementary between mornings and afternoons. The final hypothesis relates to the existence of a spatial dimension of escorting. Such an effect is not very frequent in models. Only living in a rural area significantly increases the likelihood of escorting both mornings and afternoons. The same is true for the outer suburbs, but for fathers only. This result is presumably because parents are more likely to escort children when they live in the outer suburbs and in low density areas where schools are often furthest from home. Less directly, the models tend to show that the commuting distance reduces the propensity to escort both mornings and afternoons for fathers and for mothers, and to escort children in the mornings for mothers. Thus the distance between home and work might have a negative overall effect on the likelihood of escorting children in dual-earner households in the outer suburbs and rural areas, given that these distances generally increase as one moves away from the city centre.

### ***In which cases do fathers do more escorting than mothers?***

For parents who escort their children in the mornings only, in more than two-thirds of instances it is the mother who does this (Table 4). Yet in nearly half of households (49.1%), fathers have working hours that are compatible with taking children to school in the mornings. In our sample, more women use public transport which is less amenable to escorting practices (25), especially in the mornings.

**TABLE 4. Descriptive variables of households escorting in the mornings**

Variables		N	%
Escorting	Mother	372	69.5
	Father	164	30.5
Start work > 08:30	None	85	15.8
	Mother	188	35.0
	Father	77	14.3
	Both	187	34.8
Father's transport mode	Public transport	137	25.6
	Car	345	64.4
	Foot	53	9.9
Mother's transport mode	Public transport	192	35.9
	Car	301	56.2
	Foot	42	7.9
Adult child	None	498	92.9
	1 or more	38	7.1
Home area	Urban	437	81.4
	Outer suburbs	55	10.3
	Rural	44	8.3

The model below (Table 5) predicts the probability of fathers escorting more than mothers in the mornings. The main explanatory variable relates to the work starting times. Unsurprisingly, the likelihood that fathers will do the escorting is greater when their working hours are compatible with those of the school and when the mothers' working hours are incompatible. Conversely, the probability fathers will escort children is far lower when their work starting times are not compatible with school times and mothers' working hours are. Where both parents' working hours are compatible, no trend stands out. Intuitively, in such a situation, it would be expected that mothers would do more of the escorting. For all the other variables in the model, symmetry of effects between fathers and mothers can be observed. For example, having just one car increases the likelihood that the parent using that means of transport for going to work will also escort the children. Similarly, making a big detour on the journey to work to drop off the children (materialised by the level of effort to deviate from one's route) reduces the likelihood of escorting for fathers and mothers alike. There is therefore no amplification of the asymmetry between men and women with respect to the factors that prompt them to escort the children, at least for those parents who do escort their children. That women do most of the escorting in the mornings seems therefore to be related to a structure effect: more women than men apparently have working hours that are compatible with escorting, somewhat more limited access to car use, and jobs closer to home.

**TABLE 5. Logistic Model: Probability that the father rather than the mother will escort the children in the mornings (only households escorting in the mornings)**

		Estimate	Std.Error	t-value	Pr(> t )	
Father escorts		-0.95	0.44	-2.148	0.032	*
Father escorts	Start work mother > 08:30	-21	0.41	-5.162	2E-07	***
Father escorts	Start work father > 08:30	1.5	0.37	4.122	4E-05	***
Father escorts	Start work both > 08:30	0.28	0.31	0.864	0.387	
Father escorts	Car father	0.63	0.30	2.116	0.034	*
Father escorts	Foot father	-4.2E-03	0.47	-0.009	0.993	
Father escorts	Car mother	-0.58	0.27	-2.093	0.036	*
Father escorts	Foot mother	-0.35	0.49	-0.698	0.485	
Father escorts	1 or more adult children	0.66	0.41	1.618	0.106	
Father escorts	Commute father (m)	-3.9E-05	1.2E-05	-3.385	0.001	***
Father escorts	Commute mother (m)	6.3E-05	1.5E-05	4.064	5E-05	***
Father escorts	Level of effort father	-2.5E-04	8.5E-05	-2.978	0.003	**
Father escorts	Level of effort mother	3.2E-04	8.5E-05	3.758	0.000	***
Father escorts	Home in outer suburbs	-0.21	0.36	-0.582	0.561	
Father escorts	Home in rural area	-0.45	0.44	-1.003	0.316	

Escorting in the evenings is in the great majority of instances done by women too, in a ratio of 1 to 2 (Table 6). Later work finishing times for men are amenable to more escorting for women than for men in the afternoons. The model predicting the likelihood of escorting in the afternoons for men compared with women shows, as for the morning model, a degree of symmetry of effects between men and women (Table 7). However, work finishing times aside, there is less symmetry for afternoon than for morning escorting. Thus, the length of the commute of one parent significantly increases the likelihood that the other will escort more in the afternoons, but less so than in the mornings. Moreover, the symmetry observed in the mornings in terms of car use or level of effort disappears. In the evenings, the likelihood the father will escort more than the mother depends above all on the fact that the mother travels by car or has a sizeable level of effort.

To conclude, in these two models, the spatial dimension does not seem to be directly involved since the household residential area has little or no effect on escorting by one parent rather than the other.

**TABLE 6. Descriptive variables of households escorting in the afternoons**

Variables		N	%
Escorting	Mother	330	66.2
	Father	169	33.8
Finish work < 18:00	Neither	64	12.9
	Mother only	182	36.6
	Father only	92	18.5
	Both	160	32.0
Father's transport mode	Public transport	140	28.0
	Car	313	62.6
	Foot	47	9.4
Mother's transport mode	Transports publics	185	37.1
	Car	278	55.7
	Foot	36	7.2
Adult child	None	458	91.8
	1 or more	41	8.2
Home area	Urban	399	79.9
	Outer suburbs	55	10.9
	Rural	46	9.2

**TABLE 7. Logistic Model: Probability that the father escorts in the afternoons rather than the mother (only for households escorting in the afternoons)**

		Estimate	Std.Error	t-value	Pr(> t )	
Father escorts		-0.35	0.453	-3.771	0.437	
Father escorts	Finish work mother < 18:00	-2.3	0.431	-5.427	6E-08	***
Father escorts	Finish work father < 18:00	2.1	0.389	5.492	4E-08	***
Father escorts	Finish work both < 18:00	0.11	0.329	0.341	0.732	
Father escorts	Car father	4.6E-03	0.297	0.015	0.987	
Father escorts	Foot father	-0.29	0.489	-0.599	0.549	
Father escorts	Car mother	-0.60	0.294	-2.041	0.041	*
Father escorts	Foot mother	-0.52	0.564	-0.924	0.355	
Father escorts	1 or more adult children	0.50	0.429	1.155	0.248	
Father escorts	Commute father (m)	-2.9E-05	1.23E-05	-2.401	0.016	*
Father escorts	Commute mother (m)	3.4E-05	1.54E-05	2.217	0.027	*
Father escorts	Level of effort father	-6.5E-05	4.62E-05	-1.415	0.157	
Father escorts	Level of effort mother	1.5E-04	6.17E-05	2.504	0.012	*
Father escorts	Home in outer suburbs	0.67	0.372	1.792	0.073	.
Father escorts	Home in rural area	-0.16	0.449	-0.349	0,727	

## DISCUSSION

In dual-earner families in Ile-de-France, half escort their children, and those with young children escort them more than those whose children are adults. Unsurprisingly, women escort twice as much as men, conducting two-thirds of the escorts. Above all, gender inequalities are marked by the proportion of women accompanying both mornings and afternoons. They are four times as many and represent 35% of women who escort their children.

Observation of gender differences with respect to the factors that lead parents to escort their children reveals that the main factors are common to men and women. They produce the same type of effect on the likelihood of escorting, especially in the mornings and to a lesser degree in the afternoons. These factors are, by order of importance, the presence of young children in the household, work starting and finishing times, and their compatibility with the child-care or school times. Differences between men and women are few and have little effect in the respective models predicting the probability of escorting. However, men escort less in the afternoons when they are private sector employees or in the professions, whereas women who are employed in the private sector escort more in the mornings. Next, men are more likely to escort in the mornings the more children they have, while this effect is weak or non-existent for women. Lastly, and conversely, the presence of a grown-up child in the household greatly reduces the probability women will escort in the mornings or afternoons. However, for men, these effects are weak (mornings and afternoons) but above all non-existent. Moreover, women appear more sensitive to the length of their commutes for escorting in the mornings and for morning and afternoon escorting.

This first series of results highlights the slight gender differences as to the determinants of escorting practices for dual-earner households that can be captured with this type of model. The explanations for the very marked inequality between men and women in escorting are therefore to be sought ahead of the escorting decisions. The models reveal that the parents' employment conditions are the main determinants of the decision to escort. The mother's working day is often more compatible with escorting than the father's, especially in terms of starting and finishing times, commuting distance, type of employment and means of transport. She then does most of the escorting. Unfortunately, the HTS does not enable us to determine whether the mother's choice of a job which is compatible with escorting is dictated by the need to ensure such escorting or whether there are other determinants.

The second series of models pertaining to escorting in dual-earner households confirms the observation about unequal escorting between parents prompted by the difference between their working days rather than by greater investment by mothers, regardless of the constraints of their working day and of the fathers' working day. The second series of models shows symmetry between parents of the effects of factors affecting escorting. This symmetry is stronger overall in the mornings than the afternoons, which might be in part because there is more escorting in the mornings than in the afternoons. Thus, for dual-earner households, gender inequality in their escorting practices lies in the choice of employment and the working day it involves. Many results show that women in dual-earner households tend to have jobs with shorter and more flexible working hours, jobs that are closer to home and that allow them to do most of the care-giving and escorting for the children (12).

The link for escorting between the partners and/or between afternoon and morning revealed in the Netherlands (3) is also apparent in the case of Paris and is negative, particularly in the morning. A negative link is also apparent between the probability of one partner conducting escorting trips both in the morning and afternoon. These effects express what emerged from the descriptive analysis: the dominant model is that of a household where a single partner is responsible for escorting either in the morning or in the evening. The strongest and most systematic effect involves a link between the partners for escorting trips during a given half day, which we shall characterize as optimization by the sharing of escorting trips between the couple before and after work. This sharing, which we shall characterize as complementarity, occurs when one partner takes on escorting duties before work and the other does so after work. The probability of complementarity between the partners with regard to escorting is low.

A final element is the spatial dimension of escorting practices. Parents in dual-earner households escort their children when they live in the outer suburbs of cities, in low-density areas. Schools there are less commonly within walking distance, but there are also no safe and pleasant paths for pedestrians. Yet the spatial effect identified remains slight and is applicable only in certain cases. It tends to increase the likelihood that one of the parents will escort the children in the mornings or afternoons. Children are escorted more

systematically in such areas. This effect is more striking because longer average commuting distances in these areas tend to reduce the likelihood of parents escorting their children. The spatial dimension of escorting practices therefore arises less directly, through commuting distances or levels of effort which appear to be greater in less densely populated areas. These variables act more significantly on the relative likelihood of escorting by one or other of the parents.

## CONCLUSION

Exploitation of the HTS for Ile-de-France reveals that the practice of escorting children differs between men and women within dual-earner households, with mothers being more active than fathers. Nonetheless, in dual-earner households, interactions are often at work in the sharing of escorting since the escorting practices of one parent affect the practices of the other parent. To return to other research (11), interactions between fathers and mothers most probably result in complementarity (if one escorts at one time, the other will have significantly less chance of escorting at the same time) or specialisation (just one parent takes charge of all escorting) (H2). More generally, looking at factors which influence escorting by one or other parent and especially the factors relating to the other parent (work times, commuting distance, etc.), these factors operate in similar ways on the escorting of children and the way it is shared. All else being equal, differences in escorting practices between mothers and fathers would seem to be minimal (H1).

But, in terms of gender and the sharing of activities within the household, all else is far from equal. If there is parity between the partners in terms of activity or of residential location, many inequalities remain in terms of employment conditions (working hours, location, etc.), modes, etc. These differences necessarily affect the population structure and ultimately the escorting practices that depend on it. The results presented are therefore the outcome of a structure effect related both to the conditions in which our sub-sample was selected and to the gendered inequalities in the sharing of daily activities and trips. A better understanding of the inequalities in terms of escorting would require a better understanding of the gender-based distribution of all of the household's travel patterns.

Inequalities in terms of domestic activities and more especially of care-giving for children are largely determined by the socio-spatial or cultural characteristics of the populations under study (26). The greater propensity of women in France to work part time seems to explain why an activity like escorting is less evenly shared than in other countries, especially Scandinavia. On a finer scale, like that of Ile-de-France and its various areas, these differences are not readily observable, here again because of the selection of our sub-sample of dual-earner households. This selection bias would explain why spatial variables have little effect on escorting trips within our population (H3).

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# Gendered travel mode choice: the role of key events in the life course<sup>6</sup>

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## ABSTRACT

This paper studies changes in the complexity of activity patterns (measured by entropy) and trip chaining patterns after life course (and accessibility) related key events from a gender specific perspective. It is theoretically informed by the mobility biographies approach, and by gender/travel studies. The data used is the German Mobility Panel (GMP) 1994 to 2010 in which households and their members are asked three times in three subsequent years to report the trips they made over a week. Changes made from one year to the next are regressed to key events over the life course, cohort effects and period effects, while sociodemographics, residential and workplace spatial context attributes are controlled. A cluster-robust regression approach is used to account for the non-independent character of panel observations. Significant effects were found for some key events, including the birth of a child, entry into the labour market, and changes in spatial context, accessibility and mobility. Some effects differed distinctly between men and women, suggesting that men and women are differently affected by life course events. However, taken together the associations found, as well as their gender specifics, are rather limited. Hence, key events over the life course seem to be only loosely associated with the complexity of activity and trip patterns.

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**KEYWORDS:** Gender; Mobility biography; Key event; Travel mode choice; Behaviour change.

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# Families on the run: How do Dutch households with young children organize their travel behavior?

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## ABSTRACT

In many families with young children, parents face coordination problems in scheduling household transportation tasks, such as bringing children to a day care centre, combined with work-related travel. The increasing labor participation of Dutch women over the past decades has affected their individual mobility. Most Dutch women work part-time and the weekly organization of days at work and away from work are often related to the organization of school days. This implies that allocation of activities between partners becomes more and more important on days at which both partners work and children also have to be taken care of. From a mobility and transport policy perspective it is important to get insight in how parents with young children organize their travel behavior on weekdays, what bottlenecks they encounter and how they solve them. Current policy issues such as congestion reduction can benefit from this information about the level of flexibility in daily schedules.

In this paper we examine how parents with young children organize their mobility in terms of school and preschool (childcare) related travel in combination with their work travel. By using quantitative data from the Dutch National Travel Survey from 2004 to 2009, we identified three relevant travel activity patterns, which we named 'Combination day', a 'Care day' and a 'Work day'. By analyzing these 'time-space paths' we describe how households with different background characteristics organize their weekday mobility in terms of trips, distance travelled and journey times, modes of transport used, and temporal aspects of their particular time-space paths. These quantitative data were supplemented with qualitative data from interviews with parents in 33 households. We discuss the kind of constraints parents say they encounter in their weekly scheduling and which strategies they apply to fulfill their mobility patterns. The results are discussed in relation to a number of transport policy issues, as gender differences in the allocation of responsibilities and the related mobility may lead to gender differences in the response to policy measures.

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**KEYWORDS:** Travel behaviour; Households; Young children; Scheduling; Gender.

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## INTRODUCTION

Each day the parents of young children face numerous logistical challenges, requiring extensive coordination. The children must be brought to school or day care, the parents commute to and from work, the grocery shopping must be done, and all this must occur daily in a short timeframe. At certain times of the day, these households regularly experience hectic situations; consequently, they are often called 'rush hour' families.

Due to various societal processes, such as women's increasing participation in the labor market, the Dutch population's activity patterns have changed. The structure of daily life is now under intense time pressure (1). Today, a large percentage of parents have paid jobs outside the home (2). Approximately two million parents between the ages of 25 and 45 years old wrestle with busy time schedules and the combining of work and family responsibilities. Consequently, it has become increasingly difficult for parents to coordinate their family's various activity patterns. This usually requires household members to adhere to a strict organization of daily activity patterns, which involves complicated travel patterns and continuous deliberation about the use of various transport modes. Because people usually have a limited amount of time in which to travel to the various activity locations (schools/day cares, places of employment, afterschool care centers, etc.), cars are often the transport mode used, and also at times when the roads are heavily congested. This is especially the case for families with young children under the age of 12 years old.

Although women's labor market participation has increased over recent decades, the division of paid employment and providing care for children remains unequal among fathers and mothers. On average, fathers work longer hours and for more days in the week, while mothers devote more time to caring for children and also dropping off/picking up children (2-4). Moreover, women generally feel more responsible for caring for children, while men traditionally feel more responsible for providing the family income (2, 5-7). These factors have resulted in differences in activity and travel patterns between fathers and mothers in families with young children.

From a mobility perspective it can be very useful to study activity and travel patterns of these households with their increasingly busy schedules, as these patterns may reveal to what level people have the flexibility to change their mobility behavior. This also goes for the ways in which parents with young children mutually negotiate their weekly mobility (e.g., their transport modes), the various problems/limitations they encounter and the ways in which they currently deal with these limitations (see also (7-11)). Current policy issues such as congestion reduction can benefit from this information about the level of flexibility in daily schedules. Insight into the constraints in time and space for individual household members, and the differences between men and women herein, might increase the likeliness of success for policy measures aimed at stimulating flexibility during peak hours or increasing traffic safety at specific locations.

This paper focuses on the daily mobility of two-parent families with children under the age of 12 years old. We specifically focus on how men and women divide the travel required for work and care-providing among themselves. The comprehensive results of these analyses are found in (12). In this paper, we first examine the data used and ways in which we have compiled the various types of travel patterns of young families. We provide a general overview of the mobility of young families in the Netherlands, in which the focus is on describing the mobility differences between men and women in young families. We then present our findings pertaining to the various types of travel patterns of young families, which also include gender differences, when relevant. Finally, we indicate the importance of these findings for policymaking, in terms of how they pertain to mobility questions.

## **DATA AND METHODOLOGY**

The travel patterns of households with young children are a focal point in this paper. In order to create more insight into these travel patterns for the Dutch population, we used quantitative and qualitative data, identified four types of household mobility patterns and set up rules for allocating each household to one of the identified mobility types. The following sections describe the data and methodology used.

### ***Data***

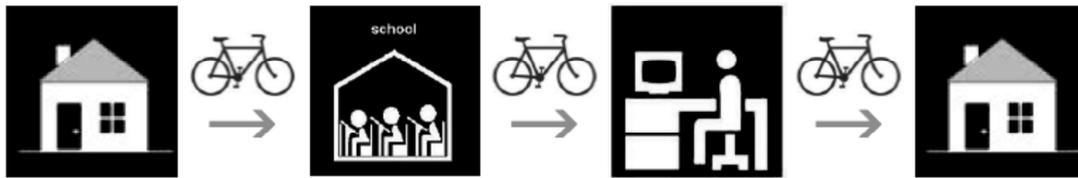
Since this paper studies interaction between parents within households, mobility data for complete households (or at least all adults in the household) was needed to identify how the allocation of duties and mobility was divided among family members. The only data source with a large enough sample that contains Dutch travel data for complete households is currently the Dutch National Travel Survey (MON), which is an annual study of travel behavior of residents in the Netherlands, including travel purposes, origin and destination of the trip, travel modes, timing and durations of trips, and trip distances (13). Household and personal characteristics are also reported. In 2010, the Dutch National Travel Survey has undergone a slight change in setup and the survey since then no longer focuses on complete households. However, data from 2004-2009 contain information about complete households. Based on this data source, statements can be made about all trips that begin and/or end in the Netherlands (13).

The MON data consists of data at four levels: data at the household level, at the individual level, at the level of trips and at the level of trip stages. All members of the same household can be traced back to that household. By using the full range of available data, it is possible to identify individual travel patterns and simultaneously determine the division of responsibilities within a household. The data for every household was registered for one single day, so it includes no information about the previous or following day for any specific household.

## Methodology

A central question in this research study is how parents divide the responsibility of dropping off/picking up children among themselves, and how they combine this with their work-related mobility. Due to this particular focus, only a part of all possible households were included in the study, and of those households, only the trips related to child-care or professional activities were selected. The households selected were those with at least one child aged 12 years or younger. Furthermore, only trips undertaken during weekdays (before 19:00/7 p.m) were included, and specifically those between home, school/daycare, places of employment, and combinations thereof. Moreover, national holidays and vacation days were excluded. The selection on which the analyses were based comprises the daily records of 34,730 parents.

These analyses differentiate between the parents' various types of travel patterns. Figure 1 shows an example of a travel pattern. This is a series of trips in which the point of departure is the home address, and one or more journeys are combined in order to carry out the various activities.



**FIGURE 1. Travel pattern of one parent bringing children to school by bicycle, immediately continuing on to work, before ultimately returning home**

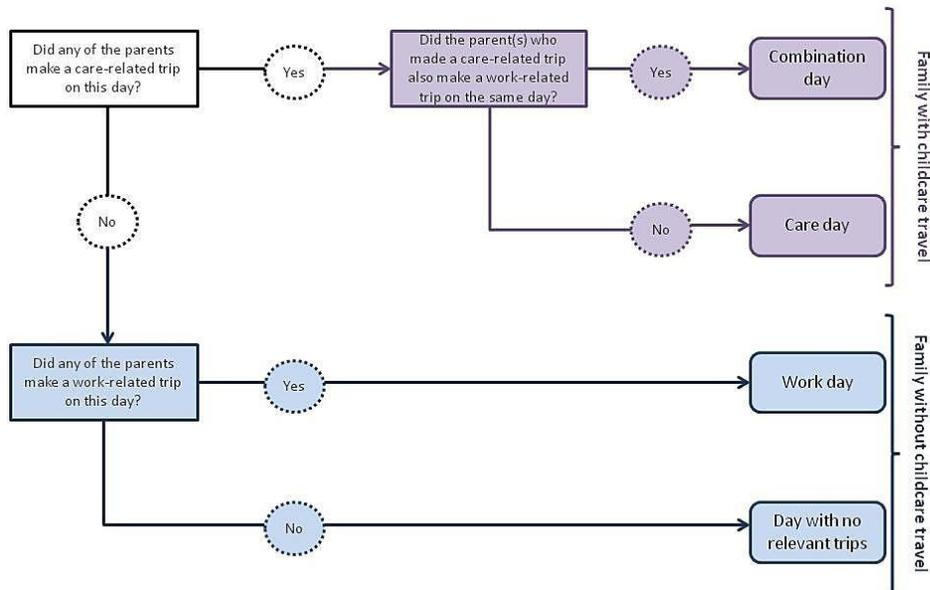
The first challenge in this study was to classify the different types of travel patterns of parents that were relevant for our study. The number of distinct travel patterns can be quite large, even with the limitation of destination types that was made. Two aspects of the organization of responsibilities are clearly related to our research question: whether a parent travels to work on a given day, and whether a parent brings the children to school or day-care and/or picks them up again.

From 33 in-depth interviews conducted with Dutch, two-parent families with young children (14), it was found that in some families one parent combined bringing the child(ren) to school or day-care facility with travelling to work, while in other families, these tasks were divided evenly among the parents. In even other families, the children were either too young or too old to be brought to school (or were taken to school or day-care by a person from outside the family for another reason). A day-to-day variation could also be seen, so the responsibilities were not always the same on any given day.

These different ways of organization showed varying divisions of parental duties and associated mobility. Four types of general travel patterns could be distinguished that had a relationship with the organization of travel for work and childcare:

- A work trip is combined with dropping off/picking up children on the same day;
- A day-care trip is undertaken by at least one of the parents and is not combined with a work trip;
- A work trip is undertaken by at least one of the parents, but no care trips are undertaken; or
- No trips for work or providing care are undertaken by any of the parents.

Based on the organization of responsibilities we assigned the different types of travel patterns to households. First, if on the registration day at least one of the parents took the children to school, the family was classified into the group of families with child-care travel (Figure 2). Next it was determined whether any of the parents travelled to work. By combining the information (occurrence of travel with children, occurrence of travel for work), it could be determined whether a combination of responsibilities or a division of duties occurred. This led to a classification of the whole household based on the individual travel patterns of parents within those families on the given day. As these classifications only contain information about one single day, the classifications were called "type of day". Figure 2 visualizes the classification process.

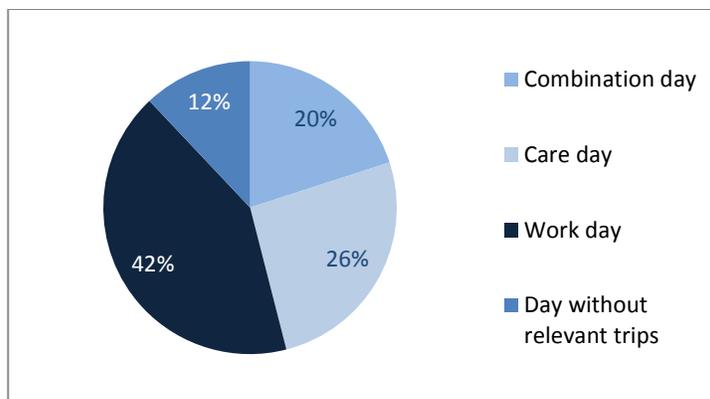


**FIGURE 2. Classification process for households into Combination day, Care day, Work day and Day with no relevant trips**

The four types of day are: [a] the Combination day, in which at least one parent combines traveling to/from work with dropping off/picking up children on the same day; [b] the Care day, in which the parents do not combine a work trip and a care-providing trip, but nonetheless a child is dropped off/picked up by one of the parents (the other parent might travel to work); [c] the Work day, in which no child is dropped off/picked by a parent, but a home-to-work commute is undertaken by at least one of the parents; and [d] a Day without relevant trips undertaken for work or care-providing.

So, when a combination of work and care-providing is performed by one and the same parent on the given day, the entire household is deemed to have had a Combination day on this day. The travel pattern of the other parent is no longer used for further classification. Subsequently, all households with child-related travel (by a parent not combining this with commuting to work) were assigned to the Care day, and a household in which no children are dropped off/picked up is assigned to one of the latter two categories.

The various types of travel days occur with varying frequencies in households with young children. By far the most days (42%) fall under the Work day category, in which at least one parent travels to work but no children are dropped off/picked up from school or daycare. The days in which neither parent undertakes a work-related or care-providing trip occur only 12% of the time. Figure 3 shows the share of the various types of travel days.

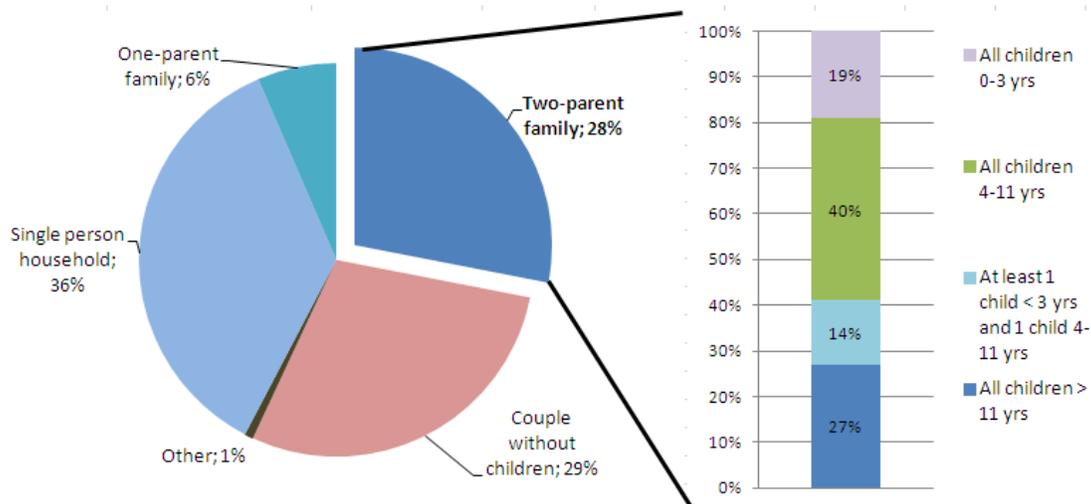


**FIGURE 3. Types of travel days of Dutch households with young children**

In the following section we first examine the general differences between mothers and fathers of young children. How do their activity patterns differ, and what does this mean for their mobility? We then return to the types of travel days of Dutch families. After we have described the general characteristics of these families, we identify gender differences in terms of responsibilities and mobility characteristics.

## MOBILITY OF MOTHERS AND FATHERS IN DUTCH FAMILIES WITH YOUNG CHILDREN

One-third of all Dutch households is a family with children. Two-parent families constitute 28% of all Dutch households, while 6% are one-parent families (Figure 4). Nearly three-quarters of all two-parent families include children aged 12 years or younger.



**FIGURE 4. Composition of households in the Netherlands and the age categories of children in two-parent families**

### ***Trips: Number, Distance and Duration***

Over the past decades, gender differences in mobility behavior have decreased. For men, the average number of journeys undertaken decreased between 1985 and 2007, while for women this number increased slightly (1). The average distances travelled by women also increased, as did the amount of time they spent travelling. Men however continued to travel greater distances and for longer amounts of time than women, but the difference became smaller (15, 16). This development was primarily due to women's increasing labor market participation, increasing possession of drivers' licenses and increasing levels of education in the Netherlands (1).

It is primarily single people and people without children who make the largest contribution toward narrowing the so-called 'gender gap'. For the fathers and mothers of young children, these developments occurred more slowly. Although they undertake more trips per day than their male counterparts, mothers with young children for instance travel some 20 minutes less per day, and on average cover shorter distances than fathers. Comparatively, fathers work further away from home than mothers, with fathers having an average home-to-work travel distance of 22 kilometers (13.7 miles), which is 9 kilometers (5.6 miles) more than that of mothers, and fathers also travel approximately 7 minutes more to and from their places of employment. The difference in home-to-work travel distances between fathers and mothers has not changed significantly since the late 1990s (13, 17). Table 1 presents various figures pertaining to the mobility of Dutch mothers and fathers and compares these to the mobility of average Dutch adults.

**TABLE 1. Mobility of Parents with Children < 12 yrs as Compared to All Dutch Adults (based on (13))**

Mobility behavior	Fathers	Mothers	All men ≥ 18 yrs. Old	All women ≥ 18 yrs. Old
Average number of trips per person per day	3,5	4,4	2,9	2,9
Average distance travelled per person per day in km (mi)	57 (35.4)	28 (17.4)	39 (24.2)	29 (18.0)
Average journey time per person per day (minutes)	82	60	84	72
Average home-to-work distance in km (mi) (only working people)	22 (13.7)	13 (8.1)	22 (13.7)	9 (5.6)

### ***Division of Duties***

Between 2001 and 2009 the labor market participation of mothers with young children increased from 56% to 71%, while over the same period the labor market participation of men remained virtually unchanged (1). Consequently, in increasing numbers of families both parents worked during more days of the week (2). Nevertheless, fewer mothers worked than fathers, and gender differences were discerned in the number of contractual hours, the home-to-work travel distances, and the division of other duties within the household (such as caring for children). It appears, for example, that fathers on average worked for more hours and days in the week, and that mothers spent more time caring for children and more often dropped off/picked up their children (2-4). On days in which both parents went to work, these parents would more equally divide the care-providing duties among themselves (8).

Table 2 shows the distribution of labor participation of parents in Dutch households with young children 0-12 years of age (18). Only 10% of these parents, both male and female, participate in full time jobs and only 2% of the women have full time jobs of 35 hours per week in combination with a partner working part time. The majority of these women work in part time jobs. It is obvious that mothers in households with young children make less working hours than men, although the total amount working hours of women has doubled since 1996, from 10 hours a week to 20 hours a week on average (18).

**TABLE 2. Distribution of Labor Participation, Parents with Children 0-12 yrs, M(ale) and F(emale) (18)**

		One fulltime, one part-time			One part-time, one not working	None of spouses working
Both fulltime	M fulltime	M fulltime	F fulltime	Both part-time	10%	4%
	F 20-35 hrs/wk	F 12-20 hrs/wk	M 20-35 hrs/wk			
10%	52%	17%	2%	10%	6%	4%

The dropping off and picking up of children from school/day care was more often done by mothers than by fathers. Mothers dropped off/picked up children on average 3.5 times more often than fathers. There is a strong correlation between the mothers' shorter home-to-work travel distances and the fact that they more often combined work and care-providing duties. Moreover, mothers were also more often the ones who responded to emergencies, such as picking up their sick children from daycare (19).

### ***Transport Mode Use***

Gender differences also have an impact on the transport modes used by mothers and fathers with young children. Mothers have a larger role in dropping off/picking up children and in household duties, such as grocery shopping. For travel in the immediate residential area, the choice is often for slower transport modes, and this is indeed revealed in the statistics: fathers used cars for nearly two-thirds of their trips, while for mothers this percentage was markedly lower (see Figure 5). Mothers clearly made more use of bicycles or walking for their trips.

For commutes to and from work, cars are the most frequently used transport mode, which is the case for both fathers and mothers. Mothers make relatively more use of bicycles. However, given the large difference in average home-to-work travel distances between fathers and mothers, the difference in transport mode use is remarkably small.

Children are primarily dropped off at school or daycare by car or bicycle. Mothers opted to use slower transport modes (bicycle or walking) 62% of the time for drop off/pick up trips. Fathers on average used cars just over half the time. Because mothers more often drop off/pick up children, children in the majority of cases either bicycle or walk to and from school.

There is however a development to be discerned in this, involving the mothers: since the mid-1990s, the percentage of trips undertaken by mothers as car drivers increased from 28% to 38% (13, 17). This increase comes mainly at the expense of trips undertaken as car passengers. For fathers the percentage as car drivers has remained relatively constant. That mothers increasingly travel as car drivers, and increasingly less often as car passengers, is related to women's increasing rates of driver license possession and car ownership, as well as to women's increasing labor market participation (20).

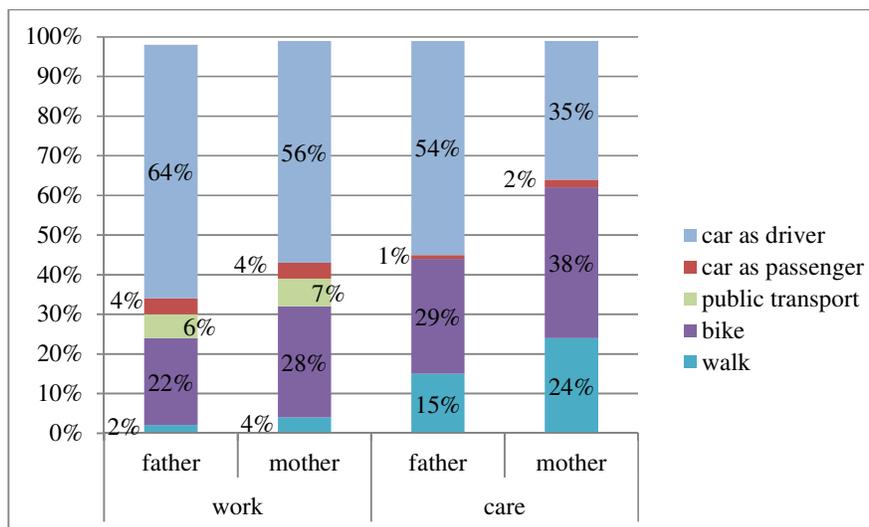


FIGURE 5. Share of transport modes for trips related to care-providing and employment for Dutch mothers and fathers with young children

## TYPES OF TRAVEL DAYS IN DUTCH FAMILIES

Parents often travel to drop off/pick up their children, but do they also have to travel to their work place? How often do parents travel directly to work, and are they not responsible for their children's transportation? Are there differences depending on the day of week? Which transport modes in the various day types are most popular among parents? And, in conclusion: what are the discernible differences between men and women?

### Combination Days

When at least one parent during the same day combines a drop off/pick up children trip with a commuting trip, this household is deemed to have had a Combination day. Notably, in most families that are classified in the Combination day on their day or travel registration (62%), both the father and mother work outside the home and drop off/pick up their children on a day they also travel to work. Often in these families, one parent brings the children to school in the morning and consequently travels to work, while the other parent travels to work directly; on the way back, the other parent picks up the children, while the first parent can travel directly from work to home.

In 26% of cases only one parent combines the commute to/from work with the drop off/pick up of their children, while the other parent during the same day only engages in home-to-work mobility. The situation wherein one parent does not work outside the home while the other parent still combines his or her work commute with the drop off/pick up children, is rare (in 9% of families).

Combination days occurred most frequently on Mondays, Tuesdays and Thursdays, which corresponds to the days in the Netherlands when both parents are most often engaged in paid employment. An important difference between men and women was discernible on Combination days. In nine out of ten households in which both parents commute to their places of employment, mothers dropped off/picked up their children considerably more often than fathers and thus combined duties more often on one single day. We assume there are three factors which might play a role in this: mothers are more flexible and have more time available for child care due to their part-time employment, they more often work closer to home and they more often feel responsible for taking care of their children.

Parents' average mobility levels on Combination days is higher than the average mobility levels of all two-parent families in the Netherlands, as they undertake more trips, cover larger distances and spend more time travelling per day (Table 3). This greater mobility is a result of the larger number of activities that these households engage in during a single day. In addition, it is possible that the set opening and closing times of day care facilities and schools (precisely during rush hours) have an effect on travel times, whereby parents have less flexibility in the travel time they have for dropping off/picking up their children. Consequently, these parents are less likely to have the opportunity to avoid rush hours, and thus their travel times increase. Moreover, children's afterschool care facilities, which parents often use on days that they (both) work, are situated slightly further from home than primary schools (21). The average distance travelled for childcare by households on a Combination day is approximately 2.9 kilometers, slightly more than the average of 2.5 km for Dutch families with young children.

There are significant differences between the spouses on a Combination day, especially concerning the distances travelled. Women in households with a Combination day travel only 13 km to their work location; for men, this is 20 km. Since women make also more trips than men, their average trip length is shorter.

**TABLE 3. Mobility Behavior of Parents on a Combination Day (based on (13))**

Mobility behavior	Work day			NL families with children < 12 yrs		
	Household	Male	Female	Household	Male	Female
Trips per person per day	4.8	4.3	5.4	4.0	4.8	4.3
Distance travelled per person per day (km)	49	60	37	43	49	60
Journey time per person per day (minutes)	83	89	76	71	83	89
Average distance to work (km)	17	20	13	18	17	20
Average distance to daycare /school	2.9			2.5		
Modal share of parents dropping off/picking up children						
Car	57%	64%	54%	46%	55%	37%
Public transport	1%	0%	1%	0%	0%	0%
Walking/cycling	40%	35%	45%	53%	44%	62%

For families having a Combination day, cars are the most often used transport mode for dropping off/picking up children (57%). Approximately 40% of trips to and from day-care centres and schools are undertaken by bicycle or walking. Public transport is seldom used (1%) for dropping off/picking up children (Table 3). Women more often use active modes of transport for dropping off their children than men, whereas men use the car more often for this purpose. Cars are the most often used transport mode for commuting to work (65%); only a quarter of parents cycle or walk to work on their Combination days.

As many as 55% of these households own two cars. That number is relatively high compared to the average Dutch households with young children (48%).

The pattern of care-providing travel on a Combination day differs considerably from the transport mode use of the average Dutch household with children younger than 12 years old. In the latter group of households, the car is less dominant for care-providing trips, with the slower transport modes prevailing (53%).

A large percentage (60%) of the parents engaged in a Combination day travel directly to their workplaces after dropping off their children at daycare or school. These parents mostly use cars for their commutes, with approximately one fifth of them opting for bicycles. The other 40% first return home after dropping off their children at daycare/school, and more than half of these parents (57%) will then change their mode of transport before travelling on to their workplaces. The combination 'car and bicycle' and 'car and walking' are the most

frequent (33%) combinations. The majority of parents use slower transport modes (bicycles and walking) to drop off/pick up their children, and cars for commuting to and from work. Parents that return home and do not change transport modes use bicycles proportionally more often (36%), while 10% opt to walk.

An interesting observation from our analysis is that women are more involved in combining day care trips and working trips than men. About 50% of the men in this type of day do not combine a day care trip with a working trip, whereas as many as 78% of women combine both responsibilities on one day. An explanation for this observation could be that women are more involved in part time jobs than men or women have more opportunities to drop off/pick up the children from school or day care centre because of the shorter distance to their work location.

### **Care Days**

A household is deemed to have had a Care day when one of the two parents travel to drop off/pick up their children from day care and/or school, but does not combine this with a commute to work on that same day. In approximately half of the households (55%), both the father and mother do not commute to work on a Care day. That is a relatively large number, given that the employment rate of Dutch parents is higher than 55%. For 40% of households on a Care day, one parent travels to work, but without combining this with a drop off/pick up, while the other parent only travels to drop off/pick up the children. The Care day most often occurs on Wednesdays, and, to a somewhat lesser degree, on Fridays. That is why parents, especially when they work part time, often choose Wednesdays as their day off work.

Compared to the Combination day, the division between fathers and mothers in terms of dropping off/picking up children on Care days is even more skewed. Mothers on average undertake 85% of the care-providing trips on these days, compared to only 15% for fathers. This is also due to the fact that in households with one or more Care days, it is primarily the mothers who hold part-time jobs or do not work at all. An additional explanation for this is that children of primary schools have shorter school days (until 12 a.m) on Wednesdays in the Netherlands. The Care day is relatively common among one-income households (36%).

On days when they have a Care day, parents on average undertake more trips in a single day and spend a longer time travelling than two-parent families have on average days (Table 4). Especially mothers are very mobile on a Care day, they make almost twice as many trips as fathers. On the other hand the travelled distance for women on a Care day is low (26 km) compared to men (60 km). This type of travel day encompasses a relatively large number of one-income families, in which the mothers specialize in the care-providing duties, including dropping off/picking up the children. Mothers make relatively much shorter household-related trips and care for the children. The breadwinners in one-income families do not have to take into account the temporal-spatial constraints associated with the need to drop off/pick up children at specific times and places. Consequently, it is easier for the breadwinners in one-income families to accept longer home-to-work travel distances (25 km on average) and corresponding travel times.

The distances travelled for dropping off/picking up children at school or daycare are shorter than for other Dutch families. This is in part due to an overrepresentation of families with children in the school-going ages (4 years and older). On the days when one of the parents does not work, these children also do not go to after-school facilities when the school day ends. As we previously indicated, primary schools are on average situated closer to homes than day care centers (21, 22). On the days when the parents' travel day is relatively uncomplicated, requiring no work-related coordination of mobility, they can also stay closer to home when dropping off/picking up children, and spend proportionally less time performing this duty.

On a Care day, cycling and walking are the most frequently used transport modes for dropping off/picking up children (69%), although the car is still used by a considerable number of parents (30%). However, this is much less than on a Combination day, where the transport mode for work is dominant for the rest of the mobility choices made and hence the car remains the dominant mode of transport. Parents having a Care day regularly combine the dropping off/picking up of children with other activities outside of the home, such as grocery shopping, for which cars are routinely used. Women use the car less frequently than men for dropping off/picking up children from school and they use active modes more considerably frequently (71%) than men do (59%).

**TABLE 4. Mobility Behavior of Parents on a Care Day (based on (13))**

Mobility behavior	Work day			NL families with children < 12 yrs		
	Household	Male	Female	Household	Male	Female
Trips per person per day	5.2	3.7	6.7	4.0	3.5	4.4
Distance travelled per person per day (km)	43	60	26	43	57	28
Journey time per person per day (minutes)	77	84	69	71	82	60
Average distance to work (km)	25	26	21	18	22	13
Average distance to daycare/school	2.2			2.5		
Modal share of parents dropping off/picking up children						
Car	30%	40%	28%	46%	55%	37%
Public transport	0%	0%	0%	0%	0%	0%
Walking/cycling	69%	59%	71%	53%	44%	62%

### Work Days

On a Work day, neither of the parents in a household bring their children to school or day care. At least one of the parents does commute to work. For two-thirds (67%) of the households on a Work day, both the father and mother commute to work. For 33% of these families, one parent commutes to work without combining this with a trip to drop off/pick up children, and the other parent does not travel at all (that is to say, not for work and not to drop off/pick up children at school or day care). These are often households with only children under the age of 4 years old who do not attend day care or school, or with older children. From the age of nine, children in the Netherlands generally can walk or bicycle to school on their own (23), no longer requiring the parents to undertake a care-providing trip.

In cases in which both parents only travel to their job and do not combine this with child-related travel, it is likely that the child care is arranged within the home or the children are picked up by a nanny at home. In the Netherlands, many parents want their children to be cared for as much as possible in their close surroundings, which, for example, includes having nannies at home or bringing children to grandparents or other family members when both parents work (3, 7).

Parents on Work days undertake fewer trips than other two-parent families (Table 5). This is not so surprising, as such days do not include trips solely devoted to dropping off/picking up children. The distances travelled remain approximately the same, while the amount of time people spend travelling is significantly lower for parents on a Work day. The car is dominant: they are used for nearly two-thirds of all commutes to work. Men are using the car more frequently than women and walking and cycling are seldom used, compared to the Combination day and Care day, while public transport is used for approximately 5% of the trips (Table 5).

**TABLE 5. Mobility Behavior of Parents on a Work Day (based on (13))**

Mobility behavior	Work day			NL families with children < 12 yrs		
	Household	Male	Female	Household	Male	Female
Trips per person per day	3.2	3.2	3.1	4.0	3.5	4.4
Distance travelled per person per day (km)	41	57	24	43	57	28
Journey time per person per day (minutes)	66	81	50	71	82	60
Average distance to work (km)	20	24	16	18	22	13
Average distance to daycare/school	19.6			20.4		
Modal share of parents for commuting to/from work						
Car	66%	68%	59%	65%	68%	59%
Public transport	6%	5%	7%	6%	5%	7%
Walking/cycling	26%	22%	33%	28%	22%	33%

## CONCLUSIONS AND DISCUSSION

The mobility of parents with children aged 12 years and younger clearly differs from that of the average Dutch person. These households have more responsibilities that require them to travel, and they consequently have less flexibility in scheduling their activities and trips. There are also considerable differences between fathers and mothers. Fathers and mothers both make on average more trips per day than Dutch people who do not have children, but mothers make even more trips than fathers. Fathers travel farther on an average day than other people, and mothers less far. Both fathers and mothers spend above average amounts of time travelling per day. Mothers make more short trips and more often use bicycles for these trips than fathers. Their mobility is focused mainly around the house and the location where their children spend their days: mothers drop off/pick up children at school and day care 3.5 times more often than fathers. Although in recent years mothers have increasingly participated in the labor market, fathers still work more hours and days per week.

On average, the higher educated a Dutch person is, the further he/she works from home, but even when educational levels are taken into account, fathers still work considerably further away from home than mothers. In this respect, mothers on average have a smaller activity range than fathers. Fathers more often use cars instead of more home-related transport modes such as bicycles.

The analyses of parents' travel patterns reveal that parents who during the same day combine dropping off/picking up children with commutes to work are also more likely to use cars for these drop off/pick up trips. However, some do prefer to use bicycles, even if they then subsequently commute to work by car. Many of them have difficulty parking at schools, and the related local traffic jams cause so much stress that they regard the changing of transport modes to be a more relaxed and efficient experience. Personal preferences seemingly play a greater role than the actual differences in travel times, although the same limitation in time and space lies at the base of the transport mode choice. On days when the home-to-work commute is not combined with the dropping off/picking up of children, more parents opt to accompany their children cycling or walking.

Many transport policy issues have a link with the reduced flexibility in scheduling arising from the combination of task and responsibilities. For instance, many unsafe traffic situations exist around schools, due to the high number of cars that have to share the same space with young children arriving by foot or on bike.

This applies specifically to parents who must combine work with accompanying their children to and from school. These parents often experience little flexibility in scheduling, which often leaves them no choice but to use the car. This is a problem from both the societal and policy perspectives. For such problems it is crucial that solutions are found on both the local and regional spatial levels. It is precisely this combination of these two scale levels that renders the mobility of parents so complex. Local traffic solutions, which contribute towards allowing both cars and slow transport modes (bicycles and walking) to reach schools in a safe and less stressful manner could provide a solution for the local problems. The concentration of various day care facilities and primary schools within the same building or in close proximity to one another may ensure that parents have to travel to fewer locations, but such concentrations can indeed lead to more traffic congestion in and around such sites. This is a distinct limitation to the concentration of childcare facilities. As women are mostly responsible for taking the children to their care facilities, their constraints should be taken into account when further developing solutions for these traffic situations.

Another topic closely related to the (limited) flexibility in daily scheduling is congestion reduction. New ways of working (independent of time and location), believed to increase the flexibility in this schedule, are widely introduced. However, if other parts of parents' activity schedules that are often combined with work-related travel, such as bringing children to child care, remain the same, the actual flexibility might only slightly increase or even remain stable. Women will probably have an even smaller increase in flexibility than men, as the mobility of mothers is more care- and home-oriented. In order to create flexibility and stimulate other mobility choices, all constraints in the daily schedule and gender differences within these constraints should be carefully considered.

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# How different are barriers against out-of-home activity participation for women raising children?

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## ABSTRACT

Against the backdrop of an ageing Japan, and as a countermeasure against the low birthrate phenomenon, the promotion of an environment that allows children, pregnant women, and parents of babies and young children to participate in out-of-home activities in a safe and comfortable manner is increasingly becoming more important. This study focuses on barriers encountered by parents with young children when conducting out-of-home daily activities. We classified barriers in several categories: Transportation system, activity opportunities, household activity scheduling, childcare services, childcare information and public attitudes towards childcare. To examine the effect of these barriers on daily out-of-home activity participation, we conducted a web-based questionnaire survey of 1,000 women with young children living in the Kanto Region, including the Tokyo Metropolitan Area. Using the data collected from this survey, we analyzed the differences in travel mode by trip, segmented according to trip purpose on both rainy and fine weather days. Then, frequency of with/without children grocery shopping, strolls and outings to parks were modeled to further investigate important barriers. Finally, we examined differences in mothers' attitudes toward several kinds of barriers given different residential location, and the effect of personal and household characteristics on those attitudes. Findings suggest that difficulties encountered when conducting out-of-home activities differ given different living areas. In the Tokyo central area, barriers were related to the public transport systems and building characteristics at the destination. In Tokyo suburban areas, barriers were associated with the pedestrian and bicycle environment. Finally, in local cities in Northern Kanto Region barriers were more related to car use. We also found evidence suggesting that mothers with children under three years old, and nuclear families not living close to others who could support them in raising children, felt the existence of more barriers. On the other hand, mothers with more years of experience in child-raising felt fewer difficulties in raising children.

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**KEYWORDS:** Women raising children; Out of home activity participation; Travel behavior; Barriers.

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## 1. INTRODUCTION

Against the backdrop of an ageing Japan, and as a countermeasure against the low birthrate phenomenon, the promotion of an environment that allows children, pregnant women, and parents of babies and young children to participate in out-of-home activities in a safe and comfortable manner is increasingly becoming more important (1, 2).

Parents of babies and young children who are not able to travel alone encounter many kinds of barriers when conducting daily activities including out-of-home activities. In recent years, through the enforcement of the Accessibility Improvement Law in Japan (2006) and several other institutional measures, a barrier-free environment not only for elderly and disabled people but also for parents with children is being promoted in public facilities, commercial spaces, and in road and public transportation facilities such as railway stations and their vicinities. However, other than barriers in transportation facilities and public facilities, there are several categories of barriers, such as barriers in household activity scheduling, childcare services and childcare information (1, 2). Furthermore, the types of barriers and their impact on out-of-home activities of child-raising parents vary according to individual and household characteristics, such as household structure, number of children, gender and age of children, support for childcare, employment and so on (1, 2).

As mentioned above, the nature of many of the barriers child-raising parents face during out-of-home activities is different from those elderly or disabled persons face; therefore, new measures to support out-of-home activities of households with young children are emerging in Japan. For example, “Kosodate Taxi” is a childcare taxi service, which offers special service for passengers with young children and in addition, a child can use the taxi service alone (3). The NPO “Childcare Network of Setagaya-City” offers a web-based map for out-of-home activities with young children called “Kosodate Odekake Map”, which shows useful information for those who want to travel with their children (4). Koto-City government designates several facilities as “Akachan-no-Eki”, i.e. baby’s station, which offer nursing places for babies, and put out information about the station on the Internet as an “Akachan Map”, i.e. baby’s map (5). However, little is known about the types and characteristics of barriers for out-of-home activities with young children, effective measures to mitigate such barriers, or the role-sharing arrangement between departments such as city planning, transportation, and public welfare. From the viewpoint of countermeasures to the falling birth rate related to welfare, family and labor policy, there is not much research focusing on child-raising in the field of transportation planning or policy. Existing literature relates to out-of-home activities of parents with young children focusing on actual condition of, and attitudes towards, public transport use (6, 7), factors which affects destination choice of parents with small children (8, 9), women’s travel behavior patterns (10–12), the relationship between women’s or children’s travel behavior and the built environment (13–17). However, there is not enough knowledge about the effect of residential location, personal and household characteristics on out-of-home activities.

The purpose of this research is therefore to reveal the actual condition of out-of-home activities of child-raising mothers and their attitude towards barriers given residential location, personal and household characteristics.

## **2. BARRIERS AGAINST OUT-OF-HOME ACTIVITY PARTICIPATION FOR WOMEN RAISING CHILDREN**

As shown in Figure 1, there are a variety of barriers against out-of-home activity participation of child-raising parents related to *the transportation system, activity opportunities* in their daily living area, and personal and household characteristics that affect parents’ out-of-home activities and their attitudes. Although there might be several ways of classifying these barriers, the authors propose the six categories as listed below:

- (i) Barriers in *the transportation system*
- (ii) Barriers in *activity opportunities*
- (iii) Barriers in *childcare services*
- (iv) Barriers in *household activity scheduling*
- (v) Barriers in *childcare information*
- (vi) Barriers in *public attitudes towards childcare*

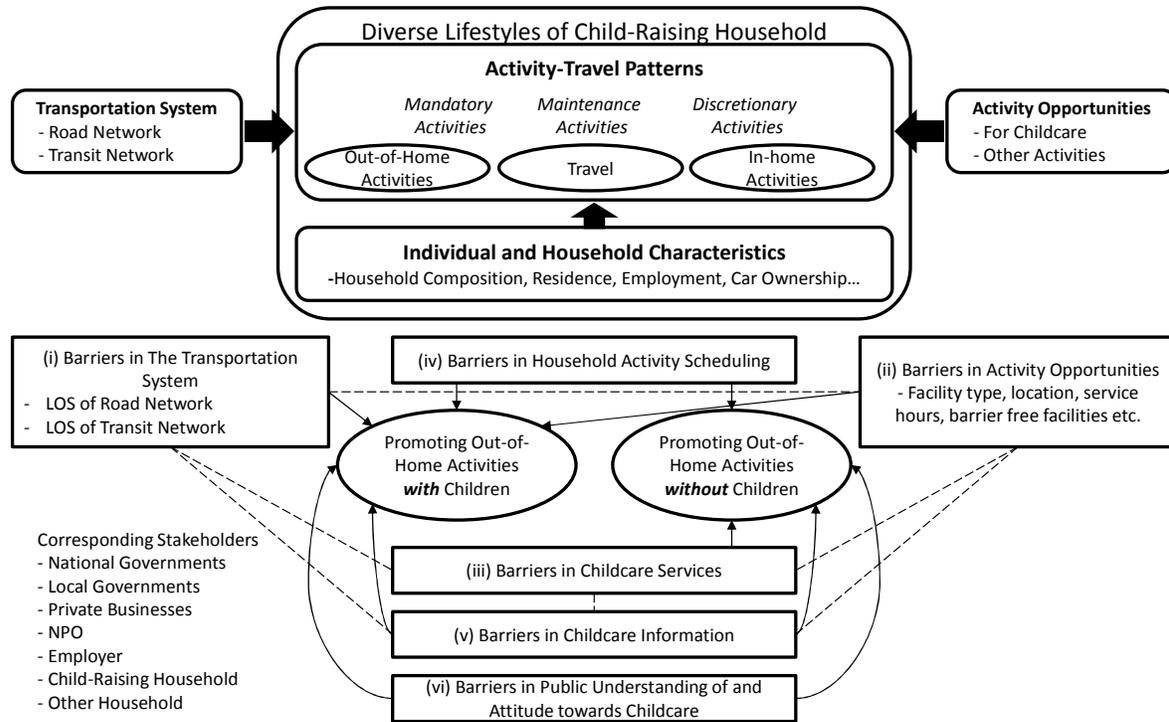


FIGURE 1. Barriers Restricting Daily Activities for Child-Raising Parents

By mitigating (i) barriers in the transportation system, and (ii) barriers in activity opportunities, child-raising parents' out-of-home activities with children are promoted. It is also important to promote out-of-home activities without children by mitigating (iii) barriers in childcare services. In Japan, policy measures tackling barriers (i) and (ii) have been taken by the Ministry of Land, Infrastructure, Transport and Tourism in the national government, and by the bureaus of city/road/transport in the local government, whereas barrier (iii) has been tackled by the Ministry of Health, Labour and Welfare in the national government, and by the bureaus of welfare/childcare in the local government. Child-raising households encounter (iv) barriers in household activity scheduling and face strong time constraints or sudden changes of schedule by their children's behavior. Therefore mitigating these barriers is also important. Along with the mitigation of barriers (i) to (iii), it is effective to alleviate (v) barriers in childcare information by offering general information on barrier-free infrastructures and childcare services. Finally, it is most important to deal with (vi) barriers in public understanding of and attitudes towards childcare to design counter measures against barriers (i) to (v) effectively. To cope with many kinds of barriers, appropriate co-operation and role sharing between national and local governments, private operators, NPOs, employers, child-raising households and other households is necessary.

The questionnaire survey was designed based on results from existing research and an original interview survey on child-raising mothers (1, 2). This survey placed special emphasis on figuring out varieties in barrier free environments in the transportation system and activity opportunities given different residential locations (Tokyo central area, Tokyo suburban area and Northern Kanto area), and varieties in out-of-home activities and attitudes towards several barriers between different individual and household characteristics (e.g., household structure, employment). To recruit child-raising mothers with diverse personal and household characteristics in such a wide study area in an efficient way, the monitors of an on-line survey company were used as the population. Table 1 summarizes the general characteristics of the survey. In the next section, the effect of barriers (i) and (ii) on out-of-home activities, which vary widely between residential locations, and barrier (iv), which differs greatly depending on personal and household characteristics, are examined. Attitudes towards these barriers are also analyzed.

**TABLE 1. Web-Based Questionnaire Survey Description**

Survey Period	April 28 - May 10, 2009
Respondents	1,000 women raising preschool children, living in Kanto Region (Monitors of on-line survey company, Rakuten Research, Inc.) *Residential location of the respondents. <ul style="list-style-type: none"> <li>- Tokyo central area: Bunkyo, Shinjuku, Minato, Chiyoda and Taito cities: 200 respondents</li> <li>- Tokyo suburban area: Residents living along Tokyu railway line in Setagaya, Kawasaki and Yokohama cities: 200 respondents Residents living along Tobu railway line and Seibu railway line in the northern Tokyo and southern Saitama prefecture: 200 respondents</li> <li>- Northern Kanto area: Tsukuba, Mito, Hitachi, Utsunomiya, Oyama, Maebashi and Takasaki cities: 400 respondents</li> </ul>
Survey Method	Web-based questionnaire survey
Information Obtained	Daily out-of-home activities <ul style="list-style-type: none"> <li>- Frequency and travel modes by activity purpose</li> </ul> Situation and attitudes about childcare <ul style="list-style-type: none"> <li>- Usage of childcare services, changes in behavior and attitudes before and after becoming a mother, ownership and usage of childcare instruments, barriers in out-of-home activities with children, usage of childcare information</li> </ul> Situation of children <ul style="list-style-type: none"> <li>- Nursery or kindergarten school</li> </ul> Individual and household characteristics <ul style="list-style-type: none"> <li>- Gender, age, employment, household structure, household income, residence year, car ownership, nearby railway station</li> </ul> Others <ul style="list-style-type: none"> <li>- Reasons for residential choice, countermeasures against sudden illness of children</li> </ul>

### 3. ANALYSIS

#### 3.1 Individual and household characteristics and residential location

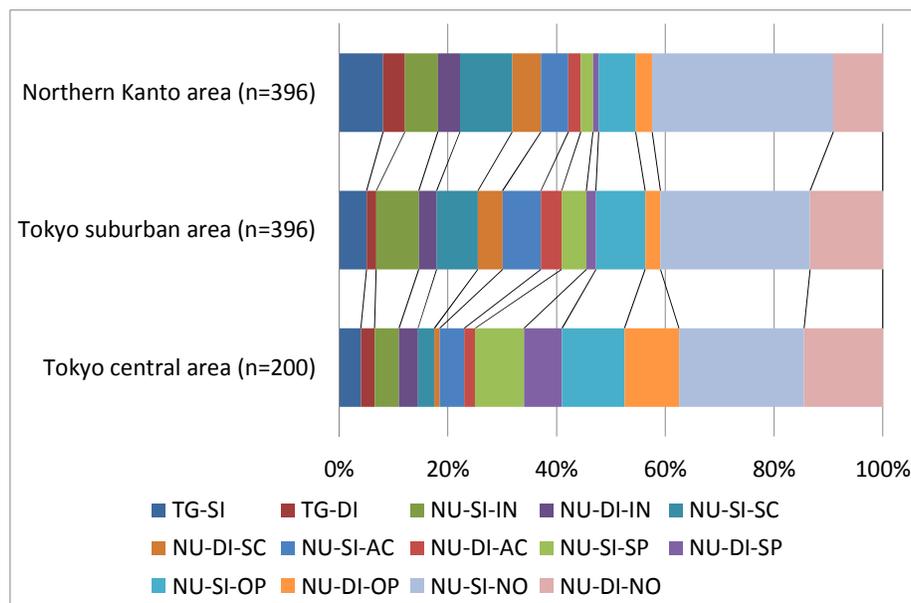
First, the characteristics of the survey sample are described from the viewpoint of variation in personal and household characteristics between different residential locations. The distribution of the age is as follows, 13% of the sample were 25 to 29 years old, 38% were 30 to 34, 36% were 35 to 39 and 12% were over 40. Three quarters of the sample were in their thirties and there was no significant difference in the age distribution given residential location. The total employment rate of the sample was 31%. This rate differed somewhat between residential locations: 39% in the Tokyo central area, 31% in the Tokyo suburban area, and 27% in Northern Kanto area. As for the number of the children, 53% of the sample had one child, 36% had two children and 12% had three or more. The ratio of mothers that had one child was 65% in the Tokyo central area, 53% in the Tokyo suburban area and 46% in the Northern Kanto area. The average number of children was 1.46 in the Tokyo central area, 1.58 in the Tokyo suburban area and 1.72 in the Northern Kanto area. 90% of the sample belonged to a nuclear household, which consists of husband, wife and their children. As for instruments for going out with children, 86% of the sample had a “baby stroller”, 78% had a “baby carrier (string)”, and 44% had a “baby sling (cloth)”. There were few differences between residential locations in these rates. Household car ownership ratio was 76% as a total; 40% in the Tokyo central area, 74% in the Tokyo suburban area and 96% in the Northern Kanto area. In these rates there were significant differences between residential locations. Especially, in the Northern Kanto area, over 60% of the samples had two or more cars. As for household income, the ratios of the sample whose household earned under five million Japanese yen<sup>7</sup> per year were 15% in the Tokyo central area, 32% in the Tokyo suburban area, and 44% in the Northern Kanto area. The ratio of households with an income over seven million Japanese yen per year was 62% in the Tokyo central area, 38% in the Tokyo suburban area and 26% in the Northern Kanto area.

<sup>7</sup> USD 1 = JPY 98; EUR 1 = JPY 128 at the time of execution of the survey (March 2009).

Figure 2 shows the household structure of the sample. The sample was classified into 14 (2 x 7) categories. The first two categories are divided by parents employment situation, i.e. single income or double income, and the latter seven are divided by the residential location of the person on whom a household can rely for childcare: living together (three generation household), immediate neighborhood, same city, adjacent city, same prefecture, other prefecture and nowhere. The persons on whom the respondents rely except their husband were “mother” (42%), “father” (18%), “husband’s mother” (18%), “husband’s father” (10%), “relatives” (4%) and “other” (4%). About 40% of the respondents answered that no one other than their husband offered any kind support to their childcare. The ratio of households that did not have anyone to rely on or who had someone to rely on in other prefectures was about 60% in the Tokyo central area and about 55% in the Tokyo suburban area and the Northern Kanto area. On the other hand, the ratio of those that had someone to rely on in the immediate neighborhood, same city or adjacent city was about 25% in the Tokyo central area, and about 40% in the Tokyo suburban area and the Northern Kanto area. As a total, over half of the sample did not have anyone (i.e., parents of their own or relatives, to rely on for childcare) living close to them, so basically, they managed to raise their children by themselves (i.e., father and mother alone).

Differences of individual and household characteristics between different residential locations are summarized below:

- Tokyo central area:	Higher rate of double income households, smaller number of children, lower car ownership rate, higher household income, higher rate of nuclear households, less support for childcare from outside of the household
- Tokyo suburban area:	Intermediate nature between Tokyo central area and Northern Kanto area
- Northern Kanto area:	Higher rate of single income households, larger number of children, higher car ownership rate, lower household income, lower rate of nuclear households, more support for childcare from outside of the household



**FIGURE 2. Household Structure of Respondents**

Abbreviations:

- 1<sup>st</sup> level TG: three generation household; NU: nuclear household;
- 2<sup>nd</sup> level SI: single income household; DI: double income household;
- 3<sup>rd</sup> level The nearest person on whom the samples could rely for childcare lived in:  
 IN: immediate neighborhood; SC: same city; AC: adjacent city; SP: same prefecture;  
 OP: other prefecture; NO: nowhere.

### 3.2 Main travel modes for out-of-home activities

In the questionnaire survey, frequency and main travel mode for several types of out-of-home activities were asked: i.e., commuting, to and from nursery/kindergarten school, to and from children’s culture lessons, outing to parks/strolls, grocery shopping, hobby/leisure/sightseeing, banking/post office/public office, hospital and others. Figures 3 and 4 illustrate the differences in main travel mode for “grocery shopping” and “outing to parks/strolls” between different residential locations. Including these two activities, in all of the activities, the modal share of car increased and modal shares of walk and bicycle decreased consistently as one moves away from the Tokyo central area to the Tokyo suburban area out into the Northern Kanto area. These characteristics would reflect differences in car ownership rate, level of services of public transport, geographical distribution of activity opportunities and so on. This finding on mode use is similar to a study that examined car use by household lifecycle stage and built environment in Kyoto-Osaka-Kobe area (17). As for “to and from nursery/kindergarten school”, main travel modes both on fine weather days and on rainy days were asked. On rainy days, the modal share of bicycle decreased largely and instead modal shares of car and walk increased compared to fine weather days in all the residential areas (Figure 5).

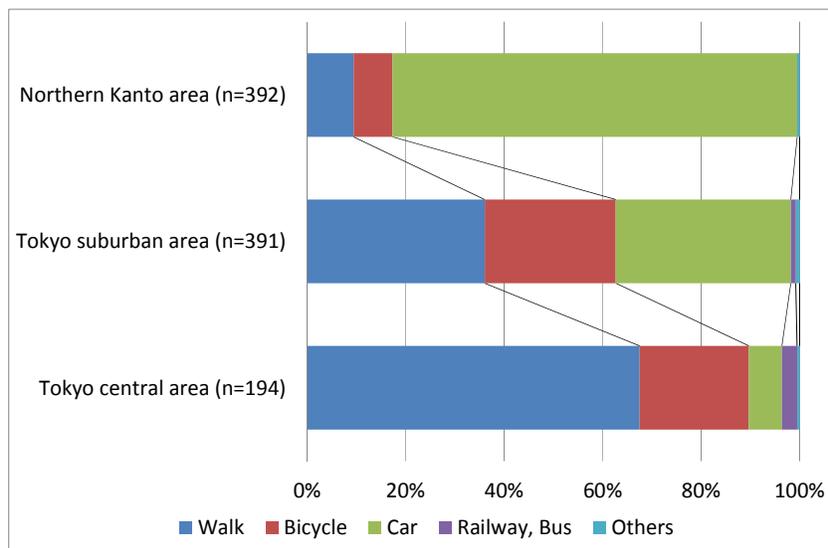


FIGURE 3. Main Travel Mode for Grocery Shopping

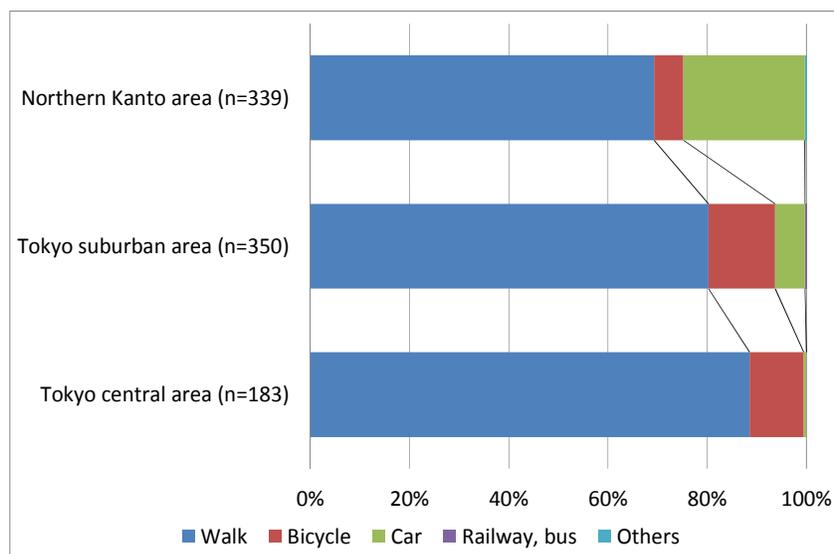


FIGURE 4. Main Travel Mode for Outing to Parks/Strolls

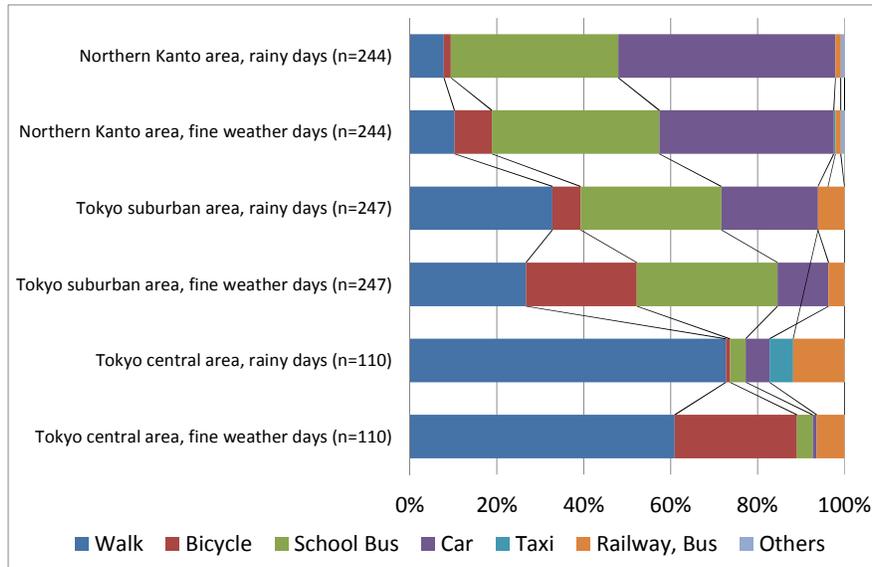


FIGURE 5. Main Travel Mode to and from Nursery/Kindergarten School

### 3.3 Analysis on frequencies of out-of-home activities: grocery shopping and outing to parks/strolls

In this section, the effect of differences in *the transportation systems* and *activity opportunities* given residential location, and the effect of differences in personal and household characteristics on out-of-home activity frequency are analyzed. In this analysis the number of days per week in which the respondent participated in an out-of-home activity was used as a dependent variable. Therefore, upper and lower censored Tobit model was used (Equation 1) (18).

$$y^* = \beta x + \varepsilon \quad (\varepsilon \sim N[0, \sigma^2])$$

$$y = 0 \quad (y^* \leq 0)$$

$$y = y^* \quad (0 < y^* < 7)$$

$$y = 7 \quad (y^* \geq 7)$$

$y$ : frequency (days per week)  
 $y^*$ : latent variable  
 $x$ : explanatory variables vector  
 $\beta$ : parameters vector  
 $\varepsilon$ : error term

Equation 1

In the questionnaire survey, “frequency of participating in an out-of home activity with children” and “frequency with children and other adults” were also asked. Therefore, three types of “frequencies” are analyzed; i.e., “out-of-home activity frequency of mother alone”, “out-of-home activity frequency of mother and children” and “out-of-home activity frequency of mother, children and other adults”. In these analyses, respondents whose out-of-home activity frequency was zero were excluded because their main travel mode was unknown. Table 2 shows the estimation results of Tobit models for “Grocery shopping” and “Outing to parks/strolls”. A positive sign of a coefficient means that the explanatory variable has a positive effect on frequency.

As for “Grocery shopping”, the average values of “out-of-home activity frequency of mother alone”, “out-of-home activity frequency by mother and children” and “out-of-home activity frequency by mother, children and other adults” were 0.63, 1.45 and 0.78 days per week respectively. Mothers take their children in about 80% of their outings for grocery shopping, and in about 30% of their outings they were accompanied by children and other adults. The models include several significant independent variables. As for “out-of-home activity frequency of mother alone”, “number of children”, “main travel mode is walk” and “main travel mode is bicycle” have positive effects and “number of children under three years old” has a negative effect on frequency. On the other hand, for “out-of-home activity frequency of mother and children”, “number of

children under three years old”, “unemployed”, “nuclear household”, “the nearest convenience store under five minutes trip”, “main travel mode is walk” and “main travel mode is bicycle” have positive effects on the frequency. In the case of “out-of-home activity frequency of mother, children and other adults”, “number of children under three years old” has positive effects and “number of children”, “nuclear household without any support from outside”, “main travel mode is walk” and “main travel mode is bicycle” have negative effects on frequency. The findings are as follows:

- Shopping facilities within walking or bicycling distance promote shopping activity;
- It is not desirable to leave children under three years old at home;
- Large number of children makes it difficult to participate in activities; and
- Differences in time constraints resulting from employment situation and differences in household structure or support from outside of a household have some effects on frequency.

**TABLE 2. Tobit Model Estimations for Out-of-Home Activity Frequencies of Child-Raising Mothers: Grocery Shopping and Outing to Parks/Strolls**

Out-of-home activity types	Grocery shopping						Outing to parks/ strolls			
	Frequency by mother alone		Frequency by mother and children		Frequency by mother, children and other adults		Frequency by mother and children		Frequency by mother, children and other adults	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Constant	-0.0192	-0.046	-0.647	-1.85 *	0.962	4.11 **	0.631	1.72 *	0.834	3.18 ***
Number of children	0.401	3.27 ***	-0.0323	-0.325	-0.22	-3.04 ***	-0.208	-2.14 **	-0.176	-2.39 **
Number of children under 3 years old	-2.44	-11.9 ***	0.72	4.55 ***	0.59	5.15 ***	1.22	7.71 ***	0.159	1.38
Mother's job: full time worker	0.393	1.47	-1.41	-6.16 ***	-0.0384	-0.248	-2.7	-10.9 ***	0.32	2.04 **
Mother's job: part time worker	0.0692	0.224	-0.597	-2.2 **	-0.0476	-0.246	-1.11	-4.05 ***	0.123	0.631
Nuclear household with support for childcare from outside	-0.28	-0.834	0.66	2.33 **	-0.189	-0.99	0.0695	0.253	-0.269	-1.35
Nuclear household without any support	-0.429	-1.35	0.736	2.73 ***	-0.504	-2.78 ***	0.0551	0.212	-0.305	-1.62
The nearest supermarket is within 5 minutes trip	0.0158	0.081	0.27	1.77 *	-0.0526	-0.48				
The nearest convenience store is within 5 minutes trip	-0.185	-0.88	0.394	2.39 **	-0.214	-1.83 *				
Living in Tokyo central area							0.298	1.46	0.443	2.92 ***
Living in Toyo suburban area							0.162	0.96	0.25	1.99 **
Main travel mode for this purpose is walk	0.484	2.13 **	0.934	5.46 ***	-0.275	-2.24 **	0.847	3.49 ***	-0.257	-1.5
Main travel mode for this purpose is bicycle	0.832	3.43 ***	0.704	3.53 ***	-0.387	-2.61 ***	0.896	2.75 ***	-0.401	-1.69 *
$\sigma$	2.27	21.9 ***	2.09	32.5 ***	1.46	29.3 ***	2.03	33.9 ***	1.45	28.7 ***
L(C)	-1105.9		-1689.7		-1311.2		-1678.8		-1207.1	
L( $\beta$ )	-1004.2		-1622.7		-1275.0		-1563.0		-1193.1	
$\chi^2 (= 2(L(C) - L(\beta)))$	203.4		133.8		72.3		231.5		27.9	
Number of samples	961						870			

\*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01

As for “Outing to parks/Strolls”, the average values of “out-of-home activity frequency of mother alone”, “out-of-home activity frequency of mother and children” and “out-of-home activity frequency of mother, children and other adults” were 0.08, 1.72 and 0.72 days per week respectively. Mothers take their children in about 97% of their outings to parks or strolls, their main purpose for this type of activity being to let their children play outside. For about 30% of outings they were accompanied by children and other adults. The models show the following findings. For “out-of-home activity frequency of mother and children”, “number of children under three years old”, “unemployed”, “main travel mode is walk” and “main travel mode is bicycle” have positive effects on frequency. On the other hand, in the case of “out-of-home activity frequency of mother, children and other adults”, “full time worker”, “living in Tokyo central area” and “living in Tokyo suburban area” have positive effects.

### 3.4 Mothers’ attitudes towards barriers when going out with young children

In this last section, the sample’s subjective evaluations on 14 types of barriers for out-of-home activities corresponding to the six categories discussed in section 2 are examined. Table 3 shows the results of a logit model based analysis of those attitudes towards barriers when going out with their children. The dependent variables of the models are whether the respondent identifies one of those factors as a barrier for herself or

not. The independent variables include personal and household characteristics. The sample was divided into three subsets by residential location, and three regional models were estimated for each barrier factor.

In the Tokyo central area, choice rates of “barriers in public transit” and “barriers in buildings or facilities at destinations” were relatively high. In the Tokyo suburban area, the choice rates of “barriers in walking” and “barriers in riding a bicycle” were relatively high. In the Northern Kanto area, choice rate of “barriers in getting children into a car” (i.e., bothered by child safety seat) was relatively high. These results reflect differences in travel modes or destination facilities between residential locations. And these factors directly relate to barrier category (i) and (ii) as mentioned in section 2. However, compared to the above-mentioned barrier factors, most of the respondents consider “barriers caused by weather”, “barriers caused by crowding” (indirectly relating to barrier categories (i) or (ii)) and “barriers in childcare schedule” (directly relating to barrier category (iv)) as barriers that affected them.

The effect of individual and household characteristics on attitudes towards barrier factors were as follow: In the Tokyo suburban area, “number of children” increased the sense of barriers in walking and cycling, shortage of nursing rooms and weather related barriers. “The youngest child is under three years old” increased the perception of many of the barrier factors in every survey area. On the other hand, this variable decreased the perception of barriers in cycling and shortage of daycare centers in the Tokyo central area only. “The age of oldest child”, which would represent the mother’s experience on childcare, decreased the perception of several numbers of barrier factors in all of the areas. “Mother is over 40 years old” had an effect on many barrier factors in the Northern Kanto area. “Car owner” increased the perception of car-related barrier factors in the two areas in the Tokyo. In addition, this characteristic decreased the perception of barrier factors related to bicycle use and crowded places in the Tokyo central area only. The car owners in the Tokyo central area would tend not to ride a bicycle or not to visit crowded pedestrian areas with their children compared to the others. In the Northern Kanto area, the coefficient of this variable was not significant because the majority of the sample in the area owned cars. “Nuclear household without any support from outside” increased the perception of barriers on shortage of daycare centers and childcare information at activity opportunities. Differences in degrees of effects of some characteristics between different areas might reflect differences in the built environment, the transportation system or in the demographic distribution. Further research is needed to reveal the effect of these regional factors.



## 4. CONCLUSIONS

This study focused on barriers encountered by parents with young children when conducting out-of-home daily activities. Barriers were classified in six categories: (i) transportation system, (ii) activity opportunities, (iii) household activity scheduling, (iv) childcare services, (v) childcare information and (vi) public attitudes towards childcare. To examine the effect of these barriers on daily out-of-home activity participation, a web-based questionnaire survey of 1,000 women with young children living in the Kanto Region, including the Tokyo Metropolitan Area was conducted. Using the data collected from this survey, the differences in travel mode by trip, segmented according to trip purpose on both rainy and fine weather days, were analyzed. Then, frequency of with/without children grocery shopping, strolls and outings to parks were modeled to further investigate important barriers. Finally, differences in mothers' attitudes towards several kinds of barrier factors between different residential locations, and effects of personal and household characteristics on those attitudes, were examined.

Findings from this analysis suggest that:

- In all of the study areas: the Tokyo central area, the Tokyo suburban area and the Northern Kanto area, more than half of the households did not have anyone who lived in their neighborhood and supported their childcare (i.e., parents or relatives).
- Regarding main travel modes for out-of-home activities of mothers with young children, the share of car increased as one moves away from the Tokyo central area to the Tokyo suburban area and out into Northern Kanto area. On rainy days, the share of bicycle drastically decreased and the share of car or walk increased compared to fine weather days in every study area.
- Frequency of “grocery shopping” increased when shopping facilities were within walk or bicycle distance. It is not desirable for the mother to go shopping alone and leave children under three years old at home. A large number of children makes it hard for a mother to participate in shopping activities. Differences in time constraints resulting from employment situations and differences in household structure or support from outside the household have some effects on shopping activity frequency.
- In almost all of “outing to parks/strolls” activities, mothers were accompanied by their children. Activity frequency was affected by the number of children under three years old, the mother's employment situation and travel mode. Out-of-home activity frequency of mother, children and other adults increased consistently from the Northern Kanto area, to the Tokyo suburban area, with the Tokyo central area exhibiting the highest frequencies.
- As for barriers in out-of-home activities with children, in the Tokyo central area, choice rates of barriers in public transit and barriers in buildings or facilities at destinations were relatively high. In the Tokyo suburban area, choice rates of barriers in walking and cycling were relatively high. In the Northern Kanto area, choice rate of car-related barrier was relatively high. However, compared to these barrier factors, most respondents considered barriers caused by weather or crowding, and barriers in childcare schedule as important barriers affecting them.
- Mothers with children under three years old, and nuclear families not living close to others who could support them in raising children, tend to feel the existence of more barriers. On the other hand, mothers with more years of experience in child-raising tend to feel fewer difficulties in raising children. Differences in degrees of effects of some characteristics between different areas might reflect differences in the built environment, *the transportation system* or in the demographic distribution.

Further study should include:

- Examining the effect of barrier categories (iii), (v) and (vi) in section 2 on out-of-home activities;
- Investigating the effect of regional characteristics such as built environment, the transportation system and demographic distribution on attitudes towards barriers and behavior;
- Examining the existence or not of a causal relation between attitudes towards barriers and behavior;
- Surveying the role-sharing arrangement in child-raising between a husband and a wife considering the father's outings as well (19–20).

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# Born to shop? Gender-specific activity travel in Germany

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## ABSTRACT

In this paper we take a gender perspective to examine whether gendered shopping participation goes beyond differences in employment and labor division within households. We associate our empirical findings with theories from cultural sciences and discuss the connection between shopping, labor division, societal gender norms and individual preferences and attitudes. Moreover, we conduct a long-term trend analysis to discover changes in gendered travel behavior. Our results indicate that gendered travel behavior is largely affected by labor division within households but still goes beyond that. For instance more frequent shopping trips can even be observed for singles. This result can be interpreted as an indirect indication of gender norms, preferences and attitudes. We conduct differentiated descriptive as well as multivariate Logit regressions to take the complexity of gender as a social category into account. The data used are the representative German national mobility surveys of 1976, 1982, 1989, 2002 and 2008.

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**Keywords:** Shopping trips; Preferences; Norms; Labor division.

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## 1. INTRODUCTION

Scientific discussion of gender-specific travel behavior has emerged since the 1970s. There are two different but complementary approaches to investigating gender and mobility. Firstly, cultural studies undertake a qualitative approach dealing with phenomena such as ‘doing gender’ and investigating how gender as a social role is constructed and reconstructed via behavior, including travel behavior ((1); (2)). The second and dominant approach is quantitative and investigates how gender affects mobility. Such studies deal with questions about gender-specific travel behavior, and they understand gender as a determinant of travel behavior (e.g. (3); (4); (5); (6); (7); (8)). The findings presented below are the results of a research project dealing with “Everyday life in the context of changing gender relations: activities, trips, travel modes and time use”, funded by the German Research Foundation. The project follows the second, quantitative approach and can be located in the field of transport geography. An attempt is nonetheless made to integrate the cultural approach in the interpretation of the research results.

Quantitative studies on gender and mobility have developed significantly since their beginnings. Early studies were mostly based on simple comparisons between women’s and men’s travel behavior. Later on, more differentiated approaches became dominant as an understanding of gender as a social role and complex social category emerged. This new understanding of gender and its complexity urged the application of far more differentiated methodologies as well as interpretation and assessment of results. In the analyses described below, gender is taken to refer to a highly complex social construct. The analyses try to model this complexity as far as allowed by the travel behavior data available.

## 2. RESEARCH ON GENDER-SPECIFIC TRAVEL BEHAVIOR

Several studies on travel behavior and gender find differences concerning driver licenses, motorization, travel mode choice, trip purposes, duration of trips and trip lengths within different spatial, temporal and social reference frames (see citations above). This paper focuses on the gender-specific relevance of trip purposes, particularly on shopping trips.

## **2.1 Gendered travel behavior and common explanatory approaches**

Studies investigating the relevance of various activities and associated trips find that the daily mobility of men is strongly characterized by their gainful employment, while for women shopping trips are found to be much more relevant (see (4), 113 and (9), 377f. for Germany; (7), 200 for Norway; (10), 71f. for the USA; (11), 452ff. for the Netherlands). Such studies mainly use the gender role based approach to explain gender-specific travel behavior, assuming a gender-specific labor division on a household and society level. Hereby women take on the major part of unpaid household work which is associated with more shopping trips, whereas men are more often and to a greater extent economically active (e.g. (4), 113f.; (1), (3)). Another, complementary theoretical approach is rational-choice theory, which assumes that labor division is an outcome of household action. Households attempt to achieve the greatest possible benefit from labor division (see (12), 30ff. as a key work). Because women have a lower average income, a household's income loss is less marked if the female partner reduces her amount of paid work rather than the male. On the other hand, there is an additional benefit and increased comfort for the household members if one partner has more time for housework.

## **2.2 Preference hypothesis**

The above outlined reasoning has served feminist theory to argue that women are suppressed by patriarchy and associated household work-sharing, because they have only limited access to marketed work and, hence, economic power and autonomy. However, a younger stand of theory claims that work-sharing is an outcome of gendered preferences. This theoretical approach is also used to explain gendered behaviors such as travel mode choice or trip lengths (e.g. (13), 21ff. concerning travel mode choice; (14); (15)).

Some psychological and sociological studies directly deal with gender-specific preferences and norms (e. g. (16)). For the discussion of gendered labor division and its change over time there is an interesting approach called 'maternal gatekeeping'. Allen and Hawkins (17) introduce this approach and find a considerable effect of norms, preferences and attitudes on the gendered division of housework ((17); also (18)). 'Maternal gatekeeping' implies that women consciously hold on to 'typically female' activities such as housework and childcare even though they could reduce their share and leave a larger proportion of such tasks to their partners. There is evidence found that women even tend to inhibit more involvement of their partners (e.g. (17), 208ff.). This is explained as a phenomena of social identification and role construction which can be interpreted as a kind of 'doing gender'.

In transport geography few studies directly investigate in preferences towards travel behavior ((15); (19); (20)). In contrast to psychological and sociological research, in transport geography a more indirect approach has become established to deal with preferences affecting travel behavior. This is due to the fact that, to our knowledge, there are no data available including direct information on travel behavior and individual preferences as a determinant. Some studies control for several gender-related factors and still find gendered travel behavior which is interpreted as a result of gendered preferences (e. g. (21); (22)).

## **3. HYPOTHESIS AND RESEARCH QUESTIONS**

Particularly when discussing the gender-specific relevance of shopping trips, including everyday shopping as well as more leisure-oriented shopping activities, we expect preferences to be relevant for gendered activity participation. This idea is not frequently encountered in studies in the field of transport geography but is explored in some studies in cultural sciences and psychology that consider gender-specific labor division (e.g. (17); (18)). Individual preferences, norms and attitudes may in turn result from gendered practices, societal gender norms and roles and perceived societal expectations. There is no strict separation of the factors mentioned that affect gender-specific travel behavior. However, gender norms and roles have changed considerably in the last few decades. Nevertheless, even recent studies find that different activities and associated trips are of different relevance for men and women (see above). This also indicates that something relatively persistent may affect gender-specific labor division and travel behavior.

We therefore examine from a gender perspective:

- whether and to what extent shopping participation of men and women converges over time and
- whether or not there is (indirect) evidence for gendered preferences and attitudes affecting travel behavior.

## 4. DATA AND METHODOLOGY

### 4.1 Data

The analyses are based on the representative German national mobility surveys of 1976, 1982, 1989 (KONTIV 'continued survey of travel behavior') and 2002 and 2008 (MiD 'Mobility in Germany'). There are some limitations in comparison because different survey methodologies were used in the five surveys. The differences between the KONTIV surveys and the MiD are especially considerable (23). While the first three surveys were conducted via mail, in 2002 and 2008 the telephone method was used and resulted in higher trip rates (24). The 1989 survey is noteworthy because the questionnaires were collected by couriers. Highly mobile persons are underrepresented in the 1989 survey (25).

Furthermore, the universe in the five surveys is not identical. The three KONTIV surveys and the 2008 MiD use German-speaking residents as the basic population, whereas in 2002 the basic population was the whole residential population. Only in 2002 and 2008 were both East and West Germany considered. Another difference is in the lower age limit: ten years in 1976 and 1982, six years in 1989 and zero in 2002 and 2008. We therefore limit our analysis sample to Germans aged 18 years and older living in West Germany (old 'Bundesländer'). Children and adolescents are not considered because of their specific everyday life, travel needs and behavior (see also (9): 374f.).

Nevertheless, the data allow analysis of long-term trends in activities and travel behavior. They also contain numerous sociodemographic factors that are interesting for analyses in a gender context. As a restriction for our research question, the data do not include direct information on preferences and attitudes. Hence our conclusions concerning norms, preferences and attitudes as influencing factors of travel behavior are necessarily more indirect. As outlined above, this indirect approach that we pursue in our analyses is established in transport geography.

### 4.2 Analysis methodology

The analyses focus on shopping trips because of their close relation to labor division, but we also expect preferences and attitudes to be more likely to impact on shopping than on commuting or leisure activities. We are aware that shopping trips recorded in travel surveys include everyday grocery shopping as well as more leisure-oriented shopping such as clothes shopping. Common gender stereotypes suggest that preferences should be relevant for gendered shopping frequency in the latter case. Some studies also show a considerable effect of norms, preferences and attitudes on the gender-specific division of housework (e.g. (17); (18) on the idea of 'maternal gatekeeping'). This gives rise to the assumption that not only 'leisure shopping' but also everyday shopping may be affected by preferences.

We conduct descriptive analyses and multiple logistic regressions. In the descriptive analyses we distinguish between selected household types and occupation groups. The three selected household types are:

- 1) couples with a child under six years (usually described as the most 'traditional' group regarding labor division);
- 2) couples without children (labor division is relevant for them but should be less traditional than in families; age limited to under 60 years to exclude typical pensioner households); and
- 3) single households (no labor division; age limited to exclude pensioner households).

These contain several interaction terms to model the complexity of gender as an explanatory factor for travel behavior, including numerous factors considered relevant in the context of gender. Such factors relevant in the context of gender and mobility are: age, cohort, occupation, educational level, spatial context, household type and motorization. As dependent variables we observe activity participation. In our case: Does a person conduct at least one shopping trip on a randomly chosen survey day? We compute one regression model for each survey year. This enables us to observe specific trends for various groups of persons. What is more, we can use even non-significant effects for interpretation in cases of strong consistency in signs and magnitude over time.

For statements concerning trends between 1976 and 2008, the constants of the models have to be considered as well as potential change of the respective factors over time. There can easily be misinterpretations when looking only at the effects and their changes. As an example, a decreasing positive factor of 'non-working' (with full-time employees as a reference group) between 1976 and 2008 does not necessarily mean decreasing shopping trips among the non-working. It can also result from increasing shopping trips among the reference group while there is no change among the non-working sample. By way of illustration and to avoid misinterpretations, we undertake some exemplary calculations for selected groups. We calculate participation rates by applying the regression equation. As the basis for these calculations we choose as an exemplary group the 'middle of the sample', meaning the most frequent subgroup of each factor. For the overall sample covering all five survey years this 'middle of the sample' comprises: men and women living in couple households without children, working full-time, aged in their forties, without "Abitur" (university entrance qualification), living in municipalities with 5,000 to 20,000 inhabitants, and with limited car access (less cars than potential users in the household). The exemplary calculations are conducted for this basis group and additionally with some variations, e.g. in occupation, to show different trends. As opposed to descriptive analyses, this procedure enables us to find differences that actually result from one special factor while keeping the other factors considered in the model constant.

## 5. DESCRIPTIVE RESULTS

For the whole analysis sample (German individuals aged 18 and older, living in West Germany) there is an obvious trend of convergence in the shopping trip participation of men and women between 1976 and 2008 (see Table 1). In every survey year women undertake significantly more shopping trips than men. But as the ratios show, this difference decreases during the investigation period. The convergence results from the changing behavior of men, as shopping trips gradually become more common in men's everyday lives (from 19 to 30%). On the other hand, women's participation in shopping trips is nearly constant, at around 35% between 1976 and 2008. This is amazing because it would be reasonable to expect that increased shopping trips among men would relieve women and thus result in women undertaking less shopping trips. Here social change has to be taken into account. The number of single households and therefore the number of individuals who have to do their own shopping is increasing steadily. Additionally, the increasing labor participation of women should be relevant for shopping activity. On one hand, increasing work trips mean increasing opportunities to do small amounts of shopping on the commute; on the other hand, the increasing time pressure in women's everyday lives could encourage more bulk purchases and, hence, fewer shopping trips or a redistribution of shopping between women and their partners. For these reasons this result of the whole analysis sample can hardly be interpreted as representing a redistribution or non-redistribution of maintenance tasks. We therefore take a closer look at the selected household types and occupation groups mentioned above.

The ratios for men and women with a partner, as well as for those living alone, show a higher relevance of shopping trips in women's everyday lives (ratios < 1; only exception: singles 2008). Especially in couple households the participation in shopping trips differs significantly between men and women, most pronouncedly in couples with small children. This aspect of labor division is, as found in several studies, remarkably 'traditional' in families. The low labor participation of mothers has to be considered here. These results show the relevance of the role theory, although there are also hints that role theory does not explain gender-specific shopping trip frequencies entirely. Nevertheless, with exceptions in 1989 (poor data base) and in 2008 (outlier for men), even among singles women undertake more shopping trips than men. Even though this is only significant in 1989 and 2002, single women undertake about 20% more shopping trips than single men. This could be cautiously interpreted to hint at gender-specific preferences concerning shopping and the organization of shopping (frequent shopping of few items vs. seldom bulk purchases). Possibly women like shopping more than men, and therefore, for instance, shop more spontaneously and tend to do less than men to reduce shopping frequency by buying many items at one time. Differing nutrition preferences in terms of the preference for buying fresh food might be relevant as well.

**TABLE 1. Shopping trip participation, descriptive results**

		shopping trip participation				
		men	women	ratio	sign.	
whole analysis sample	1976	19.2%	34.3%	0.56	**	
	1982	20.5%	34.6%	0.59	**	
	1989	19.2%	34.2%	0.56	**	
	1995	no survey				
	2002	27.8%	36.5%	0.76	**	
	2008	30.0%	36.2%	0.83	**	
household type	couples with child under six	1976	17.2%	39.8%	0.43	**
		1982	19.7%	41.4%	0.48	**
		1989	16.4%	45.1%	0.36	**
		1995	no survey			
		2002	25.3%	32.1%	0.79	**
		2008	25.1%	39.2%	0.64	**
	couples without children (both 18 to 59 years)	1976	18.0%	32.2%	0.56	**
		1982	21.0%	34.9%	0.60	**
		1989	16.0%	31.1%	0.51	**
		1995	no survey			
		2002	25.1%	34.6%	0.72	**
		2008	29.1%	33.3%	0.87	**
	single households (18 to 59 years)	1976	26.4%	33.0%	0.80	**
		1982	25.2%	30.8%	0.82	**
		1989	20.5%	29.6%	0.69	**
		1995	no survey			
		2002	25.5%	30.9%	0.83	**
		2008	34.5%	33.6%	1.03	**
occupation	working full-time	1976	16.5%	24.2%	0.68	**
		1982	17.3%	26.1%	0.66	**
		1989	15.2%	23.9%	0.64	**
		1995	no survey			
		2002	23.0%	30.2%	0.76	**
		2008	26.2%	30.6%	0.86	**
	working part-time	1976	17.5%	36.6%	0.48	**
		1982	22.2%	37.7%	0.59	**
		1989	19.4%	37.1%	0.52	**
		1995	no survey			
		2002	31.1%	39.3%	0.79	**
		2008	30.0%	37.7%	0.80	**
	non-working	1976	29.5%	39.5%	0.75	**
		1982	33.8%	40.5%	0.83	**
		1989	34.0%	41.0%	0.83	**
		1995	no survey			
		2002	38.3%	39.4%	0.97	**
		2008	36.9%	38.7%	0.95	*

\*\* p<0.01, \* p<0.05 (McNemar for dependent samples, Pearson's Chi<sup>2</sup> for independent samples)

In couple households with or without children convergence takes place between 1976 and 2008 (ratios draw near 1). While women's shopping trips remain constant over time, men in couple households undertake gradually more shopping trips. Yet women make significantly more shopping trips than their partners until 2008. Moreover, the great difference between the shopping trips of men and women living as couples with small children and those living as couples without children persists until 2008. Mothers make more shopping trips than women without children, while fathers make fewer shopping trips than men without children. Notably, the increase in the shopping trip frequency of men does not cause a decrease in the shopping frequency of their partners. This gains additional importance in light of the fact that labor participation, especially part-time employment of women and mothers in particular, has increased notably since 1976. This implies an increasing variety of activities and possibly greater time pressure for women. But why, against this background, do women not reduce their shopping? One possible factor is that the majority of women in couple households works part-time and thus tends to be side-earners, therefore continues to take on the predominant part of the housework and associated trips. But this does not explain increases in their partners' shopping activities, while theirs remain constant. A possible explanation could be that couples shop increasingly often together. A third argument can be derived from cultural sciences. This is the concept of 'maternal gatekeeping'. According to this understanding women consciously hold on to 'typically female' activities such as housework and childcare even though they could reduce their share and leave a larger proportion of such tasks to their partners. Studies find that women even tend to inhibit more involvement of their partners (e.g. (17), 208ff.). This is explained as a phenomena of social identification and role construction which can be interpreted as a kind of 'doing gender'.

Differentiating by occupation shows that non-working men and women make more shopping trips than the employed. It should be mentioned that non-working people include pensioners as well as the jobless and housewives/househusbands. Time constraints may be a relevant factor here. Interestingly, there is hardly any difference in shopping trips between non-working and part-time employed women. This might result from common constellations and the associated labor division within households: male heads of households are predominantly in full-time employment, whereas their female partners are often housewives or work part-time. From the perspective of rational choice theory this logically results in a large share of the housework and shopping being done by the women even if they work part-time. On the other hand, preferences and attitudes can conduce to this as well. Women possibly have a higher affinity for maintenance and care tasks and

consciously choose part-time jobs to facilitate the compatibility of family and work.

Another interesting finding is that, even among full-time employees, women make significantly more shopping trips than men. This has to be seen against the background of very similar temporal constraints for both. On the one hand, gender role theory provides an explanation for this. Several studies have found a 'traditional' labor division in households even if both partners work full-time (e.g. (26), 11). On the other hand, social norms, perceived societal expectations as well as preferences and attitudes may be relevant again (see 'maternal gatekeeping' above).

Considering the development of shopping trip participation shows a trend especially among the men, and particularly employed men, who are increasingly participating in shopping. A rise in shopping trips is observable among full-time employed women as well. Probably their motorization growth, increasing car use and the associated temporal and spatial flexibility are conducive to more frequent purchases of a few items on the way to or from work.

In summary, it can be stated that there are some indications of the relevance of factors such as individual preferences and attitudes that are surely interrelated with social norms and perceived societal expectations. The explanations of the findings proposed so far imply the relevance of several factors for gender-specific travel behavior. The following multivariate analyses are thus able to provide a much more differentiated view.

## 6. MULTIVARIATE RESULTS

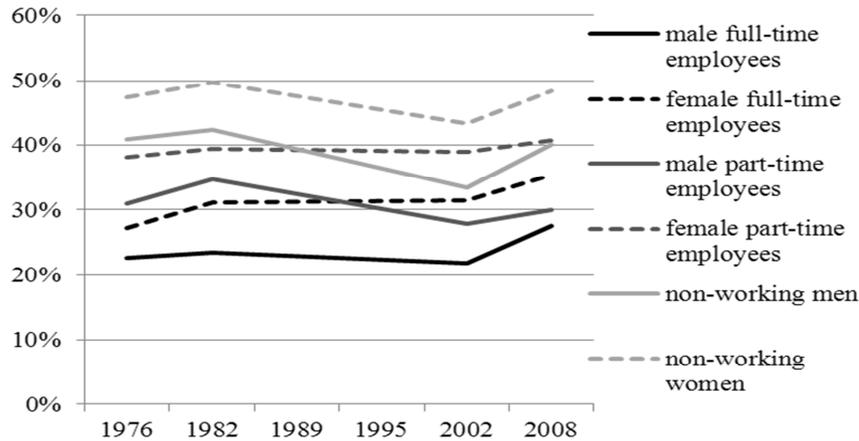
The multivariate logistic models (dependent variable: at least one shopping trip on the survey day = 1, no shopping trip = 0) presented here contain a variety of factors considered relevant when thinking about gender and mobility (see Table 2). Still, the given set of determinants is a compromise in terms of the lowest common ground of the five surveys used. The models yield a vast number of results, but the following remarks focus on those that are interesting for our research questions.

Beginning with the constant (as the average of all reference groups), there is no systematic trend observable in shopping trip participation. The general effect of the factor sex (female), although not significant, is positive and fairly strong from 1976 until 2002. This effect cannot be interpreted as a higher level of shopping activity of women in general because of the numerous interactions (\*female). Yet this effect has to be considered for all subgroups of women which are differentiated by using interaction terms. Remarkable effects of gender are described for the respective groups.

Occupation significantly affects the likelihood of whether a person undertakes a shopping trip. Compared to full-time employees, non-working men and women make significantly more shopping trips, which confirms the descriptive results. This effect does not differ between men and women (no remarkable effect of 'non-working\*female'). Although not significant, men and women working part-time also make more shopping trips than those in full-time work. This effect is nearly identical for men and women, but it must be taken into account that part-time work is an exception among men but more typical among women. Although there are no noteworthy interaction effects, women undertake more shopping trips than men, regardless of whether and to what extent they are gainfully employed (see Figure 1). These more frequent shopping trips among women can be seen in the effect 'female' which is relevant for all groups of women unless adjusted by the respective interaction effect. Despite the similar temporal constraints of men and women in full-time work, this is not associated with more similar shopping trip participations. Labor division within households (although these results do not explicitly show differences within households) seems to be independent of the occupation of the female head of household. This could be related to social norms or individual preferences, which are closely linked to each other. The idea of 'maternal gatekeeping' (see above) might be relevant as well.

In contrast to the descriptive findings, the multivariate models do not show similar shopping trip frequencies for part-time working and non-working women. This may result from the control of household type in the Logit-models. Part-time working women are disproportionately mothers and therefore live in households identified as very 'traditional' concerning labor division. An additional descriptive analysis shows that 13% of the part-time working women live with children younger than six years (referring to the youngest child in the household) and 41% live with children between six and 17 years. For comparison, only 4% of the full-time working women live with children under six and 16% live with children between six and 17 years. With respect to trends, the decreasing effects of 'non-working' and 'part-time employee' between 1976 and 2008 suggest decreasing differences in shopping trips between the occupational groups considered. As in the descriptive analysis this results from an increase in shopping trips among full-time employed men and women, while there are no such systematic trends for the part-time and non-working men and women (see Figure 1 illustrating

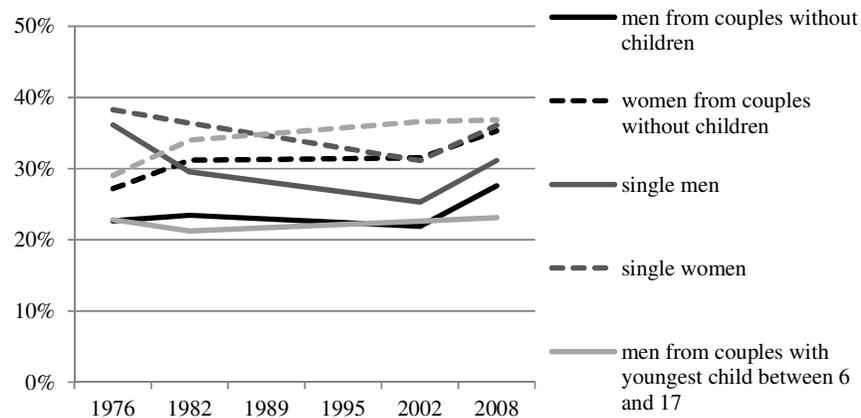
the exemplary calculation for occupation). This illustrates that there is an increase in shopping among full-time working men and women beyond the scope of increasing motorization (this factor is held constant in the model). Among men the increasing employment rate of their partners and the associated redistribution of a certain share of the unpaid work such as shopping might be relevant. Of course, this has to be set into the context of changing societal and individual norms. For women this argument is not applicable. Perhaps there actually is a greater preference for shopping among women that can increasingly be realized because of their increasing average income. Perhaps women working full-time in 1976 were different from those working full-time in 2008. It is conceivable that it was predominantly women with a 'modern' lifestyle and relatively equal labor division within the household who worked full-time in 1976. Perhaps in 2008 working full-time is more normal than it was in 1976, even for women living in relatively 'traditional' households as far as labor division is concerned.



**FIGURE 1. Shopping trip participation by occupation (calculated from Logit regression)**

As shown by the descriptive analysis, household type is an interesting factor for gender-specific shopping participation as well. For our research question, the effects of 'multi-person household\*female' and 'couple with children\*female' are of most interest. First of all, the main effect 'female' is relevant for all groups but in each case adjusted by the respective interaction effect. Hence the consistently positive but insignificant interaction effect 'multi-person household\*female' shows greater differences between men and women living together concerning their shopping trips than between men and women living alone. Additionally, the interaction effect 'couple with children\*female', although not significant, is worth mentioning. It shows that differences concerning shopping trip frequencies are largest between mothers and fathers living together.

Firstly, even among singles, women make more shopping trips than men (see consistently and fairly strong positive but insignificant effect 'female'). Secondly, living with a partner is associated with a 'traditional' division of shopping. Thirdly, living together with children is associated with an even more 'traditional' labor division in terms of shopping trips between mothers and fathers (this can be stated for couples with school children and small children likewise). The exemplary calculation illustrates these findings (see Figure 2) and confirms the descriptive analyses above.



**FIGURE 2. Shopping trip participation by household type (calculated from Logit regression)**

Furthermore, the multivariate analysis shows that the ‘traditionalizing’ effects of cohabitation and especially living with children not only results from gender-specific labor participation in the sense of a rational choice approach. The differences found within couples and families in the descriptive analysis can also be observed when occupational status is held constant. As the results for singles show, neither gender-specific labor participation nor labor division within households can entirely explain differences in shopping trips. These results may be interpreted as indicating gender-specific societal norms and expectations and their perception as well as individual norms and preferences even though there is no direct measurement of these factors in the data.

The effects of sex (‘female’) vary over time but do not change systematically between 1976 and 2008. This shows that the findings described above are consistent until 2008. Against the background of changing gender norms this is an interesting result. It is possible that mothers are especially affected by societal norms and expectations (e.g. the model of the ‘good mother’) or perceive these norms very intensely. Those societal norms change over time but such change is a very slow process (e.g. (27), 37f.). This may be accompanied by a consistently ‘traditional’ labor division in families and therefore high shopping trip participation of mothers. Furthermore there might be specific individual norms among mothers that are associated with a ‘traditional’ labor division within families. The concept of ‘maternal gatekeeping’ may explain this persistence. Of course, individual norms and preferences and societal norms are strongly interrelated. Besides, a selection bias concerning family formation has to be taken into account. Presumably women with ‘traditional’ norms and lifestyles are more likely to start a family and have children than those with very ‘modern’ lifestyles.

TABLE 2. Shopping trip participation, Logit regressions

	1976		1982		1989		2002		2008	
	B	Sign.								
<b>sex (ref.: male)</b>										
female	0.21		0.35		0.60 *		0.28		0.03	
<b>age groups (ref.: 44-49.5)</b>										
18-23.5	-0.23		-0.22		-0.18		-0.30		-0.40 *	
23.5-30	0.16		0.14		0.00		-0.46 *		-0.14	
31-36.5	0.11		0.14		0.13		-0.12		-0.13	
36.5-43	0.00		0.04		0.11		-0.07		0.20	
44-49.5 (reference)										
49.5-56	0.00		0.18		0.10		-0.03		-0.25	
57-62.5	0.01		0.15		0.17		0.13		0.07	
62.5-69	0.00		0.22		0.13		0.09		0.00	
70-75.5	-0.13		0.14		0.04		0.21		0.00	
75.5-82	0.14		-0.09		-0.10		-0.18		-0.08	
83-88.5	-0.23		-0.58		-0.27		0.51		-0.42	
88.5 and older	-0.52		-1.17		-1.20		-0.34		-20.83	
18-23.5*female	0.07		0.00		-0.27		-0.19		-0.05	
23.5-30*female	-0.05		-0.07		-0.13		0.18		-0.25	
31-36.5*female	-0.11		-0.13		-0.15		-0.15		-0.19	
36.5-43*female	0.04		0.00		-0.10		-0.09		-0.31	
44-49.5*female (reference)										
49.5-56*female	0.07		-0.10		-0.04		-0.02		0.28	
57-62.5*female	-0.17		-0.26		-0.25		-0.15		-0.21	
62.5-69*female	-0.22		-0.46		-0.26		-0.18		-0.17	
70-75.5*female	-0.34		-0.30		-0.45 *		-0.41		-0.36	
75.5-82*female	-1.04 *		-0.59		-0.67 *		-0.25		-0.43	
83-88.5*female	-1.30 *		-0.69		-1.05 *		-0.99 *		-0.30	
88.5 and older*female	-2.87 *		-0.21				1.19		20.59	
<b>occupation (ref.: full-time employees)</b>										
non-working	0.86 *		0.88 *		1.10 *		0.58 *		0.56 *	
non-working*female	0.02		-0.10		-0.24		-0.07		-0.02	
part-time employee	0.43		0.55		0.58 *		0.32		0.12	
part-time employee*female	0.08		-0.19		-0.13		0.00		0.11	
students and apprentices	0.51 *		0.44 *		0.24		0.14		-0.19	
students and apprentices*female	-0.38		-0.30		-0.15		0.08		0.06	
<b>educational level of those with completed education (ref.: lower than "Abitur")</b>										
"Abitur"	0.24 *		0.10		0.21 *		0.13		0.17 *	
"Abitur"*female	-0.12		0.18		-0.09		0.00		-0.06	
<b>household type (ref.: single household)</b>										
multi-person household	-0.66 *		-0.31 *		-0.23 *		-0.19 *		-0.17 *	
multi-person household*female	0.15		0.08		-0.10		0.21		0.14	
couple with children	0.01		-0.13		0.00		0.04		-0.24	
couple with children*female	0.08		0.26		0.16		0.19		0.30	
couple with child under 6	0.02		0.21		0.01		-0.05		-0.01	
couple with child under 6*female	0.02		-0.19		0.16		-0.18		-0.02	
single father/ mother	0.45		0.50		0.48 *		0.25		0.04	
household with only adults	-0.22		-0.31 *		-0.21 *		-0.12		-0.17	
household with only adults*female	0.06		0.22		0.06		0.05		0.02	
grown-up "child" living with parents	-0.50 *		-0.39 *		-0.49 *		-0.22		-0.40 *	
grandfather/ -mother living in 3-generation household	-0.78		-0.72		-0.54		-0.95		-0.86	
<b>municipality size (ref.: less than 5 000 inhabitants)</b>										
5 000 to under 20 000	0.23		0.24		-0.05		0.10		-0.05	
20 000 to under 100 000	0.19		0.30 *		0.04		0.27 *		0.13	
100 000 to under 500 000	0.13		0.32 *		0.08		0.37 *		0.15	
500 000 and more	0.25		0.35 *		-0.09		0.31 *		0.28 *	
5 000 to under 20 000*female	-0.04		-0.09		0.09		0.03		0.09	
20 000 to under 100 000*female	0.15		-0.05		0.03		-0.09		0.05	
100 000 to under 500 000*female	0.14		0.04		0.04		0.00		0.12	
500 000 and more*female	0.23		-0.09		0.18		-0.07		-0.03	
<b>motorization (ref.: car is always available<sup>a</sup>)</b>										
car not available <sup>b</sup>	-0.34 *		-0.21 *		-0.22 *		-0.05		0.02	
car not available*female	0.16		0.17		0.19		-0.12		-0.08	
limited car availability <sup>c</sup>	-0.07		-0.05		-0.11		0.01		0.00	
limited car availability*female	-0.08		0.05		0.05		-0.02		0.10	
<b>constant</b>	-0.73 *		-1.07 *		-1.12 *		-1.20 *		-0.74 *	
<b>Nagelkerke's R<sup>2</sup></b>	0.10		0.09		0.11		0.05		0.05	

<sup>a</sup> persons with a driver license and at least as many cars as potential users (persons with driver license) in household

<sup>b</sup> persons without a driver license and persons with a driver license but no car in household

<sup>c</sup> persons with a driver license but less cars than potential users (persons with driver license) in household

significance level = 0.1% (5 % / number of tests = 53) after Bonferroni-adjustment; \* = significant

## 7. DISCUSSION AND CONCLUSION

We find shopping trip participation is greater for women than men in both our descriptive and multivariate analyses. This is widely independent of socioeconomic factors and observable for every survey year from 1976 until 2008.

Interestingly, the descriptive analysis shows increasing shopping trips for men living with a partner, but this does not result in fewer shopping trips by their female partners. This suggests the relevance of societal norms on the one hand and preferences on the other hand, both of which are interrelated. An explanatory approach is the concept of ‘maternal gatekeeping’, meaning that women hold on to ‘typically female’ tasks even though their partners increase or try to increase their contribution. In the case of shopping this could mean that men increasingly accompany their partners on shopping trips.

Furthermore, the higher shopping trip participation of women observable even among singles has to be emphasized. This is noteworthy, especially as gender-based role theory is to date the most common explanatory approach for gender-specific activity patterns and trip purposes. However, among singles labor division has no relevance. Other explanations must therefore be found. Primarily, gender-specific preferences seem to be a relevant factor at this point.

Other findings also suggest the relevance of ‘soft’ factors such as societal gender norms but also individual norms and preferences. Firstly, even among full-time employees women undertake more shopping trips. Secondly, there is a remarkably large difference between mothers and fathers concerning their shopping trips. This goes beyond the gender-specific employment patterns within households in terms of the male main earner and the female additional earner (controlled for in multivariate models). Moreover, it is consistent over time and therefore suggests norms and preferences with a particular relevance for families with children.

To sum up, some of our results can be interpreted as indicating that ‘soft’ factors such as societal and individual norms, preferences and attitudes are relevant for gender-specific activity and trip patterns.

However, the data base has important limitations. The KONTIV and MiD data do not contain direct information on lifestyles or preferences. This is why our conclusions concerning these ‘soft’ factors are more indirect. Furthermore, there is no information on the division of indoor work. Therefore, it would be desirable for future surveys and studies to bring together information on travel behavior, indoor labor division, lifestyles and preferences. This would allow interesting analyses of the relation of individual and societal gender norms, preferences and everyday life and mobility from a gender perspective. Qualitative surveys and studies on this topic would undoubtedly be a worthwhile supplement to this.

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# Gendered mobility surveys – Practical Experiences by an Austrian transport planner and consultant

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## ABSTRACT

Using examples of completed Austrian travel surveys, the gender analysis shows that not only the interpretations of the data, but also the questionnaires reveal bias and simplifications, which veil crucial aspects in the behaviour concerning mobility, particularly the behaviour of caregivers in their everyday lives. Using the common "travel purposes" the paper stresses this argument and proposes gender-sensitive approaches. The paper is based on Bente Knoll's doctoral thesis (2004-06) as well as the practical work experience as a researcher at B-NK Consultancy for Sustainable Competence (B-NK GmbH), in Vienna. This paper can be understood as an example on how to implement gender and diversity aspects into applied mobility research.

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**KEYWORDS:** Gender aspect; Travel mode; Mobility survey; Rural area; Women.

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## INTRODUCTION

Within transport planning, different parameters, such as distance, vehicle ownership and availability, means of travel and trip purposes, are used to describe people's mobility behaviour. These parameters are also used when transport planning related political decisions are made. To gain data, public administrations as well as public transport providers carry out standardized household travel surveys (1). Questioning is carried out by means of PAPI (paper-and-pencil), CATI (computer aided telephone interview) or CAWI (computer aided web interview).

Using the examples of completed travel surveys (Austrian-wide survey 1995; Lower Austrian survey 2005 and 2008) the author wants to provide an insight into these procedures as carried out in Austria:

The surveys focus on travel behaviour, defined as the external-domestic activities and trips, of all people living in a household. All examples mentioned above provided pre-defined weekdays to document all trips that have been undertaken by household-members older than the age of six. The travel surveys define "trip" as every stationary change for an unequivocal purpose which takes place within the public sphere regardless of the modes of transportation used. A journey starts at a certain place, at a certain time and has a certain travel purpose. A trip can also be taken by several means of transportation. A trip ends when the person has achieved their purpose and/or the place reached at which an activity is made.

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## GENDER ANALYSIS OF TRAVEL SURVEY METHODS – FOCUSING TRAVEL PURPOSES

<p><b>Zu welchem Zweck haben Sie diesen Weg unternommen?</b> Bitte nur eine Nennung!</p>	<p><b>Zweck:</b></p> <p>Arbeitsplatz <input type="checkbox"/></p> <p>Dienstlich/geschäftlich <input type="checkbox"/></p> <p>Schule/Ausbildung <input type="checkbox"/></p> <p>Bringen und Holen von Personen (z.B. Kinder zur Schule) <input type="checkbox"/></p> <p>Einkauf <input type="checkbox"/></p> <p>Private Erledigung (z.B. Arzt, Behörde) <input type="checkbox"/></p> <p>Freizeitaktivität <input type="checkbox"/></p> <p>Zurück nach Hause <input type="checkbox"/></p> <p>Anderes, und zwar: <input type="text"/></p>	<p><b>PURPOSE:</b></p> <p><input type="radio"/> <u>Work</u></p> <p><input type="radio"/> <u>Work related</u></p> <p><input type="radio"/> <u>School / education</u></p> <p><input type="radio"/> <u>Bringing and picking up people (e.g. children to school)</u></p> <p><input type="radio"/> <u>Shopping</u></p> <p><input type="radio"/> <u>Personal business (e.g. doctor's, authority)</u></p> <p><input type="radio"/> <u>Leisure activity</u></p> <p><input type="radio"/> <u>Home related</u></p> <p><input type="radio"/> <u>Other, namely</u></p>
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The question related to the travel purpose provides the following answering-fields "work", "work related", "education", "bringing and picking-up people", "shopping", "personal business (e.g., doctor's, authority)", "leisure activity", "home related" or "other, namely" (this is a free field). Only one out of these possibilities is to be marked ("Please, only one naming" or "You may tick one travel purpose"). This caused a focus on "single-purposes" trips being made.

From a gender perspective it has to be stated that the categories reflect current gender stereotypes and clichés. (2) Purposes that are related to re-productive activities, e.g. domestic work or care-giving, are not questioned in their entire dimension and kept obscure within travel surveys and their results. Accompanying journeys or questions on trip chaining are also not provided. However, travel purposes that are related to paid work and the economic spheres do have at least two answering-fields ("work" and "work related").

Within the questionnaires used in Austria, the trip purposes are mainly seen as activities related to a particular destination. Being on the move as an activity (e.g. going for a walk with the dog, strolling, walking – apparently without purpose) is not illustrated.

Thus, the common methods of mobility surveys do not adequately examine short trips, trips taken to accompany others, or complex combinations of single distances. The categories available under so-called "travel purposes" reflect patriarchal life concepts: trips made in connection with domestic work and care-giving are either under-represented or fully hidden. The analysis shows that crucial information on people's mobility behaviour cannot be surveyed, analysed, or interpreted with the usual methods.

The separation of the travel purposes and subsequently the planners' division of "rush-hour traffic" and "shopping traffic and leisure traffic" correspond to the patriarchal primate of productive work and hence under-represent travel purposes related to child-care and other issues of reproductive care work (3, 4).

### **Day-to-day trip chains**

To strengthen the argument, the portrayal of a 32-year-old man is to be brought up: He is a father on part time paternal leave who carries out several activities and purposes always in the company of his 2-year-old son and his 6 month-old daughter: the playground, the pharmacy, further to the chemist's shop, bakery, grocery store. When filling out the trip questionnaire, what should be the option for such travel purposes?

- Work? As a father in part time paternal leave he spends the working day at home. Is his current flat his working place? Finally, with his work at home he covers the expenses to care for his children.
- Bringing and picking-up people? No, because the son was not brought to a child care facility. Or perhaps this could be an option because the father has brought his son to the playground and has looked after him?
- Shopping? Yes partly, but what about time spent at the playground?
- Personal business? No, not by any means! The father did not carry out any personal business; neither at the playground, nor at the chemist's shop (medicine for the son), nor at the bakery (bought a snack for

the hungry child). However, maybe the grocery store was for the purpose "personal business" because the father has also bought a newspaper for his personal pleasure.

- Leisure activity? Yes, this is the last but the only possibility to be marked. The very last possibility to be marked ("back home") is used for the next way.

Also, the father will not mention person XX whom he has met along his way back home from the playground because the purpose of this trip was not to meet person XX. Additionally, the fact that his journey back home lasted longer due to chatting and children playing along the way by half an hour or longer than normal – these are issues that transport and urban planners' should be more focused on.

Another example: A person with care duties accompanies his/her children to their regular sports training and waits at the gym for an hour until the training is over. Which trip purpose should s/he mark?

- Bringing and picking-up people? What to do then with the hour-long waiting period?
- Leisure activity? This leisure time related only to the children; however, the waiting period is, from the adult's perspective, without recreational value and recreational assets.

### ***Quantitative results and their limits***

Travel surveys in Austria and their results show that differences within the mobility behaviour between women and men can be empirically shown. Appropriate literature and data evaluations repeatedly indicate the following results: (5)

- The number of trips per day of women is higher than for men;
- The road length of trips per day of women is shorter than for men;
- Women more often use public means of transportation and walk more often than men;
- Women connect their activities and that leads to their complex trip chains.

Concerning these figures it is crucial to point out the shortcoming of those statements and figures stemming from the results of limited or biased questionnaires. The analysis points out that for everyday trips, the complex and differentiated trip chains with different purposes undertaken by people with child care duties or care responsibilities for the elderly still remain unrecorded. In Austria, the unpaid housework and care responsibilities are still mainly assumed by women however, the trips related to these purposes remain invisible. Therefore not all relevant basis information is available in transport and urban planning.

### **GENDER SENSITIVE APPROACH IS NEEDED**

A way to make up for this deficiency is to develop new surveying methods. During several research projects, carried out by B-NK Consultancy for Sustainable Competence, gender-sensitive methods have been developed and put into practice. Our work is based on the following hypothesis: Due to common quantitative mobility survey methods, travel habits and mobility patterns of those providing child care, care for the elderly are underestimated.

Within the scope of research projects the author has already developed various gender-sensitive methods for mobility surveys.

### ***Experience from the research project "Women's trips – men's trips"***

Based on results of the project "Women's trips – men's trips" (commissioned by the Austrian Federal Ministry of Transport, Innovation and Technology, 2006-07) (6) as well as the gender analysis of Austrian common travel survey methods (2), a new gender-sensitive quantitative questionnaire was developed. The innovations of those questionnaires included the provision of categories to capture data covering more diverse family living arrangements of those being questioned, including response options for those persons not living in a household on a permanent basis. Since it has now become possible to focus on the mobility behaviour of adults according to such living arrangements, evidence can now better reflect the mobility patterns of patchwork families. Questions for individuals with regular care-taking responsibilities became more revealing of mobility patterns for those escorting children, the elderly or people with impediments. One main change on the questionnaire was the question concerning travel purpose which was provided as open question.

Respondents were asked to write down in their own words, the answer to the question "Why or for which purpose have you undertaken this trip?" To make accompanying trips visible an additional question concerning "other people with whom the trip was undertaken and the number of the children respectively number of the adults" was asked. For testing and validation purposes, the gender-sensitive questionnaire was compared with a "traditional" questionnaire, both of which contain similar samples in terms of socio-economic and regional variables. An equal number of the traditional and gender-sensitive questionnaires were distributed to various sample groups.

Regarding the trip purposes the results reveal the importance of each open question. Each response given to this question was recorded. After two steps, the clustering of 21 different categories were arranged. Besides the well-known pre-defined categories of trips made for purpose of work, work related, education, school, shopping, pick up/drop off other people, home, the other pre-defined trip categories were collected in more detail: doctor's, health care, visiting friends, visiting relatives, meeting someone, going out for sports, going for a walk, further lessons e.g. music, dance, further training, honorary office, theatre, cinema, church related trips.

Other differentiated statements can provide a quantitative assessment of the mobility patterns of other groups of individuals.

### ***"Mapping everyday trips" – a qualitative approach***

In her doctoral thesis (2004-06) (2) the author developed the method "**mapping everyday trips**", a gender-sensitive qualitative method for surveying people's everyday mobility that combines elements of surveying spatial structures of the built environment. At the start of developing the methodological process, the following questions were first given focus: Where does a person typically start when setting out on a trip? Which trips are to be undertaken to cope with the daily needs? What kinds of modes of transportation are used? What kind of activities take place within a residential area, what kind of activities take place farther away? The aim was to develop a method which indicates that, as mobility is varied, day-to-day trips can be made for a variety of reasons. This method is aimed quite consciously at the qualitative aspects of a person's mobility pattern and travel habits. "Mapping everyday trips" is carried out, on the one hand, by a face-to-face interview and, on the other hand, by mapping the person's everyday travel habits, trips and the relevant everyday places on a city map that the respondent is accustomed to. Thus, the everyday trips and the modes of transportation used could be visualised using various colour schemes on a map.

This method is applicable for surveying people's everyday mobility that combines elements of surveying spatial structures of the built environment AND the day-to-day mobility modes and travel purposes of women and men. Using visual representations, the manifold mobility patterns and trip combinations of women, men, and youth can be mapped out. The method demonstrates that people cover a great number of distances in their everyday lives based on a diverse set of travel purposes that sometimes need to be combined into a single trip.

### ***Experiences from on-going research***

With the scope of three research projects, the author was able to carry out qualitative mobility surveys based on the method "Mapping everyday trips" containing face-to-face interviews and mapping of everyday trips. Within the project "Mobility4Job – Gender-appropriate mobility solutions for better working opportunities in rural areas" (commissioned by the Austrian Research Agency and the Federal Ministry of Transport, Innovation and Technology, 2012-14) the goal of the project was to identify obstacles within the mobility system which hinder people from obtaining gainful employment. Furthermore, preconditions and mobility services in rural areas will be defined in order to enable women and men who are responsible for the care of family members as well as their own household to have fair opportunities to participate in the workforce. Within the working package "qualitative mobility survey", conducted by the author, 15 in-depth interviews in a rural area (Triestingtal and Schneebergland, both located in south-west region of Lower Austria) were conducted.

The project "Gender Module" was commissioned by the Federal Ministry of Transport, Innovation and Technology in addition to the recent Austrian-wide representative quantitative mobility survey (2013-14). Within this piece of research, five regions with various (public) transportation and geographic pre-conditions in Austria were defined and face-to-face in-depth interviews were carried out with individuals responsible for (unpaid) day-to-day care of their (own) children, parents, in-laws etc. The five selected regions are:

- Inner city districts of Vienna with a dense public transportation system and huge infrastructure facilities;
- City of Graz, the second largest city in Austria;
- City of Eisenstadt which serves as an example for middle size towns in Austria with a lower level of public transportation service that nevertheless serves a high-level of public infrastructure, such as public authorities, secondary schools etc.;
- The region of Waldviertel as a peripheral rural area with wide-spread villages and smaller cities;
- The region of Defereggental as a peripheral alpine rural narrow valley with three municipalities with approximately 500 meters of altitude distance from one point of the built-up area to another.

In addition to these five regions, another peripheral rural region area in the south of the Burgenland is also investigated (commissioned by the Office of the Provincial Government of Burgenland).

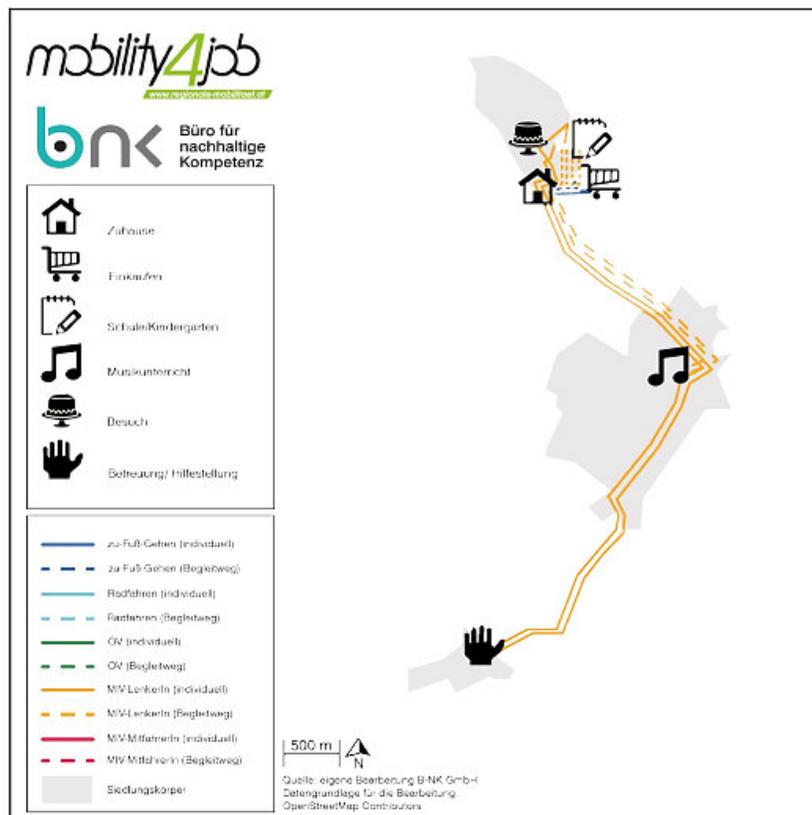
## INTERIM RESULTS

Within the scope of these three research projects, approximately 130 in-depth interviews of about 45 to 90 minutes each were carried out by the author and her team between March 2013 and January 2014.

The central questions of the interviews focus on, on the one hand, the respondent's personal attitude towards family, household, employment and the division of paid and unpaid work among family members. On the other hand, information concerning the day-to-day mobility patterns and travel purposes was also questioned.

The trips of the "day before" were mapped to visualize the trip-chains and their relations.

The example provides highlights the various destinations and numerous trips that were undertaken (The dashed lines symbolise accompanied trips). During the interview the respondent stated: *"And then, at about half past eight, or a quarter to nine, I went by car with my two boys to bring them to the kindergarten. They got off, I continued my travel and met my friend [x]. And afterwards I drove that way to my grandmother's house, like I usually do on Tuesday. I am assisting my grandmother, which means I work there without charge."*



This study also surveys the needs and forms of mobility used by those people who are responsible for family-members' care as well as their existing mobility obstacles. Interim results show that the following issues characterise the mobility patterns of care-givers:

- Responsibility: *"As long as the kids sit in the baby carriage, you can handle the situation. But when they start walking by their own, approximately at the age of three, you bear a great responsibility. You have to keep your eyes on the kids and look after them, so that nothing happens. For me, that is the big difference."*
- Steadiness and flexibility: *"These are two counter-parts. On one hand we have got a well-structured agenda of the week and well-organised work-days. But on the other hand you have to keep flexible. There are so many odds and ends that force you to change your plans."*
- Time as a determining factor: *"One has to schedule more time for everything when accompanying kids. There are no just-for-fun-trips. And that does not change even when the children get older."*
- Needs of accompanied people get more important: *"When accompanying my walking impaired father, I have to look out for a parking-lot with enough space at the passenger's side for him to get out of the vehicle. I have to help him out of the vehicle. Everything goes very slowly."*

In accordance with the qualitative paradigm, this study will then provide a detailed understanding of those processes, mobility and travel (purposes) and the connection with a person's daily life and care duties. It should then become apparent that one can generate even more information about everyday mobility and trips rather than by simply focussing on just five to six pre-defined categories of "travel purposes".

This approach enables a multi-disciplined perspective for mobility of people who are care-givers, specifically through the study of their day-to-day responsibilities, and can also tackle gender roles and gender stereotypes as well as the social intercourse of individuals and assumed patterns of behaviour within their social systems. The first preliminary results show that women mostly take responsibility for accompanied trips at the expense of their own mobility needs. Preliminary results of the maps of everyday trips of care-providers show differences between the travel behaviour of women and men: Whereas, women tend to have more complex path routes with stops and multi-purpose destinations, they also tend to cover their own trips more often in the accompaniment of others, mainly with children.

## CONCLUSIONS

In general, one has to point out that compared to quantitative mobility surveys with standardised questionnaires, the qualitative and gender-sensitive approach provides several benefits. Due to the face-to-face setting of the interview, the respondents are actively encouraged to reflect upon their actions and habits in consideration of their own personal mobility patterns. During the interview, attempts will be made to recall with each individual respondent the chain of their entire trip journey, including those stops made between trips that cannot be compiled in an accurate way using quantitative methods. Secondly, it is conceivably possible that there might be instances in which a respondent will not be able to accurately recollect certain segments of a trip. Researchers participating in this study, could also enquire and determine why a respondent decided in favour of or against a particular mode of transportation. With the qualitative approach, the respondent's actions and habits can therefore be better "understood" rather than just simply "explained" (7).

An inter-sectional approach, therefore, takes gender and diversity aspects into account, which should provide a deeper insight into research questions and their corresponding results. When describing interview partners and their mobility patterns, the "Four Layers of Diversity" (8) are used to enable a multidimensional perspective. Mobility patterns and people's needs concerning mobility and transportation are no longer understood based on typical socio-economic attributes like age OR gender OR regional allocation. Rather, due to an approach that takes the inter-sectional and multifaceted relationship between gender AND age AND care responsibility AND regional allocation into account, more qualitative and reliable information can be provided as a basis for transport and urban planning decision makings.

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# Men and women drivers: A study of social representations through prototypical and correspondence analysis

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## ABSTRACT

Representations of men and women drivers and their implications are a major societal issue for several years. However, so far, few studies have demonstrated the precise content of these representations among adults. This study is based on the structural approach of social representations. The aim is to analyze the representations of men and women behind the wheel according to sex, age and social status, and to generate hypotheses about the central or peripheral status of the items revealed. According to an intergroup pattern, 414 French participants were asked to answer a questionnaire, using verbal association methodology (N = 203 for men drivers, N = 211 for women drivers). They were equally distributed on the basis of sex, age class (from 16 to 50 years-old and over) and social status. The thematic analysis revealed four large topics, including 16 subtopics in both cases. By comparing occurrence frequencies of these associations (salience in the representational field) and average ranks (importance given by subjects), the structural pattern of these representations was explored. Besides, differences and social anchors were analyzed through a correspondence analysis. The results seem to reflect the effect of social positions on the choices made to designate a man or a woman driver. Attitudes also seem to vary according to age: younger people referred more to risk and rules, whereas older individuals referred more to skills and expertise. The results are discussed through gender-related essentialism, in-group/out-group relations, age and socialization impacts in gender stereotypes associated with driving.

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**KEYWORDS:** Social representations; Prototypical analysis; Correspondence analysis; Stereotypes, Drivers.

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## 1. INTRODUCTION

In most Western countries, men are two to three times more likely to die in a traffic accident than women (1-3). Their chances of being injured in a car accident are 25% higher compared to women (4). Studies show that men are more frequently involved in accidents related to a violation of the rules. In France, at equal mileage, women have 2.5 times fewer points removed from their driving license, and are 6.2 times less convicted for offenses (5). However, despite these objective data about accidentology, it seems that the negative stereotype against women, according to which they would be poor drivers (6), continues. These stereotypes, providing the foundation for strong inductive inferences, can have significant cognitive and behavioral consequences (7-9). In the context of driving, the study of stereotypes appears to be an important aspect of understanding social construction of such content, gender identity, as well as threat phenomena and its implications. Nevertheless, so far, few studies have demonstrated the precise content of these stereotypes among adults. Although some studies are based on a brief review of its characteristics, their study is often restricted to preliminary research (8), and no study has reported this content in terms of social representations. To the best of our knowledge, the specific content of these representations has not been explored in depth among an adult population yet, although we are using it for many other studies. As a consequence, the objective of this study is to analyze the specific contents of the social representations of men and women behind the wheel according to sex and age.

Some social objects can be described as “social representations” (10). These objects, concerning which each individual has a structured definition, are developed through interactions with others, including consensual elements shared by all, as well as minor items on which differences can be observed. On the axis of the work of

Moscovici (10), another approach was developed by Abric (11, 12) to account for the internal organization of social representations. According to this structural approach, the central core theory aims to demonstrate how the elements constituting a representation are structured. This theory assumes that any representation is organized around a central core. These few elements forming the core (opinions, beliefs, knowledge elements...) are subject to a consensus among the individuals who share this representation. In this manner, the core has two main functions: a generating meaning function, by conferring meaning to the other elements of the representation, and an organizing function, by characterizing the type of links of the elements constituting this representation. The core has another important property: the stability of the component elements, which are more resistant to change. Other elements related to the representation, but not part of the central core, are called "peripheral elements". These elements allow certain flexibility in the representation and reflect the individual appropriation and the context in which they are developed. Thus, unlike the central elements characterized by a consensus, the representation considers many interindividual variations in the peripheral system. The work of Guimelli (13) shows in this way that some hunters say that hunting is "a solitary activity", others that it is a "way to meet friends". These individual variations at the peripheral level, however, are not sufficient to reconsider the central element that corresponds to the "territory management". A protective function of the central core (or defense function according to Abric) is also involved: the peripheral system operates as "bumper of the representation", according to the expression of Flament (14, 15). Indeed, it allows the integration of new elements in the representation: the transformation of representation first takes place at a peripheral level. Thus, even if the core is the foundation of the representation, peripheral elements play an important role, by operating in a complementary manner with the central system. They are the interface between the core and reality, the concrete situation in which the representation is developed. In the theoretical field of social representation, the aim of the present study is to analyze the contents of social representations of men and women behind the wheel according to sex, age and social status, and to generate hypotheses about the central or peripheral status of items revealed.

## **2. METHOD**

### **2.1 Material**

This study is based on the verbal association procedure and the substitution technique. These tools are relevant for the study of specific social groups and for identifying the content of social representations, which is the case of the present research. Many studies used the method of verbal associations to reveal various representational contents (16-21). During a first phase, participants were asked to associate 5 words or expressions to an inductor related to the object of representation. Thus, following instruction was given to the subjects: "Give 5 words or expressions that come immediately to mind to describe a man (vs. a woman) driver". In a second phase, after completing these associations, participants were asked to rank their answers, from the most important to least important to characterize the object. Thus, two indicators are used in the study of associations produced: the frequency of appearance of an item (is the item cited by many participants?) and its importance in the representational field (what is the rank associated with the item by the participants?). Elements that are considered particularly important to characterize the object (and that are potentially the core elements of the representation) are both characterized by a high frequency (consensual aspect) and a high importance. Therefore, a low rank reflects a high importance, because it indicates that the word has been ranked in the first positions. Conversely, a high rank reflects a low importance because it indicates that the word was ranked in the last position (i.e. close to 5).

The median is used to determine the threshold from which a word can be considered to have a low vs. high importance. Given that the importance can be rated from 1 to 5, the associations for which importance is evaluated less than 3 are considered to be the most important for the participants. For the frequency criterion, we consider that a word is characterized by a high frequency (vs. low) when cited by more than 10% of the population (22, 23). Given that the population consists of 203 and 211 participants, thresholds are respectively equal to 20 and 21. Concerning elements that can lead to masking strategies, Guimelli and Deschamps (20) propose to use a substitution instruction, which consists of not directly asking individuals about their personal opinions but what they think the opinions of others are (typically those of the "French in general"). Participants thus give the opinion they think the French have on men or women drivers. The assumption is that this instruction lowers the normative pressure, which allows individuals to express views they would mask in another situation. Therefore, this procedure allows identifying relevant content, including the problematic and non-problematic aspects. This instruction was used as a precaution, assuming that the potential undesirable

content (especially against women) would have led to a masking phenomenon (20), which would have made a whole section of the social representation not accessible. However, the results showed that there were no differences between the two types of instructions.

## **2.2 Population**

The sample consisted of 203 participants for the “man driver” questionnaire and 211 participants for the “woman driver” questionnaire. We divided the population into subgroups based on certain criteria (gender, age, socio-professional category). The socio-economic status (SES) of the participants or of both their parents (for students or high school students) was obtained by referring to the grid of the National Institute of Statistics and Economic Studies, in order to obtain a balanced sample between higher SES (Entrepreneurs, liberal professions, intellectual professions) and lower SES (intermediate professions, employees or workers). Four age groups constituting targets that are likely to differentiate in attitudes or driving behaviors were identified: 16-18 year-olds, 19-29 year-olds, 30-49 year-olds, aged 50 and over. A southeastern France junior-high school and high school were solicited in order to collect data on participants aged between 12 and 15 years and between 16 and 18 years. Concerning adult participants, data collection was conducted on a random basis, in some southeastern French cities, such as Marseilles and Salon-de-Provence.

## **3. RESULTS**

### **3.1 Thematic content analysis**

Thematic analysis of the words used by the participants was conducted using four independent judges. The study of the social representation of “the man driver” allowed identifying 16 characteristics (self-confidence, citizenship, practical skills, technical skills, arrogance, impatience, carelessness, inattention, incivility, incompetence, patience, pleasure, caution, transgression of the rules, virility and speed). The study of the representation of the “woman driver” allowed identifying 16 characteristics (lack of practical skills, lack of technical skills, the functional aspect of the conduct, citizenship, skills, compliance with rules, danger, impatience, inattention, incivility, slowness, patience, lack of confidence, caution, transgression of the rules, and vigilance). The categories determined and their frequencies of occurrence in the population are presented in Table 1.

**TABLE 1. Categorical analysis of the associations produced**

Categories (Men drivers)	Characteristics	Frequency	Categories (Women drivers)	Characteristics	Frequency
Caution	Prudent, security, responsible, attentive, focused, alert	N = 34	Caution	Cautious, prudent, reassuring, protective, less risk	N = 152
Carelessness	Reckless, dangerous, unconscious, accidents, road hog	N = 99	Danger	Reckless, dangerous, imminent death, unconscious, accident	N = 133
Inattention	Inattentive, low concentration, distracted	N = 18	Vigilance	Attentive, focused, alert	N = 46
Speed	Drive fast, speed	N = 104	Inattention	Low concentration, distracted, makeup while driving, doing two things at the same time	N = 91
Transgression of the rules	Non compliance with the code, irresponsible, alcohol, drug, offenses	N = 70	Slowness	Drove slowly, drives like a granny, traffic jam	N = 63
Practical skills	Mastery of vehicle, control, reflexes, pilot, performance, facilities, talented, natural talent, abilities.	N = 55	Transgression of the rules	Non compliance with the code, irresponsible, alcohol	N = 37
Technical skills	Maneuvers, mechanics, sense of direction, technique, good for parking	N = 22	Compliance with rules	Compliance with limitations, code compliance, compliance with traffic signals, responsible	N = 48
Incompetence	Drive poorly	N = 13	Lack of practical skills	Clumsy, lack of mastery, poor reflexes, poor conductor, is not made for it, "another woman at the wheel"	N = 85
Citizenship	Gallant, cordial, civic, polite	N = 10	Lack of technical skills	Difficulties for maneuvering, understands nothing in mechanics, does not know their way, difficulties to park	N = 61
Incivility	Aggressive, angry, rude, vulgar, grumpy, intolerant, disrespectful, discourteous, selfish, individualistic, self-centered	N = 193	Skills	Mastery, control, smooth driving, good driver	N = 20
Patience	Calm, serenity, patience	N = 6	Citizenship	Respectful, courteous, cordial, civic, polite, kind	N = 46
Impatience	Impatient, hurry, brutal conduct, nervous, impulsive, stressed, horn	N = 130	Incivility	Rude, vulgar, disrespectful, aggressive, hysterical, angry	N = 38
Arrogance	Show off, flirt, proud, arrogant, conceited	N = 54	Patience	Calm, patient, less impulsive	N = 38
Virility	Virility, domination, sense of superiority, power, macho, sexist	N = 61	Impatience	Impatient, hurry, nervous, stressed, horn	N = 38
Self-confidence	Confidence	N = 38	Lack of confidence	Shy, hesitant, unsure of herself, timid, anxious, panic	N = 39
Pleasure	Pleasure like driving, freedom, travel, big cars, fast cars, the importance of the car, attached to the vehicle	N = 22	Functional aspect of the driving	Daily trips, small cars, cheaper car, sober car, practical car	N=19

### 3.2 Prototypical analysis

The prototypical analysis of the characteristics was carried out with the “Evoc” program (24, 25). For “men drivers”, the most frequent words cited by participants and considered at the same time as the most important to define the object were “speed”, “self-confidence”, “carelessness”, “caution”, “impatience” and “transgression of the rules” (Table 2). These words were those with the highest probability of belonging to the central system (22, 23). The first periphery (i.e. the frequently mentioned elements but considered as less important) revealed interindividual variations, with terms such as “arrogance” or “incivility”. Elements such as “citizenship” and “incompetence” composed the second periphery (i.e. the elements characterized by a low frequency and a low importance). No contrasted element (i.e. not frequently mentioned but very important items) for the representation of the men drivers was found. This area outlines the elements that can be the foundation of diverging or even conflicting conceptions in the representational field.

**TABLE 2. Prototypical analysis of the representation of the “men drivers”**

Frequency	Rank		Rank			
	< 3	> 3	< 3	> 3		
> 10 %		N	Rank	N	Rank	
	Speed	104	2,21	Incivility	193	3,05
	Self-confidence	38	2,57	Virility	61	3,06
	Carelessness	99	2,71	Arrogance	54	3,07
	Practical skills	55	2,72	Technical skills	22	3,40
	Caution	34	2,73	Pleasure	22	3,50
	Impatience	130	2,83			
< 10 %						
				Inattention	18	3,55
				Citizenship	10	4,00
				Patience	6	4,00
			Incompetence	13	4,07	

For “women drivers”, the most consensual and important terms were “caution”, “compliance with rules”, “vigilance”, “lack of practical skills and confidence” and “danger” (Table 3). Concerning the first periphery (i.e. consensual elements but with a low importance), were found elements such as “impatience” and “slowness”. Aspects related to “skills” were part of the contrasted elements (i.e. items characterized by a low frequency but high importance). Finally, the functional aspects of the driving, were found in the second periphery (i.e. not frequently mentioned elements and considered as unimportant).

**TABLE 3. Prototypical analysis of the representation of the “women drivers”**

Frequency	Rank		Rank			
	< 3	> 3	< 3	> 3		
> 10%		N	Rank	N	Rank	
	Caution	152	2,28	Patience	38	3,00
	Compliance with rules	48	2,37	Transgression of the rules	37	3,02
	Vigilance	46	2,56	Lack of technical skills	61	3,21
	Lack of practical skills	85	2,69	Citizenship	46	3,40
	Lack of confidence	39	2,82	Slowness	63	3,23
	Danger	133	2,90	Incivility	38	3,39
< 10%						
				Inattention	91	3,40
				Impatience	38	3,42
			Functional aspect of the driving	19	3,21	

### 3.3 Correspondence factor analysis (CORR. F. A.)

The analysis of the associations produced for each representation was conducted through a Correspondence factor analysis (CORR. F. A.) (26). This analysis aimed to identify differences in the frequency of the associations, according to the selected variables. This permits a revealing of the relationship between associations to define a man or a woman driver and the different variables, i.e. disclose connections between collected items and modalities of variables. Two CORR. F. A. were performed by focusing the analysis on the variables of sex and age. The two-dimensional graph displays the results of the CORR. F. A. Only items with a sufficient contribution per factor were selected. The more an item is located at the intersection of the two axes, the more this item is consensual (no deviation from independence). On the contrary, the more an item is located at the extremity of the graph, the more it is specific to a particular group. In other words, the more an item deviates from the center, the less it indicates a consensus, but rather reflects a specific discourse of a given group. For each axis, the modalities were selected for which the contribution to the formation of an axis exceeded the average (1.666 for the variables and 0.0625 for the observations).

Concerning the first analysis (men drivers), dimension 1 (eigenvalue: 0.030813, 52.59% of inertia) opposes the male respondents to the female respondents. Dimension 2 (eigenvalue: 0.016489, 28.15% of inertia) opposes aged 16 to 18 to those aged 30 and over. Thus, we can see that men associate with their social representation of the “men drivers” characteristics related to practical skills and caution. In contrast, women consider more aspects related to transgression of rules and inattention. Concerning Factor 2, we notice that respondents aged between 16 to 18 years associated with more frequency characteristics such as practical skills to the “men drivers”. Conversely, those aged 30 and over rather mentioned characteristics related to technical expertise and the manly aspects of driving.

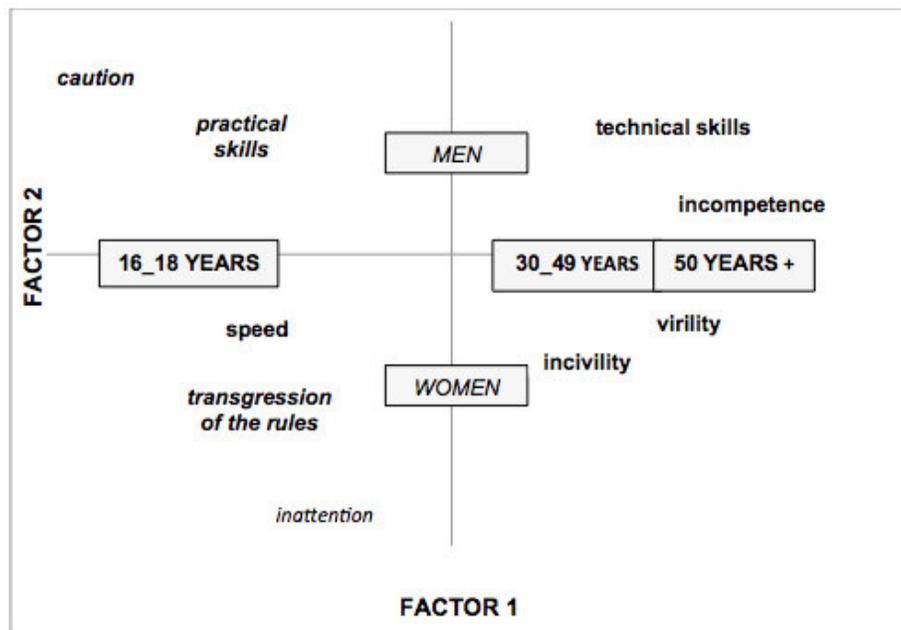


FIGURE 1. Two-dimensional correspondence analysis graph according to sexe and age group (men drivers)

Note: Abbreviations in capital letters inside grey frames represent the terms of independent variables

“**TERM**” means that the independent variables accounts for the construction of Factor 1

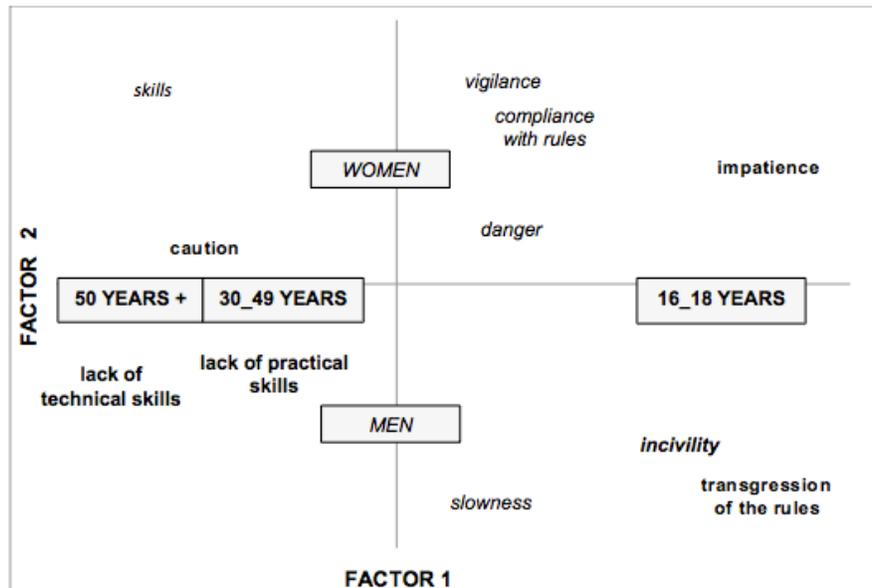
“**TERM**” means that the independent variables accounts for the construction of Factor 2

“**Item**” means that the item accounts for the construction of Factor 1

“**Item**” means that the item accounts for the construction of Factor 2

“**Item**” means that the item accounts for the construction of Factors 1 and 2

Concerning the “women drivers”, modalities were also identified for which the contribution to the formation of an axis exceeded the average contribution (0.1666 for the variables and 0.0625 for the observations, the number of variables and observations being equivalent as for “the men drivers”). Dimension 1 (eigenvalue: 0.022775, 49.89% of inertia) opposed the male respondents and female respondents. Men associated women drivers with criteria such as slowness, more than women. In contrast, women more frequently mention characteristics related to danger, vigilance and compliance with rules to describe “women drivers”. Dimension 2 (eigenvalue: 0.013483, 29.54% of inertia) opposed respondents aged 16 to 18 years to those aged 30 and over. The former refer to transgression with the rules, impatience and incivility, while the latter focus more on the lack of practical and technical skills.



**FIGURE 2. Two-dimensional correspondence analysis graph according to sexe and age group (women drivers)**

Note: Abbreviations in capital letters inside grey frames represent the terms of independent variables

“**TERM**” means that the independent variables accounts for the construction of Factor 1

“**TERM**” means that the independent variables accounts for the construction of Factor 2

“**Item**” means that the item accounts for the construction of Factor 1

“**Item**” means that the item accounts for the construction of Factor 2

“**Item**” means that the item accounts for the construction of Factors 1 and 2

We see the social construction of these attitudes, depending the social positions occupied by the individuals. Consequently, we can see that men emphasized characteristics related to the skills and expertise in their social representation of the “men drivers”, while women further consider aspects related to the transgression of the rules and inattention, i.e. the dangerous aspects of their driving. To describe the “women drivers”, women more frequently mention characteristics related to compliance with rules and vigilance, and highlight a careful driving style. Meanwhile, men associate more criteria for slowness, – which seems to indicate an excess of caution –, lack of confidence or competence in their description of the “women drivers”. It seems that the attitudes also differ depending on the age (Dimension 2) where the younger participants suggest more the relation to risk and rules, unlike the older participants, making more references to skills and abilities, in both cases. Thus, for men and women drivers each group emphasized different skills and behaviors needed to drive safely, men and experienced drivers stressed the technical and practical skills, whereas women and younger drivers stressed on safety skills and compliance with rules. It seems that social groups highlight and evaluate men and women drivers in relation to the skills they think they possess or that are important to them.

## 4. DISCUSSION

The objective of this study was to analyze the social representations of men and women behind the wheel according to sex and age. These analyses allowed some constants to be identified. Associations showed shared cognitions, some of which are common to the whole group of participants. This is the case of the elements related to self-confidence and impatience (man driver) and lack of confidence (woman driver), ranked first and most frequently cited in the prototypical analysis and not included on the correspondence analysis (which seems to reflect more of a consensual rather than a specific discourse). In the end, it appears that the vision of the “men drivers” seems to be primarily based on their skills. In contrast, the vision of the “women drivers” seems to be primarily based on their incompetence. However, a second aspect appears to come into opposition simultaneously, in both cases. While women seem to be described as very cautious and vigilant, men seem to be seen as driving fast and risky. This could explain the aspects related to the confidence (low confidence for women vs. high confidence for men), which could be seen as a cause or a consequence of the level of competence in driving. These findings are consistent with some studies which have shown that adolescents and preadolescents already differentiate expertise and driving skills according to sex: women have abilities for safety but not for driving, while men have driving skills but neglect security and safety (27). It seems since women are incompetent they must be cautious and because men are competent they can become careless. These results are in line with stereotypes describing men as taking risks, being more aggressive (28), competent (29-32) and women more hesitant, less active (33), and considered less competent in driving, even if they have fewer accidents (34). Furthermore, the results of Näätänen and Summala (35) showed that even among adolescents, the tendency to drive fast and to overtake is considered as an indicator of competence (one of the most important and frequent characteristic to describe “men drivers”). This suggests that asymmetrical attributions may be made according to the sex of a driver: in case of an accident, men would be judged to not have taken enough the other users into account while women would be judged to have demonstrated a lack of mastery of the vehicle (34). Conversely, in case of good driving (or accident avoidance), women would have been cautious and vigilant towards other road users (thus avoiding an accident) while men would have expertise and dexterity for driving cars (and it is due to those skills that they avoid an accident). This can be related to Deaux’s findings (36, 37) according to which performances that are consistent with expectations are attributed to stable and internal causes (such as ability) while performances that are inconsistent with expectations are attributed to more unstable causes (such as effort or luck). Since people more usually expect men to succeed rather than women (which remains the case for driving), women’s successes are more likely to be attributed to luck or effort, and less to ability, contrary to men. Similarly, since people more usually expect women to fail than men, women’s failures are more likely to be attributed to a lack of ability, and less to a lack of effort or luck, contrary to men. In this perspective, this indicates that men succeed through internal factors, these factors explaining failure for women. Note that these performance expectations and the reasons attributed to these performances are elaborated by consensus to both sexes (38). This means that women also consider themselves as incompetent and explain it by internal factors, rather than other factors. These results tend to suggest this phenomenon, since negative terms are used by both sexes for women drivers, such as “danger”, “lack of practical skills” or “lack of confidence”, characterized by a high frequency and high importance. Regarding terms characterized by a high frequency and high importance, no elements indicating any lack of competence are used by both sexes to characterize men drivers. Thus, the representation that the members of the dominant group elaborate toward the members of the subordinate group enables the former to legitimize their dominant position. But at the same time, the representation that subordinate group members elaborate toward dominant group members allow them to justify their position of subordination. Otherwise, according to Fiske (39), the stereotypical judgment is a way of exercising control over others, which reinforces the power of an individual or a group. In other words, stereotypes are used by members of dominant groups to maintain the status quo. This echoes the work of Berger (6), according to which negative stereotypes about women drivers were spread in the early twentieth century due to emancipation that could be generated by the car. As a result, this threat would have been at the base of a negative stereotype toward women drivers, in order to minimize the impact of the automobile as a perspective of women’s liberation and involvement into social change. Various popular beliefs against their driving style appeared according to which, due to their physical and emotional sensitive constitution, they would be unable to handle stressful situations requiring rapid decision making, which would make them poor drivers.

Beyond these consensual aspects, nevertheless, elements that can give rise to differences within the group are observed. This is the case of “contrasted elements” for women drivers, for example. Aspects related to the “skills” are considered as very important (listed in the first positions), but only through a part of the population,

which explains why it is considered to have an overall low frequency. This discrepancy is also found in the analysis of correspondence, where these aspects are more frequently mentioned by women. In fact, women promote more the in-group and denigrate more the out-group than men. Men being members of the dominant group, women tend to defend their position (40). However this phenomenon does not occur for “men drivers” for whom no “contrasted elements” are observed, as if there was no real divergence point among participants.

## 5. CONCLUSION

This research attempted to analyze the social representations of men and women drivers among young adults and adults. This work allows a start to the establishment a representational content but does not allow the drawing of any conclusion yet. The results seem to indicate the effect of social positions to designate a man or a woman driver. Indeed, it seems that the characteristics selected to determine these objects can differ according to social affiliations. We have seen that the vision of the “men drivers” was mainly based on their skills whereas the vision of the “women drivers” was mainly based on their incompetence. Other characteristics also differed by sex or age. However, an accurate diagnosis of these items cannot be established at this point, because the methodology used here only allows making assumptions about the central vs. peripheral status of these elements. Indeed, the method of free associations is an effective method to identify a representational content, but does not enable specifying its structural organization. In this perspective, this analysis must be completed by a structural diagnostic test, such as the “Test of Context Independence” (TCI) (41) or the technique of “calling into question” (42). Future research should focus more specifically on this differentiation, as this study was unable to distinguish directly what comes under the central core and what comes under the peripheral system, which limits the conclusions of this study.

The practical significance of these results concerns the gender differences in driving behaviors and its implications in terms of accidents and risk-taking. Differences in risk taking between men and women in road space can be due to the manifestation of a behavior consistent to social expectations (43). Moreover, the differentiated beliefs about the driving skills of men and women that this study shows could have direct implications on men’s and women’s behaviors and may cause an effect of stereotype threat on women drivers (7, 8, 9).

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# Sustainability transitions and gender in transport sector decisions

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## ABSTRACT

In this paper we explore the possibilities for climate and sustainability transitions through a focus on transportation issues. We are particularly concerned about gender aspects in the change toward low carbon transportation systems.

Based on Sweden as a case study, data shows that women's transportation behaviour has lower environmental impact than men's and also women tend to have stronger preferences for measures improving 'soft' issues such as e.g. sustainability or safety in the transport sector. The results imply that there are interesting behaviour and attitude characteristics expressed by women that ought to be recognised and applied e.g. through contesting prevailing norms, standards and methods, in order to achieve the climate and sustainability goals for the transport sector. The results altogether suggest that women, beyond democracy reasons, should become more active as change agents.

There are policy implications of the findings in this study. Measures to improve fair participation of women and men would e.g. make it possible to take advantage of behavioural and attitudinal gender differences. More emphasis on the relationships between travel patterns, sustainability and gendering on all levels in transportation planning could also be used as a measure. Gender mainstreaming could be used as an approach to monitoring the impacts that policies and programs have on different groups of men and women. However, today there is a lack of incentives to apply these tools. Since there is a tremendous complexity in the relationship between travel patterns, sustainability and gendering on all levels more research is needed together with improved dissemination of knowledge for the competence level to increase within the transport sector.

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**KEYWORDS:** Gendering; Change agents; Transitions.

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## 1. INTRODUCTION

The overall concern in this paper is how climate and sustainability goals can be achieved together with gender awareness in decisions of the transport sector. Climate problems are a result of human activities over a long time of industrialization, and a dependency on fossil fuels such as in the transport sector is a crucial part in actions for change. Research carried out within LETS 2050 in Sweden (1) has shown that both technological solutions and behavioural changes are needed in order to reach the stated climate goals for the transport sector. However, LETS 2050 has also shown that measures aiming for reductions in carbon dioxide (CO<sub>2</sub>) emissions through behavioural changes contribute to more sustainability goals than technological solutions do. In line with this research, the paper discusses sustainability transitions focusing on reductions in CO<sub>2</sub> emissions.

There is a demand and urgency for action from policy makers at all levels (2-4), and there is an imminent need for large scale societal transition toward low-carbon and sustainable societies (5). To successfully achieve long-term transformative change in democratic systems is likely to require broad support of men and women and participation of social groups. Democratic values and norms of justice reasons can be used to argue that women should be included on equal terms in the transition toward sustainability and a decarbonisation of society.

The transport sector is highly implicated in this transition and it is a sector that is gendered (6). Transport has a major role in advanced economies in the movement of people and goods, in maintaining standards of living and in improving the quality of life. However, it is also a major consumer of non-renewable sources of energy and is responsible for much of the growth in pollution emissions. The transport systems worldwide are

currently not sustainable, and are in many respects moving away from sustainability rather than towards it. The European Environment Agency (EEA) highlights in particular the sector's growing CO<sub>2</sub> emissions that threaten the EU's meeting its target under the Kyoto protocol (7).

Gender relations are reflected in the transport sector because gender is a crucial principle of social organization (8; 9). Taking a gender perspective on climate transitions and how they are shaped in the context of the transport sector calls for the recognition of inequities and injustices in the sector, but also suggest that norms can be relevant. Gender concerns the social organization around the difference between men and women, masculinity and femininity (10) and is expressed at many levels. Gender scholars speak about a gender power order that structures policymaking and institutions. The gender order can be studied at the level of individual men and women, at the group or organizational level, expressed as material forms of power that distributes resources, or at a more structural level as norms for behaviour (11). The overarching ambition of this paper is to discuss different levels of the gender order of the transport sector, and its possible implications for a transition toward climate and sustainability goals. To do so we use empirical data and examples mainly from the Swedish case.

We have chosen to focus on Scandinavia and we argue that Swedish transport policy is particularly interesting to study because it includes a gender dimension. The overall target of Swedish transport policy has long been to 'ensure an economically efficient and long-term sustainable transport for citizens and businesses throughout the country' (12, 13). The target is further divided in two parts where the first, 'functional' target, is to create accessibility with the intention that design, function and use of the transport system should help to give everyone a basic accessibility (availability) of good quality and usability. Unique for Sweden's policy is that it is said that 'the transport system should respond equally to women's and men's transport needs'. The second part of the policy, called 'the considerations targets', states that the targets of increased accessibility should be achieved while road safety and environmental performance improve. The environmental part of the transport policy relates to the national overall generation goal for environment and environmental quality goals by stating that the transport policy should see to it that these targets are achieved. The official parliamentary definition stating that 'the overall goal of environmental policy is to hand over to the next generation a society in which the major environmental problems are solved, without causing increased environmental and health problems outside of Sweden'. The Swedish Parliament has adopted a vision of zero net emissions of greenhouse gases to the atmosphere in Sweden by 2050.

Transport seems to be gendered in a particularly interesting way when it comes to climate and sustainability goals (14, 15). Women's transportation behaviour has, in general, lower environmental impact (measured as CO<sub>2</sub> emissions) than men's. More sustainable patterns of transport could be modelled on women's transport choices. Women also tend to have stronger preferences for measures improving 'soft' issues, such as e.g. sustainability or safety in the transport sector, and they are also more willing to take action on climate concerns. Results provided in this paper indicate that when transport behaviour is analysed from the perspective of gender, women's transport behaviour in general terms is assumed to be more in line with what is required for a transition that favours climate and sustainability objectives.

This paper starts off with an overview of research results and data showing differences between men and women in travel behaviour and attitudes towards environmental actions, but also related differences in CO<sub>2</sub> emissions in Sweden.

In the following chapter and with the overview as a basis, issues related to sustainability transitions are discussed. There are arguments that women should be included beyond the ambition to increase the democratic quality of policy making, and the chapter starts with a mapping of women's and men's representation in a selection of decision making bodies and a discussion on the quality of that representation, but also the framing and understanding of gender differences. Questions asked are what role women should have and whether we should be satisfied with gender-balanced representation, or does women's transport behaviour also imply that women should become more active as change agents in the transport sector. In transition theory (16), as well as in gender theory, there is an emphasis on the potential that certain actors – who burn for the topic, are willing to think in new ways, have different perspectives and participate in decision making – can disrupt powerful actor constellations and break path dependencies. Experiences, knowledge and ideas emerging from groups that have been outside power can be included in the agenda through these agents.

In the second section the framing and understanding of gender differences is discussed based on interviews at the national level with civil servants, politicians, interest group representatives and analysis of text documents e.g. impact assessment documents and the Swedish transport policy target regarding gender equality. The investigation pictures the (lack of) knowledge, framing and understanding of gender differences among both planners and decision makers.

The last section discusses the importance of gendered norms to how climate transitions in the transport sector of Sweden are articulated. The gender analysis considers the normative aspects of the gendered transport order. Also, in transition theory, there is a call to recognize the context for transformation (17). Transitions always occur in some broader context of norms, institutionalized over time. Also, gender theory points to this broader context of norms and practices, for example, that dominant images of men and certain types of masculinity have become the norm for governance (18). We may assume that climate governance happens in a transport context in which masculinity is the accepted norm, deeply embedded in transport administrations (19). The power of the normative is that it often remains unarticulated and invisible (20). When gender is understood as normative, policies and access without a gender perspective simply re-produce the existing normative order.

In the last chapter, final conclusions are made.

## 2. DIFFERENCES IN TRAVEL BEHAVIOR AND IN ATTITUDES

The report on Gender mainstreaming Europe transport research and policies published by University of Copenhagen and produced through the EU project Transgen states that there are clear and persistent gender differences in travel patterns (21).

In this section we present in what respects women's travel patterns in Sweden are different from men's, based on an analysis of the Swedish National Travel Survey. Further, we investigate if the differences in travel patterns also result in any differences regarding transport related CO<sub>2</sub> emissions. We also present gendered differences in attitudes to what would be more sustainable transport patterns. What does this imply for the possibility to achieve climate and sustainability goals both within the transport sector but also for the society as a whole?

It is still unusual for statistics on travel behaviours to be presented for men and women separately. There are, however, reports presenting statistics on travel behaviour differences between men and women (e.g. 22-24). Men's and women's travel patterns are different and, looking into those differences, it is found that men and women make approximately the same amount of trips but men travel further than women. The total mileage travelled differs significantly between men and women in Sweden, see Table 1. Men travel further for all displayed purposes except 'Purchase/service', for which women travel somewhat further. Most of the differences stems from differences in work-related travel. Men on average make considerably more business trips (almost four times as many kilometres per person per day) and also commute more (see Table 1). In total men travel as much as 36 percent further per person and day than women.

**TABLE 1. Total daily mileage in kilometre presented for different errands and separately for men and women**

	Work/ school	Business travel	Purchase/ service	Leisure	Other	Total
Men	11,0	11,8	5,2	19,3	5,7	53,1
Women	7,4	3,0	5,8	18,8	4,2	39,1
All	9,2	7,5	5,5	19,0	4,9	46,1

Source: RES 2005-2006 – The Swedish National Travel Survey

**TABLE 2. Total daily mileage by car in kilometre presented for different errands and separately for men and women**

	Work/ school	Business travel	Purchase/ service	Leisure	Other	Total
Men	7,0	6,5	4,3	12,4	2,8	33,1
Women	4,0	1,2	4,7	11,2	2,6	23,7
All	5,5	3,9	4,5	11,8	2,7	28,4

Source: RES 2005-2006 – The Swedish National Travel Survey

Another explanation for the differences in total mileage is that men travel more by car than women (see Table 2). The mileage travelled by car differs even more than the total mileage, and the difference again stems from work-related travel. Differences for other purposes are small. On average men travel 40 percent further by car per person and day compared to women.

The latest assessment of the Swedish national transport policy (25) presents changes between results from the national transport survey RES 2005–2006 and RVU Sweden 2010–2011 and concludes that the differences between men’s and women’s travel behaviour remains. Men still travel further than women and they use a car as driver for twice the distance as women do (the figures in Tables 1 and 2 include car trips both as driver and passenger). A common explanation has been that this difference is the result of men’s and women’s different access to the household car. This is not confirmed in the report. The gendered use of the car that we noted remains the same in households with more than one car, i.e. men drive the care more. This suggests that there are gender differences in the choice of car-related mobility.

Another explanation often used when accounting for the differences, is that men’s and women’s living conditions, i.e. household responsibilities, and employment factors influence trip lengths. While there is some truth to it, gender difference in mobility choices is not explained by level of income. Interestingly, studies showing that women with good conditions for making free choices (high income, access to a car, etc.) prefer to use public transport more often than men with the same good conditions (26, 27). These results correspond also with Rätty and Carlsson-Kanyama (28) who show that men use more energy for transport than women. The conclusions are based on their results for single households showing that the average single man spends more on vehicles and fuel than the average single woman all else being equal. The difference is equivalent to approximately twice as high transport related CO<sub>2</sub> emissions for single men compared to single women with similar pattern in several countries (28). This indicates a difference in the chosen use, rather than a caused use, of the transport system in terms of explanations of the differences, beyond socio-economic factors.

To understand what the differences in transport mode and lengths travelled means for sustainability issues we calculated the CO<sub>2</sub> emissions from all travel for women and men separately. The calculations are based on the mileage per mode and errand from RES 2005–2006 (The Swedish National Travel Survey) and the standard Swedish emissions factors for car and public transport, and assuming that walking and cycling do not produce any emissions. The emission factor for cars today is 144 g/km per person, assuming an occupancy rate of 1.2 for each journey (29). Since the public transport mode choice is not subdivided into different modes of public transport, the emissions factor for ‘public transport’ is taken as a weighted average of the emission factors for different public transport modes, based on the mode share of different public transport modes in 2011 from the Swedish National Travel Survey. This gives an emission factor of 33 g/km per person for a public transport journey today. The emission factors for bus, train and tram/metro are 0.002 g/km, 62.1 g/km and 0.002 g/km per person respectively (NTM).

Looking at the transport behaviour translated into daily CO<sub>2</sub> emissions from transport the pattern of differences presented above remains, with women in a total average emitting less than 70 percent compared to men (see Table 3).

**TABLE 3. Daily CO<sub>2</sub> emissions from transport presented for different errands and separately for men and women. Calculations based on RES 2005-2006 – The Swedish National Travel Survey and national emission factors for different transport modes.**

	Work/ school	Business travel	Purchase/ service	Leisure	Other	Total
Men	1276	1662	688	2 471	765	6863
Women	721	403	760	2 317	556	4757
Difference	-556	-1259	72	-154	-209	-2106

Apart from the differences in travel behaviour there are also some systematic differences in attitudes towards different aspects of sustainability issues. Women put a higher emphasis on environmental issues and on traffic safety issues than men (e.g. 26, 30). Furthermore, results from attitude surveys e.g. Lindén (31) show that women are more environmentally concerned and express more criticism of automobility than men. A study of the Swedish EPA (32) on climate change showed differences in knowledge and attitudes towards climate change and measures that could improve the situation. Women are consistently more engaged in the issue and to a higher extent think it an important issue. Women are also more in favour of implementing measures and inclined to changing their own behaviour. Especially for questions related to mobility and transport behaviour show differences between men's and women's responses, e.g. the study showed that 80 percent of the women were willing to consider driving less to reduce CO<sub>2</sub> emissions compared to 66 percent of the men. 75 percent of the women, while only 53 percent of the men, stated that they were willing to increase their use of public transport to reduce CO<sub>2</sub> emissions. The same pattern shows for ridesharing as well as driving at slower speeds to decrease climate change impact.

Our summarised reflection is thus that the presented research results and the data from Sweden supports the idea that women could be important change agents in the efforts to transform the transport sector more in line with sustainability and climate goals.

### 3. SUSTAINABILITY TRANSITIONS

#### 3.1 Gender Distribution of Representation

Based on the analysis of women's transport behaviour and women's attitude toward sustainability and climate goals in Sweden in the previous section we concluded that there is ground for expecting that women could be the change agents who, by participating in the transport sector decisions, could support the sector through a transition.

In this section we will map women's and men's representation in a selection of transition decision-making bodies in order to discuss more profoundly also the quality of that representation. Gender equality, i.e. when women and men are represented on equal terms in decision making is important for reasons of justice and democracy. It increases the democratic quality of decision making, which may be particularly important in situations of societal transitions, such as are envisioned for climate and sustainability issues. Gender equality is also assumed to increase the quality of transport policy-making, because knowledge, attitudes and behaviour of women in relation to transport issues are more in line with climate and sustainability goals. In the following we will look closer at gender equality, representation and norms in the transport sector. The empirical samples are from transport agencies in the Scandinavian countries and from decision-making on infrastructure development in Sweden.

While there is reasonable gender parity in the political arena in Sweden, the private sector, and particularly many areas of the transportation and energy sectors, are dominated by men (33). Men with a background in the engineering profession control decisions on transport infrastructure investments (34, pp. 297–299) and men dominate the transport and energy sectors in the labour force, the educational system and in management for Sweden (35).

A recent study of gender equality in climate policy-making in the Scandinavian countries, Magnúsdóttir and Kronsell (34), concluded that women were well represented in decision-making positions in political as well as administrative institutions involved with climate issues. This included environment, energy and transport departments. However, it is noteworthy that the only units among those involved in climate policy-making

explored in the study that were not gender-balanced are the Scandinavian transport administrations. The Danish Transport Administration has 66 percent male officials and the Norwegian Transnova, has 70 percent male officials, although the management board would be gender balanced, with 60 percent women and 40 percent men.

The Swedish Transport Administration has 36 percent female officials in total. This is a number that has been constant the last three years for the management level; 38 percent of the management consists of women officials. Although, there has been a decrease in the number of women in leadership positions over the last three years, this is not recognized in the yearly report which simply states that efforts are made to increase the number of women in leadership positions (36). Gender is discussed by the Transport Administration only in terms of assuring that 'the transportation system should respond to both men's and women's transport needs' in a non-discriminatory way (36). That the transport agencies in the three Scandinavian countries were not gender balanced may be an effect of transport issues being masculine coded (37).

The Magnusdottir and Kronsell (34) study worked with the assumption that gender equality in decision-making would also lead to policy changes that would be visible in climate policy documents. Through a text analysis of selected documents it was revealed that none of the documents made any recognition of gender aspects. The documents from gender balanced institutions, compared with those from the more male dominated transport agencies, did not reveal any difference in regards to gender recognition. The identical invisibility of gender and lack of gender awareness in all the documents explored was indeed puzzling and suggested that women's presence in policymaking makes little difference in the outcomes. This could be because they do not have a different voice than the men or maybe while women are present they are not listened to.

As a way to probe this further we investigate more closely the institutions and how they are organized in relation to gender equality. Our example is from the long-term infrastructure plans, which have important implications for climate and sustainability, as they lock the system into certain transport structures for a long period of time.

Every fourth year the long-term infrastructure plans for the Swedish infrastructure investments are updated. The process takes around two years and involves a multitude of actors and levels of decision-making as well as actors preparing the decision-support documents. During 2008–2010, long-term infrastructure plans covering national and regional investments in new roads, railway and navigation infrastructure for the period 2010–2021 were developed by the responsible national transport agencies and regional authorities in Sweden. A study initiated by The Network for Women in Transport Policy (Nätverket för kvinnor i transportpolitiken) investigated whether gender balance was achieved in the development of the above long-term infrastructure plans for 2010–2021 by studying the composition of the various groups involved in the infrastructure planning process (38). The study included a mapping of the physical presence of men and women in working and steering groups through a questionnaire. This material was complemented by interviews with a sample of participants in these groups. The purpose of the interviews was to also get a picture of how men's and women's values and preferences have been heard in the process of producing the plans.

The study concluded that the presence of men and women in the process differs regarding different kinds of tasks. In little less than half of the type of groups studied, those participating in the national as well as regional working and steering groups were dominated by men (8 out of 17). In 8 other types out of the 17 studied types of groups there were a gender balanced distribution of men and women (40-60%) but it is mainly in the groups that can be assumed to have less influence over the outcome. There was one type of group where women were in majority and this was working and advisory groups on environmental assessment. In the steering groups, where also the most important decisions can be assumed to be taken, there is no gender balance.

According to Trivector (38), there is a strong preponderance of male participants in the groups responsible for the dialogue between municipalities, businesses, and planners in the transport department or county/regional governments. In these groups, interest organizations and other stakeholders are given opportunities to provide feedback on the suggested plans and investments. This opportunity to influence the content of the plans was mostly given to men. Through the interviews it became evident that in connection with the invitations to these meetings the organizations were encouraged to consider gender aspects when appointing their delegates. This appeal to gender aspects was criticized by municipal officials who were inclined to see this as a questioning of their competence in selecting delegates.

Some of the interviews and questionnaires revealed a tendency that the ones that 'are allowed to be involved and think' in these groups should have many years' experience in infrastructure issues, and that this is a reason why it is often men who are appointed and included in such working groups. The officials explained that men, and often older men, have more experience in previous planning processes and are thus preferred to women delegates. Here we note that the call for competence and experience becomes a conserving element, which leads to the reproduction of gendered patterns as women are considered 'less competent'.

In the literature on gender equality in decision making it is often argued in favour of more women in important posts, and the importance of amounting to a critical mass (39-41) but it has actually been difficult to point to the evidence of substantive effects on policy-making, i.e. there is no clear link between a critical mass and critical acts (42, 43). This is due in part to limitations of the data and methodology. The researchers expected that women who also represent sustainable norms would thus, in this respect, be change agents, but the only evidence of this here was that they clustered their presence in those groups that dealt explicitly with environmental issues. This did not necessarily invest them with more power over the process.

### **3.2 Framing and Understanding of Gender Differences**

In a study on Swedish climate policy making from 2011 we conducted 59 semi-structured elite interviews at the national level with civil servants, politicians, interest group representatives (44). One of the questions we asked was if a gender perspective was relevant to climate policies. 39 respondents answered this question and, among those, 8 came from the transport sector. What was most striking about the results concerning the whole group of respondents was the 'ignorance' and unawareness of the relevance of a gender perspective, in the sense that a majority of policy makers simply did not know, were unsure or could not really say whether it was relevant or not. For those who were more convinced of the relevance of a gender perspective to climate politics, most did not really know what to do about this knowledge in policy making. Neither were they able to come up with concrete examples of policies implemented related to gender issues. The latter may be considered remarkable as Sweden's policy makers have been asked to gender mainstream policies in accordance with regulation starting in the mid-1990s. In another study we asked climate policy makers also in Norway and Sweden the same question with a similar result. About 2/3 of Norwegian and Danish officials interviewed did not deny the relevancy of gender, but most were very uncertain about what gender in climate change entailed, thus they appeared to lack knowledge or insight rather than the will to include gender as a relevant issue in policy-making. Typical expressions were: 'I don't know if gender is relevant, I don't know enough to speak about it with any credibility' (33).

This corresponds to results found in the study initiated by *The Network for Women in Transport*, where also overall impact assessment documents were analysed (38). Each of these impact assessment documents presents the assessment of a suggested investment object in the Swedish infrastructure plan with respect to the different objectives in the national transport policy. The study examined the overall impact assessment documents for 284 investment objects with respect to how the contribution to the goal of gender equality was described.

Throughout, the assessments on the contribution to gender equality were very brief and often referred to the lack of, or unclear, understanding of these effects. The majority of formulations of the impact assessments were identical to general instructions from the guidance on effects assessment handed out by the Transport Administration (45). Very few assessments were based on any form of report or analysis of specific object's impact on gender equality.

It is noteworthy that the standard wording 'The measure is, however, not expected to have any significant impact on gender equality' has been used in so many cases (approximately 80 percent of the impact assessment documents examined), especially since there is no basis for this conclusion. The repeated and routine use of formulations from the official Guide reveals a lack of knowledge and understanding of what infrastructure investments result in among those who produce these plans.

It does not appear in the overall impact assessments for individual investment objects how gender has been taken into account in the prioritizing and balancing of different options. Nor do the overall efficacy assessment of national and regional plans show how gender equality has been considered and applied in the development of the plan. There is no account of how the target of gender equality has been factored into the selection of the various investments included in the plan, or any decision support that has been the basis for the assessment of the impact of investment or the prioritization of the investments to be included in the plan.

Studies thus indicate uncertainty regarding how gender differences could be framed. On the other hand, there are studies showing that knowledge of gender differences regarding travel pattern seems to be spread among policy makers in general and well-known among those in the transport sector. For instance, according to Magnúsdóttir and Kronsell (33), many of the interviewees knew about the gender differences in the transport behaviour of women and men, e.g. that men travel longer distances and with private cars or airplanes while women more often use public transportation and walk. This 'gender difference' was the most frequently referred to among the respondents. There was also some awareness that women and men have different attitudes toward climate issues. However, it was very difficult for the respondents to know what to do with this knowledge in the context of policy making. One respondent said: 'should men become women, or behave like women?' suggesting somehow that this would be an impossible, even ridiculous, call.

Through the analysis of the interviews it became evident how policy makers understood gender. A majority of the informants take gender to mean addressing differences in behaviour and attitudes between women and men. They seem to suggest that women and men 'are' different and this leads to different transport behaviour. Others explained that gender per se was not so relevant, 'women have to use public transportation for economic reasons', stressing that it has to do with economic status, with class and socio-economic relations rather than gender. However, socio-economic relations and class are gendered and part of a gender power order.

In a discussion with one policy maker in the transport field about how these gendered transport behaviours may change, he suggested that a problem for getting more men to travel on public transportation, is that 'men demand that things work to a larger extent, otherwise they will switch to the car or choose the plane to travel', and he goes on to explain 'men tire faster if there are delays'. This statement suggests who has power: men expect that society will deliver to their needs and have more confidence in the right to expect it to work. Is it the result of the breadwinner model: men are the most important actors as family providers and thus, their transport needs are prioritized? We could ask if it is a sign that the 'male is norm' for the transport system, just as it seems to be in the society at large as pointed out by feminist researchers. When 'male is norm' it also becomes ridiculous to ask men to behave in transport like women. The failure not to address it simply reproduces the current (gender) landscape, closes the agenda and narrows the actors and the actions considered possible for climate transition.

The understanding and framing of gender differences can also be analysed based on the wording of the Swedish transport policy target regarding gender. The Swedish transport policy target frames the gender policy as 'the transport system should respond equally to women's and men's transport needs'. This has been criticized since it implies that women have different transport needs than men (38). Other researchers Larsson and Jalakas (46) frame the differences as being consequential of differences in both situation and role. On the other hand in the latest follow-up report of the transport policy targets (25), the following assessment was made: *"In the functional target it is stated that the transport system should equally respond to women's and men's transportation needs. There is nothing to contradict that by large it is so. However, the existing transportation needs are a consequence of differences in gender roles. But, as research indicates that men and women value traveling about the same all else equal, one can assume that in a more equal society would also men's and women's transport needs to be more equal."*

### **3.3 Change of Gendered Norms**

Gender is also part of a normative order which rests on specific constructions of men and women (10, 47). The gendered normative order is deeply structural and creates path-dependencies that impact and set some of the conditions for transitions to sustainability. That male is norm and masculinity is normative means that it becomes perceived as natural, given and remains unquestioned. As Raywyn Connell has argued, the gender order does not require any explicit politics to be maintained, the gender order is simply reproduced through this normalization (48). Behavioural standards tend to become normative in this way. If the middle-class man is the norm for transport then this does not require an explicit politics. The norms are simply maintained and reproduced within the relevant institutions through daily routine. Paterson (49) explains this in terms of the embedded norms of masculinity, of freedom and autonomy in the ecological and cultural economy of the automobile. In other words, automobility and car use has become part of masculine identity and what it means to be a modern man. Thus, when transport planners are trying to get people to move from cars to buses, trains, bicycles and walking, this is not a simple technical change, nor only a re-shaping of daily habits, it is also about identity, a re-shaping of the identity of people moving from a transport mode to another (49). It is about the relationship between what we do and who we are.

Also the norm of 'mobility' is highly structuring for the transport sector and has implications for sustainability and climate objectives. Mobility holds moving at centre stage. Mobility seems intertwined with modernity and has, not the least through globalization, become normative and an aspiration for modern life (50, 51). Because mobility is normative, it is impossible to question 'mobility' and it is perceived as something inherently good. For example, we see this in the EU White Paper *Transport 2050* where the EU sets the stage for transport in the future, by stating that 'Curbing mobility is not an option' (52). Mobility is tied to modernity, globalization, growth and prosperity. Essebo (53) investigates the myth of prosperity through a focus on mobility. She concludes that the prosperity myth permeates regional and local mobility processes including legitimization of both past and future infrastructural developments, institutional praxis and the solutions. Other examples of research questioning the ever increasing mobility and the sustainability of regional expansion through means of stimulating economic growth are e.g. Adolfsson Jörby (54) and Gil Solá and Vilhelmson (55). The mobility norm must be challenged in the light of a sustainable transition.

Mobilities are also highly gendered. As we already demonstrated in this article with the data on travel behaviour, feminine and masculine transport mobilities are different, and this difference acts to reaffirm and reproduce gendered power relations (56). The statistics on transportation patterns based on gender difference are often used in planning and, when used, are simply projected into the future through the norm of predict and provide (57, 58). This means that, rather than questioning transport behaviour as revealed through the statistics, a certain transport behaviour (including different patterns between men and women) are taken as given, they become the norm, and may also be normative for future transport planning (46) and create obstacles and impediments to attempts towards sustainability transitions.

In a previous section, we concluded that the difference between men and women regarding their transport choices were such that women's transport choices were more sustainable, and we argued that this difference is partly *chosen* rather than *caused by* for example economic status or some features of the transport system. With the insight of the normative dimensions of gender it is necessary to qualify this statement: while the transport behavior of women and men are chosen, the choices occur within a normative framework, where different transport uses relate to masculine and feminine identities and norms of mobility as something inherently desirable, something which is at odds with sustainability and climate goals.

## 4. CONCLUSION

This paper discusses how climate and sustainability goals can be achieved together with gender equality in decisions of the transport sector. The review of statistics and other research on travel behaviour suggest that women's travel patterns reveal less need for adjustment for the much needed sustainability transition. Women also have a higher acceptance for actions needed on the path towards a more sustainable transport sector. They, moreover, have shown to be more prone to change behaviour than men. The results imply that there are interesting behaviour and attitude characteristics expressed by women that ought to be recognised and applied e.g. through contesting prevailing norms, standards and methods, in order to achieve the climate and sustainability goals for the transport sector. In a situation in need of a transition toward low-carbon and sustainable societies, actions to more actively involve women can be advocated to go beyond the ambition to increase the democratic quality of policy making. The result altogether suggests that women should become more active as change agents.

We can thus find strong arguments that women should be further included in the policy-making. Still our investigation into the distribution of decision-making power between women and men in the transport sector proves it to be unequally distributed, with an overweight of men. Also when looking at the quality of the representation, women are less represented in important decision-making bodies.

Our investigation also shows that there is a lack of knowledge, framing and understanding of gender differences among both planners and decision makers, indicating that even if we were satisfied with the gender-balanced policy processes, more knowledge and other ways of planning policies and structures are needed. Even though we argue that gender-balanced policy-making could improve transition, we do not believe this to suffice. In this study we also argue that the articulation of gendered norms is a key issue for climate transitions in the transport sector. Research discussed in this study indicates that masculinity is the accepted norm, deeply embedded in the transport sector, and without a gender perspective it is likely that the existing normative order is re-produced. Based on research we argue that there is a prevailing norm within the

transport sector of constantly increasing mobility and with a strong focus on the accessibility of cars which, if left undisputed, will contribute to the preservation of an unsustainable transport system.

There are a number of policy implications of the findings in this study. One implication is that measures should be taken to improve fair participation of women and men in the sector activity in order to take advantage of behavioural and attitudinal gender differences. Efforts should thus be made to at least increase the share/number of women in decision-making positions. Today the recruitment process is much focused on the 'people that know the business', (mainly men) and this process has to change in order to ensure that disciplines such as gender studies also are represented.

Another implication is that there should be more emphasis on the relationships between travel patterns, sustainability and gendering on all levels in transportation planning. Gender mainstreaming could be used as an approach to monitoring the impacts that policies and programs have on different groups of men and women (59). For instance the City of Malmö in Sweden has decided to gender-mainstream the process of developing the city's system of public transport, integrating gender equality into the broader work to achieve sustainable transportation. Other tools that could be applied are gender budgeting, gender planning, various indicators etc.

There is a need to implement new ways of thinking and framing the problems to be solved. The planning norms should therefore be altered in such a way that the norms support the climate and sustainable goals of the transport sector and the society as a whole. Furthermore, research of environmental psychology using theoretical models like e.g. Theory of Planned Behaviour have shown that we do not need to emphasize attitudinal or perceptual change about sustainability per se; rather, we need to prioritize the behavioural component e.g. Bamberg et al. (60). These results suggest that the prevailing norms can be broken through implementation of new planning policies and structures which, in turn and over time, affects the gendered planning norms.

At the same time one has to acknowledge that there is a tremendous complexity in the relationship between travel patterns, sustainability and gendering on all levels. More research is therefore needed. But there is also a need to distribute knowledge (new and exciting) so the competence level generally increases within the transport sector.

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# Communicating transportation carbon dioxide information: Does gender impact behavioral response?

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## ABSTRACT

General concern and knowledge on climate change have been increasingly studied over the past decade. Gender differences have been found for general environmental concern and knowledge, but there are mixed findings with respect to climate change. In transportation, research has examined potential relations between environmental attitudes and transportation behavior, with mixed findings as well. Recently, the use of carbon dioxide (CO<sub>2</sub>) emissions information to influence choice has been tested, with women being found to be willing to pay more to reduce their personal impacts, suggesting that women are either more willing to change or that their response to information on climate change is stronger. However, those studies used CO<sub>2</sub> mass and studies that examined understanding of CO<sub>2</sub> information as a mass have found that people struggle to understand it. If concern and knowledge about climate change differ amongst individuals, then, according to theories such as the Transtheoretical Model, the type of information used to motivate choices is likely important. Using a unique data set (n = 236) it is possible to take a first look at how gender might affect concern, knowledge, and action in terms of transportation and climate change. Further, it is also possible to examine behavioral responses to transportation climate change information. Finally, an empirical analysis is conducted of the effect of *how* the information is presented might differ by gender. Thus, this work aims to investigate whether gender differences might contribute to the explanation of individual behavioral responses (from concern to action) in a transportation climate change context.

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**KEYWORDS:** Carbon dioxide; Transportation; Gender; Information; Behavior change.

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## INTRODUCTION

Environmental concern, knowledge, and action, and the links between them, have been studied for several decades, while general concern about climate change and knowledge on the subject have been increasingly studied over the past decade. Gender differences were reported in such studies; specifically, findings show that women generally have higher concern about environmental issues and conduct more environmental action, though less activism. However, evidence of gender differences on attitudes towards and knowledge of climate change are mixed.

Studies have examined how environmental attitudes might affect daily travel, but have either found that the environment was not considered (1), or that higher education was the defining characteristic for those who did (2). Despite the considerable role that transportation plays in anthropogenic greenhouse gas emissions (in particular carbon dioxide (CO<sub>2</sub>) that contribute to climate change (3)), research in transportation has only recently examined how knowledge (through information) of climate change impacts might affect an individual's transportation behavior in choice experiments (e.g. 4-6). In those studies, women were generally found to be more willing to pay to reduce personal emissions.

One problem that likely exists in the provision of climate change information is whether or not it is useful. *Useful* can be interpreted as providing the individual with information that they can apply to their choices, or as a means to reduce society's overall impacts. Presumably, improving the first could help with the latter. Previous studies on the use of CO<sub>2</sub> as a mass have found that people struggle to understand the information (7-9). In those studies, gender influenced results related to *how* the information was presented.

Using a unique data set from the European Commission Framework 7 project Carbon Aware Travel Choices (CATCH; [www.carbonaware.eu](http://www.carbonaware.eu)), it is possible to take a first look at how gender might explain concern, knowledge, and action in terms of transportation and climate change. Further, it is also possible to examine behavioral responses to transportation climate change information. Finally, an empirical analysis is conducted to study whether the effect on behavioral responses of how the information is presented might be explained by gender. Thus, this work aims to investigate whether gender differences might contribute to the explanation of individual behavioral responses (from concern to action) in a transportation climate change context. The results will be useful for any program that aims to use information to aid in reducing individual climate change impacts, in particular those that apply segmentation.

## **BACKGROUND**

### ***Theoretical Considerations***

Knowledge and concern do not translate directly into action. This is often referred to as the attitude-action gap (e.g. 10), where individuals may know and be concerned about a problem, but not take action. Anable et al. (10) discuss how there are two opposing views on this. One suggests that if people had the relevant information they would behave appropriately (according to knowledge deficit theory), while the other suggests that information is necessary but not sufficient. Their review found that the latter is emerging as the consensus.

There are many different behavioral models that relate to how information might influence behavior (11-13). In this work a dynamic model is used as we focus on the process of change from having no concern about a problem behavior to a behavior that addresses that problem.

#### **Transtheoretical Model: Stages of Change**

According to the Transtheoretical Model (TTM; 14) people pass through different stages on the path to behavioral change and different information will be relevant at each stage (11). These stages begin with not being concerned about the problem (*pre-contemplation*), then possibly moving to a point where an individual considers the pros and cons of changing behavior (*contemplation*). Individuals may remain for a long time, or even permanently at this stage where they are concerned about the problem, but are not sufficiently concerned that they truly consider changing. They may think about how they might change, but do not take steps to decide what action they will do.

Following that stage, the individual has now decided to do something and must find what possible behavior changes are relevant and decide which ones they might try (*preparation*). In the *action* stage, the individual has decided on a change in behavior and is testing it out. This testing may last for many months until they have found something that works for them. Following that they may work to maintain this new behavior (*maintenance*), and finally if they are successful they will reach a point where they conduct the behavior without allocating much cognitive effort to it, like a habit (*termination*).

In this research, the Transtheoretical Model is applied in two ways. The first is to measure the research participants' current level of change with respect to climate change. The second is to measure the level of their reported motivation to reduce car use in response to information. These two applications are detailed in the *Method* section.

### ***Gender-related potential differences in environmental concern, behavior, and response***

In this section a review of relevant background literature is given along with the hypotheses (based on previous work and theory) to be tested.

#### **Environmental Concern**

Environmental concern is generally defined as “an individual’s insight that humans endanger the natural environment combined with the willingness to protect nature” (15). It is considered to be composed of two primary components: a cognitive one and a conative one (ibid). However, environmental sociology also takes into account an emotional reaction (affective component) (ibid) which has been found in previous research related to climate change (e.g. 16, 17). The cognitive component relates to knowledge, the conative one to

action, and the affective one to emotional connections. Responses to environmental threats “*appear to be largely determined by interactions between people’s cognitive and affective psychological mechanisms*”(18).

Women are generally found to have more concern than men for environmental problems (19), and this concern is stronger at a local level than a national one (20). For climate change, women have been found to have slightly more concern than men in the USA (21), while in Europe men were found to have higher concern (22). In the UK, men have been found to be more likely skeptics of climate change (23). Thus it is not clear, from an international perspective, which gender, if either, would have more concern about climate change.

Unlike other environmental problems such as garbage, water pollution, or acid rain, people in western-developed countries have been found to believe that climate change is temporarily and geographically distant (24). In general, this reduces concern and action. However, altruistic tendencies might reduce this negative psychological impact. Women have been found to be more altruistic, which is argued to be due to social factors relating to their upbringing (25 in 19, 21). In environmental sociology research from the USA (e.g. 26), this relates to relevant aspects such as increased attention on impacts to others. According to Stern et al. (19), “*women have stronger beliefs than men about consequences for self, others and the biosphere.*” If women have greater altruistic tendencies and increased attention on impacts to others and the environment, then this should result in generally higher concern (H1). However, a meta-analysis of altruism and gender found inconsistent findings (27). With respect to those findings, some research has found that women are more altruistic when the costs are higher, and men when the costs are lower (28).

**H1: Women, as an aggregate, will report greater concern about climate change, as an environmental problem, than men.**

An increase in the level of educational attainment is generally linked to greater environmental concern (if not environmental behavior) (15, 29). Internationally, this was found to be true (15). However, findings are not consistent. For climate change, Clements (23) found lower education to associated with greater skepticism in the UK; Kellstedt et al. (30) found no relation between education and concern in the USA; and finally, McCright (21) reviewed work that found education to be negatively associated with concern over climate change among the American public.

**H2: Higher education will be associated with less concern about climate change.**

A country’s development stage and GDP are associated with higher levels of environmental concern about climate change. However, they are also associated with higher levels of GHG outputs. Franzen and Vogl (15) in a study of 33 countries found that attitudes towards global environmental change differed greatly, with the more affluent countries having higher concern<sup>9</sup>. However, environmental concern is not necessarily related to environmental action, as Canada had the second highest level of concern (behind Switzerland), but is one of the worst per-capita greenhouse gas emitters. One study suggested that, although affluence and education were associated with greater concern, they were also associated with increased per-capita CO<sub>2</sub> emissions (29).

**H3: Residents of developed countries will have higher concern for climate change.**

**Environmental Knowledge**

There are conflicting thoughts on the role of knowledge on concern. The theory of knowledge deficit suggests that having higher knowledge increases concern and this has been found to be true for actual (as opposed to reported) knowledge of climate change (31)<sup>10</sup>. Research in the USA has found that men generally have higher knowledge of science, and higher confidence in their knowledge (the latter may be related to the former) (21). Due to those general findings, women are expected to have lower knowledge on climate change (as a group). However, recent findings (ibid) in the USA for climate change knowledge suggest that a difference may not exist.

<sup>9</sup> It should be noted that individual differences *within* a country will be larger than averages across countries.

<sup>10</sup> However, other findings suggest that there is an inverse relationship between knowledge and concern. The “Environmental Knowledge” hypothesis (24, 29) suggests that knowledge differences in science help explain differences in environmental concern. Kellstedt et al. (29) argue that higher knowledge may relate to a stronger science interest and belief that science will find a solution to climate change. Swim et al. (23), who report findings from the American Psychology Association, argue that people with greater knowledge and wealth feel that they can avoid/escape the problems of climate change.

**H4: Women, as an aggregate, will demonstrate a lower level of knowledge on climate change as it relates to transportation than men.**

**Environmental Action**

As mentioned above, concern and action are distinct, and as the adage goes, “actions speak louder than words” this section will discuss differences between individuals for environmental action.

Research has found that women generally do more local or private environmental behaviors such as recycling, while men are more likely to do more public behaviors such as activism (32, 33). However, this may be related to “biographical availability” (32), where women often retain greater responsibilities at home, limiting their available time to participate in such public behaviors.

**H5: Women will demonstrate more environmental behavior than men.**

In terms of car use, women typically do not travel as far on average, and often have lower access to a car (e.g. 34, 35). This would, from an environmental perspective, mean that women’s travel patterns are more environmentally friendly (if not environmentally benign in numerous developed countries). Segmentation analyses of various European populations have found mixed differences in driver behavior with respect to environmental concerns and attitudes (1, 2, 36). One paper used the term “aspiring environmentalists” to refer to people who wanted to reduce their car use due to environmental concerns (2). However, that group’s defining socio-demographic characteristic was having higher education. Beirao and Cabal (1) found that neither gender was inclined to consider the environment when making transportation decisions. For Anable (2), the one group that was dominantly female, was the “reluctant riders” who were also most likely to be retired (and over age 65)<sup>11</sup>, here supported by findings by Beirao and Cabal (1) which found that men had more positive attitudes towards public transport.

**H6: Women, as an aggregate, will not use cars as much as men.**

**Behavioral Response to Transportation Climate Change Information**

The last aspect of this research deals with how individuals might respond to transportation climate change information.

Research on habits suggests that people who have a mixed-use transportation profile are more likely to change behavior (37). In general, it would be expected that people who usually use other modes would be more likely to have higher behavioral response (BR) to change car use. Further, in relation to H6 we expect women would be more likely to change travel behavior in response to climate change information.

**H7: People who do not report using a car as their usual mode of travel, will be more likely to report being motivated to change travel behavior.**

Women are generally found to be more risk adverse than men in a general, non-transportation context (e.g. meta-analysis (38); or 22,000 person study in Germany (39)). This suggests that for a problem such as climate change, which poses a risk to people, they might attempt to reduce such risks. Research on risk and climate change has found that women are more fearful of the risks of climate change (30, 40, 41). For environmental concerns, findings have shown that when the information explicitly taps risk perceptions, women express more concern than men (21). We therefore expect that women should have a stronger reaction to information that more clearly communicates a risk.

**H8: Women will have stronger responses than men to climate change information that is framed as a risk.**

Differences have been found in concern about climate change between developed and other countries, with findings generally suggesting that people from developed countries are more concerned (15). However, psychological research suggests that people in wealthier nations feel that they are more resilient or could escape the problems of climate change (23). Further, climate change impacts are predicted (42) to be more damaging to less developed countries (related to location, infrastructure deficiencies, and financial capacity to deal with impacts). Thus, despite having less concern about climate change in general, people from less developed countries may respond to climate change information more strongly as they may feel more

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<sup>11</sup> It should be noted that in the UK, elderly people can use public transport without charge.

vulnerable to the negative impacts. It is not clear what the impact of gender might be with respect to different countries' development levels.

**H9: People of each gender in transition countries (despite potentially having lower concern), will have stronger responses to climate change information.**

As discussed above, TTM argues that people need to first accept that there is a problem, and then convince themselves to try a new behavior. People who have already convinced themselves of the need to reduce their climate change impacts should be more likely to respond to climate change information related to their behavior (this would be also be supported by the need to reduce the so-called 'cognitive dissonance' (43) between two cognitions, in this case people's behavior and their attitudes). Previous research has not considered the level of climate change concern when comparing genders. The impact of climate change concern within each gender is therefore examined.

**H10: People of each gender at higher levels of environmentalism should have stronger responses to information on climate change.**

Finally, with respect to TTM and the cognitive dissonance theory, and following from environmental concerns and environmental action, we expect that women will have higher behavioral response (BR) than men.

**H11: Women will have stronger responses to climate change information.**

## METHOD

Surveys were distributed at work places in five countries associated with the Carbon Aware Travel Choices project (CATCH; [www.carbonaware.eu](http://www.carbonaware.eu)) ( $n = 236$ ;  $w_{\text{women}} = 102$ ;  $n_{\text{men}} = 134$ ). Two of the countries (Brazil and China) can be considered transition countries, while the remaining three (Great Britain, Italy, and Spain) are considered to be developed countries. Questions tested general knowledge on CO<sub>2</sub> emissions related to transport (mix-and-match style), giving a sustainability rating to CO<sub>2</sub> information presented in different formats (see below), and behavioral intention questions related to changing car use<sup>12</sup>. Demographic questions included age, gender, education level, and income level. Transportation questions related to usual mode, and the perceived usual modes of friends, family, community, and city. Respondents were asked whether they performed other daily environmental behaviors: normal (recycling), and less common (composting). Finally, a question asked about the participants' level of environmental stage of change (based on the Transtheoretical Model; ESC) with respect to climate change.

### *Country development*

The three developed countries contained in the data used for this research were included in the Franzen and Vogl study discussed above (15), but the two transition countries were not. Spain, Great Britain, and Italy were in the middle of the table, but towards the bottom of the developed countries. Of the transition countries, only Chile had higher concern than those three. We therefore expect that concern should be higher for the developed countries in this study.

### *Formats: how the information is presented*

Four different formats (see Table 1) were used in this experiment: mass, tree-equivalent, earth-equivalent, and carbon-budget. The mass of CO<sub>2</sub> was included, as it is the scientific measure, and an example of simple information content without either environmental or emotional contextual information. It is the most commonly used format for the results of on-line carbon calculators (13). The tree-equivalent format was chosen as a common equivalent that related to the carbon cycle and was associated with environmentalism. It represents a contextualized format that should contain an emotional context, but with less analytical basis (as it lacks a clear limit). The earth-equivalent format was chosen as it was based on a concept of equality, (was believed to) clearly conveyed sustainability and was used by well-known environmental groups such as the 'World Wildlife Funds' Footprint calculator (<http://footprint.wwf.org.uk>). It represents a contextualized format that is more analytical than the tree-equivalent format as it suggests a limit and has emotional associations. To

<sup>12</sup> The full survey results can be found in (17).

examine the effect of contextual information void of emotional associations, a carbon-budget format based on a fictional limit was included. The limits in the carbon-budget and earth-equivalent formats were the same.

**TABLE 1. Formats and information presented in the experiment**

Format	Information presented
Mass	4 tonnes of CO <sub>2</sub>
Tree-equivalent	
Earth-equivalent	
Carbon budget	111% of your carbon budget

### ***Applications of the Transtheoretical Model***

To measure the participants’ current environmental stage of change (ESC) they were asked to choose a phrase related to concern and action that best described them. These four choices were (TTM relevant levels are given in brackets here, but were not given in the study):

- 1) 'I don't worry about climate change' (pre-contemplation);
- 2) 'I worry about climate change, but don't know what to change' (contemplation);
- 3) 'I worry about climate change and I am planning to reduce my impacts' (preparation);
- 4) 'I have made changes in the last year to reduce my impacts' (action/maintenance).

Thus it will be possible to compare whether there is a difference not only in concern, but also how developed their behavior change paths.

The second application of TTM was for the behavioral responses (BR) to transportation CO<sub>2</sub> emissions information. The participants were given these response choices to choose from (again, TTM relevant levels are given in brackets, but were not included in the study):

- 1) Change nothing (pre-contemplation);
- 2) Consider a change in the future (contemplation);
- 3) Change how you get around (check all that apply): reduce trips by car; shorten trips; change vehicle (e.g. better mileage); or stop driving. (preparation/action).

### ***Analyses of hypotheses***

For the hypotheses on *concern*, results from the ESC are used where the first level is taken as *not concerned*. For the hypotheses on *knowledge*, the results from the matching exercise are used. With respect to *environmental behavior*, participants’ responses to recycling, composting, ESC level, and usual travel mode are used.

For the hypotheses on *behavioral response*, higher-level responses (e.g. change how you get around) will be compared for each format (mass, tree-equivalent, earth-equivalent, and carbon-budget).

## **RESULTS**

The descriptive statistics for the dataset used are shown in Table 2, while the results of the analysis on the hypotheses related to concern and knowledge are shown in Table 3. For non-parametric analysis (e.g. categories and number), a  $\chi^2$  test was used. For parametric analysis (e.g. percentages) with categories, analysis of variance (ANOVA) was used. In Table 3, hypotheses that were analyzed intra-gender are shown with the suffix “.w” for women and “.m” for men. The final table, Table 4, shows the percentage of individuals who responded to the transportation CO<sub>2</sub> emissions information with the highest grouping of behavior change (i.e. change how you get around).

**TABLE 2. Select descriptive statistics for the dataset (n = 236)**

Measure	Female (n = 102)	Male (n = 134)
Age (years)	37.5 (+/- 12.4)	38.6 (+/- 12.1)
Have higher education	74.5%	78.4%
Usual mode is car	64.7%	62.7%
Environmental Stage of Change		
- No concern	10.6%	11.0%
- Concerned but don't know what to do	28.7%	25.2%
- Will do something soon	22.3%	40.9%
- Have done something in the last year	38.3%	22.8%

**TABLE 3. Results for hypotheses related to concern, knowledge, and environmental behavior. Suffix *w* (women) and *m* (men) are used to indicate intra-gender analyses (n = 236)**

Hypothesis: A/B	Measure	A	B	Interpretation and implications
H1: women/men	Concern	89%	89%	H1 <i>rejected</i> ♦. Both genders have equal levels of concern (ESC) with respect to climate change.
H2: normal/higher education	Concern	86%	90%	H2 <i>rejected</i> . People with higher education showed a tendency to be more concerned.
H2.w: normal/higher education	Concern	83%	91%	H2.w <i>not supported</i> . However, possibility that a larger sample would be significant.
H2.m: normal/higher education	Concern	89%	89%	H2.m <i>rejected</i> . Results were equal.
H3: transition/developed*	Concern	96%	85%	H3 <i>confirmed</i> . Residents of transition countries were statistically more likely to be concerned.
H3.w: transition/developed	Concern	94%	87%	H3.w <i>not supported</i> . Female residents of transition countries were more likely to be concerned, but not statistically so.
H3.m: transition/developed*	Concern	98%	84%	H3.m <i>confirmed</i> . Male residents in transition countries were statistically more likely to be concerned.
H4: women/men	Knowledge	46%	46%	H4 <i>rejected</i> . Men and women both struggle to rank different travel scenarios by their CO <sub>2</sub> emission amounts.
H5.recycle: women/men	Recycle	74%	70%	H5.recycle <i>rejected</i> . Women were not statistically more likely to recycle in this sample.
H5.compost: women/men	Compost	30%	27%	H5.compost <i>rejected</i> . Women were not statistically more likely to compost in this sample.
H5.ESC_4: women/men*	ESC_4	38%	23%	H5.ESC_4 <i>confirmed</i> . Women were more likely to report having done something, implying that they are further along the behavioral change stages (TTM).
H6: women/men	Travel mode	65%	63%	H6 <i>rejected</i> . Women reported that the car was their usual mode of transport as often as men in this sample. However, distances and frequencies were not requested.

♦*rejected* = Not statistically different and difference was less than 5%; *not supported* = not statistically different, but difference was greater than 5%; *confirmed* = statistically different  $p < 0.05$ .

\*  $p < 0.05$

**TABLE 4. Percentage of each segment that reported a higher behavioral response (BR; a change in car behavior) across the four format types.**

	Gender	Secondary division	n	Mass (g)	Trees	Earths	Carbon-budget
H8,	Female		102	64%	78%	76%	82%
H11	Male		134	66%	82%	72%	80%
H7	Female	Other mode	35	80%*	91%*	85%	91%
		Car	50	52%*	68%*	70%	76%
	Male	Other mode	50	77%*	89%	84%*	84%
		Car	84	58%*	77%	63%*	77%
H9	Female	Transition country	31	77%*	87%	81%	87%
		Developed country	71	56%*	72%	74%	80%
	Male	Transition country	47	85%*	89%	83%*	89%*
		Developed country	87	50%*	76%	63%*	72%*
H10	Female	ESC_low	37	52%	68%	67%	74%
		ESC_high	57	70%	80%	78%	85%
	Male	ESC_low	46	48%*	79%	61%	73%
		ESC_high	81	74%*	85%	77%	85%

\*  $p < 0.05$

## DISCUSSION

### *Concern, knowledge, and current action*

Following previous findings on concern and knowledge of climate change (21), sizeable differences between men and women were *not* found. This is in contrast to other findings on general environmental concern (e.g. 15, 19). From our sample, education was not found to have a significant impact on concern. It is notable that the only variable to have statistical significance on the level of concern was the country of residence's development stage, with residents of transition countries more likely to report at least some concern. Thus, from our findings, it appears that the more difficult task relates to improving concern in the "problem" population where greater emissions per capita occur.

While a deep knowledge of climate change was not tested, a simple matching exercise (five items) was used to determine whether people could match a CO<sub>2</sub> amount to a transportation mode. Men and women had equivalent results, suggesting that they had equal levels of knowledge (both "failed" on average) in this sub-category of climate change concern. Thus, our findings suggest that, although people know generally about climate change and are concerned, most do not have sufficient knowledge to make informed decisions about transportation choices to reduce climate change impacts.

The differences between developed and transition countries' residents were mixed and different between the genders. In both genders, residing in a transition country was associated with greater levels of some concern (though not statistically so for women). That finding is contrary to previous findings on differences between countries (15). As there was a high percentage of people with higher education in both country types (81% in transition countries, 75% in developed), this may be a result of the sample group not being representative of the respective countries, but offering a comparison of similar groups across the countries.

Our sample group did not show any difference between the genders in general household environmental behavior (recycling, composting). However, in a larger sample, the tendencies found here could be statistically significant. For transport, women in our sample were not less likely to report usually using cars to travel (we did not measure overall frequency or distances). This result may be related to surveying employed people who generally had finished higher education degrees. The results suggest that recycling behavior is more developed, though arguments could be made that it is an "easier" (barriers are low in terms of infrastructure and time) environmental behavior that might have a direct financial reward (e.g. deposit refund for returns).

Women were found to be statistically more likely to report having done something to reduce their climate change impact with nearly 40%. This suggests that, although the percentage of concerned individuals was not different between the genders, women in this sample were further along the TTM path of behavior change suggesting that they have accepted the problem, investigated ways to address it, and applied one of those. Considering that most gender studies on environmental behavior are decades old, it may be the case that, at the time of previous studies recycling was a less common activity, so the findings at the time reflect those found here for the next environmental behavior paradigm. Thus, our findings suggest that, although considerable work remains to reduce climate change impacts, it is men who require additional help to reach the action stage of change.

In summary, for concern, only the country of residence's stage of development resulted in significantly different results. There were no differences found for knowledge between genders. For action, more women report having done something to lower their climate change impact.

### ***Behavior responses to how the transportation CO<sub>2</sub> information is presented***

No statistical differences were found between the genders for any of the formats, thus rejecting *H11*. Differences in BR for the earth-equivalents format were minor, thus *H8* is rejected as well.

In both genders, individuals residing in transition countries were more likely to have a high BR to the information, thus confirming *H9*. Findings were statistically significant for mass (women, men), earth-equivalents (men), and carbon-budget (men). In general, the percentage differences were larger for men, with men from developed countries being the least likely to report high BR to change their car use. Women from developed countries reported the highest BR for the analytical format of carbon-budget, while men from developed countries reported their highest BR for the emotional tree-equivalent format (see Waygood and Avineri (16) for an analysis from an analytical-emotional perspective). For both men and women in transition countries, those two formats (tree and carbon-budget) were equally most effective at stimulating high BR. Thus, our findings suggest that the type of format can impact BR, but it is not possible to say from these results that there is a "best" format for improving BR.

People who reported using other modes were more likely to have reported higher BR. This is perhaps not surprising considering that the BR question related to car use. Within this subset, women's responses were statistically different for mass and tree-equivalent formats. For men it was mass and earth-equivalent formats. For both women and men who reported usually using cars, the carbon-budget format resulted in the highest BR (for men it was tied with the tree format). For women and men who usually use other modes, the tree-equivalent format had the highest BR (for men it was tied with the carbon-budget format). Regardless of their usual mode, all of the formats with some context (tree-equivalent, earth-equivalent, and carbon-budget) resulted in most people reporting high BR. Thus, in terms of the "problem" behavior of usually using cars, the carbon-budget format is the most effective.

For ESC, people who reported being at higher levels were found to have higher BR, but only statistically so with men for the mass format. For women reporting low ESC, the carbon-budget format had the highest BR, while for men with low ESC the format tree-equivalent was best. For women and men who reported high ESC, the carbon-budget format was the best (though it tied with the tree-equivalent format in men). Surprisingly, the earth-equivalents format only performed better than the contextless mass format. Thus, it appears that as long as some context is given, the impact of being further along an environmental stage of change on BR is negligible.

In summary, a number of important findings are reported here. First, *even if a person usually used a car to get around*, they reported high BR, in particular for the carbon-budget format. Second, people from transition countries more frequently reported high BR. Third, although women and men had similar rates of high BR for each format, differences were evident when intra-gender analyses were conducted, suggesting that intra-gender heterogeneity is an important consideration. Fourth, ESC showed that when people are not already concerned, how poorly the most commonly used format of communicating CO<sub>2</sub> information, mass, was at stimulating a high BR. Finally, considering the results for usual mode and ESC, CO<sub>2</sub> information with some context resulted in most people reporting high BR suggesting that, if given useful information on climate change, people might change their behavior to reduce their impacts.

## **Recommendations related to findings**

1) Provide context-based CO<sub>2</sub> information that relates to a recommended limit to facilitate informed decisions and motivate BR towards less damaging behavior.

2) Focus efforts on changing the behavior of men, particularly in developed countries, as they are both the greater problem segment and the least motivated to change.

## **Limitations**

This research examined mostly employed individuals and had a high percentage of participants with higher education, thus it is not a representative sample of the countries. It is however an examination of similar socio-demographic groups across the five countries. This research did not examine actual behavior response, so the potential for socially acceptable responses exists. As well, the ESC was self-reported and it is not clear what change the individuals had made and whether it actually reduced their climate change impact. A larger sample size would improve future research.

## **CONCLUSIONS**

A gender analysis was conducted on results from a transportation-related climate change survey containing questions on concern, knowledge, action, and behavioral intention responses to reduce car use. Confirming previous findings related to climate change, differences between men and women on general concern and knowledge were not found. However, looking at action and not just concern, women were more likely to report having done something to reduce their climate change impact, thus suggesting that they are further along the stage of change sequence. The usual mode of travel was found to significantly influence the degree to which transportation climate change information motivated a transportation behavior change. People who live in transition countries showed greater concern, and men in developed countries reported lower intention to change behavior for all information formats; women only reported lower intention for the context-less format of mass. Finally, only for men was an individual's environmental stage of change with respect to climate change concern and behavior significantly related to intentions to change behavior in response to contextless transportation CO<sub>2</sub> emissions information. All results suggest that CO<sub>2</sub> emissions information with some context could lead to personal behavior change to reduce climate change impacts and that men in developed countries require the greatest efforts to reduce their impacts.

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# Gendered perceptions of positioning technologies

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## ABSTRACT

The aim of this study is to investigate gendered perceptions of three potentially privacy-invasive technologies relevant to daily mobility – video surveillance (CCTV), positioning via mobile phone, and radio-frequency identification (RFID) tags – via contrasting scenarios and items measuring factors such as acceptance and desirability. Gender analysis indicates that females may favor more anonymous forms of surveillance. Also, that females, to a *lesser* degree, find it appropriate to use technologies, are willing to search for information about or are willing to discuss the technologies. The interaction of parenthood and gender is also explored, where parenthood also proves to affect males and females differently, where female non-parents often perceive technological applications less favorably than do other groups by having heightened risk perception, lower trust, lower acceptance, etc. These results, combined with an overall lack of willingness to discuss with influential parties (elected representatives or relevant authorities or companies) and a lack of willingness to search for information about a technology regardless of ratings of acceptance or privacy-invasiveness, lead the authors to submit that the respondents, and perhaps females even more so, feel a sense of resignation towards technological development. This may have broad implications for decision-making and democratic processes, as perceived lack of influence and perceived lack of interest in participation feed back into each other, which may further divide laypersons from experts, companies, and authorities, and entrench the gendered nature of surveillance.

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**KEYWORDS:** Surveillance; Gender; Parenthood; Mobility; Privacy; Risk; Trust; Acceptance; Positioning, CCTV; RFID.

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## 1. INTRODUCTION

Data, data collection, and Information and Communication Technology (ICT) are not only pervasive in modern society, they are also considered the tools by which society will progress in this age of knowledge production and service provision. Within transportation, so-called Intelligent Transportation Systems (ITS) include sensors, cameras, global positioning systems (GPS), real time information, radio frequency identification (RFID), smart cards, etc., all of which are envisioned to aid in optimizing and managing travel and mobility, both on an aggregate level (flows) and on an individual level (choices). As personalization of services increases and alternatives to using these technologies become increasingly scarce (e.g. one cannot practically avoid CCTV or RFID if one needs to use public transportation), the picture of our movements and activities becomes increasingly detailed. Does the pervasiveness of these technologies translate into general acceptance or desirability? How is acceptability linked to perceptions of privacy, risk, and trust for the data collectors? How does context influence these perceptions? Are perceptions of these technologies gendered?

The aim of this article is to investigate gendered perceptions of three potentially privacy-invasive technologies relevant to daily mobility – video surveillance (CCTV), positioning via mobile phone, and radio-frequency identification (RFID) tags – via contrasting scenarios and items measuring factors such as acceptance and desirability. We also explore the interaction of gender and parenthood. However, in order to discuss these perceptions, we first need to have some sort of understanding of risk perceptions and how they relate to socio-demographic characteristics, as well as of surveillance concerns and the potentially gendered nature of surveillance technologies.

The structure of the article is as follows: Section 1 discusses risk perception and surveillance; Section 2 describes the method and material used in the study; Section 3 presents results of the study; Section 4 includes a discussion of the results and conclusions; and Sections 5 and 6 contain the acknowledgements and references, respectively.

## **1.1 Risk Perceptions**

Formal definitions of risk vary, but often include a probability assessment based on statistics or expert opinions, e.g. the probability of an event with negative consequences. However, this technical definition has been criticized by e.g. Slovic (2001), who points out that experts' and laypersons' opinions alike are subject to value judgments and context, e.g. "framing" consequences in different but statistically equivalent ways (benefit vs. loss), and that many factors affecting risk perception are not included in theoretical, technical models of risk, e.g. inequity, control, voluntariness, and trust.

Framing a risk as general versus personal affects perceptions as well. This is also known as "unrealistic optimism" (Weinstein, 1980), where people think that bad things are more likely to happen to others and good things to themselves. Sjöberg (2000) also finds evidence of such "risk denial", where risk for oneself and one's family are both rated lower than risk for the general public, and that the "risk target" affects perceptions, where "no target" and "any one person" results in the same ratings as general risk.

Trust has also been proposed as a determinant of risk perception. In Sweden, trust in science has been found to play a more important role than social trust, emphasized in the United States (Drottz-Sjöberg and Sjöberg, 2003). Slovic (1999) points out that trust is subject to the "asymmetry principle", where distrust has the advantage as negative, trust-destroying events are more visible, influential, and psychologically believable. Distrust is also self-perpetuating and low trust for those defining and managing risk will also lead to low trust in their risk assessments. Trust is easy to destroy and hard to build.

### **Socio-demographic Factors**

Socio-demographic factors such as gender, race, political affiliation, etc., are also important in explaining risk perceptions. Enander (2005) reviews how perceptions of security measures are affected by socio-demographics – gender, age, parenthood, civil status, and foreign background. She found that: women have higher perceptions of risk, worried more, and found the measures less inconvenient and more worthwhile than men; risk awareness increased with age, and older people found security measures more worthwhile while younger people found them more inconvenient; parenthood and living with someone both increased risk awareness and led to the adoption of more security measures; friends and family were considered important sources of information regarding risk; and people with foreign backgrounds were more risk aware but less prone to adopt security measures.

Previous research also shows the importance of interactions between socio-demographic factors. Studies from the United States have identified a so-called "white male effect" where white males perceive the world as safer and risky activities as more beneficial compared to other groups (e.g. Flynn et al., 1994; Finucane et al., 2000). Olofsson and Rashid (2011) investigated this effect in Sweden and concluded that it should be called a "societal inequality effect" instead. They found that in the relatively more gender equal Swedish society, foreign background, as a mediator of social inequality, etc., had a much greater effect than did gender. No matter the basis of social inequality, these studies clearly illustrate the importance of considering views of minority groups in each society.

Clearly risk is an elusive concept that depends on many factors, such as socio-demographic characteristics, context, framing, and statistics. As much as our modern society tries to minimize and control risk, Beck (1992) argues that we now live in a risk society, which, despite its futile attempts to eliminate risk, actually creates new risks. Lyon (2001) maintains that one such example is data collection, or surveillance, defined as "any collection or processing of personal data, whether identifiable or not, for the purposes of influencing or managing those whose data have been garnered" (Lyon, 2001:2).

## **1.2 Surveillance**

Lyon (2001) argues that an information society is a surveillance society, as surveillance data flows are becoming general institutionalized phenomena creating webs of surveillance, reminiscent of Castells' network society in which "the key social structures and activities are organized around electronically processed information networks" (Castells, 2001). Even our relationships and activities are increasingly achieved via data flows, as we no longer need to be present to work, conduct business, or socialize. Already several years ago, the European Union stated that it is practically impossible for individuals to keep track of all the electronic traces they leave or take precautions regarding them (EPTA, 2006). Solove (2010) argues that the more fundamental problem is this powerlessness of the individual to control their personal data. This aspect of

control is an important element of the concept of privacy (as related to personal data), as reflected in Westin's definition from the 1960s: "the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others" (Westin, 1967:7).

Another key factor in surveillance and privacy is context, as we do not share the same information with everyone. Nissenbaum (2010) argues that privacy concerns are concerns about "appropriate flows of control" that are dependent on contextual, social norms. Surveillance (personal data collection and processing) is not necessarily the issue per se as it can be beneficial in the right context. Rather it is linked to the ability to develop into an autonomous individual, as well as to power and control, privacy, and social inclusion/exclusion. As we will now see, the social context in which surveillance is exercised is also relevant to consider.

### **Surveillance in a Social Context**

Although one may consider technology to be neutral or objective, treating all individuals in the same way, it is used in social and institutional contexts which are likely not neutral. Monahan (2009) argues that surveillance technologies operate on an abstract level and are not objective, but objectifying; that the stripping of social context and turning individuals into data enforces masculinized representations of the world. "In other words, exercises of power are rendered invisible by nature of the supposed neutrality of technologies, such that the sociotechnical sorting of the world is normalized" (Monahan, 2009:291).

Koskela (2000) argues that (video) surveillance (CCTV), for example, is inherently gendered, as those who decide to install surveillance devices and subsequently the surveillance operators (police and security guards) tend to be male. And although CCTV is often installed in public spaces and transit environments, women are still relatively more fearful in such places and do not view technology as a substitute for staff presence (Loukaitou-Sideris, 2009). Perhaps, this is because CCTV is not generally preventive and cannot undo damage already done, and it cannot even "see" some threatening situations such as verbal harassment. In interviews with women in Helsinki, Koskela (2002) found that surveillance evokes mixed feelings of both increased security and mistrust towards their effectiveness, as well as towards those behind the cameras. A Swedish study, however, found that women held significantly more favorable attitudes towards CCTV in terms of reducing crime, increasing their sense of assurance, and not invading their privacy (Lindkvist et al., 2002), although no statistically significant gender effects were found in Oslo (Sætnan, Dahl, and Lomell, 2004). And despite containing a very relevant discussion into the potential effects of ITS and location-based services on women (including privacy aspects), Cottrill and Thakuriah's study (2009) is based on non-response rates in a Chicago-area household travel survey, rather than on any direct study of women's perceptions of ITS and privacy. In general, more research is needed in investigating the effects of technology on women's mobility experiences, and women's perceptions of those technologies.

### **Themes of Care, Control, and Convenience**

Care, control, and convenience are common themes within discussions of surveillance technologies. For example, Lyon (2001) discusses the dual nature of surveillance (care and control) and also points out that surveillance is usually motivated by good intentions and "plausible justifications" such as safety, security, convenience, or efficiency, which fosters compliance. These themes are also relevant for the technologies of focus in this article, as exemplified below.

For CCTV, control is not only relevant in terms of trying to manage risk or space, or in the lack of control over privacy and personal data as touched upon above, but also in the sense of CCTV not empowering the person under surveillance. Those on the receiving end can only *hope* that the CCTV system is monitored, that negative events will be identified in a timely manner, that help will be dispatched accordingly, and that one can trust the surveillance owners and operators. As Koskela (2000) points out, being "under control" is not the same as being "in control", which, although potentially unpleasant, can increase one's sense of assurance (Sochor, 2013, 2014).

Although there are many positioning services targeted towards social networking, some are particularly geared towards "care", e.g. finding people or getting help in emergency situations. However, the same locator service or software that can "give you peace of mind and protect you and those you love against dangerous situations" (MTN WhereRU, 2013) can also be used to secretly track partners, children, and employees, or even stalk victims. Mason and Magnet (2012) argue that new surveillance technologies are more frequently used to stalk victims than they are to protect victims. From this perspective, surveillance technologies are, again, not neutral, but reflect the cultural contexts in which they are used.

Masters and Michael (2007) reviewed the applications of RFID within the framework of control, care, and convenience. They found that although care and convenience are often the justifications of use, control was the common, dominant theme. Günther and Spiekermann (2005) found that consumers' trust in RFID was dependent on their feelings of control over the technology. Also, those with higher formal education felt even less in control, which calls into question the effectiveness of the common expert response of "educating the public" (i.e. to attempt to align public opinion with expert opinion) in the face of risk (Söderberg and Wester, 2012).

We will now introduce the study and describe how applications of CCTV, mobile phone positioning, and RFID have been developed into scenarios. Furthermore, we will outline the survey questions developed from studies of risk and privacy perceptions.

## 2. METHOD AND MATERIAL

In the study presented in this paper, factors related to risk and privacy concerns are used to assess the Swedish public's acceptance of privacy-invasive ICT solutions. The questionnaire consisted of twelve scenarios (developed in cooperation with researchers at FOI, the Swedish Defense Research Agency); six potentially privacy-invasive technologies – retinal scanning, video surveillance, mobile phone positioning, e-mail monitoring, RFID tags, and DNA registration – each described in two different ways. For each scenario, one variable was altered in order to investigate if this manipulation would influence perception of the technology and is described below. Each participant was assigned two random scenarios (although not two scenarios within the same technology category), and answered in total 24 questions and rating statements after each scenario, covering themes found within the above discussion of risk perceptions and privacy concerns. TNS SIFO International, a Swedish research company working with opinion polling, administered the individual, online questionnaires, and recruited the participants so as to represent the Swedish population in terms of gender, age, and region. In addition the participants were presented with background questions.

As the data is extensive, this article concentrates on the three technologies most relevant for today's urban mobility – video surveillance (CCTV), mobile phone positioning, and RFID tags – and two explanatory variables – gender and parenthood. For these three technologies, 21 items were selected for analysis in this article<sup>13</sup>. In total, 1196 participants' responses are included in this analysis.

Each of the technologies is described in two different scenarios. The video surveillance scenarios (designated "CCTV ID" and "CCTV no ID") differ in how easy it is to identify individuals in the recordings. Both scenarios are based on the local municipality installing CCTV cameras in your local town square in order to improve safety and security. The cameras are visibly placed in order to have a deterring effect and are connected to a manned surveillance center. The recordings are saved for three months. However, in Scenario "CCTV ID", the cameras will make it easier to identify persons if a crime is committed, while in Scenario "CCTV no ID", the cameras are equipped with software that de-identifies faces, making it hard to identify individuals.

The mobile phone positioning scenarios (designated "Phone Positioning" and "Phone Police") differ in the police being able to activate the positioning function or not. Both scenarios are based on a new service offered by your mobile phone provider that enables one to see the position of a mobile phone with a certain telephone number. The information is shown on a map accessed via a password-protected website. The positioning functionality is built into most mobile phones, but one must actively register in order to access the service. Scenario "Phone Police" goes on to describe how the police can activate the positioning function under special circumstances and without having to notify the subscriber.

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<sup>13</sup> The questions/rating statements are described here in the order in which they are presented in the figures and tables (19 of 21 items). The results for the two items regarding who should be allowed to use the technology and with whom the participants would be willing to discuss the technology are presented in the text. *Left radar graph clockwise from the top (figures), and Q1-6 (appendices), "yes" or "no" response:* The technological application is privacy invasive: the participant would actively avoid it; the participant would search for information about it; it is acceptable; it improves society; and the risk for misuse of collected data is worth taking for society. *Right radar graph clockwise from the top (figures) and Q7-19 (appendices), response on a 1-5 scale:* The technological application makes society more vulnerable; the participant worries over its use; the participant is offended or upset by its use; the level of risk for misuse of collected data; the participant's trust for the data collectors; data collection is necessary; data collection is useful; it makes society safer or more efficient; it is effective in reaching the desired goal; it has many (dis)advantages; it is good-bad; the participant wants it; the participant would actively request it.

The RFID scenarios (designated “RFID Travel” and “RFID Clothing”) differ in the type of company using the personal information gathered via the RFID tags in order to improve or tailor their services. “RFID Travel” describes how you have many different cards using RFID technology, e.g. access cards at your workplace, public transportation travel cards, and a transponder in your car for paying road tolls. The information from these cards can be connected to you and your habits. You use your public transportation card daily by holding it up to a special card reader. Information about your trips is saved for three months and is used by your public transportation provider to improve their services, e.g. more frequent departures or new stations. “RFID Clothing” describes how there are many areas of application for RFID technology, e.g. access cards at work, public transportation travel cards, and marking goods for transportation and in stores. These RFID tags can be placed inside clothing, and special readers can get information about your clothing. This means that when you go into the (clothing) store, a salesperson can see where you bought your clothes and how much they cost. The store can make tailored offers based on this information.

To facilitate the flow of reading, aggregate responses (percentage “yes” answers and average ratings) can be found in Table 2. Asterisks indicating statistically significant differences between two scenarios (for a specific technology) or between participant groups (for a specific scenario) are placed in the figures and can also be found in Table 3 (\* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$ ). The analysis has been performed using the statistical software package SPSS.

### 3. RESULTS

The results are presented as follows: first, the socio-demographic characteristics of the participants; then, the participants’ general attitudes towards the technologies and across scenarios. Finally, the effects of gender are explored, as well as the interaction of parenthood and gender.

#### 3.1. Demographic characteristics

Table 1 provides an overview of the socio-demographic characteristics of the participants who received the six scenarios (about three technologies) presented in this article. The characteristics of this subgroup closely mirror those of the entire participant group, which is representative of the Swedish population in terms of gender, age, and region.

**TABLE 1. Socio-demographic characteristics of the participants (in the discussed scenarios).**

Demographic	Category	Number	Percentage
Participants	-	1196	100%
Gender	Male	596	49.8%
	Female	600	50.2%
Parent	Yes	909	76.0%
	No	287	24.0%
Gender × Parent	Male Parent	454	38.0%
	Male Non-Parent	142	11.9%
	Female Parent	455	38.0%
	Female Non-Parent	145	12.1%
Age	16-24	37	3.1%
	25-34	172	14.4%
	35-44	256	21.4%
	45-54	276	23.1%
	55-64	260	21.7%
	65+	195	16.3%
Region	Large Town	347	29.0%
	Medium Town	549	45.9%
	Countryside	300	25.1%

### 3.2. General attitudes towards technologies and across scenarios

The participants clearly considered CCTV the most positively of the three technologies: non-privacy invasive, acceptable, effective etc. Neither were participants worried over or upset by its use. However, this did not lead to particularly low ratings of risk for data misuse, or particularly high ratings of trust for the data collector, of the necessity of data collection, or of actively requesting the technology. The possibility to identify individuals (or not) had little influence on the ratings between the two scenarios, although, as can be seen in Figure 1, “CCTV ID” received significantly higher ratings for the usefulness of data collection and for the risk of data misuse being worth taking in society.

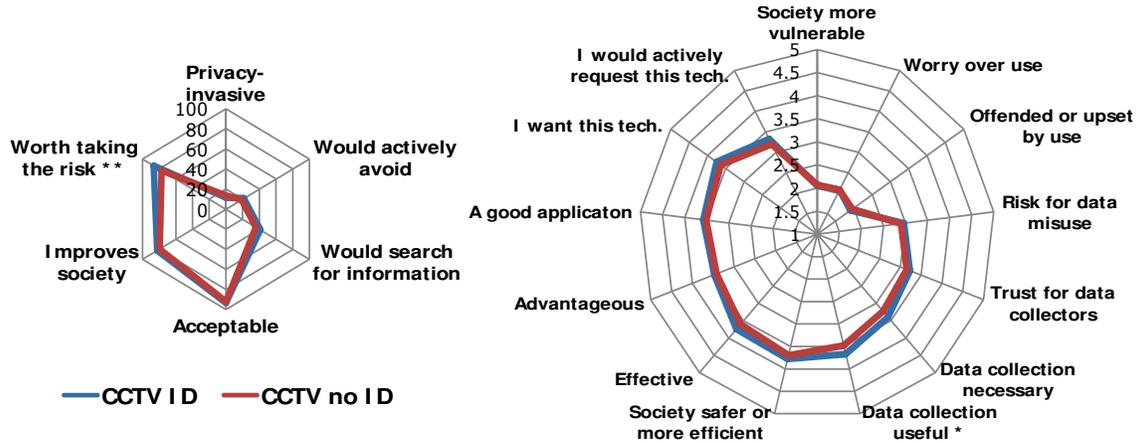


FIGURE 1. “CCTV ID” vs. “CCTV no ID” scenarios; percentage “yes” (left) and mean rating 1-5 (right); \* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$  for  $\chi^2$  (1) (left) and t (right); † sig. results fall on opposing sides.

Positioning via mobile phones received more mixed results, as 52.8% of participants considered it privacy invasive and 37.6% thought that it improves society. Despite this, a majority found it acceptable and a minority would actively avoid it. Data collection in this context was not considered necessary, but perhaps useful. Trust for the data collector was lower and the risk for data misuse higher compared to CCTV. The participants were not generally worried over or upset by its use, although the ratings were higher than for CCTV. The possibility for the police to activate the positioning function, even without notifying the subscriber, induced a relatively more positive response. As can be seen in Figure 2, “Phone Police” was considered significantly more acceptable, effective, and received significantly higher ratings for improving society and making it safer or more efficient. It also led to significantly greater trust for the data collectors, to considering data collection significantly more useful and necessary, and to significantly fewer stating that they would actively avoid it. Despite this relatively more positive response, the ratings for “Phone Police” did not manage to reach the positive levels of CCTV.

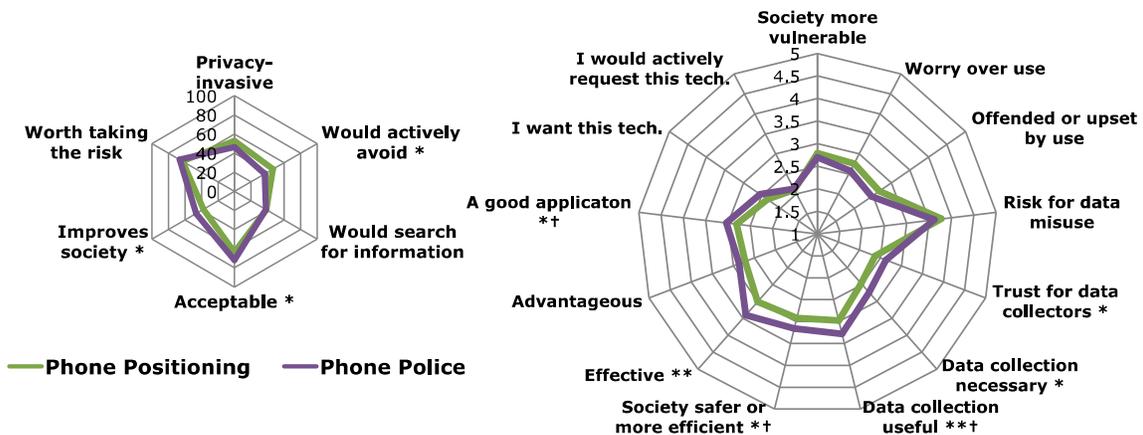


FIGURE 2. “Phone Positioning” vs. “Phone Police” scenarios; percentage “yes” (left) and mean rating 1-5 (right); \* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$  for  $\chi^2$  (1) (left) and t (right); † sig. results fall on opposing sides.

The RFID scenarios elicited the most extreme differences in responses (see Figure 3). The responses to “RFID Travel” generally fell somewhere between the CCTV scenarios and “Positioning Police”, i.e. it was considered non-privacy invasive, acceptable, fairly effective, etc., and participants were generally not worried over or upset by its use. The ratings for trust, risk for data misuse, and the necessity of data collection were slightly unfavorable, and that for the usefulness of data collection slightly favorable. On the other hand, “RFID Clothing” was clearly considered the most negatively of all the scenarios and in a fairly consistent manner across the board. It was by far considered the least acceptable and the most privacy-invasive, and it was the only scenario where the majority of participants stated they would try to actively avoid this application of the technology and where a majority stated that the risk for data misuse was *not* worth taking in society. It received the lowest ratings for desirability (I want this tech.), for trust in the data collectors, and for the necessity of data collection. But surprisingly, the rating for risk for data misuse was not much higher than that of “Phone Positioning”. Neither did the dislike for “RFID Clothing” lead to particularly unfavorable ratings for making society more vulnerable, or for being worried over or upset by its use, even if the ratings were more unfavorable than the ratings for the other scenarios.

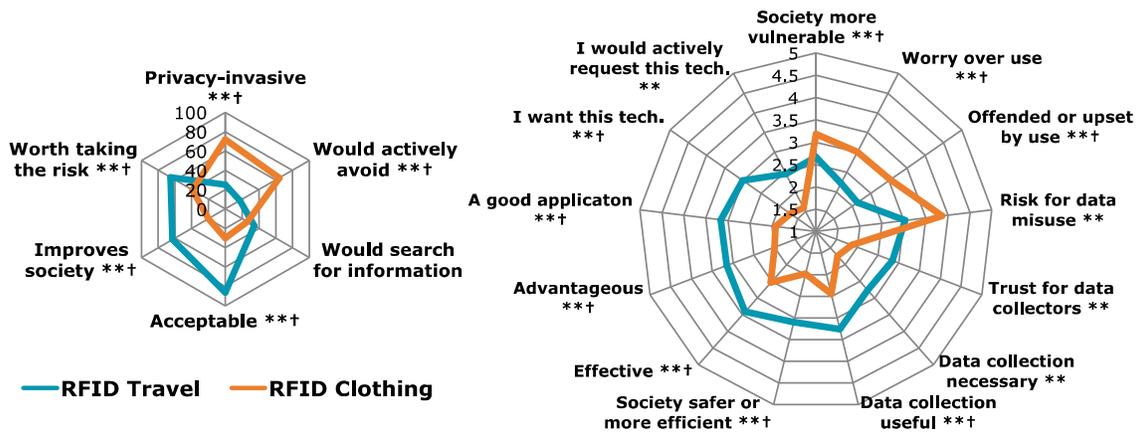


FIGURE 3. "RFID Travel" vs. "RFID Clothing" scenarios; percentage "yes" (left) and mean rating 1-5 (right); \* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$  for  $\chi^2(1)$  (left) and t (right); † sig. results fall on opposing sides.

Curiously, participants’ willingness to search for information about the technological application in question was fairly constant over the scenarios, where 26.4-41.2% stated “yes”, they would search for information. The application with the highest acceptability rating (“CCTV ID”) received the highest percentage of “yes” answers for searching for information, while “RFID Clothing” (with the lowest acceptability rating) received the lowest percentage. The survey also asked if each of the following groups should be allowed to use the technology: persons of age, parents, guardians (and should not be used). Again, no clear pattern emerges, although “Phone Police” received the highest percentage of “yes” responses for the groups, parents (39.3%), and guardians (48.4%); “RFID Travel” received the highest percentage for persons of age (49.2%) and the lowest percentage for shouldn’t be used (12.4%); and “RFID Clothing” received the lowest percentage for persons of age (19.2%), parents (10.4%), and guardians (15.6%), and 48.8% stated that it should not be used.

One final aspect which did not yield the expected differences across scenarios, although the results are interesting nonetheless, was in asking the participants to what degree they would be willing to discuss this technological application with the following groups: work colleagues, relevant authorities, relevant companies, their elected representatives, and their family and friends. In all six scenarios, family and friends was the highest rated option,  $\bar{X} \in [3.25, 3.60]$ , followed by work colleagues in second place,  $\bar{X} \in [2.71, 3.14]$ . The other three groups’ averages do not reach the value of three on a 1-5 scale in any scenario,  $\bar{X} \in [2.13, 2.58]$ . The potential implications of this will be discussed below.

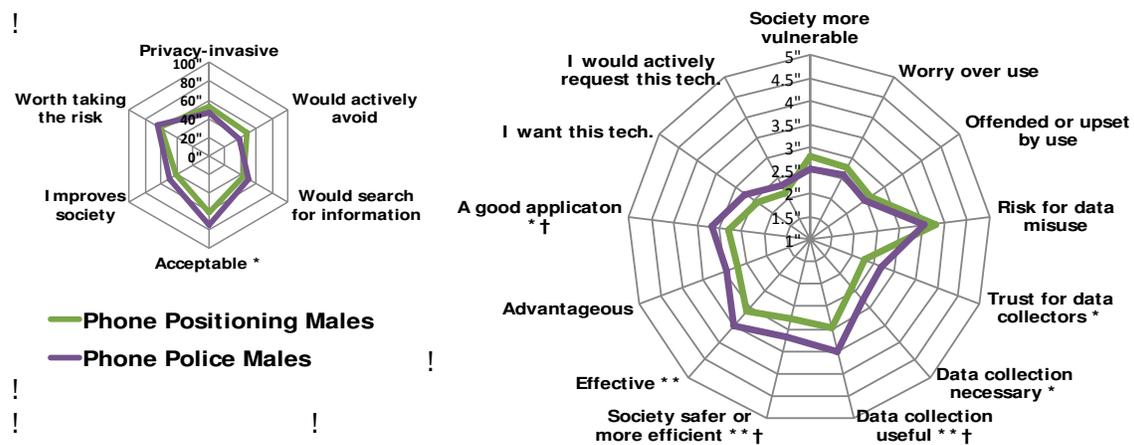
### 3.3. Gender's influence on attitudes

Gender proves to have mixed effects on attitudes towards privacy-invasive ICT solutions. Note here that this discussion is about *relative* differences between females and males, i.e. while both groups may think in the “same” way in general (e.g. both groups’ averages are over (or under) three, or both may have majority yes (or no) answers, one group’s attitudes can be significantly more favorable or unfavorable. In the case that the

groups' averages are significantly different *and also* fall on opposite sides of the scale (e.g. one average above 3 and one below), this will be specifically indicated by a † symbol in the text and figures.

For the CCTV scenarios, there were almost no statistically significant differences between females and males. However, the trend was that "CCTV ID" yielded more favorable responses from males (11 of 18 points<sup>14</sup>), while "CCTV no ID" elicited higher favor from females (14 of 18 points), indicating that women may have a slight preference for a more anonymous form of video surveillance.

The "Phone Police" scenario also tended to be viewed more favorably by males compared to females (14 of 18 points, 2 significant differences), while females viewed "Phone Positioning" slightly more favorably than did males (10 of 18 points). However, in comparing the scenarios for each gender, the effect of the police did elicit more favorable responses among both males and females, including both groups having perceived the "Phone Police" scenario as significantly more effective († for females) than "Phone Positioning". For males, "Phone Police" was also considered significantly more acceptable, with higher ratings of trust, data collection more necessary and useful (†), society safer or more efficient (†), and a good application of technology (†) (see Figure 4).



**FIGURE 4. "Phone Positioning" vs. "Phone Police" scenarios for males; percentage "yes" (left) and mean rating 1-5 (right); \* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$  for  $\chi^2$  (1) (left) and t (right); † sig. results on opposing sides.**

For RFID, the "RFID Travel" scenario was more favored by females (12 of 18 points), who found it significantly less privacy-invasive, would less actively avoid it, and rated the risk for data misuse as lower (†). "RFID Clothing", on the other hand, was more favored by males (17 of 18 points), who agreed to a significantly greater extent that it improved society and made society more safe or efficient, was worth taking the risk, that the data collection was necessary and useful, that it was advantageous and a good application, and that they wanted and would actively request this technology. However, it can be pointed out that among each gender group, "RFID Clothing" was perceived far more negatively than was "RFID Travel", with significant differences in all 18 points for females and in 17 points for males (excepting "society more vulnerable").

In terms of searching for information, neither males nor females were particularly interested, although males were relatively more interested (males 35.5-50.0% and females 17.5-36.2%). However, males showed a greater interest in all but one scenario ("CCTV no ID") and this difference was significant in the cases of "CCTV ID", "Phone Police" and both RFID scenarios. And regarding which groups should be allowed to use the technology, results show that males generally feel it is more appropriate for more groups to use a technology compared to females. Males responded "yes" more often than females across all three groups (persons of age, parents, guardians) for 4 of 6 scenarios – "CCTV ID" (significant for guardians), "Phone Police" (significant for persons of age), "RFID Travel" (significant for parents and guardians), and "RFID Clothing" (significant for persons of age). It was vice versa for "CCTV no ID", where females responded "yes" more often. "Phone Positioning" was mixed where males responded "yes" more often for persons of age and parents, while women

<sup>14</sup> Here we also exclude the point on willingness to search for information, as we do not feel this reflects any particular favorable or unfavorable attitude.

responded “yes” significantly more often in the case of guardians. This indicates that males generally feel it is more appropriate for more groups to use a technology compared to females.

Results also show that males are also more willing to discuss technological applications than are females. Out of 30 situations (6 scenarios x 5 potential discussant groups) males gave a higher average rating in 25 of them, including in all 5 of those situations that yielded a significant difference between genders. Both males and females followed the general trend, with the highest willingness to discuss in the case of family and friends followed by work colleagues (in all scenarios), and with ratings lower than three for all other discussant groups in all scenarios.

### 3.3. Parenthood’s influence on attitudes

As one aim of this article is to explore the interaction of parenthood and gender, the focus here will be on briefly describing the effects of parenthood in order to set the stage, rather than on exploring the effects in depth. The general trend across the scenarios (with the exception of “RFID Clothing”) is that parents had more favorable attitudes towards the technological application in question (with higher positive effects and lower negative effects), e.g. more effective, society more improved and more safe and efficient, higher trust for data collectors, lower risk for data misuse, less privacy-invasive, less worried and upset. Looking across scenarios by question, parenthood influenced responses to all questions in at least one scenario (with the exception of willingness to search for information). Note again that this discussion is about *relative* differences between parents and non-parents, as was the case in the discussion regarding females and males above.

The two most extreme examples of the influence of parenthood, where “CCTV ID” elicited significant differences in 13 of 19 questions and “Phone Police” in 16 of 19 (see Figure 5), both of which offer the potential to help if something happens, albeit after the fact and via the authorities. Although the same trend applies in the other scenarios (with the exception of “RFID Clothing”), there were fewer significant differences: 8 of 19 questions for “CCTV no ID” and only one to three questions in the remaining three scenarios (“Phone Positioning”, “RFID Travel”, and “RFID Clothing”, where the one significant difference showed that parents were the more negative).

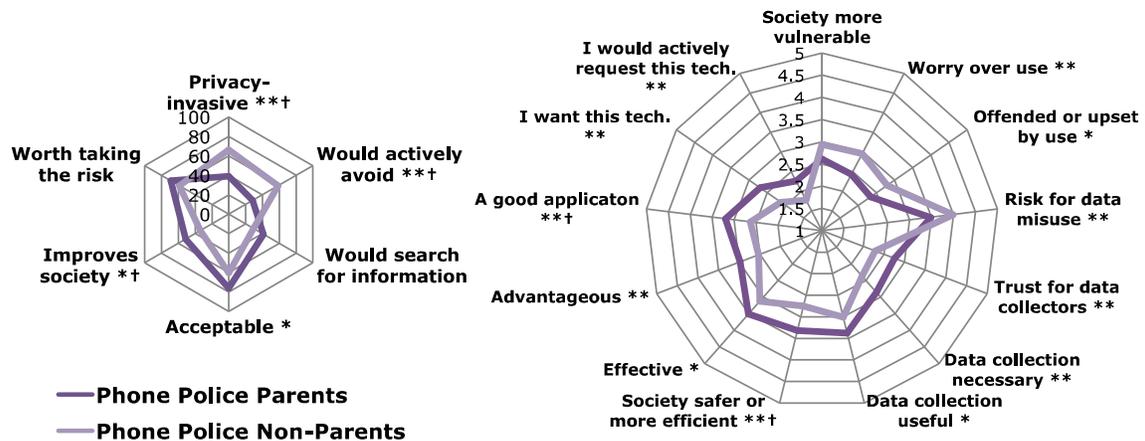


FIGURE 5. “Phone Police” scenario for parents vs. non-parents; percentage “yes” (left) and mean rating 1-5 (right); \* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$  for  $\chi^2(1)$  (left) and t (right); † sig. results on opposing sides.

### 3.4 Does parenthood affect males and females differently?

In the initial analysis, parenthood and gender proved to be the strongest explanatory variables, but does parenthood interact equally or in the same ways with males and females in this study? The answer proves both interesting and complicated, although the general conclusion is that parenthood affects females’ attitudes to a greater extent than it does males’ attitudes (and in different ways), although differences were only found in a subset of scenarios.

In terms of the scenarios, “Phone Police” triggered parental reactions in both males and females, and both CCTV scenarios revealed differences for female parents versus non-parents. On the other hand, “Phone

Positioning” and “RFID Travel” revealed few differences, and “RFID Clothing” proved impervious to such effects. All of the questions except for searching for information were affected in at least one scenario for females (parents versus non-parents), whereas only eight questions were affected in at least one scenario for males. Overall, privacy-invasive, worry, and society safer or more efficient were affected the most frequently for females (in at least three scenarios), and society safer or more efficient for males (in two scenarios). This will be discussed further below.

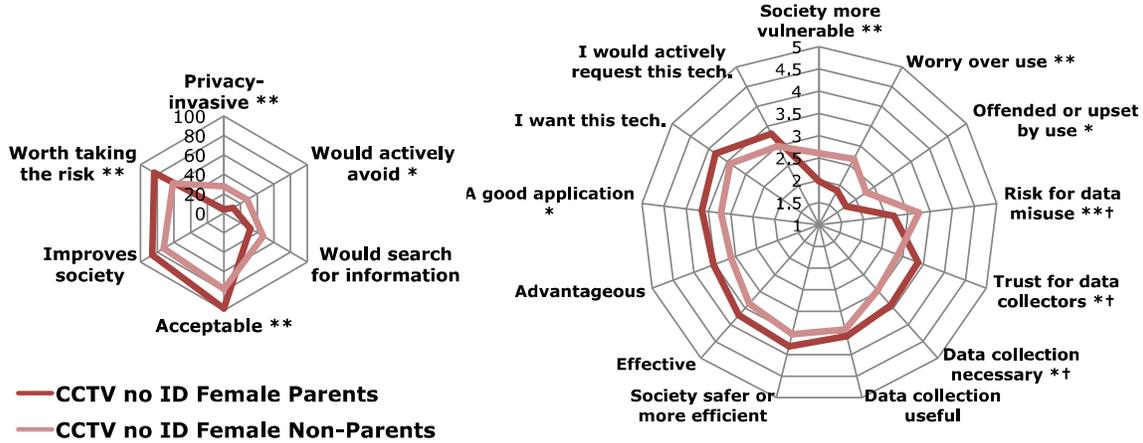


FIGURE 6. "CCTV no ID" scenario for female parents vs. female non-parents; percentage "yes" (left) and mean rating 1-5 (right); \* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$  for  $\chi^2$  (1) (left) and t (right); † sig. results fall on opposing sides

As mentioned in the previous section, parents gave more favorable ratings for “CCTV ID” than did non-parents. However, further analysis showed that it was nearly always the affect of parenthood on females that generated the differences, where female non-parents gave the least favorable ratings in 15 of 19 questions (significant for 9 of the 15 compared to female parents), while the most favorable ratings were mostly spread between male and female parents. This pattern was even stronger for “CCTV no ID”, where female non-parents gave the least favorable rating in 13 of 19 questions and female parents the most favorable in 17 of 19 questions (significant for 11 of the 19) (see Figure 6). For the questions regarding risk for data misuse, trust for data collectors, and the necessity of data collection, the averages even fell on opposite sides of the scale (†). Across both CCTV scenarios, female non-parents (compared to female parents) felt that CCTV is significantly more privacy invasive and that it makes society more vulnerable; they also expressed worry and offense to a greater extent and had lower trust for the data collectors. (Of these scenarios, parenthood only affected males’ attitudes in the case of “CCTV ID” being significantly more worth the risk for male parents.)

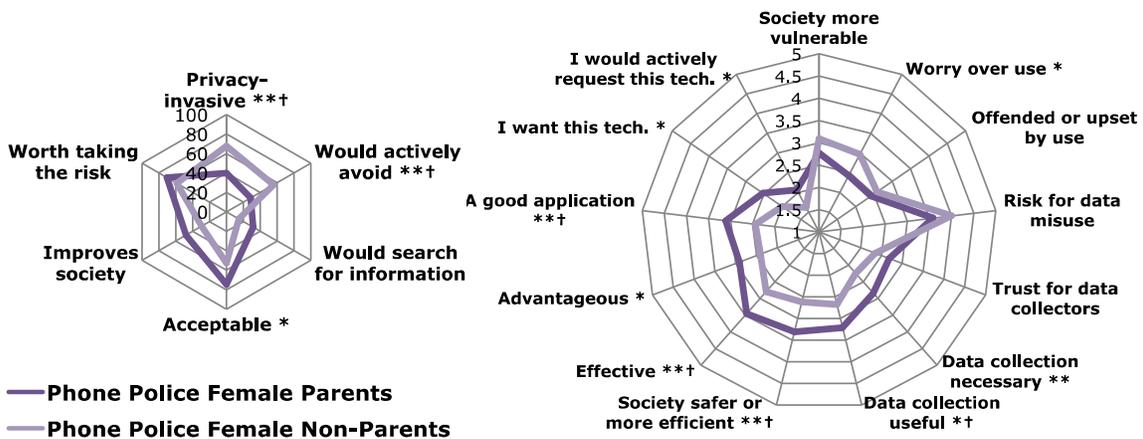
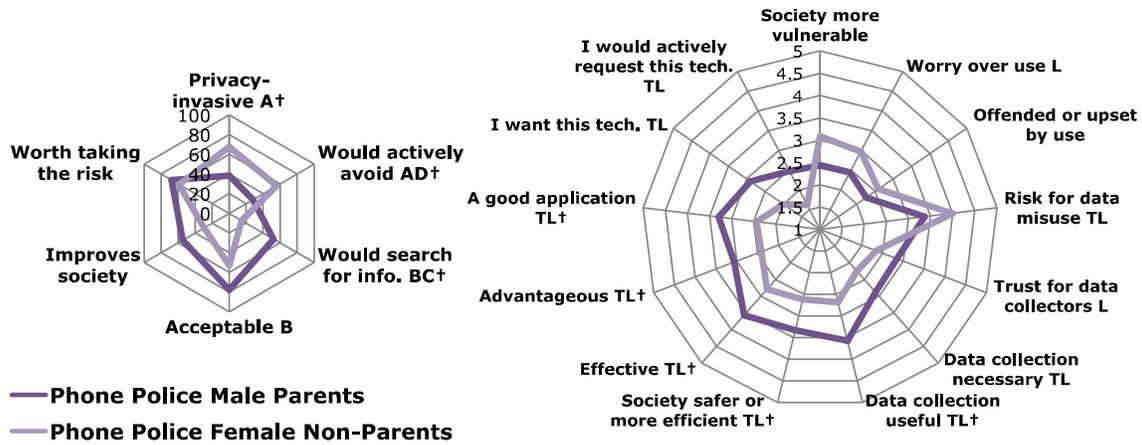


FIGURE 7. "Phone Police" scenario for female parents vs. female non-parents; percentage "yes" (left) and mean rating 1-5 (right); \* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$  for  $\chi^2$  (1) (left) and t (right); † sig. results fall on opposing sides.



**FIGURE 8. "Phone Police" scenario for male parents vs. female non-parents; percentage "yes" (left) and mean rating 1-5 (right);  $\chi^2$  (3) (left): A & B = FNP overrepresented in "yes" and "no" categories (respectively), C & D = MP overrepresented in "yes" and "no" categories (respectively); F(3) (right): T & L = significant difference ( $\alpha = 5\%$ ) between MP & FNP in post hoc test (Tukey and LSD, respectively); † sig. results fall on opposing sides.**

Parenthood proved to affect both males' and females' attitudes in "Phone Police", but not necessarily in the same way (see Figures 7 and 8 contrasting female non-parents with female parents and male parents, respectively). Here, female non-parents gave the least favorable rating in 15 of 19 questions (significant for 12 of the 15 compared to female parents), while male parents gave the *most* favorable rating in 16 of 19 questions (significant for 6 of the 16 compared to male non-parents). Parenthood had similar affects on males and females in that, for both groups, non-parents gave significantly less favorable ratings for privacy-invasive (+), would actively avoid (+), and I want this tech. Otherwise, the effects did not overlap for males and females. Male non-parents (compared to male parents) were more offended, perceived greater risk for data misuse, and felt lower trust for data collectors. Female non-parents (compared to female parents) perceived the application as less acceptable, effective (+), good (+), or advantageous and would actively ask for it to a lesser extent. They also worried more and thought that data collection was less necessary and less useful (+), and that society would be less safe or efficient (+). These results become even more interesting when taking the "Phone Positioning" scenario into consideration, in which we find no affects of parenthood for females and only one for males (society safer or more efficient). In general, the most favorable ratings for "Phone Positioning" were found among the parents and unfavorable among non-parents (in both cases, mixed between males and females). Here we conclude that factoring in the police definitely triggers parental effects, although more frequently for women and not necessarily in the same ways for men and women.

Parenthood did not prove to affect males and females much in the RFID scenarios. In "RFID Travel", the most favorable ratings were generally found among parents (slightly more often among females), and the unfavorable among parents (slightly more often among males), although these differences are not often significant. Again, female non-parents found the application to be significantly more privacy invasive than female parents, and both male and female non-parents gave significantly lower ratings in the application making society safer or more efficient (+). For "RFID Clothing", almost all the most favorable ratings were found among males, mostly non-parents (14 of 19 questions) and the unfavorable ratings among females, more among parents (9 of 19 questions), although we find no significant affects of parenthood on either males or females. Rather, gender yields the significant differences.

As we have seen, parenthood affected males and females differently in three scenarios in particular (and across the majority of questions as well), but in any questions in particular? Female non-parents rated four of six scenarios as significantly more privacy invasive than did female parents – both CCTV scenarios, "Phone Police" (+) and "RFID Travel" – versus one scenario for male non-parents ("Phone Police" (+)). Female non-parents also worried significantly more than female non-parents (both CCTV scenarios and "Phone Police") and had a more negative outlook on the application making society safer or more efficient ("CCTV ID", "Phone Police" (+), and "RFID Travel" (+)). Male non-parents also questioned the application's contribution to safety and efficiency to a greater extent for "Phone Positioning" and "RFID Travel" (+).

## 4. DISCUSSION AND CONCLUSIONS

The results from our analysis paint a complex picture of how females and males perceive risks and benefits associated with privacy-invasive technologies. In the following discussion, we will start by presenting more specific points and then move to broader conclusions.

Parenthood affects males and females differently in this study. Our analysis suggests that female non-parents perceive technological applications less favorably than do other groups, especially the CCTV and “Phone Police” scenarios. We argue that if parents have a heightened risk awareness compared to non-parents due to the dread of something happening to their child(ren), this means that the risk target shifts from oneself to one’s child, which would explain why parents are more favorable towards the scenarios in this study. This is in line with parents being more likely to adopt security measures (Enander, 2005). Female non-parents, however, differ from the other groups by having heightened risk perception, lower trust, lower acceptance, etc., of the surveillance technologies. For this group, we argue, the risk target is oneself, and if trust for the data collectors and the perceived effectiveness of surveillance technologies are low, the risk target is seen as more vulnerable rather than more secure. This is in line with arguments presented by e.g. Koskela (2000) who points out that being “under control” is not the same as being “in control” and that surveillance is inherently gendered.

Gender revealed several trends of interest. For the CCTV and Phone scenarios, males (relative to females) tended to favor the alternative in which there is a greater possibility for control by external parties or authorities, i.e. “CCTV ID” and “Phone Police”, whereas women (relative to males) tended to favor the alternative with less possibility for control, i.e. “CCTV no ID” and “Phone Positioning”. This is again in line with the above argument regarding control (Koskela, 2000).

Males found it more appropriate for more groups to use a technology, and males were also relatively more willing to search for information regarding the technological applications, although neither group was particularly interested in the absolute sense. Furthermore, males were generally more willing to discuss the technological applications than were females, although both groups showed the same patterns regarding with whom they were willing to discuss. Both groups were most willing to discuss the technological applications with their friends and family, which is in line with Enander’s (2005) findings, followed by work colleagues. On average, they were not interested in discussing them with the three groups who may have any influence: relevant authorities, relevant companies, and their elected representatives. And these results were stable across all scenarios, regardless of levels of acceptance, trust in the data collectors, or risk for data misuse.

Taken together, this paints a rather bleak picture both from the gender and the aggregate group perspectives. First, that females are less likely to be self-informed about technological applications, perhaps partly due to their relatively greater skepticism towards the appropriateness of their use; then, that females’ opinions are also less likely to be communicated at all, let alone to parties of influence. Second, that both males and females are dissuaded from communicating with government and companies about technology. We submit that the participants do not feel that they can avoid or affect these types of surveillance (as generally pointed out by e.g. Lyon (2001), EPTA (2006), and NRC (2007)) and, thus, feel a sense of resignation towards them, especially as it is these very companies and government agencies that are behind the surveillance. For female participants, the situation is compounded, perhaps due to the gendered nature of surveillance. If, as Strickland and Hunt (2005) point out, negative public opinion is not enough to stop the use of negatively perceived technologies, and that the most negative voices of all are less likely to be heard, then the public (and women in particular) may feel resignation towards technological development or even decision-making processes in general. This is particularly ironic given that technology is now perceived as a tool for increasing democratic participation in governance, so-called e-governance.

Another issue related to this postulated resignation is a lack of true choice. We argue that the idea that there is always a choice of whether or not to use a technology is fast becoming, if not already, a false choice. We cannot *practically* refuse the technological solution in use, as trying to perform daily tasks without it is *too* inconvenient, expensive, or difficult. Only avoiding the scenarios presented in this article would entail avoiding public transportation (which tends to be relatively more utilized by women) and mobile phones, which is not realistic. If true alternatives are not available, either for the technologies themselves or for the data collection policies (opt-out/opt-in), then what motivation does an individual have to discuss these issues with government and companies, particularly if women are underrepresented in those decision-making bodies?

The results of this study show no relationship between perceived privacy-invasiveness, acceptability, and the willingness to search for information. Thus, it is not likely a useful approach to try to bridge the so-called “knowledge gap” between experts and laypeople with more information. This reinforces research showing that providing “factual” information does not necessarily change attitudes (or change them in the direction desired by the experts, see e.g. Günther and Spiekermann, 2005; Söderberg and Wester, 2012), especially if differences of opinion are based on differing aims and values (Hansen et al., 2003). In the case of surveillance technologies, when they and their (contextual) consequences violate (or reinforce) one’s values in some way, one’s perceptions of them will be duly influenced; thus, merely attempting to address the perceptions of the technologies by presenting information about them will not be effective. Furthermore, if that information does not even reach all segments of the population, then this creates an additional social imbalance.

In the information age, our entire society is becoming binary – either use the technology or do not participate in the modern society. If one does accept the idea of technology being able to drive governance, what then happens with those who do not have access to the technology, who are singled out by the technology, who cannot use the technology as the developers have intended, who do not know how to use the technology, or who are not interested in such technological solutions? Here there are clearly barriers for social groups such as the poor, elderly, disabled, women, etc. Indeed, the future of democratic processes is unclear if the ability to make one’s voice heard also becomes dependent on e.g. purchasing power (of technology) and technological savvy.

Further work, all of which should contain a gender perspective, includes extensions and specifications of scenarios to study effects of function creep and shifts in balance of power between individuals and organizations or authorities. Also, to investigate the potential interactions of resignation, willingness to pay, and the concept of privacy as a public good. If end users consider or assume privacy and data protection to be a default (or to address a general risk more likely to negatively affect someone else), then they will not likely take active steps to protect their privacy or be willing to pay for it if it is approached as an extra feature or service. If so, “privacy by design” (e.g. RAE, 2007; DIB, 2013) becomes an even more important tool in protecting privacy and personal data.

## ACKNOWLEDGEMENTS

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**TABLE 2. Aggregate responses; Q1-6 percentage "yes" answers; Q7-19 average rating (1-5 scale); P = parents, NP = non-parents, M = males, F = females.**

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19
		%	%	%	%	%	%	$\bar{X}$												
CCTV ID	All	11.6	21.6	41.2	93.2	82.4	86.4	2.05	2.08	1.91	2.96	3.23	3.40	3.67	3.78	3.74	3.47	3.58	3.75	3.33
	M	14.8	25.8	47.7	90.6	82.0	85.2	1.93	2.04	1.90	2.93	3.28	3.38	3.72	3.80	3.75	3.54	3.70	3.75	3.38
	F	8.2	17.2	34.4	95.9	82.8	87.7	2.17	2.13	1.93	3.00	3.17	3.43	3.62	3.75	3.73	3.39	3.47	3.75	3.27
	All	8.4	19.9	43.5	93.7	85.3	89.5	1.92	1.96	1.82	2.89	3.35	3.47	3.69	3.88	3.84	3.54	3.65	3.84	3.43
	P M	13.3	24.5	49.0	91.8	82.7	88.8	1.81	1.91	1.86	2.86	3.38	3.44	3.67	3.88	3.83	3.62	3.76	3.81	3.46
	F	3.2	15.1	37.6	95.7	88.2	90.3	2.06	1.98	1.78	2.92	3.31	3.51	3.71	3.89	3.85	3.46	3.55	3.87	3.40
	All	22.0	27.1	33.9	91.5	72.9	76.3	2.42	2.49	2.20	3.20	2.85	3.17	3.61	3.42	3.42	3.22	3.36	3.46	3.00
	NP M	20.0	30.0	43.3	86.7	80.0	73.3	2.33	2.37	2.03	3.17	2.97	3.17	3.87	3.53	3.50	3.27	3.50	3.57	3.13
	F	24.1	24.1	24.1	96.6	65.5	79.3	2.52	2.62	2.38	3.24	2.72	3.17	3.34	3.31	3.34	3.17	3.21	3.34	2.86
CCTV no ID	All	13.2	18.8	36.0	92.0	79.2	77.2	2.07	2.08	1.96	2.90	3.15	3.23	3.48	3.70	3.60	3.42	3.52	3.64	3.20
	M	15.4	22.0	35.8	91.9	76.4	77.2	1.98	2.08	2.03	2.96	3.06	3.18	3.43	3.67	3.59	3.42	3.51	3.58	3.19
	F	11.0	15.7	36.2	92.1	81.9	77.2	2.16	2.09	1.88	2.84	3.24	3.28	3.53	3.73	3.61	3.41	3.53	3.71	3.22
	All	10.0	16.8	35.3	94.7	82.1	81.6	1.97	1.93	1.86	2.81	3.22	3.29	3.51	3.76	3.67	3.48	3.59	3.72	3.29
	P M	15.2	22.2	38.4	91.9	78.8	79.8	1.96	2.00	1.99	2.93	3.08	3.19	3.45	3.72	3.63	3.43	3.54	3.63	3.27
	F	4.4	11.0	31.9	97.8	85.7	83.5	1.98	1.86	1.73	2.68	3.37	3.41	3.57	3.81	3.71	3.53	3.65	3.82	3.31
	All	23.3	25.0	38.3	83.3	70.0	63.3	2.38	2.57	2.25	3.18	2.92	3.03	3.38	3.52	3.38	3.22	3.30	3.40	2.93
	NP M	16.7	20.8	25.0	91.7	66.7	66.7	2.04	2.42	2.21	3.08	2.96	3.13	3.33	3.50	3.42	3.38	3.42	3.38	2.83
	F	27.8	27.8	47.2	77.8	72.2	61.1	2.61	2.67	2.28	3.25	2.89	2.97	3.42	3.53	3.36	3.11	3.22	3.42	3.00
Phone Positioning	All	52.8	46.4	38.4	63.6	37.6	63.2	2.79	2.76	2.67	3.78	2.37	2.47	2.98	2.92	3.01	2.72	2.81	2.35	2.11
	M	53.5	48.8	43.4	61.2	41.1	61.2	2.81	2.75	2.64	3.81	2.29	2.39	2.99	2.78	3.10	2.70	2.82	2.40	2.15
	F	52.1	43.8	33.1	66.1	33.9	65.3	2.77	2.78	2.69	3.74	2.45	2.55	2.97	3.06	2.92	2.75	2.80	2.29	2.07
	All	49.0	44.8	38.1	64.4	37.6	64.4	2.76	2.74	2.62	3.75	2.41	2.51	2.99	3.01	3.06	2.78	2.87	2.41	2.18
	P M	50.0	48.0	42.9	62.2	41.8	62.2	2.80	2.71	2.60	3.82	2.32	2.43	3.02	2.92	3.19	2.77	2.92	2.46	2.22
	F	47.9	41.7	33.3	66.7	33.3	66.7	2.73	2.77	2.65	3.69	2.51	2.58	2.96	3.09	2.93	2.79	2.82	2.36	2.13
	All	66.1	51.8	39.3	60.7	37.5	58.9	2.89	2.84	2.82	3.86	2.23	2.34	2.95	2.61	2.84	2.54	2.61	2.13	1.87
	NP M	64.5	51.6	45.2	58.1	38.7	58.1	2.87	2.87	2.77	3.77	2.23	2.26	2.90	2.35	2.81	2.48	2.52	2.23	1.90
	F	68.0	52.0	32.0	64.0	36.0	60.0	2.92	2.80	2.88	3.96	2.24	2.44	3.00	2.92	2.88	2.60	2.72	2.20	1.84
Phone Police	All	46.4	36.5	38.1	71.8	46.4	66.3	2.70	2.58	2.46	3.62	2.63	2.73	3.28	3.16	3.40	2.86	3.04	2.55	2.13
	M	45.8	37.5	50.0	75.0	50.0	65.0	2.53	2.58	2.47	3.54	2.67	2.77	3.51	3.20	3.53	2.94	3.16	2.72	2.33
	F	47.0	35.6	27.3	68.9	43.2	67.4	2.85	2.57	2.46	3.69	2.60	2.68	3.08	3.13	3.28	2.78	2.94	2.39	1.95
	All	39.1	28.3	41.3	76.1	51.1	69.0	2.61	2.43	2.34	3.48	2.76	2.86	3.38	3.32	3.51	2.98	3.20	2.70	2.26
	P M	38.4	27.9	52.3	77.9	54.7	67.4	2.43	2.44	2.26	3.37	2.85	2.88	3.57	3.33	3.57	3.06	3.29	2.90	2.48
	F	39.8	28.6	31.6	74.5	48.0	70.4	2.77	2.43	2.42	3.58	2.68	2.84	3.21	3.31	3.45	2.91	3.11	2.53	2.07
	All	66.2	58.8	29.4	60.3	33.8	58.8	2.94	2.96	2.79	3.99	2.29	2.37	3.01	2.75	3.12	2.53	2.63	2.13	1.78
	NP M	64.7	61.8	44.1	67.6	38.2	58.8	2.79	2.94	3.00	3.97	2.24	2.50	3.35	2.88	3.44	2.65	2.82	2.26	1.94
	F	67.6	55.9	14.7	52.9	29.4	58.8	3.09	2.97	2.59	4.00	2.35	2.24	2.68	2.62	2.79	2.41	2.44	2.00	1.62
RFID Travel	All	25.2	17.2	34.4	86.4	62.8	65.2	2.67	2.22	2.14	3.03	2.85	2.76	3.26	3.10	3.41	3.15	3.16	3.01	2.46
	M	32.2	25.6	40.5	85.1	66.1	62.8	2.79	2.30	2.27	3.25	2.74	2.74	3.29	3.18	3.49	3.15	3.16	3.12	2.55
	F	18.6	9.3	28.7	87.6	59.7	67.4	2.57	2.14	2.02	2.83	2.95	2.78	3.22	3.02	3.33	3.16	3.17	2.91	2.37
	All	20.8	16.7	35.4	88.5	64.6	67.7	2.64	2.17	2.07	2.95	2.88	2.80	3.25	3.20	3.45	3.20	3.22	3.07	2.51
	P M	30.0	25.6	42.2	87.7	67.8	67.8	2.77	2.24	2.20	3.16	2.77	2.79	3.26	3.30	3.53	3.22	3.22	3.16	2.56
	F	12.7	8.8	29.4	89.2	61.8	67.6	2.53	2.11	1.95	2.76	2.98	2.81	3.25	3.11	3.38	3.18	3.22	3.00	2.46
	All	39.7	19.0	31.0	79.3	56.9	56.9	2.78	2.36	2.38	3.31	2.74	2.60	3.28	2.78	3.26	3.00	2.98	2.81	2.29
	NP M	38.7	25.8	35.5	77.4	61.3	48.4	2.84	2.45	2.48	3.52	2.68	2.58	3.39	2.84	3.35	2.94	2.97	3.00	2.52
	F	40.7	11.1	25.9	81.5	51.9	66.7	2.70	2.26	2.26	3.07	2.81	2.63	3.15	2.70	3.15	3.07	3.00	2.59	2.04
RFID Clothing	All	72.0	64.4	26.4	30.0	20.0	39.2	3.18	3.01	3.04	3.87	1.86	1.74	2.44	1.98	2.53	2.00	1.92	1.70	1.59
	M	66.9	61.3	35.5	34.7	26.6	49.2	3.02	3.02	2.97	3.83	1.92	1.87	2.66	2.19	2.67	2.16	2.07	1.92	1.76
	F	77.0	67.5	17.5	25.4	13.5	29.4	3.33	2.99	3.12	2.90	1.91	1.60	2.22	1.79	2.40	1.84	1.78	1.49	1.43
	All	73.5	64.6	25.4	27.5	18.0	40.2	3.19	3.01	3.06	3.86	1.85	1.72	2.44	1.93	2.52	1.95	1.88	1.61	1.55
	P M	68.5	60.9	32.6	30.4	22.8	50.0	3.07	3.01	2.97	3.79	1.89	1.84	2.59	2.11	2.58	2.05	2.01	1.83	1.74
	F	78.4	68.0	18.6	24.7	13.4	30.9	3.30	3.00	3.15	3.93	1.81	1.62	2.31	1.75	2.46	1.85	1.75	1.41	1.37
	All	67.2	63.9	29.5	37.7	26.2	36.1	3.15	3.02	2.98	3.89	1.90	1.77	2.43	2.16	2.57	2.16	2.07	1.98	1.72
	NP M	62.5	62.5	43.8	46.9	37.5	46.9	2.91	3.06	2.97	3.94	2.00	1.97	2.88	2.41	2.94	2.47	2.25	2.19	1.81
	F	72.4	65.5	13.8	27.6	13.8	24.1	3.41	2.97	3.00	3.83	1.79	1.55	1.93	1.90	2.17	1.83	1.86	1.76	1.62

**TABLE 3. Statistical significance (\* for  $\alpha = 5\%$  and \*\* for  $\alpha = 1\%$ ); Q1-6  $\chi^2$  (df=1), Q7-19 t; S1a-S3b = “CCTV ID”, “CCTV no ID”, “Phone Positioning”, “Phone Police”, “RFID Travel”, and “RFID Clothing”, respectively, P = parents, NP = non-parents, M = males, F = females.**

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	
		$\chi^2$	$\chi^2$	$\chi^2$	$\chi^2$	$\chi^2$	$\chi^2$	t	t	t	t	t	t	t	t	t	t	t	t	t	
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	P	.	.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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	F	·!	·!	·!	·!	·!	·!	·!	·!	·!	·!	·!	·!	·!	·!	**	·!	·!	·!	·!	·!
	P	.	**	.	*	**	.	.	*	*	*	**	**	**	*	**	.	*	*	.	.
	NP	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2xRFID	All	**	**	.	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
	M	**	**	.	**	**	*	.	**	**	**	**	**	**	**	**	**	**	**	**	**
	F	**	**	*	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
	P	**	**	*	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
	NP	**	**	.	**	**	*	.	**	**	**	**	**	**	**	**	**	**	**	**	**
M vs. F	S1a	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S1b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S2b	.	.	**	.	.	.	.	.	.	.	.	.	.	**	.	.	.	.	.	*
	S3a	*	**	*	.	.	.	.	.	.	**	.	.	.	.	.	.	.	.	.	.
	S3b	.	.	**	.	**	**	.	.	.	.	.	*	*	**	.	*	*	**	*	*
P vs. NP	S1a	**	.	.	.	*	**	**	**	*	.	**	*	.	**	**	*	.	*	*	*
	S1b	**	.	.	**	*	**	*	**	*	*	.	.	.	.	.	.	.	.	.	.
	S2a	*	.	.	.	.	.	.	.	.	.	.	.	.	*	.	.	.	.	.	.
	S2b	**	**	.	*	*	.	.	**	*	**	**	**	*	**	*	**	**	**	**	**
	S3a	**	.	.	.	.	.	.	.	.	*	.	.	.	**	.	.	.	.	.	.
	S3b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*	.
P: M vs. F	S1a	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S1b	*	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S2b	.	.	**	.	.	.	.	.	.	.	.	.	*	.	.	.	.	.	.	*
	S3a	**	**	.	.	.	.	.	.	.	**	.	.	.	.	.	.	.	.	.	.
	S3b	.	.	*	.	.	**	.	.	.	.	.	.	.	*	.	.	.	.	*	*
NP: M vs. F	S1a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S1b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S2a	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S2b	.	.	**	.	.	.	.	.	.	.	.	.	*	.	*	.	.	.	.	.
	S3a	.	.	**	.	*	.	.	.	.	.	.	.	**	.	*	*	.	.	.	.
	S3b	.	.	**	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
M: P vs. NP	S1a	.	.	.	.	.	*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S1b	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	S2a	.	.	.	.	.	.	.	.	.	.	.	.	.	*	.	.	.	.	.	.
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# MOBILITY AND POLICY

## *Equity*

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# How equitable is access to transportation options?<sup>15</sup>

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## ABSTRACT

Social impacts of transportation policies, strategies or services are typically receiving less attention than environment and economic impacts. Equity is probably one of the key concepts that can contribute to a better understanding of the social impacts of decisions (1) and to its pragmatic inclusion in sustainability level assessment. Equity is explored from various angles: distribution of costs and benefits (4), social exclusion (3), environmental justice (5), and access to urban opportunities (2).

This paper proposes an equity indicator applied to transportation options (transit systems, carsharing and bikesharing pods). It aims at assessing whether the spatial and temporal configuration of transportation systems is equitable for various population segments (gender, age, household structure, income). It is well documented of women.

This research relies on various sets of data available for the Montreal region:

- A large-scale household travel survey conducted among 4% of the population in 2008;
- GTFS (General transit files specification) files providing spatio-temporal configuration of the transit network;
- Carsharing and bikesharing pods locations extracted from administrative datasets.

The conduct of the research involves the following steps: 1) formal definition of an equity indicator of accessibility, 2) estimation of three accessibility indicators at the household level: transit stops/shared cars/shared bikes within walkable distance, runs per transit stops for a specified temporal unit, reachable surface within 30 minutes using transit, 3) statistical analysis to validate if differences between indicators are significantly different for various population segments.

This research will help to understand, in a dynamic way, the equity level of access to transit and other transportation options by women as well as in vulnerable segments in which they are often over-represented (low-income, elderly, single-parent households). It definitely can assist in locations and segments requiring particular attention and where supply needs to be adapted.

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**KEYWORDS:** Social impacts; Accessibility; Equity indicator; Montreal region; Transit; Carsharing; Bikesharing.

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# Lessons learned from Uganda's gender mainstreaming policy in the road sector

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## ABSTRACT

Uganda has made significant advances in the empowerment of women in political, economic and social spheres. In road transportation, policies were adopted for fostering the integration of gender issues in the sector, but their implementation has not been consistent. There are knowledge gaps in understanding how gender is addressed in road projects and how relevant actors in the transport sector (i.e., ministries; institutions; and partners) can encourage gender mainstreaming.

The paper reviews both the legal and institutional framework in place for addressing gender issues in road sector activities in Uganda. The approach included a desk study of national and transport sector documents and an analysis of the challenges and successes encountered in implementing the policy. Consultations were done with stakeholders at both national and district levels along with a gender capacity assessment and a semi-structured urban travel survey. The review identifies the effectiveness of the mechanisms in place for integrating gender into the planning and programming of road sector activities. The review concludes that a more integrated approach is needed between transport departments, various government tiers and implementing units to strengthen the institutional dimensions. The review recommends areas where gender policy can be strengthened.

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**KEYWORDS:** Developing countries; Policy; Road sector.

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## 1. INTRODUCTION

Transport plays a key role in accessing economic resources, education, health and other elements necessary for enhancing women's empowerment. In the Sub-Saharan Africa region, like in many other developing regions, women's mobility is constrained by limited transport supply but also by social factors that can reduce women's access to the outside world.

Gender sensitive policies in transportation have been prepared in several African countries. Some countries have also enacted gender-sensitive constitutional provisions and have promoted the establishment of gender focal points in line ministries (IC Net 2004). Countries that have integrated measures in national transport policies to reduce gender inequality and improve the socio-economic and political status of women have often included women and other vulnerable groups as part of the government task forces to oversee gender and transport policy coordination and by having sizeable representation of these groups on village, ward and district committees and road boards.

A good practice example of legal and policy provisions and a supportive institutional structure at national and district level for mainstreaming gender equality is Uganda, where road sector programs and projects have continuously addressed gender mainstreaming (DANIDA 2006). A gender management plan was developed to mainstream gender in the Ministry of Transport, focusing on stakeholder's capacity, the development of a communications strategy and a monitoring system. Data and information collected are used in implementation of policy, guidelines formulation. Funding has also been made available for awareness raising, capacity building and establishing gender sensitive procedures.

Gender policy in Uganda is particularly important considering the high transport burden facing women. It is estimated for example that 67 percent of the rural women walk for more than 30 minutes to a clean water source, an activity which is sometimes performed more than once per day. Likewise, the average distance

travelled to collect firewood averages more than 4 km suggesting a time burden for women who are often associated with this responsibility.

Over the years, Uganda has formulated and enacted various policies and legislation intended to promote gender equality and women's empowerment. However, commitment to mainstream gender at the national level is not sufficient to guarantee that gender issues will be addressed in transport policies and projects. Gender awareness needs to be increased at all levels of government to ensure that national gender policy is incorporated in transport policies and planning. The review recommends areas where gender policy can be strengthened.

The present review assesses the experience and performance of Uganda's road sub sector in mainstreaming gender over the past five years. The review focuses on the various measures taken by the Government to implement its national gender policy commitments and reviews the effectiveness of implementation in the past five years, with a particular focus on the national policy environment for women's empowerment and gender equality as it relates to the transport sector, and specifically the road sub-sector. Another aspect is the extent to which the national gender commitments have been translated into transport policy and practice including planning and budgeting, procurement, as well as capacity building in the government, agencies and the creation of specific training programs in the road sector.

## 2. GENDER POLICY IN UGANDA

Uganda's approach to gender issues, including in transportation, has been a leading example for other countries to follow. Uganda set an example of the type of legal and policy provisions, including the necessary supportive institutional structure at national and district level, for mainstreaming gender equality into policy-making.

Uganda has adopted a strong framework for focusing on gender issues. This is also reflected in the road sector where policies have also been adopted to foster the integration of gender issues, and several tools and guidelines have also been created to help with implementation.

**The Government's commitment to gender is reflected in its international agreements.** The Government of Uganda's commitment to achieve gender equality across all aspects of social, economic and political domains is reflected in its being signatory to key global, regional and sub-regional treaties and instruments. These include: i) the 1979 Convention on the Elimination of all forms of Discrimination Against Women (CEDAW); ii) the Commonwealth Plan of Action for Gender Equality (2005-2015); iii) the 1995 Beijing Platform of Action; iv) the 2000 Millennium Development Goals (MDGs); v) the 2003 Protocol to the African Charter on Human and Peoples Rights (African Women's Protocol); vi) the 2009 Gender Policy of the African Union (AU); and vii) the 2004 AU Solemn Declaration on Gender Equality.

These treaties and instruments have progressively influenced the national gender operational and institutional terrain. The legal basis for promoting gender equality and women's empowerment in Uganda is enshrined in the 1995 Constitution. This embodies the principle of equality between women and men, provides for gender balance and fair representation of disadvantaged groups as well as affirmative action in favor of women.

**Gender equality has progressively become a priority in Uganda.** Over the years, Uganda has formulated and enacted various policies and legislation, respectively, intended to promote gender equality and women's empowerment (Table 3 provides a summary of Uganda's main policies for addressing gender in the transport sector). Those which have implications on the road sub-sector include:

- The 1993 Decentralization Policy states an obligation for gender responsive planning; defines structures and processes to ensure that gender is addressed in all future activities; and promotes gender awareness among local government politicians and technocrats to enable them to address gender concerns.
- The 1997 Local Governments' Act (amended 2001) prescribes that at least one third of the membership of all local councils at all levels must be women; and reserves positions for women in strategic local government bodies such as the executive, contracts committee, land board and the district service commission.

- The 1998 Land Act provides for the protection of women's land rights. The amended Act (2006) introduces the requirement for spousal consent to dispose of land on which they subsist.
- The Employment Act (2006) i) outlaws discrimination in employment on the basis of, amongst other things, sex; ii) defines sexual harassment and outlines measures to seek redress; iii) requires that an employer who employs more than twenty five employees to have in place measures to prevent sexual harassment occurring at their workplace; iv) provides for 60 working days of fully paid maternity leave and job security associated to role/function; and v) provides for 4 working days of paternity leave.

**Gender Dimensions are now established in the National Development Management Framework.** The Government adopted a National Gender Policy in 1997, and its revision in 2007 confirmed the country's commitment to take actions that will bring about more equal gender relations. The policy supports the principle that all Government policies and programs, in all areas and at all levels, are consistent with the long-term goal of eliminating gender inequalities. The policy gives a clear mandate to the Ministry of Gender, Labour and Social Development (MoGLSD) and other Line Ministries to mainstream gender in all sectors and at both the national and district levels across all levels of planning, resource allocation and implementation.

In its 2011-2014/15 National Development Plan (NDP) – which describes the country's macroeconomic and social policies in support of growth and poverty, the Government of Uganda also emphasized that discrimination against women in the country is embodied in traditional rules and practices that explicitly exclude them or give preference to men, resulting in a lasting constraint on women's empowerment and economic progress.

The National Development Plan (NDP, 2010) is the overarching progressive policy development framework and medium-term planning tool. The NDP specifies Uganda's strategic direction, development priorities and implementation strategies over the planning period. It guides the formulation of policy and implementation of Government programs through sector wide approaches (SWAPs) and a decentralized system of governance. The NDP is implemented through 16 sectors including works and transport as well as social development of which road and gender equality are sub sectors, respectively. The NDP is implemented through 16 sectors including works and transport as well as social development of which road and gender equality are sub sectors, respectively.

**Gender equality in local governance.** At the regional and local level, the responsibility for service delivery lies with the sub national Governments. The decentralization policy states an obligation for gender equality and community development. The 1997 Local Governments' Act (amended 2001) provides for affirmative action for women, PWDs and youths at all levels of local councils

At the sub national level, the MoGLSD is decentralized into district and sub county Community Based Services (CBS) departments which support all sectors in community mobilization and participatory planning to ensure that Government programs respond to the needs of the citizens. The CBS department is also responsible for sensitizing and educating the communities about their social responsibilities.

### **3. APPLICATION OF THE GENDER POLICY IN THE ROAD SECTOR**

In road transportation, policies were adopted for fostering the integration of gender issues in the sector, but they have not been consistent. Uganda's "White Paper on Sustainable Maintenance of District, Urban and Community Access Roads (DUCAR)" (2001) outlined a strategy for addressing gender issues in the transport sector and for institutionalizing labor-based technology in roadworks (Tanzarn, 2006). The DUCAR Paper includes an "Action Plan for Promoting Women Participation in Roadworks" and affirmed that the "Government is to take affirmative action to ensure that women and other marginalized groups participate at all levels of road rehabilitation and maintenance."

Overall, the national Transport Policy and Strategy provides for equal opportunities to be accorded to women to obtain gainful employment or provide services in the construction industry and in ministries and Government agencies. Further, it commits Government to ensure that all relevant gender concerns are taken into account in the planning, design and construction of infrastructure, and that adequate facilities or mitigation measures are provided to the satisfaction of both men and women. In addition, it states that all the stakeholders in the industry will be made aware of gender issues and be required to conform to the appropriate legislation and regulation.

In 2008, the MoWT published a Gender Policy Statement, the approved operational framework for addressing gender inequalities and advancing women in the road sub-sector. The MoWT also published Guidelines for Mainstreaming Gender into the Roads Sub-Sector (2008) to operationalize the Policy Statement. The Guidelines present a step-by-step “what to do” and include questions as well as checklists in the form of indicators. The checklists are intended to be used as the internal tools for monitoring gender compliance of the sub-sector policies, plans, programmes and budgets.

To further demonstrate the commitment of the then MoWHC to actualize the implementation of the National Gender Policy, a manual on Gender Guidelines for District Engineers was released in March, 2002. The manual gives explicit directions on how gender mainstreaming could be accomplished to include women at each level of road construction, rehabilitation and maintenance. The Ministry of Works and Transport (MoWT) also prepared a Gender Policy Statement for the Roads Sub-Sector as well as Guidelines for Mainstreaming Gender in the Roads Sub-sector.

The recently launched Non-Motorized Transport Policy (2012) acknowledges that whereas men, women, children and the elderly are all pedestrians, most means of transport in Uganda are owned and operated by men. Furthermore, that in some parts of the country, negative cultural traditions inhibit women from riding, thus excluding them from the productive benefits that bicycles can offer.

The Policy states that Government recognizes that men and women have equal rights to own and use bicycles and that gender discrimination will be actively discouraged. The Policy commits the Government to undertake research in order to:

- Gain greater understanding of the practices and attitudes relating to bicycles and gender;
- Establish bicycle ownership and use disaggregated by sex;
- Understand the social and economic implications of women using bicycles;
- Initiate culturally appropriate promotion of bicycle use by women.

It is anticipated that the Government will continue to promote the importance of integrating gender into road sub-sector legislation, policy, plans and strategies. For example, the new proposed Rural Transport Policy and Strategy aims to take into account equity, economic development and environmental sustainability as well as the particular needs and priorities of women, children, the elderly, persons with disability and other disadvantaged and minority groups.

Yet, a number of important policies related to road sector activities have not incorporated gender aspects. First, there is no recognition of gender in the 1998 The Road Traffic and Safety Act which is completely gender neutral. In contravention of the Constitution, there is no provision for affirmative action for women’s representation on the statutory Transport Licensing Board as well as the National Road Safety Council. The Act obliges implementers to collect data on the number of persons injured and killed. In line with the sub-sector Gender Policy Statement, the National Road Safety Council should ensure that this and other safety data are sex disaggregated. Likewise, the Transport Licensing Board should also disaggregate, by sex, the information collected on ownership of categories of vehicles as well as licensed drivers.

As with the Road Traffic and Safety Act, the regulations of city bus services are gender neutral. For instance, whereas the Regulations have a section on conduct of passengers, it is silent on sexual harassment and other forms of gender based violence, which pose challenges for women users of public transport.

#### **4. METHODOLOGY AND SCOPE OF THE REVIEW**

The review of the implementation of Uganda’s gender policy in the road sector included an assessment of the policy, institutional and project dimensions by which relevant national gender policy commitments have been integrated into the road sector policy and strategies, planning, and budgeting, with the intent to assess overall impact on women’s economic and social empowerment. In particular, the review included a survey of the following issues:

- The national policy framework for integrating gender considerations in road sector activities, with an institutional analysis of the legal and policy framework; review of responsibilities and coordination at the ministry level; institutions; relevant partners and survey of the implementation of the tools and measures agreed through the national gender policy commitments and at the transport sector level.

- The extent to which national gender commitments have been implemented through specific interventions within the road sector, either through planning and budgeting, procurement, as well as capacity building in government agencies and the creation of specific training programs; this included the analysis of how gender is addressed in different stages of the project cycle focusing on roads: design, implementation and supervision, monitoring and evaluation of selected road interventions.
- The extent to which road projects have improved women's economic empowerment, either through increased mobility or through increased employment opportunities in the roads subsector, in particular road works and labor-based work and the impact on their income and empowerment.

The review included surveying national and transport sector policy documents, consultations with stakeholders at the national and district level, a gender capacity assessment and a semi-structured urban travel survey:

- **Review of policy documents.** The desk study involved a gender review of relevant national, transport and social development sector as well as road project documents such as: i) policies and statutory instruments; ii) strategic investment plans; iii) budget framework papers (BFPs); iv) ministerial policy statements (MPS); v) project formulation reports; vi) feasibility studies; and vii) performance reports.
- **National and district level consultations.** At the national level, discussions were held with key actors in the roads and gender equality sub-sectors including ministries, road sub-sector agencies, local government authorities, development partners, civil engineering consultants; road contractors, and civil society organizations (CSOs).

To engage with communities, visits were made to the eastern and western parts of the country. Discussions were held with staff members of the Mbale-based Mount Elgon Labour-based Training Centre (MELTC) as well as Kumi District Local Government. Two visits took place in two Danida funded labour-based projects located on the Kafir-Morukakise-Mukura road and the Akeit-Akisim road in Ngora district respectively. During the site visit, discussions were held with the contractors, contractor staff and workers on the road.

In western Uganda, discussions were held with the European Union (EU) funded Mbarara-Ntugamokatuna road project and the African Development Bank (ADB) funded Nyakahita-Kazo road construction projects where interviews were conducted with the project consultant and contractor and their respective staff. Discussions were also held with the respective projects' sub-contractors in charge of addressing cross cutting issues such as gender, HIV and AIDS as well as occupational safety and health aspects.

The total number of people consulted at both national and field level was 67, the majority (76%) of whom were men. This was not by design but on account of the predetermined gender representation in the sub-sector institutions. Table 1 summarizes the issues explored by key actor/institution.

**TABLE 1. Summary of Issues Explored by Key Road Sub-Sector Actor**

Key Actor/Institution	No. consulted		Issues explored
	F	M	
Ministry of Works and Transport (MoWT)	1	7	How gender is incorporated in the following: <ul style="list-style-type: none"> <li>– Transport/road sector policies</li> <li>– Transport/road sector strategic investment planning</li> <li>– Transport/road sector annual planning and budgeting BFP and MPS</li> <li>– Road sector procurement, contracting etc.</li> <li>– Transport/road sector information management system</li> <li>– Transport/road sector institutional structure</li> </ul>
Ministry of Finance, Planning and Economic Development (MoFPED)	1	2	<ul style="list-style-type: none"> <li>– Gender responsiveness in resource mobilization and allocation</li> <li>– Gender sensitivity of budget monitoring</li> </ul>
Ministry of Gender, Labour and Social Development (MoGLSD)	2	0	<ul style="list-style-type: none"> <li>– National policy environment for women's empowerment and gender equality as it relates to the transport sector, and specifically the road sub-sector.</li> <li>– Gender equality bills, laws, policies, strategies and implications for the road sub-sector</li> </ul>

**TABLE 1 (continued). Summary of Issues Explored by Key Road Sub-Sector Actor**

Key Actor/Institution	No. consulted		Issues explored
	F	M	
Ministry of Local Government (MoLG)	1	0	– Gender in the transport sector service delivery
Uganda National Road Agency (UNRA)	0	5	– Gender considerations in development and maintenance of national roads – UNRA procurement, contracting etc. – UNRA information management system – UNRA sector institutional structure
Uganda Road Fund (URF)	1	1	– Gender considerations in financing road maintenance
Mount Elgon Labour-based Training Centre (MELTC)	1	6	– Gender sensitivity of curriculum and training material – Gender representation in training participants over past five years: contractors, staff and workers
District Local Governments	0	4	– Gender considerations in development and maintenance of district and community access roads
Development partners	1	5	– Gender dimensions in financing the road sub-sector
Contractors and consultants	2	6	– Gender sensitivity of road project implementation, supervision and reporting
Contractors' and consultants' staff	3	12	
CSOs	3	3	– Gender responsiveness of transport policy engagement – Gender activism and advocacy in the road sub-sector
<i>Total</i>	<i>16</i>	<i>51</i>	

- **Gender capacity assessment survey.** In order to assess the gender capacities and related training needs, a short questionnaire was administered to key actors in the road sub-sector at the national and sub-national level. The questionnaires were administered with the assistance of the ELU of the MoWT. Others were administered in person during the face-to-face interviews. A total of 47 filled questionnaires were returned from the MoWT (including MELTC), UNRA, URF and district local governments. Only two of the returned questionnaires were from women.
- **Semi-structured travel survey in Kampala city.** A semi-structured travel survey questionnaire was administered to a sample of women and men working in Kampala city. A total of 200 questionnaires were administered to an equal number of women and men. These were drawn randomly, but in equal proportions, from the formal and informal sector. The valid questionnaires from the female and male respondents were 99 and 93, respectively.

The purpose was to elicit information on gender dimensions of urban public transport from the perspective of the road users. Table 2 presents the demographic characteristics of the respondents. As the table shows, most of the respondents are aged 18-65 years, are married and have young dependents.

**TABLE 2. Demographic Characteristics of Respondents**

	Women		Men		TOTAL	
	No.	%	No.	%	No.	%
Sex	99	51.6	93	48.4	192	
Age Group						
> 18	7	7.1	11	11.8	18	9.4
18-65	87	87.9	74	79.6	161	83.9
< 65	5	5.1	8	8.6	13	6.8
Marital Status						
Single	13	13.1	28	30.1	41	21.4
Married	45	45.5	62	66.7	107	55.7
Divorced	21	21.2	0	0.0	21	10.9
Widowed	7	7.1	1	1.1	8	4.2
Separated	13	13.1	2	2.2	15	7.8
Young children?						
YES	67	67.7	62	66.7	129	67.2
NO	32	32.3	31	33.3	63	32.8

The information collected from these four separate levels of review was analyzed to make recommendations for better addressing gender issues in the transport sector, highlighting short-term and long-term needs, including technical support requirements for MoWT.

## 5. THE EFFECTIVENESS OF THE GENDER POLICY IN THE ROAD SECTOR

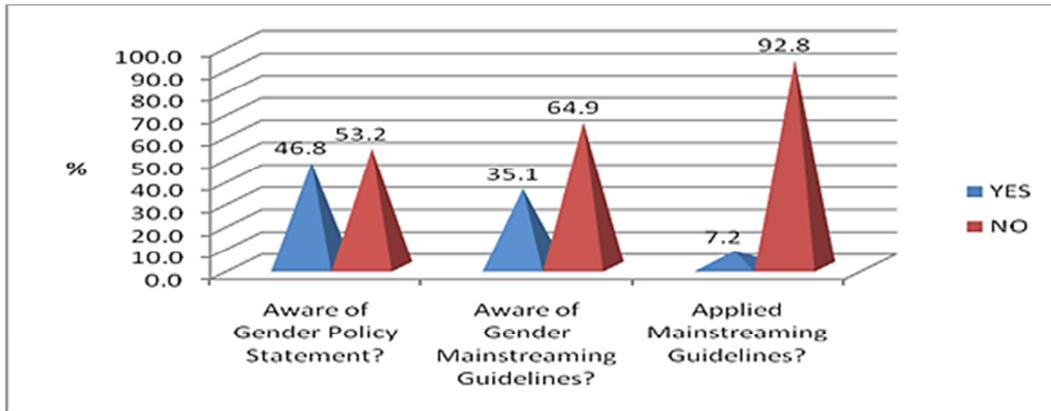
Discussions with stakeholders in the road sector revealed the limited application of the Policy Statement and Mainstreaming Guidelines. This could, in part, be attributed to insufficient dissemination. The policy documents were prepared in 2006. However, they were not published until two years later in 2008 with MoWT embarking on systematic dissemination, largely through workshops for local governments in 2012-2013 only. This process was then halted on account of the government's restrictions on cash advances to cater for costs such as transport reimbursement and subsistence allowances.

**There is limited knowledge about the national gender policy in the transport sector.** Not many of the people consulted, including the ministry charged with gender, and less than half of the respondents to the capacity needs assessment survey were aware of the existence of the Policy Statement and Mainstreaming Guidelines. An even smaller proportion had copies of the documents and hardly any (7.2%) were able to describe how they had applied the mainstreaming guidelines to their work (Figure 1).

Among the challenges identified as to the non-implementation of gender in the sector is the lack of technical capacity. The other is that the Policy Statement is not prescriptive and that, while it sets useful standards for addressing gender in the road sub-sector, there is no mechanism for enforcement of compliance. The issues raised in both documents are still relevant. Nonetheless, both the Policy Statement and Guidelines should be reviewed and updated to include developments in the road sub sector over the years, including the establishment of UNRA and the URF. Relevant mechanisms including regulations should be put in place to enforce gender responsiveness at all levels. In addition relevant aspects should be incorporated in prequalification, bidding and contract documents. Furthermore, the MoWT should disseminate the documents and orient all the key sector actors into their application in their relevant mandates.

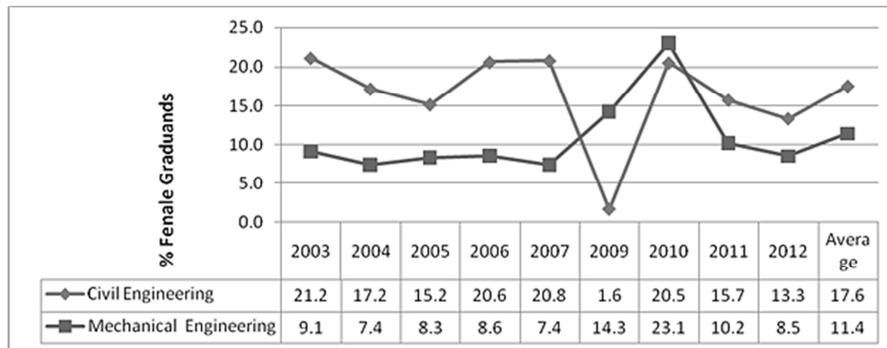
**There is low representation by women among engineering graduates.** The proportion of women in civil and mechanical engineering courses in Makerere University has not increased much over the past ten years (Figure 2). Women constitute 17.6 and 11.4 percent of civil engineering and mechanical engineering graduates, respectively. These low absolute figures contrast sharply with women's advancement in education over the years. According to the 2010 UDHS, the adult female literacy rate is 66 percent compared to 79 percent for males.

The trend is likely to continue because the Association of Women Engineers, Technicians and Scientists (WETSU), which used to interest girls in high school in sciences, stopped being active more than four years ago. This, according to the members, is due to lack of funding for their activities.



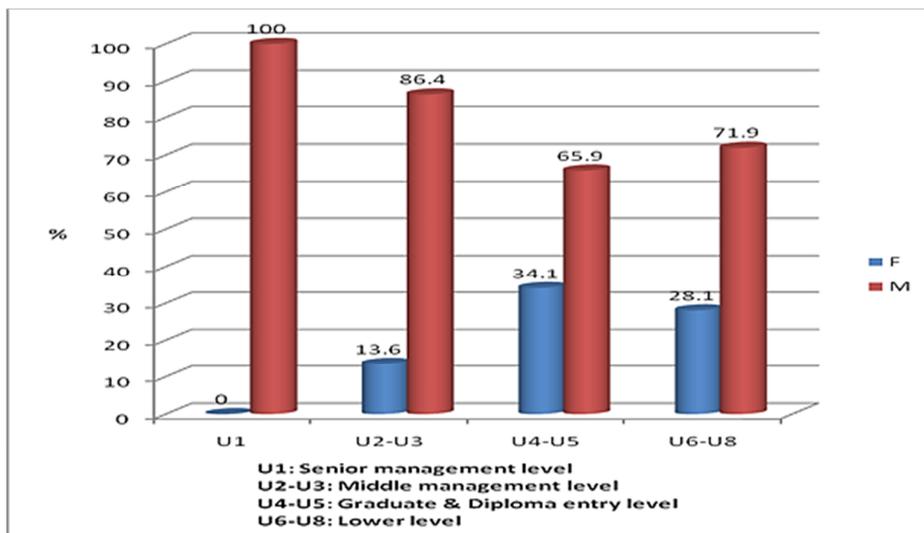
**FIGURE 1. Knowledge and application of gender policy statement and gender mainstreaming guidelines for the road sub-sector (n = 101).**

Source: Analyzed Gender Capacity Needs Assessment Survey (n = 47) and In-depth Interviews (n = 54)



**FIGURE 2. Trends in proportion of women graduating with BSc. Civil Engineering & BSc. Mechanical Engineering Degrees from Makerere University (2003-2012)**

Source: Makerere University Graduation Lists 2003-2012



**FIGURE 3. Gender representation in the Ministry of Works and Transport**

Source: Works and Transport Sector. Ministerial Budget Policy Statement FY 2012/2013

Some of the legal instruments for setting up the sub-sector institutions do not guarantee women's representation in governance and others are lacking in gender sensitivity. For instance, while not fully functional, the composition of the statutory district road committee as provided for under the 2008 Uganda Road Fund Act is not likely to be gender sensitive. This is on account of the fact that the constituents are male dominated institutions: i) local authority chairpersons and mayors; ii) members of parliament; iii) chief administrative officers; iv) district roads engineers; v) district secretary for works; and vi) municipal works engineers. The district road committees have the overall oversight in the preparation of plans for district and community access roads in liaison with the MoWT.

**TABLE 3. Gender representation in road sub-sector institutions by level**

Level of establishment	Sub-sector institution						Total		Public service average
	MoWT		UNRA		URF		No.	%	
	No.	%	No.	%	No.	%			
Management level	1	5	1	3	1	14	3	5	22
Senior level	12	13	8	13	4	33	24	14.5	16
All levels	104	24	82	8	5	21	191	12.9	33

Source: MoWT. Annual sector performance report 2012, Uganda Road Fund. Annual Report 2010/2011 & MoPS. Guidelines for gender Mainstreaming in Human Resource Management. April 2011.

The gender representation in the road sector is less than the average for the entire public service. For instance, women make up only 12.9 percent of total sub-sector staff compared to more than one third of the entire public service. Furthermore, whereas women constitute 22 percent of the managers in the entire public service, they make up a paltry 5 percent of the management of the sub-sector institutions (Table 3). This suggests that the sub-sector is not likely to meet the 30 percent national target by 2015. But even more importantly, the lack of a critical mass in top management suggests that women are not likely to influence agenda setting as well as decision making in the sub-sector in the foreseeable future.

Women are nearly absent in the engineering profession. For instance, there are only six engineers in the MoWT, five of them being recently recruited (Figure 3). These include a principal mechanical engineer, a senior mechanical engineer, two civil engineers and two mechanical engineers. Only one out of the 22 UNRA Station Engineers is a woman. None of the more than 100 Local Government District Engineers is a woman. None of the civil engineering consulting firms belongs to a woman. Only two of the contracting firms registered with UNABCEC (Uganda National Association of Building and Civil Engineering Contractors) are owned by women.

What happens to female engineering graduates? Part of the answer lies in work-life balance and female attrition in the engineering field. Many young women quit work when, they start to have children, and a large number find it difficult to regain the same position and momentum if, and when they return. Furthermore, anecdotal evidence suggests that, when it comes to choosing between client-based work involving travel versus office-bound back-end work, women engineers prefer the latter.

While it would be extreme to conclude that the sub-sector institutions are gender insensitive, discussions revealed that the prevailing organizational culture and practices are, to some extent, discriminatory against women and exclude them in various ways. For instance, the MoWT headquarters in Entebbe and their Kampala offices do not have separate toilet facilities for women.

**Challenges to Promoting Gender Equality and Women's Empowerment in the Road Sub-Sector.** Most (83%) respondents identified inadequate capacities as the key challenge to promoting gender equality and women's empowerment in the sub-sector (Figure 4). As a result, sub-sector institutions do not collect, analyse and utilize gender disaggregated data to inform planning, budgeting, performance monitoring as well as technical auditing. The only institutionalised form of gender capacity building has been through the MELTC but as the foregoing sub-section suggests, this has benefitted only a few people and none of them from the MoWT. Only 14.9 percent of the respondents indicated that they had undergone gender training. Unsurprisingly, these were typically sociologists or individuals who took on the function of gender in their respective institutions.

Despite the MoFPED requirement to undertake gender and equity budgeting, the subsector institutions do not always do so. Accordingly, there is limited financing of gender equality enhancing activities such as awareness creation, capacity building and dissemination of policy statements.

More than 30 percent of the respondents attribute this to the fact that, while gender is regarded as a cross-cutting theme, it is the least valued amongst the sub-sector priorities. For that reason, when funding, time or other resources are limited, gender-related activities are typically not implemented. Notwithstanding decades of gender being on the national development agenda, negative attitudes persist and stereotypes about what work women and men can and cannot do prevail. This, in part, is attributed to inadequate awareness as well as appreciation of gender equality at policy, institutional, service delivery and community level. To many, gender continues to be synonymous with women.

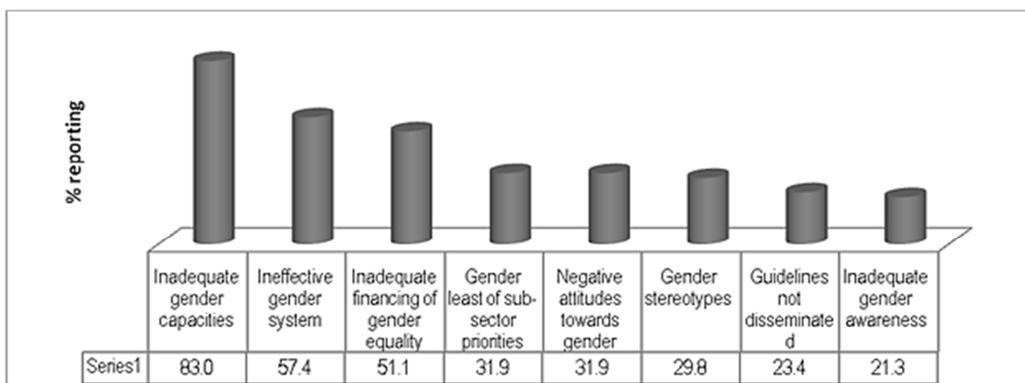
Nearly 60 percent of the respondents believe that the gender mainstreaming set up in the sub-sector is ineffective. The MoWT has an ELU with a designated GFP and, whereas UNRA has a Safeguard Unit which is responsible for addressing crosscutting issues, there is nobody dedicated to gender mainstreaming both at headquarter and station level. According to one of the URF staff members, gender is nobody’s business and the institution does not really care about it.

While the GFP set-up in the MoWT has achieved some results, the designated officer is at the lowest rank (U3) of the middle management level suggesting limited influence to strategic decision making. The ELU is strategically positioned under the Construction and Quality Assurance Department but the challenge is the compartmentalization of gender. Addressing gender in the sub-sector is perceived to be the sole responsibility of the GFP, and to some extent, the Quality Assurance Division under the Department. Accordingly, the GFP does not effectively engage with and, therefore, impact on other departments namely: i) Roads and Bridges; ii) Transport Services and infrastructure; iii) Transport Regulations; and iv) Mechanical Services Engineering. Additionally, whereas gender equality is categorised as a cross cutting issue, there are no demonstrable links with other issues. Instead, there is a separate section on gender in all the documents reviewed, which further marginalizes it.

In order to address this gap, the MoWT should institute a gender management team comprising of GFP and representatives drawn from senior management of all the relevant departments. The team should include men to deconstruct the persistent stereotype that gender is exclusively a women’s concern.

An additional challenge is that the sub-sector gender policy statements have not been effectively disseminated and thus applied due to commitment, capacity or funding gaps.

The fore-mentioned challenges notwithstanding, there seems to be a genuine interest by the sub-sector institutions in addressing the pertinent gender equality issues. This could partly be due to the MoFPED requirement as well as the increasing vigilance by parliament for sector MPS to apply gender and equity budgeting.



**FIGURE 4. Perceived challenges to promoting gender equality in the road sub-sector (n = 47)**

Source: Gender Capacity Needs Assessment Survey, 2013.

Most of the gender equality gains achieved in the country can be greatly attributed to CSOs engaging the Government for responsive policies, laws, investment plans, budgets and service delivery. The challenge is that there is limited CSOs activism in the road subsector which is perceived as being “too technical and something

to do with only engineers". The two oldest CSOs in the sub-sector have been lone voices for decades. The First African Bicycle Information Organization's (FABIO) focus is on the promotion of the use of non-motorized means of transport (NMTs). The National Forum Group, the Uganda chapter of the International Forum for Rural Transport and Development (IFRTD), engages policy for improved rural mobility and access. The Uganda Building Construction, Civil Engineering and Allied Workers' Union is involved in collective bargaining for (permanent) road workers' rights largely based on the national Employment Act. A relatively new entrant in the field is the Uganda Road Sector Support Initiative (URSSI) established in 2009 to facilitate modern road transport and urban planning practices in the country.

Discussions with these CSOs showed that, while they were aware of the importance of promoting gender equality in their respective mandates, it was not something they prioritized on their respective agendas. There is also limited critical engagement with mobility and access in the women's movement. Accordingly, the voices of women as regards their travel and transport needs are not captured and effectively reflected in the mandates, governance and agendas of the movement.

## 6. THE IMPACT OF THE GENDER POLICY ON WOMEN'S MOBILITY

The travel survey undertaken in Kampala district and the focus group discussions conducted along the Mbarara-Ntungamo and the Nyakahita-Kazo road projects revealed that women's mobility has not increased substantially after all. This information is supplemented by information from the 2009/2010 Uganda National Household Survey (UNHS).

**Modes of Transport and trip patterns.** The travel survey established that the majority of the female respondents (87.9%) and male respondents (51.9%) do not own any means of transport (Figure 5). Only 9.1 percent of the female respondents, compared to more than one third of the men own a car. An even lower proportion of women own a bicycle or motor cycle.

The most common means of transport for both women and men is public transportation (Table 5). More than half of the female respondents, compared to about one quarter of the men, report that they walk to the nearest road in order to access public transportation. The majority also walk from the taxi ranks to their places of work. A much lower proportion (6.1%) of women indicates that they hire a boda boda (motor cycle) to access public transportation.

Nearly 70 percent of the female compared to one third of the male respondents, indicated that their urban trips involve an aspect of walking either to and from work or in order to access public transportation.

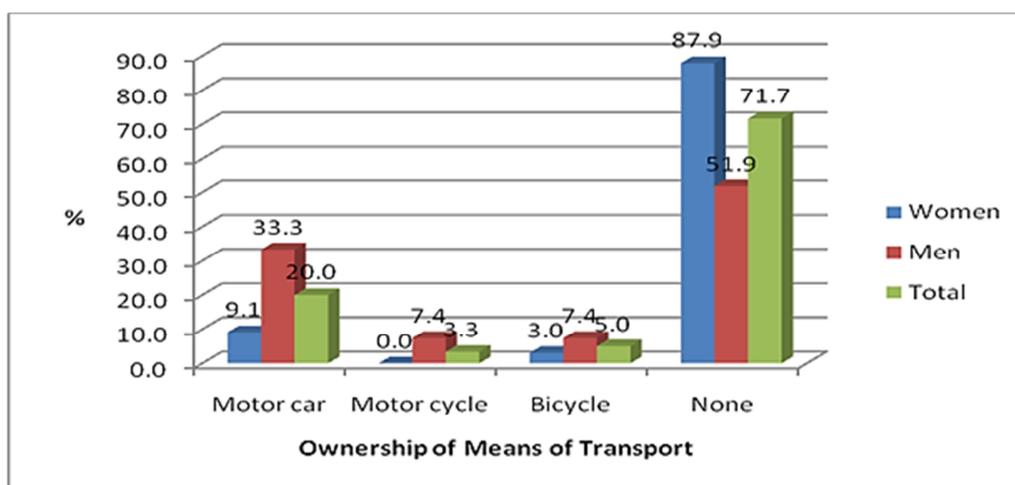


FIGURE 5. Distribution of transport modes by gender

Source: Travel Survey Conducted in Kampala City, May 2013.

**TABLE 5. Means of travel to work by gender**

Means of travel to work	% of respondents reporting		
	Women (n = 99)	Men (n = 93)	Total (n = 192)
Walk to access public transportation	51.5	25.9	40
Hire <i>boda boda</i> to access public transportation	6.1	18.5	11.7
Walk to work	18.2	7.4	13.3
Ride bicycle	3	3.7	3.3
Company vehicle	6.1	11.1	8.3
Drive own car	9.1	33.3	20
Spouse's car	6.1	0	3.3

Women's activities in the care and productive economy are largely undertaken using foot paths and bridges and without the benefit of labor- and/or energy saving technology as well as IMTs. Women's multi-tasking suggest that their work/time burden is much higher than what is reported. As a result, they experience time poverty which imposes restrictions on their economic choices, as well as the elasticity of their labor, which would otherwise enhance their livelihoods.

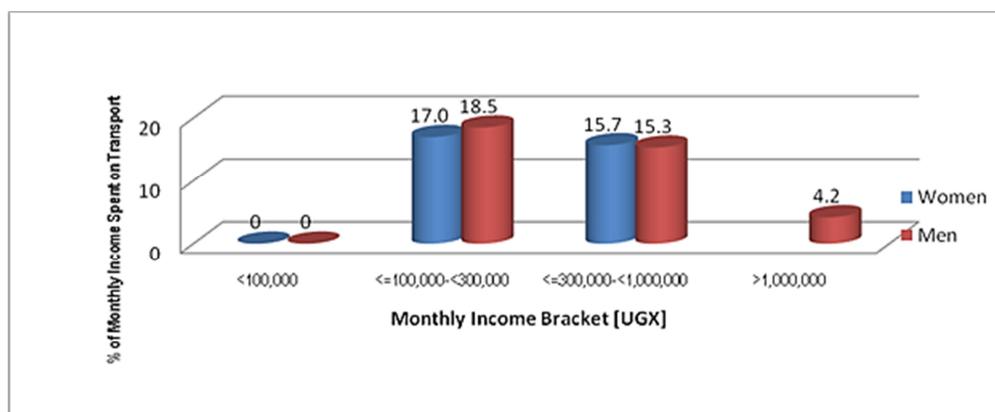
The survey also showed that all the women and men who own cars drive to and from work. A few women indicated that their husbands drop and pick them up from work. A relatively low proportion of women (18.2%) and an even lower percentage of men (7.4%) reported that they walk to work. Other reported means of transportation are use of a company vehicle and riding.

**Affordability of transport.** Slightly more than half (54.5%) and more than one third (36.4%) of the female respondents revealed that their personal monthly income ranges from UGX<sup>16</sup> 100,000-300,000/= and UGX 300,000-1,000,000/=, respectively. In contrast, most male respondents (40.7%) earn more than one million shillings monthly. The proportion of male respondents in the monthly income brackets of UGX 100,000-300,000/= and UGX 300,000-1,000,000/=, are 22.2 percent and 33.3 percent, respectively. Only 9.1 percent women and 3.7 percent men reported that they earned less than UGX 100,000/=.

The cheapest one-way trip by public transportation (mini bus) to the city is UGX 700/= which totals UGX 36,400/= for a 26-working day month. But low income women and men are likely to reside far away from the city and are thus likely to spend much more on transport. The survey established that both female and male respondents who earn less than UGX 100,000/= cannot afford to pay for transportation and, therefore, walk to and from work. For that reason, many reside in urban slums. Further, the lower the monthly income, the more vulnerable a user is. For instance, the male respondents who earn more than UGX 1,000,000/= spend only 4.2 percent of their income on transport.

On average, the lower income groups experience catastrophic payments for transportation in the excess of 15 percent of their income (Figure 8). Considering that they constitute the majority of the poor, women are disproportionately affected. The cost is much higher, especially for women whose daily commute is more likely, than men's, to include a caring trip such as dropping off and picking up young children from school. Whereas the Government does not directly participate in the provision of transport services, fare levels should be regulated by Kampala City Authority. This would potentially promote affordable transport and would benefit the poorer segments of society, including women.

<sup>16</sup> 1 USD is equivalent to about UGX 2,600/=



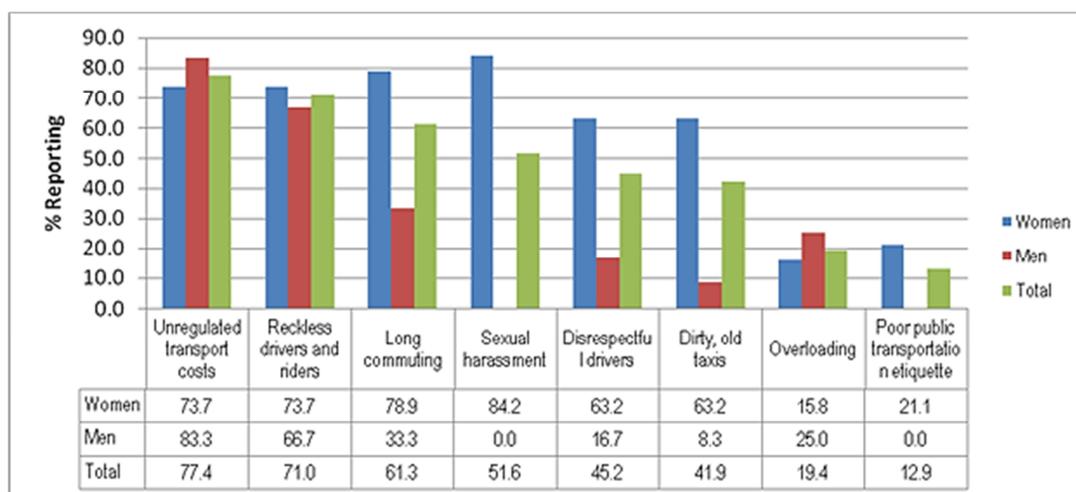
**FIGURE 6. Proportion of monthly income spent on transport by monthly income bracket and gender**

Source: Travel Survey Conducted in Kampala City, May 2013.

**Quality and security concerns.** The travel survey explored the gender dimensions of space in passenger service vehicles as experienced by female and male users. While most (83.3%) male respondents highlighted the lack of regulation resulting in high transportation costs as the biggest challenge, for the majority of women (84.2%), sexual harassment, by transport operators and fellow passengers, is their biggest concern (Figure 7). On account of time poverty, nearly 80 percent of women, compared to slightly over 30 percent of men, prioritize long commuting in terms of long waits for public transport, traffic congestion and multiple stops by the operators as another challenge. The figure below illustrates that aggregated figures mask these gender differences. Many women's concerns become non-issues if they are not experienced and, therefore, prioritized by men.

Issues such as disrespectful transport operators who physically and verbally assault women on account of being pregnant, travelling with young children and being dressed "inappropriately, were identified by only 16.7 percent of the male respondents. Women are also equally concerned about the poor hygiene in the vehicles, of the passengers as well as the operators. Besides making commuting unpleasant, the female respondents are concerned that poor hygiene could cause infections especially amongst their young children. Another issue expressed by only women is the poor public transportation etiquette such as talking loudly, inconsiderate use of the mobile phone and littering.

If transport policy, plans and regulations are to be responsive to women's as well as men's prioritised concerns, it is essential that data is disaggregated by sex. Women make up more than half of public transportation in the city and thus their needs deserve singular attention.



**FIGURE 7. Constraints experienced by users of passenger service vehicles, by gender**

Source: Travel Survey Conducted in Kampala City, May 2013.

The survey also identifies issues of concern to all road users. In general both female and male road users identified traffic congestion, especially during peak hours, as their biggest issue of concern which impairs the mobility of both motorized and non-motorized means of transport. The other is inadequate road infrastructure in terms of being too small, in a poor state of disrepair and not being responsive to the needs of the road users, particularly the pedestrians and the cyclists. Sidewalks are either lacking or inadequate.

The biggest concern for both female and male pedestrians is the issue of safety on the roads for vulnerable users who also include cyclists (Figure 8). Women (91.3%) expressed more concerns for personal safety, crime and disorder than the men (77.8%). Some women reported that the fear of losing personal items, especially golden necklaces and handbags, restricted them from travelling to certain parts of the city. Both female and male pedestrians identified unlit spaces and ways both in the city and the suburbs as one of the causes of physical and gender based violence on the roads.

All road users	% of women (n = 99)	% of men (n = 93)	% of total (n = 192)
Traffic congestion	60.6	70.4	65
Poor road infrastructure	42.4	37	40
Pedestrians	(n = 69)	(n=27)	(n = 96)
Unsafe roads	91.3	77.8	87.5
Motorists do not respect pedestrians	60.9	33.3	53.1
Roads flooded during wet season	52.2	44.4	50
Dusty and dirty roads	26.1	11.1	21.9

**FIGURE 8. Perceived constraints by road users in Kampala, by gender**

Source: Travel survey conducted in Kampala, May 2013.

An additional prioritized issue of concern is motorists not respecting pedestrians, which in part contributed to their vulnerability to accidents. Related to poor infrastructure is the concern of roads becoming flooded during the wet season rendering walking almost impossible. Women also voiced the specific challenges they faced in attending to their multiple roles as homemakers, breadwinners and mothers.

## 6. CONCLUSIONS: AN INNOVATIVE POLICY THAT SHOWS SLOW RESULTS

The adoption of gender policy instruments is critical for implementing gender equality in transport projects. An integrated approach is often required between departments and implementation units in order to achieve gender equality goals.

Uganda has a relatively good framework, with multiple institutional mechanisms, for promoting gender equality and women’s empowerment. This is reflected in the gender responsive constitution, the NDP as well as its national gender, decentralisation, human resource and fiscal policies. The institutional mechanisms include the MoGLSD, the EOC and gender focal points in MDAs at national and local governments’ levels. Even so, there is a critical institutional drawback reflected in the apparent weak coordination between the MoGLSD and the MoWT<sup>17</sup> and the related weaknesses in actively influencing road sub-sector policy.

The findings of the field study pointed to the differences between rural as well as urban women’s and men’s mobility patterns and access needs. Women are less skilled, experience time poverty and have restricted access to means of transport. Many walk and carry their burdens. Due to their relatively lower incomes, urban working women experience catastrophic payments for transportation.

The study established that public transport and road travel spaces are gendered. More women than men reported personal safety and vulnerability as an issue of concern which influenced their decision of whether, when and where to travel using what means of transport. Further, whereas men prioritized lack of regulation resulting into high transportation costs, for women it is issues such as sexual harassment and long commuting. Furthermore, that culturally sanctioned stereotypes about women’s and men’s work and ability persist. These limit women’s potential to participate in and benefit from the road sub-sector.

<sup>17</sup> As an example, the MoGLSD was not aware of the MoWT Gender Policy Statement and Mainstreaming Guidelines.

There has been progressive improvement in promoting gender equality in transport policy and strategic investment planning. Amongst other things, the MoWT has a Gender Policy Statement as well as Guidelines for Mainstreaming Gender in the Road Sub-Sector. These have, however, not been fully disseminated to the sub-sector institutions and actors. Accordingly, they have not effectively translated in to annual planning and budgeting, suggesting that investments in the road sub-sector may not be benefitting women equitably with men.

**There are mixed levels of gender sensitivity in the transport policy oversight tools which are used in the implementation, supervision and monitoring of road improvements.** The specifications for the national roads make it a contractual obligation to address some aspects of gender in construction and rehabilitation projects. There is no specific tool for promoting gender mainstreaming in the maintenance of national roads.

Whereas the MoWT road manuals incorporate some aspects of gender, they are not applied uniformly across the district road network due to the multiplicity of guidelines from the different funding agencies. In addition, there are various institutional and regulatory weaknesses which compromise the effective incorporation of a gender dimension in the road sub sector institutions. These include lack of accurate, relevant and appropriate sex and gender disaggregated data for proper sector planning and general lack of awareness and application of the MoWT Gender

**The application of gender equality criteria in road projects has not been systematic.** Contractors of road development projects typically employ sub-contractors to facilitate compliance to gender equality requirements. This has seen an improvement in the proportion of women employed, as well as some changes in the gender sensitivity of the working environment. However, not all sub-contractors have effected meaningful change. This is because the approach used does not challenge the status quo: the conditions that have led and continue to lead to gender inequalities in transport. Rather, an attempt is made to find space for women within existing opportunities.

**There is even stagnation in the promotion of gender equality in labor-based road works.** This is particularly so for district roads where there is a potential risk of reversal of the gains achieved under past gender responsive programs. This is partly attributed to a shift from project funding modalities to sector budget support.

**In terms of mobility, there continue to be important gender differences between rural and urban differences in mobility patterns and access needs.** Women are less skilled, experience time poverty and have restricted access to means of transport. Many walk and carry their burdens. Due to their relatively lower incomes, urban working women experience catastrophic payments for transportation.

**More women than men reported personal safety and vulnerability as an issue of concern which influenced their decision of whether, when and where to travel using what means of transport.** Further, whereas men prioritized lack of regulation resulting into high transportation costs, for women it is issues such as sexual harassment and long commuting. Furthermore, culturally sanctioned stereotypes about women's and men's work and ability persist. These limit women's potential to participate in and benefit from the road sub-sector.

## **7. RECOMMENDATIONS TO INCREASE THE POLICY'S IMPACT**

The review helped identify a number of recommendations to increase women's participation and empowerment through better implementation of legal and policy provisions; better transport service provision; and a stronger emphasis on road work and routine maintenance programs.

At the institutional level, there is a need to promote a more gender balanced management team with the deployment of gender focal points across relevant institutions and the creation of a gender working group. The MoWT should institute a gender management team, with well-defined ToRs, comprising the GFP and representatives drawn from senior management of the entire road infrastructure and transport services departments as well as the Human Resource Management Unit.

There should be better dissemination of existing guidelines and tools on gender equality and differences in the road sector. The Gender Policy Statement and Mainstreaming Guidelines should be disseminated in a manner that clarifies the concept of 'gender mainstreaming' as it relates to the road sub-sector. Compliance with the Gender Policy Statement should be enforced through regulation and/or by putting in place an incentive mechanism.

Capacity building for addressing gender differences and constraints should also be provided. This should include raising general awareness at the highest level of management in order to get political commitment for gender mainstreaming as well as very specific training sessions to transfer more specialized knowledge on gender issues.

Effectiveness of the policy implementation efforts should be monitored through the definition and monitoring of specific indicators and sector targets. If transport and road policy are to be responsive to women's as well as men's mobility patterns, access needs and prioritized concerns, it is essential that planning data are disaggregated by sex. Women make up more than half of public transportation in the city and are the primary movers in the rural areas, thus their needs deserve singular attention and they should be prime targets for transport planning.

To promote gender mainstreaming in the road sub-sector in a sustainable manner, it is still important to illustrate the value added of designing gender responsive policies. This could be through conducting a cost benefit analysis quantifying women's time savings on account of improved transport efficiencies and the related contribution to economic growth, and illustrating the (negative) implications of gender inequality to the achievement of road sub-sector objectives. This would include engendering the review and revision of the Transport Policy and Strategy.

At the project level, measures should also be taken to increase and monitor women's participation and empowerment through employment creation in the road sector. Gender equality provisions should be incorporated in prequalification, bidding and contract documents and it should be a provisional sum rather than competitive BoQs item (e.g. 1% of project cost). Compliance to gender equality should be a certifiable item.

Annual technical audits with clearly defined indicators on gender should be proposed. Examples of indicators to be monitored through the audits could include the following: i) Gender responsiveness of the work-plans and budgets; ii) Gender sensitivity of contract documents; iii) Employment in road works disaggregated by work days and sex; iv) Income from road works disaggregated by sex; and v) Number of women-owned compared to male-owned firms awarded contracts.

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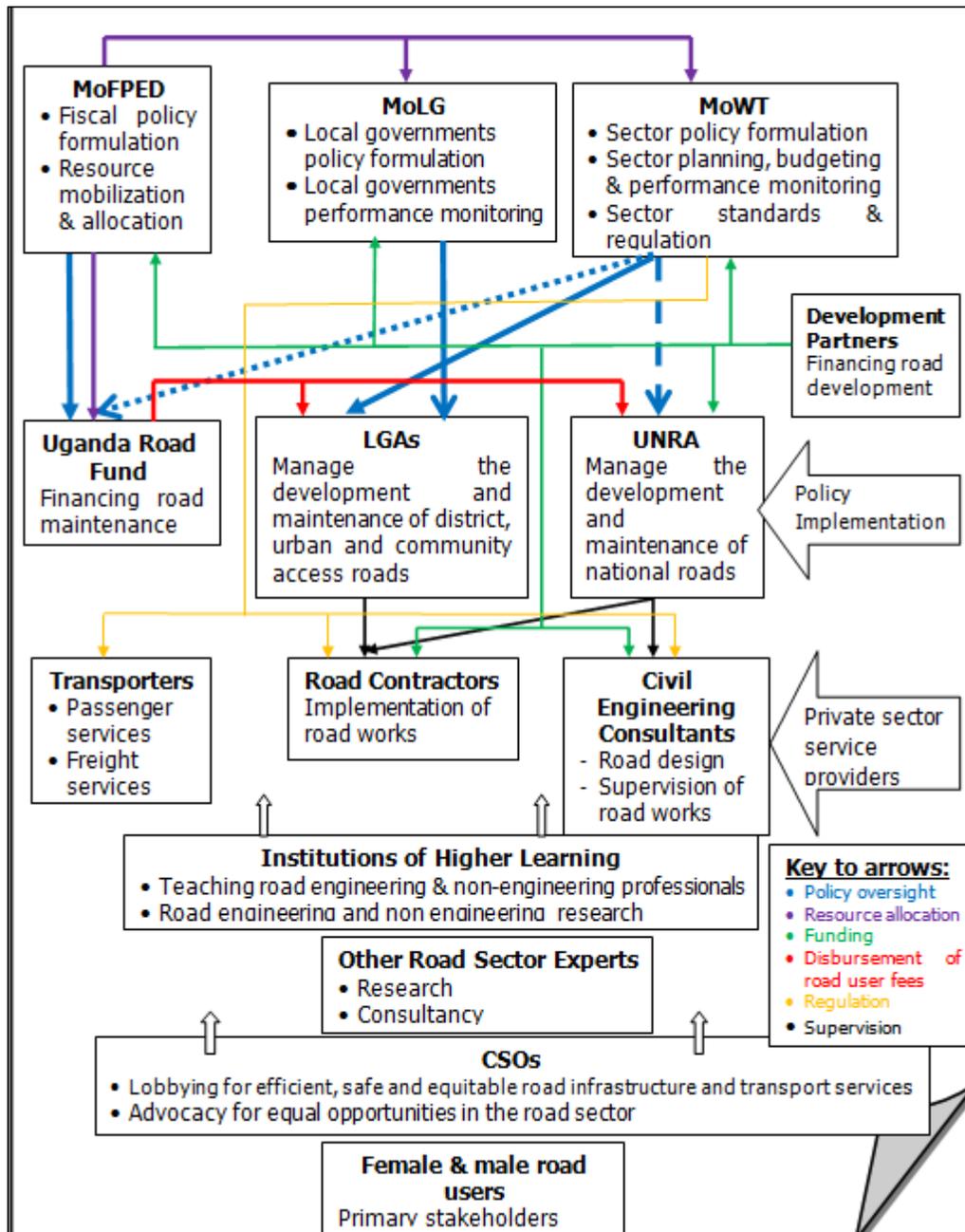
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**Annex 1. Road Sub-Sector Policies, Sector Strategic Investment Development Plan and Budgets**

	Level of Gender Sensitivity	Status of Implementation of Gender Equality Provisions
<b>Legislation/Regulation</b>		
Uganda Road Traffic and Safety Act [1998]	Silent on gender.	N/A
Uganda National Road Authority Act [2006]	Provides for affirmative action for women's representation on UNRA board.	Fully implemented
Uganda Road Fund Act [2008]	Provides for affirmative action for women's representation on URF board.	Defined quota of one third women's representation on board not always achieved.
Traffic and Road Safety [City Bus Services] Regulations [2011]	Silent on gender.	N/A
<b>Transport/Road Policy</b>		
Transport Sector Policy and Strategy [2003]	<ul style="list-style-type: none"> <li>- Works component gender responsive.</li> <li>- Silent on gender dimensions of transport.</li> </ul>	Not implemented
Gender Policy Statement for the roads sub-sector [2008]	Outlines strategies and actions to promote gender equality in road sub-sector institutions and in road development and maintenance.	Yet to be fully operationalised
National Construction Industry Policy [2010]	Commits to various implicit and explicit measures to promote gender equality in road construction.	Not implemented
Non Motorised Transport Policy [2012]	Sensitive to, and promotes women's transport needs.	Recently launched
Draft Rural Transport Policy and Strategy [2013]	Makes policy commitments to address women's mobility and access needs in the prioritisation of rural transport improvements.	Not yet approved by Cabinet
<b>Transport/Road Sector Strategic Investment or Development Plan</b>		
Transport Sector Strategic Plan [2011/12-2015/16]	Completely silent on gender.	The Annual Sector Performance Report [ASPR] which operationalised the Strategic Plan includes indicators on gender.
Draft Third Road Sector Development Plan [RSDP3 2012]	Provides a strong basis to strengthen the gender dimension in the identification, design, implementation, monitoring, supervision and evaluation of road sub-sector investment projects.	Still a draft
<b>Annual Investment Plans and Budgets</b>		
Works and Transport Sector Budget Framework Papers and Ministerial Policy Statements	<ul style="list-style-type: none"> <li>- An attempt to plan for gender capacity building, gender sensitive M&amp;E, and gender audits.</li> <li>- But planning and budgeting are not informed by a comprehensive gender analysis.</li> </ul>	<ul style="list-style-type: none"> <li>- Draft M&amp;E to measure gender mainstreaming has been developed.</li> <li>- Gender Policy Statement and Mainstreaming Guidelines partly disseminated.</li> </ul>

Annex 2. Road Sector Institutions and Stakeholders



# Methods and tools for gender mainstreaming in Swedish transport planning

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## ABSTRACT

Gender mainstreaming has been the Swedish government's strategy for gender equality policies since the Government Bill *Shared Responsibility* came into effect in 1993–1994. A transport policy objective of gender equality was introduced in 2001 and modified in 2009. How gender equality in transport should be interpreted and clarified has been discussed and studied by various operators since its introduction. A characteristic feature in many discussions has been a focus on differences in men's and women's travel patterns. Differences in travel patterns have been interpreted to mean that women and men have different values and needs. However, these over-simplifications both of men's and women's travel patterns and of their mobility needs often result in stereotypes.

The aim of this paper is to bring in a critical approach to generalisation of men's and women's travel patterns. The purpose is to present a method of how to work with gender mainstreaming in transport planning, and to provide tools to make systematic gender impact assessments adapted to the Swedish context of gender mainstreaming<sup>18</sup>.

The method we propose is based on methods and quality requirements similar to those existing in the fields of environmental impact assessment (EIA) and social impact assessment (SIA)<sup>19</sup>. That is: the method should be *appropriate, effective, knowledge-based and open to participation and criticism*.

- *Appropriate* means it should be useful as a knowledge base for planning and decision. Consequences should be discernible, and key issues (project-based and business-based) should be clearly defined.
- *Effective* means it can be implemented systematically, and can be structured with the intention of affecting the planning and project solution. It also means that resources should be available in terms of time and money.
- *Knowledge-based* means that it should be based on rationality and professionalism. It should be designed according to good scientific practice and implemented using methods and techniques that are applicable.
- *Open* means that discussions should take place both within the project organization and in open consultation. These discussions should be included in the reports produced and in the decision making process.

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**KEYWORDS:** Gender mainstreaming; Gender equality objectives; Gender impact assessment; Transport policy.

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## INTRODUCTION

Gender mainstreaming has been the Swedish government's strategy for gender equality policies since the Government Bill *Shared Responsibility* came into effect in 1993–1994. In addition, a transport policy objective of gender equality was introduced in 2001 and modified in 2009 (Näringsdepartementet, 2009). Since then, how gender equality in transport should be interpreted and clarified has been discussed and studied by various players. A characteristic feature in many discussions has been a focus on differences in men's and women's travel patterns (transport statistics, national travel surveys). This often means that differences in men's and women's travel patterns are overemphasised while similarities are underemphasised, leading to problems

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<sup>18</sup> Faith-Ell, C., & Levin, L. (2013). *Kön i trafiken. Jämställdhet i kommunal transportplanering [Gender Mainstreaming. Guidance for Regional and Local Transport Planners]*. Stockholm: SKL, Sveriges Kommuner och Landsting.

<sup>19</sup> Vanclay, F., & Esteves, A. M. (2012). *New Directions in Social Impact Assessment. Conceptual and Methodological Advances*. Cheltenham, UK; Northampton, MA, USA: Edward Elgar.

when men's and women's transport needs are being formulated. One problem is that differences in travel patterns are often interpreted as entailing that women and men have different values and travel needs (cf. Law, 1999). However, men and women are not homogeneous groups, but differ in terms of age, occupation, income, life stage and household composition – and this is reflected in their conditions of travel and activity patterns. Researchers in Denmark, Finland, Norway and Sweden have problematized the stereotypes of gender and travel trajectories in these countries (see for example contributions in: Christensen et al., 2007; Cresswell & Uteng, 2008). For many reasons, the standard solution of equating travel behaviour (e.g. choice of transport mode) and travel needs (e.g. preferences) has come under criticism in their work. Depending on individuals' intentions and their views of the accessibility and safety of their transport options, this solution is quite problematic. Preferences are clearly connected with how various individuals experience their environment and evaluate their real options, so an intersectional perspective with a focus on experience and for example ageing (cf. Anu Sirén, 2005; Siren, Anund, Sörensen, & Hakamies-Blomqvist, 2004; Siren & Hakamies-Blomqvist, 2006; A Sirén & Hakamies-Blomqvist, 2005; A Sirén, Heikkinen, & Hakamies-Blomqvist, 2001), and family relationships and living in combination with working career is also fruitful (cf. Gil Sola, 2013; Gil Sola & Vilhelmsen, 2012; Scholten, Friberg, & Sandén, 2012). Another consequence of the overemphasis on travel patterns is that groups of women and men who are vulnerable in terms of access to transport are at risk of becoming invisible (Listerborn, 2013; Lucas, 2004; Rosenbloom & Winsten-Bartlett, 2002).

The aim of this paper is to bring in a critical approach to generalisation of men's and women's travel patterns, and to highlight the heterogeneity that exists within groups as well as similarities between traditional traveler categories. The purpose is to present a method of how to work with gender mainstreaming in transport planning, and to provide tools (using both statistics and other data collection methods) for making systematic gender impact assessments by an objectives-led process (see e.g. Thérivel, 2010). In this case it should be possible to adapt the assessment to existing routines and practical circumstances.

A further aim with this approach is to inspire those who work with the planning process, and to increase the knowledge base in transport planning. This will be done by constructing an action-based (*verksamhetsanpassad*) model of the national gender equality policies that is adapted to the transport sector. The focus is on transport planning in municipalities and regions. The method takes its departure from previous research and case studies and practice in Sweden. It has been compiled and discussed in a recently published inspiration "handbook" published in Swedish (Faith-Ell & Levin, 2013). The foundation of the method is Sweden's comprehensive national policy on gender equality with its total of four objectives: equal power; equal work opportunities and livelihood; equal responsibility for domestic and caring work; and a safety objective conceptualised in terms that violence against women must stop (Swedish Code of Statutes 1993/94:147).

## PERSPECTIVES ON WOMEN'S ISSUES IN TRANSPORT

When our research team started investigating gender and equality issues in transport planning eight years ago, we found the focus was on treatment of gender equality at a quite general level. Much knowledge was based on travel surveys outlining the main differences between women and men in *travel patterns* and how they behave in the transport system, e.g. how they act and move in the environment around the transport system (car parks, travel centres, bus stops, station areas, etc.). The main focus of planners, on the other hand, was on *safety* in transit environments and on *power* in transport organisations and transport planning processes.

### **Safety**

Previous and current international research show high responsiveness to what are called women's issues in transport, often defined in terms of personal security and measures to improve the notion of safety of the transport system and the probability that women will be treated decently.

As Loukaitou-Sideris and Fink (2009), Lahiri-Dutt and Ahmad (2012), and Markovich and Lucas (2011) explain, there are important gender differences to the perception of personal safety in public transport stations, car parks and other public places. Women are more likely to change their travel behaviour based on fears of harassment and violence from other passengers, which may result in the loss of independence associated with limited mobility and social exclusion from basic service and work opportunities. Yavuz and Welch (2010) have outlined a couple of issues which may improve the sense of safety: adequate lighting and visibility at transport stops, stations, car parks, etc.; the appearance of vehicles and stations (e.g. cleanliness,

space); reliability of services; the presence of CCTV cameras or police officers; and previous experience of crime. Yavuz and Welch also identify other socioeconomic factors as being important, with older men and women, people with disabilities, people on a low income, and visible minority groups more likely to be fearful of crime in transport environments. A focus on safety is also the dominating gender perspective in transport planning and in much previous research on transport and gender in Sweden. It has resulted in comprehensive safety programmes (e.g. how to organise public transport and create safer transit environments), and also in an increasing awareness of safety issues in, for example, municipalities run by local administrations, and in initiatives and support provided by The Swedish Association of Local Authorities and Regions (SALAR). SALAR is both an employers' organisation and an organisation that represents and advocates for local government in Sweden (see: SKL <http://www.skl.se/>).

### ***Travel patterns***

Travel patterns documented in national travel surveys serve as a good basis for knowledge of how different groups use the existing transport system. From national travel surveys we know that men travel more often as car drivers than do women. On the other hand, women more often travel by public transport (Eliasson & Mattsson, 2006). Women also commute shorter distances, and when living in partnership with a man they chain trips together to a greater extent, e.g. taking children to school on the way to work, or stopping off to shop after work (Friberg, 1999, 2002, 2006; Friberg, Listerborn, Andersson, & Scholten, 2005).

However, this is a broad and general description of travel patterns. In fact women's travel behaviour has changed in the last three decades: women are making more trips, and more frequently travel by car as drivers, also covering longer distances. This is the case in many Western countries (Rosenbloom, 2004). There are also considerable differences in the travel patterns of subgroups of women, which are due to factors such as economic circumstances and age. At the same time, however, older women still do not drive as often as older men, and they stop driving earlier; we would expect this picture to alter when today's younger and middle-aged cohorts grow old (Hjorthol, Levin, & Sirén, 2010).

Recent studies have also emphasised the importance of not generalising too much between the groups (men/women), and instead taking context into consideration: What kind of life opportunities do they have? What are the environmental and individual opportunities for subgroups (cf. Listerborn, 2007, 2013; Lucas, 2004)? Moreover, the travel surveys offer very little documentation about non-travelers, and trips-not-taken.

### ***Power dimensions***

Another perspective in women's issues in transportation is that power dimensions of users of transport systems have received more attention in recent years (Friberg & Larsson, 2002; Gil Sola, 2013; Polk, 2002, 2004, 2005; Wittbom, 2009).

Our first research project addressed the issue of gender equality in public participation in road planning in the Swedish National Road Administration. In this project we evaluated and developed methods for consultation with the public (Faith-Ell et al., 2010; Levin & Faith-Ell, 2011b). The research project was based on a multiple methods approach: interviews with transport planners, text and image analysis of advertisements, and documentation and analysis of public meetings using questionnaires, observations and conversation analysis.

From previous national and international research we know that men and women do not take part equally in public consultations. Researchers have pointed out historical asymmetries (Greed, 1994; Scott, 1988) and lack of power of the female portion of society in political and other public situations (Burns, Lehman Schlozman, & Verba, 2001). Earlier research about the participation of women and men in public meetings, e.g. 'talk in interaction' among men and women, have stated that there are differences between conversational styles, and for example Maltz and Borker (1982) suggested that cultural aspects could be an explanation. Research has also shown that both women and men can experience barriers to participation because of power asymmetries (Kendall & Tannen, 2001; Tannen, 1993).

In our reports and articles from the study of public participation in road building projects we have stated that it seems quite clear that some of the participants had a more extensive experience of taking part in public meetings and talking in front of other people (see e.g. Faith-Ell et al., 2010; Levin & Faith-Ell, 2011b). However, it is not that obvious that men are more experienced and women are the less experienced. Both women and men in the study elaborated their arguments. Two main communication trajectories (strategies) were found:

one was talking and arguing alone in front of the public, and the second was to put in a question or a statement and try to involve other participants and then taking kind of a moderating role in the following discussion about the topic. Men more frequently than women talked and argued alone in the public meetings; however, some of them simply followed another strategy in making their topics known. Women more frequently asked questions or put in short comments starting a discussion involving both women and men in the evaluation and knowledge-seeking process (cf. Ford, 2008; Kendall & Tannen, 2001; Tannen, 1993). Moreover, most women and men said they were satisfied with the information they got at the meetings in these studies. However, according to the questionnaire answers, women tended to be more satisfied than men with the content of the meetings. The documentation of the meetings, observations and recorded ‘talk in interaction’ that was conducted by the researchers also showed that women and men got equal attention from the experts for their questions (Levin & Faith-Ell, 2011a, b).

The next step for our research team was a research project for the municipality of Malmö, focusing on a planning project about the future of public transport in the city of Malmö. The project was designed in interaction with the municipal planning team that developed the future public transport plan. The researchers started by addressing the planners’ attitudes and ideas about public transport and gender. These ideas and attitudes were explored through focus group discussions. The results showed interesting views on how planners regarded the users of public transport and those who do not use the public transport. For example, they expressed the view that women like travelling by public transport more than men do, and they referred to current travel patterns. Among the focus groups, imagined non-users of public transport were identified. Two categories of men were identified as potential non-users: older traditional men and businessmen. Both of these groups were expected by the participants in the focus groups to choose private car and never to travel by bus. However, the planners in the focus group study ascribed different reasons to these two groups for their choices: while the older traditional men were expected to never use public transport due to their strong attachment to their cars, it was expected that the businessmen would perhaps use public transport if it were more convenient and faster (Dahl, Henriksson, & Levin, 2012). The research team also intervened in the organisation of public meetings about the transport plan. Instead of traditional open meetings, dialogue meetings were organised and adapted to seven main target groups: young women and young men (high school students); trade representatives from the city; representatives from culture and sports associations; employees at the regional hospital; and employees at the police station. This approach resulted in new knowledge about specific experiences among the strategic chosen groups. For example, young men and women described different travel experiences in relation to taking part in leisure activities in the municipality, which was also discussed by the representatives from sports associations (Levin & Faith-Ell, 2011a).

### ***An intersectional approach in addressing gendered issues in transportation***

The gender concept implies a need for more problematisation of ‘the issue’, moving away from the stereotypes of female and male. We therefore prefer to take an intersectional approach in addressing gendered issues in transportation. Accessibility and social inclusion are key concepts here, and (taken a little bit further) the concepts involve participation objectives, finding the variations among users and players in transportation. Access to transport mobility widens the opportunities for all to reach services, education, financial independence, giving and receiving care among family members, and so on. There is an important dimension of power, to have influence over their own transport mobility, e.g. choice of transport mode, number and destination of trips, space and environment. Recent international research on social impact, gender and transport, where differences between and within groups are problematized, appears to regard this power, place and space dimension as crucial to future planning and research (cf. Lucas, 2006; Mackett, 2008; O’Faircheallaigh, 2012; O’Riordan, 2012; Power, 2012; Sairinen, 2004).

Based on our experience from the two studies described above, we continued by addressing the Swedish national objectives for gender mainstreaming on a railway-building project in a third study carried out together with the Swedish Transport Administration (Faith-Ell & Levin, 2012).

Departing from the Swedish National Gender Equality objectives, we suggested a method called JKB (an acronym for the Swedish concept *jämställdhetskonskvensbedömning*), which translates word for word as ‘gender equality impact assessment’. The method follows the structure of impact assessment (IA) developed by researchers and practitioners in an ongoing process. International processes has tried to adapt social aspects in planning (for example, NEPA in 1969 in the United States), and the work has followed with progression in impact assessments worldwide. In the past few decades there have been efforts to implement international principles of social impact assessment (Burge & Vanclay, 1996; The Interorganizational Committee on Principles

and Guidelines for Social Impact Assessment, 2003; Vanclay, 2003, 2006; Vanclay & Esteves, 2012a). Gender is one part, but not the only one, of a concept of social impact assessment and social inclusion.

First, international principles of human equal rights are of course a part of gender impact assessment processes. Second, our studies have connections with the international principles of impact assessment ([www.iaia.org](http://www.iaia.org)), and finally – third – these principles have been adapted to national gender equality objectives and the national transport policy and ideas of gender mainstreaming. Our point is that these national policies should form the basis for further assessment and measures to improve the situation in each planning context. These ideas will be further described and discussed in the next section.

## TRANSPORT AND GENDER OBJECTIVES

In relation to the Swedish National Gender Equality Objectives and to international research on gender and social impact assessment, we have suggested a number of areas to work with in the Swedish transport planning context.

The point of departure for the development of a systematic method for gender mainstreaming is the policy work: in Sweden, this means the four national objectives for gender equality formulated by the Swedish government and parliament. In two research projects we took the four national objectives together with the transport policy as the background and aim of the work with gender mainstreaming. The following adaptations are suggested:

1. *Equal distribution of power and influence.* There should be equal distribution of power and influence between women and men in decision-making and implementation processes in the transport planning.
2. *Economic equality.* Transport should contribute to equal opportunities for women and men to access education and paid work which gives economic independence.
3. *Equal distribution of unpaid care and household work.* Transport would contribute to the establishment of equal distribution between men and women of responsibility for unpaid household chores and the ability to give and receive care.
4. *Security.* Security should be increased by minimising the risk and eliminating the fear of being subjected to gender-related violence and crime in connection with travel and transport environments.

Our studies during the past few years show that two of the objectives (1 and 4) are clearly being dealt with in practice and are reflected in recent and current research (cf. 'Perspectives on women's issues in transport', above), whereas the other two (objectives 2 and 3) are not as visible in the transport planning process. This will be illustrated below with two examples from our research. The example projects' results connect with the four national gender equality objectives.

### **Example 1**

In the study on gender mainstreaming process in the planning of a future public transport system in the city of Malmö (Levin & Faith-Ell, 2011a), it was revealed that the most substantial focus on gender equality was found in the planners' work with public consultations, which related to objective 1 (equal distribution of power and influence). A systematic and strategic focus on the development of dialogue meetings had resulted in groups usually under-represented in public consultation (i.e. women and young people) attending the process. Further, there was on-going systematic work with the objective of security in connection with public transportation. This work related to objective 4 in the national equality policy, with a clear focus on measures for minimising the risk and eliminating the fear of being subjected to gender-related violence and crime in travel and transport environments. Meanwhile, objective 2 (economic equality) and objective 3 (equal distribution of unpaid care and household work) seem to be understood as less important in transport planning. One conclusion was that a functioning public transport system should be able to contribute to more equal distribution of resources and more equal distribution of work in the home, and that the perspective on objectives 2 and 3 should therefore be more developed in transport planning.

## Example II

In the study on gender mainstreaming in Swedish railway planning, safety was found to be the most investigated of the national gender equality objectives in the planning process (Faith-Ell & Levin, 2012). The respondents in the study also stated that verbal reflections (i.e. analytical discussions) within the planning team were important for understanding variations among citizens and groups of citizens. However, these highly valued verbal reflections were rarely performed within the planning process, due to established procedure, time and other resources. Three main themes were identified in the research as key areas for the Swedish Transport Administration's and municipalities' work with gender mainstreaming in infrastructure planning:

- *Working with gender equality objectives;*
- *Tools and methods intended to guide the organisation's work on the basis of specific goals;*
- *Tools and models for impact assessment of gender equality.*

One conclusion is that, although the Transport Administration has initiated work with gender equality in transport planning, the Administration needs to work more on developing both policy and planning. The research project proposed a method for integration of gender equality impact assessment in different stages of the planning process, from procurement to implementation and evaluation (different parts corresponding to transport authorities' internal and external gender equality). Moreover, the project argues that policy and planning should be better linked together so it is clear that what is said in policy is also implemented in practice. An important policy instrument in this work will be the new performance criteria currently being developed by the Swedish Transport Administration at the request of the government.

## A SYSTEMATIC APPROACH TO GENDER MAINSTREAMING IN TRANSPORT PLANNING

The method we propose is based on methods and quality requirements similar to those existing in the fields of environmental impact assessment (EIA) and social impact assessment (SIA) (cf. Vanclay & Esteves, 2012b). That is: the method should be *appropriate, effective, knowledge-based* and *open to participation and criticism*.

- *Appropriate* means it should be useful as a knowledge base for planning and decision. Consequences should be discernible and key issues (project-based and business-based) should be clearly defined.
- *Effective* means it can be implemented systematically and can be structured with the intention of affecting the planning and project solution. It also means that resources should be available in terms of time and money.
- *Knowledge-based* means that it should be based on rationality and professionalism. It would be designed according to good scientific practice and implemented with methods and techniques that are applicable.
- *Open* means that discussions should take place both within the project organization and in open consultation. It would be included in the reports produced and in the decision-making process.

In essence, the method is a systematic process that examines in advance the consequences of development actions on gender equality (Faith-Ell & Levin, 2013). The method is one of several tools generating a basis for decisions in the transport planning process. Based on the results of the assessment, more informed decisions will be made. Just as with other impact assessment tools, a number of criteria need to be met in order for knowledge from experts and lay persons to be included and inform decision makers during the process of development projects:

- *The impact assessment is a process that results in a document that describes how the project, through the systematic process, has come to a certain conclusion (Vanclay, 2003).*
- *The process needs to be integrated with the planning process and cannot be carried out without interaction with other disciplines in the planning project (cf. Aretun, Levin, & Faith-Ell, 2010; Faith-Ell & Levin, 2012).*
- *The impact assessment shall be carried out before the plan or project has been finalised in order to be able to integrate the results into the plan or project (Thérivel, 2010).*

The four national objectives for gender equality formulated by the Swedish government and parliament can serve as a basis for the impact assessment method presented above. A research project called 'Implementation of a Method for Gender Equality Impact Assessment in Swedish Transport Infrastructure Planning' was started at the end of 2013. The project aims to further develop the method and test it on two county transport plans in Sweden.

## CONCLUSIONS

This paper has suggested a method for working with gender mainstreaming in transport planning and to make systematic gender impact assessments adapted to the Swedish transport planning process. The point of departure for the method is the specific objectives for accessibility and gender equality within the national transport policy and the four national objectives for gender equality formulated by the Swedish government and parliament. It has been stated that all public administrations should adapt their work to the national policy, and the transport sector has also included a specific gender equality objective in the overall transport policy. However, research shows that, so far, it is mainly the two objectives of 'Equal distribution of power and influence' and 'Security' that are being dealt with in transport planning. The objectives of 'Economic equality' and 'Equal distribution of unpaid care and household work' are not as visible in the practice of infrastructure planning.

Today, a great deal is known about differences in *travel patterns* between women and men, and behaviour in environments connected with the transport system. *Safety issues* and *power dimensions* have been evaluated in some cases. However, gender impact assessment is not a well-developed methodology, and gender equality work is not routinely integrated in transport planning. Further research will be needed focusing on a more developed method for gender equality impact assessment that is adapted to the transport system. Comprehensive mobility options within regions can increase career opportunities for both men and women, help to break the gendered labour market, and contribute to a more equal division of responsibility for the everyday care of children and household chores.

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# The challenges of enhancing women's mobility: Examples from road rehabilitation projects in Timor Leste and Kiribati

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## ABSTRACT

Knowledge about men's and women's transportation needs and patterns cannot be taken for granted. In many transportation projects in developing countries, the relevant social and cultural context of gender differences is not analyzed. Without such knowledge, transport interventions meant to cater to both men's and women's transport burdens cannot be tailored. To capture evidence of the challenges and needs of project road beneficiaries, and women in particular, social benefit surveys that included focus group consultations were piloted in the context of two road rehabilitation projects in the Pacific Island region. The surveys which took place in 2011-2012 covered nine villages with 209 households from Kiribati and ten villages with 360 households from Timor Leste. The results provided examples of constraints affecting the transport access, mobility and safety needs of men and women, as well as missed opportunities for improvement. The findings highlighted the challenges and concerns of the intended project beneficiaries regarding road use. No significant differences between men and women were found in relation to the appreciation of road conditions. No gender link was shown in relation to perceived road condition and increased employment opportunities or agricultural productivity. However, there were gender differences in relation to use of modes of transport, personal safety issues and accessing services such as health and education. This review demonstrates the critical importance of collecting gender-disaggregated data for planning and implementing road transport projects, and ensuring that these data are used to adapt project investments to maximize opportunities for both men and women.

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**KEYWORDS:** Developing countries; Rural roads; Transport services; Access; Household surveys.

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## 1. INTRODUCTION

The development of road infrastructure is critical for economic growth and social development in many developing countries. A particular challenge is how to address the transport needs of people living in rural areas where low population density and low income levels make the supply of accessible transport more difficult. In addition, conventional rural road transport planning has tended to focus on road networks and long-distance transport of goods, with less consideration for the transport needs and requirements of the rural poor. There is often a lack of information on the travel patterns at the village or household level and by gender.

Surveys implemented in the context of two road rehabilitation projects in the Republics of Timor Leste, and Kiribati in the Pacific Region demonstrate the importance of understanding local constraints. In addition to both being located in the East Asian and Pacific Island region, the countries of Kiribati and Timor Leste both have small populations, with the majority of the population concentrated around the capital cities. While the projects' focuses were different, the fundamental road design elements of each project sought to address the overall condition and usability of the roads.

Social benefit surveys and focus group consultations in Kiribati and Timor Leste were undertaken to determine the possible impact of the road projects on the communities living in the project areas and to inform the detailed designs. The surveys helped capture some of the views of men and women beneficiaries concerning household transport, general road use and access to transport options, road safety, and access to school and healthcare facilities. Results of focus group consultations and social benefit surveys provide examples of some of the constraints affecting the transport access and safety of women and their communities; their mobility needs and missed opportunities for adequate transport planning.

To understand the constraints of women in the Pacific Island Countries (PICs), where there was no previous gender assessment of differences in transport access and mobility patterns, the present review contrasts the

results of the surveys of these two road rehabilitation projects. It contrasts the findings with existing literature on gender and transport and concludes with recommendations for encouraging the participation of local beneficiaries in assessing the needs and in setting priorities to improve transport efficiency and access. While the surveys were successful in capturing important gender concerns, the results also highlight the limitations of small scale surveys and the necessity to tailor research to collecting gender-disaggregated data. In the end, only the survey data done in Timor-Leste adequately captured gender-disaggregated data. In both countries however, data collected remains insufficient to meaningfully evaluate the factors that may influence mobility and access to transportation of both men and women.

## 2. GENDER BENEFITS OF ROAD TRANSPORT INVESTMENTS

The literature on transport access in rural areas and the impact of investments on rural transport by gender is limited. There are nonetheless several benchmark studies that identified a number of factors that are gender specific for planning transport interventions and show that women tend to have access to a wider range of social and economic opportunities where transportation is available, safe and affordable.

**Trip patterns of women in rural areas.** The mobility patterns of women in rural areas tend to relate to their domestic, economic and social tasks. Women make trips to take care of their children, handle household responsibilities and to maintain community and social networks (Moser, 1993). In rural areas, women’s domestic travel can also include fetching water, firewood and food (Malmberg-Calvo, 1994). In terms of trip purposes, women tend to travel to access services at education and health facilities, visit relatives and go to church and shopping. Women are more likely than men to travel for health and education and to conduct shopping activities (Srinivasan, 2002; Hettige, 2006). Women are also more likely to work closer to home because they tend to have fewer work opportunities and transportation choices to get to their work opportunities (Srinivasan, 2002). A recurring theme from these trip patterns is that women are often at the greatest risk from road safety issues.

**The mobility constraints of women.** Women in rural areas have much less access to private motorized modes of transport such as cars, and their most prominent mode of travel remains walking and headloading<sup>20</sup> (Venter et al., 2007; Srinivasan, 2002; Fernando and Porter, 2002). For many women in rural areas of developing countries, intermediate modes of transport (IMTs) are the most accessible and affordable modes of transport available other than walking. While IMTs can increase access to markets, schools and health care facilities, their introduction needs to be adapted to local contexts, taking into account local cultural norms and traditions (World Bank, 2010). A study in Uganda on access to bicycles found that women were denied access to bicycles for both economic and social reasons (Malmberg-Calvo, 1994). Likewise in Tamil Nadu, India, women may gain access to bicycles but they rarely control its use as men’s or boys’ needs can take precedence (Rao, 2002) or as a status symbol (Bryceson and Howe, 1993).

**Access to maternal and child care services.** Empirical evidence from developing countries that quantifies the availability and access to transport for health reasons is scarce (Babinard and Roberts, 2006). Evidence suggests that in rural areas, considerable time is spent by women and their families waiting for transportation and traveling to a health facility. In addition, poor roads, too few vehicles and high transportation costs are major causes of delay in deciding to seek and reach emergency obstetric and postnatal care. Improving access to emergency transport could help reduce maternal and child mortality rates. It is estimated that in some cases, 75 percent of the women who die in the course of childbirth do so as a result of inadequate emergency transport. There are examples of transport interventions that have successfully provided better access to maternal and child care. However, evidence of sustainable good practice at a country or regional level remains limited. In addition, studies are primarily of community interventions in Africa, making comparisons between interventions and across various levels of referral difficult (Babinard and Roberts, 2006).

**Rural transport projects with gender dimensions.** Projects that have best addressed women’s needs in transportation have taken gender into account. In the context of the World Bank’s Peru Rural Roads Project, women were given the opportunity to express their transport needs in participatory workshops. The results of the focus group consultations and survey work led to changes in the program designs to support the

<sup>20</sup> Across many Sub-Saharan countries, and in some parts of other developing countries, women carry loads, including water and firewood for domestic purposes, on their heads. This has been linked to the lack of alternative modes of transport and also has consequences for the health and well-being of women.

improvement of roads connecting to the communities and of non-motorized tracks, which are most often used by women and are commonly ignored by traditional road upgrading programs (World Bank, 2007). The forthcoming World Bank financed Papua New Guinea Road Maintenance and Rehabilitation Project Phase 2, contains specific activities to address gender, including empowerment through employment creation. The forthcoming World Bank financed social benefit survey for the Samoa Enhanced Road Access and Enhancing the Climate Resilience of the West Coast Road Projects, will analyze the current concerns, problems and experiences of the beneficiaries, with a particular focus on women in relation to the existing transport infrastructure. The survey will be undertaken by a local consultant and the team will include male and female enumerators and female representatives from the Department Women, Community and Social Development, and the data will be gender disaggregated.

### 3. THE ROAD PROJECTS

The surveys took place in the context of road projects aimed to repair and rehabilitate critical transportation connections on the main road networks of Kiribati and Timor Leste. These projects were the first World Bank financed road investment projects in both countries due to the very difficult and deteriorating road conditions in both countries.

**The Kiribati Road Rehabilitation Project.** With an estimated population of 101,000, Kiribati is a small remote country comprising of 33 atolls and reef islands, of which 21 are permanently inhabited, and 44 percent of its population living in its capital, the South Tarawa atoll (maximum elevation 3 meters above sea level). There is one main road along the length of South Tarawa, connecting several small islands with causeways. All road traffic on South Tarawa travels along the road, and all other roads connect to this one main road. There is very high population density along the road due to the scarcity of land in South Tarawa. The project would therefore directly or indirectly affect all inhabitants on the atoll.

The Kiribati Road Rehabilitation Project<sup>21</sup> is designed to improve the condition of South Tarawa's main road (approximately 26 km in length) and to help strengthen road financing and maintenance capacity. Currently, the road system consists of about 36 km of bituminous sealed main roads (including causeways), about 20 km of secondary roads (half of which are sealed and half unsealed); and about 40 km of unsealed feeder roads. Virtually the entire population lives close to, and is affected by, the road's condition. While about 7 km of main road in Betio in the west of South Tarawa was rehabilitated in 2008 using finance from Japan, about 29 km of paved roads have received no major maintenance for over twenty years.

Road use on South Tarawa is growing rapidly: in central Bairiki, traffic volume on the main road has reached 6,000 vehicles per day and is growing at an average rate of 4 percent per year. High traffic levels on the road, combined with persistent heavy rainfall in 2009/10, have caused extensive damage, to the extent that substantial sections have completely lost their surface and reverted to unpaved status. The state and condition of the roads in Kiribati are having both economic and social repercussions; particularly with regards to the health and safety of the population. The traffic speed has been reduced in places to 20 km/h or less as a result of the damage, and driving conditions are hazardous, particularly after the rain. In 2010 taxi drivers went on strike because they were unable to make the usual five return trips per day along South Tarawa, sometimes only managing at most three. Further, during the dry season the dust from unpaved sections of the road is contributing to upper respiratory problems among local residents.

**The Timor-Leste Road Climate Resilience Project.** In contrast, with an estimated population of 1.1 million, Timor Leste comprises the eastern half of the island of Timor, the nearby islands of Atauro and Jaco, and Oecussi, an enclave on the north-western side of the island of Timor within the Indonesian West Timor Leste. Dili, the capital of Timor Leste supports approximately 20 percent of the total population (220,000 people). Timor Leste is a very mountainous country, with a spine dominated by Mount Ramulau bisecting the island from east to west and located in proximity to the Dili-Ainaro road corridor. Approximately 44 percent of Timor Leste's total land area lies between 100 and 500 meters in elevation, and 35 percent lies above 1,000 meters. The coastal zones in many parts of Timor Leste consist of narrow steep hillsides.

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<sup>21</sup> The Kiribati Road Rehabilitation Project is jointly financed by the World Bank, the Asian Development Bank, the Government of Australia through Pacific Region Infrastructure Facility, and the Government of Kiribati (GoK).

Financed by the World Bank and the Government of Timor Leste, the Timor Leste Climate Resilience Project is designed to increase the climate resilience of the Dili to Ainaro road corridor (approximately 113 km in length), and to help strengthen climate responsive maintenance and emergency planning and response systems. Very little improvement has been made over the years to the road network, other than some work on the main road between Dili and the Indonesian border with West Timor and emergency repairs—largely a result of frequent landslides. Japan International Cooperation Agency (JICA) has done some work on selected links, largely rehabilitation and resurfacing.

According to a road condition survey in 2009, the national road network has almost entirely deteriorated and is no longer maintainable. Many roads are often impassable during the rainy season due to landslides and road failure. This has arisen in a large measure due to underinvestment in maintenance and resulted in increased isolation of communities, higher vehicle operating and freight costs, and longer journey times. In many cases, however, the roads were also not properly designed, lack sufficient drainage capacity and/or are structurally unsound. Due to the steep terrain, ground conditions and local climate, slope instability is a major problem and frequent slips result in significant damage to the road network and potential risk to road users. Combined with the general shortage of maintenance funds, these factors result in the need to focus on emergency repairs rather than systematic maintenance.

## 4. DATA AND METHODOLOGY

Conducted between December 2011 and July 2012, the surveys were adopted during the preparation of both projects to inform each road design. The methodology used for each survey included the use of a household questionnaire and focus group discussions (Table 1). Each survey collected household data from villages near areas of the project.

**Sampling and data collection.** Local consultants were used to undertake the surveys. The sample populations were selected on the basis of their proximity to the project areas. In Kiribati, the road network is primarily located in South Tarawa and sample villages were selected along the main corridor spanning from the airport at Bonkiri in the East of Betio to the main port town in the West, between January and February 2011. In Timor Leste, the sample included a number of *Sucos* at approximate distances long the road from the start of the Dili-Ainaro corridor.

**TABLE 1. Characteristics of Social Benefit Surveys**

Study area	Sample size	Questionnaire & methodology	Focus groups	Location of data collection
South Tarawa road, Kiribati (Kiribati Road Rehabilitation Project (KRRP))	209 hh selected from 9 villages	65 questions in structured questionnaire with focus group discussions led by semi-structured interview guide.	6 focus groups targeting different stakeholders (village; women; catholic youth group; bus driver; mini store owners; and big store owners).	6 villages (Bikenibeu, Temaiku, Eita, Banraeabra, Teaoraereke and Bairiki) and 3 control villages (Bonriki, Teaoraereke (off-road) and Bikenibeu (off-road)).
Dili to Ainaro Road Corridor, Timor Leste (Timor Leste Climate Resilience Project)	360 hh selected from 18 <i>Aldeias</i> from 10 <i>Sucos</i> <sup>22</sup> .	70 questions in structured questionnaire with focus group discussions led by semi-structure interview guide.	4 focus groups targeting both men and women from (1 focus group of 7 men; 1 focus group of 6 women; 2 focus groups of 19 men and women in total). Participants included <i>Suco</i> chiefs, youth chiefs and youth members, business merchants, local agriculturists, housewives and public officials. Attendees were selected from listed provided by the <i>Suco</i> chiefs	10 <i>Sucos</i> selected from six sub-districts located in the three districts (Dili; Aileu; Ainaro) traversed by the road. 8 <i>Aldeias</i> surveyed in the Aileu district, 8 in the Ainaro district and 2 in the Dili district.

<sup>22</sup> Sub-village administration units that together form a *Suco* or village.

**Focus groups.** Each household survey included the interviews of focus groups covering various groups of stakeholders ranging from store owners, villagers and church goers to women. Focus groups aimed to provide valuable qualitative information that would not have been captured by the quantitative analysis of the formal survey work. It also allows groups that are underrepresented or who may not often be provided with the opportunity to share their views to participate and share their views. The discussions of the focus groups sought to capture the main concerns and problems experienced by project beneficiaries in relation to travelling on the road. The focus group consultations also provided data to assess whether there was broad community support for the road programs and proposed activities in the respective project areas.

## 5. MAIN FINDINGS

The findings highlight the challenges and concerns of the intended project beneficiaries regarding road use. No significant differences between men and women were found in relation to the appreciation of road conditions or in relation to the perceived road. However, there are gender differences in relation to use of modes of transport, personal safety issues and accessing services such as health and education.

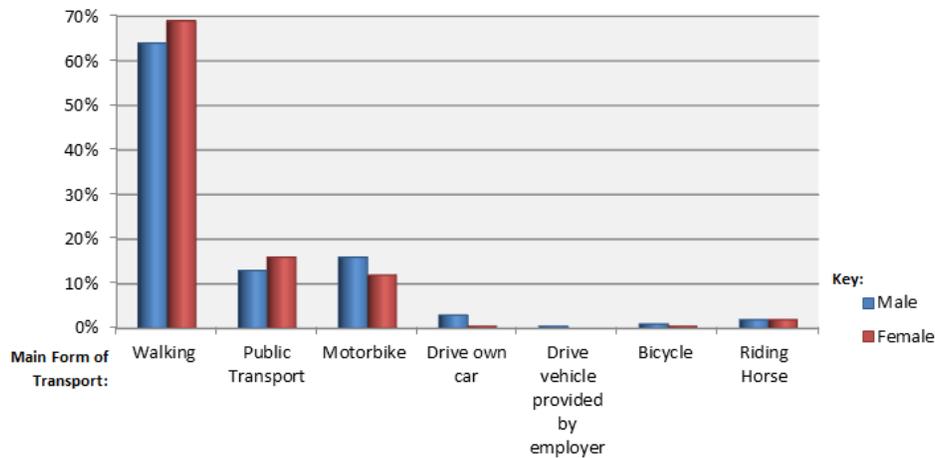
**Household characteristics.** Household sizes in both Kiribati and Timor Leste are relatively large, with a high number of people under the age of 18 sleeping in the homestead on a regular basis. These results are characteristic of the typical demographic composition of households in countries of the region. The majority of respondents were either the Head, or the Husband or Wife of the Head, of the household (78 percent in Kiribati and 89 percent in Timor Leste). In Kiribati and Timor Leste some 60 percent of households had six to nine people sleeping in the homestead on a regular basis and some 10 percent had over ten people sleeping in their homestead on a regular basis.

There are differences in terms of length that respondents have lived in their current location. Respondents from Timor Leste reported a longer term of residence at their current homestead, while the majority of respondents from Kiribati reported having recently moved to Tarawa atoll from other islands in Kiribati. In Timor Leste some 80 percent of respondents had lived in their homestead for more than 20 years, and in Kiribati some 67 percent of respondents have lived in their homestead for more than five years.

**Modes of transport.** Both Kiribati and Timor-Leste are low income countries, and this is reflected by low levels of car ownership. The most reported forms of transport in Kiribati and Timor Leste were "public transport" and "walking", followed by "motorbike" or "driving a car". In Kiribati the response "minibus" received the highest proportion of answers (77 percent) followed by "walking" (46 percent) and then "driving (their) own car" (16 percent). In Timor Leste the response "walking" received the highest proportion of answers (67 percent), followed by "public transport" (14 percent) and "motorbike" (14 percent).

In both countries, alternative modes of transport to the car are predominant for different reasons. In Timor Leste, it is primarily because owning a car is not common and the Dili to Ainaro road corridor is not well serviced by public transport. In Kiribati car ownership is similarly low; however, public transport is more readily available and is frequently utilized by respondents as reflected in the survey results. In Kiribati only 26 percent of respondents and in Timor Leste 21 percent of respondents reported owning or having someone in their homestead own a car or motorbike.

When the main forms of transport were examined by gender (Figure 1), the results demonstrated moderate gender differences. Slightly more women than men reported 'walking' (69 percent) and using 'public transport' (16 percent) as their main forms of transport, while moderately more men than women reported 'motorbike' (16 percent) and driving their 'own car' (3 percent) as their main forms of transport.



**FIGURE 1. Mode of transport by gender in Timor Leste**

**Road conditions and quality.** The surveys showed that the road network is in poor and deteriorating condition in both Kiribati and Timor Leste, with secondary and feeder roads in even poorer conditions. However, there were no gender differences reported regarding the overall poor condition of roads affecting residents’ level of comfort except in the case where expecting women need to travel to reach maternal health services.

When asked about the general condition of the road and the condition of the road between seasons, 88 percent of respondents in Kiribati stated that they considered the general condition of the main road to be “very poor” or “poor”. In Timor Leste 91 percent of respondents considered that the general condition of the Dili to Ainaro road is “very poor” or “poor”. The questionnaires in Kiribati and Timor Leste asked questions related to the condition of the road during the ‘wet’ and ‘dry’ seasons. Respondents from both Kiribati and Timor Leste indicated that the condition of the roads deteriorates during the wet season. Some 95 percent of respondents from Kiribati reported that the condition of the road during periods of heavy rain was “very poor” and “poor”.

Another important criterion associated with road conditions is the quality of the road infrastructure and its linkages to perceptions of comfort. In Kiribati 80 percent of respondents cited that it was “very uncomfortable” or “not very comfortable” and 17 percent responding that it was “comfortable” or “very comfortable”. The impact of the condition of the road on the level of comfort was highlighted by participants from focus group consultations in Kiribati and Timor Leste. In Kiribati the Bus Driver Focus Group stated that they would “only drive on tar-sealed roads because it is comfortable to drive on and the bus won’t easily breakdown” and in Timor Leste one focus group member commented “I think the problem is my whole body is painful when traveling to Dili to Ainaro because the condition of the road is bad”.

**Trip patterns and frequency.** In Kiribati, some 60 percent of respondents reported that they spend five or more times travelling along the main road during the weekdays or school term by motorized vehicle, while only 18 percent reported traveling one to two times per day on the main road. In Timor Leste 74 percent of respondents travel one to two times per day by motorized vehicle (car, motorbike and public transport) during the week, 91 percent of respondents travel one to two times per day over the weekend, and some 56 percent of the respondents walk one to two times per day along the Dili to Ainaro road.

The results also showed slightly longer time is spent traveling on the road in Timor Leste than in Kiribati, where more than 42 percent of the respondents spend between five to 29 minutes a day travelling along the main road, 28 percent spend 29 minutes to 1 hour, and almost 20 percent spend one to three hours. In contrast in Timor Leste, 34 percent of the respondents spend five to 29 minutes a day travelling along the Dili to Ainaro road, 22 percent spend 29 minutes to one hour, 34 percent spend one to three hours and 15 percent spend more than three hours travelling.

The results showed respondents in Kiribati perceive traffic is heavier than respondents in Timor Leste. In Kiribati, almost 90 percent of respondents agreed that traffic on the main road is “very heavy” or “heavy”, while only 58 percent of respondents in Timor Leste think that traffic on the Dili to Ainaro road is “heavy” to “medium” and 24 percent reported that the travel level is “light”. The likely reason for a reported heavier level

of traffic reported in Kiribati is because there is only one road for all traffic in South Tarawa, leading the same cars, mini-buses and trucks to travel on the road multiple times per day. While in Timor Leste, the mountainous terrain and poor road condition may result in respondents opting to travel on the Dili to Ainaro road only when necessary or when an alternative route is not available.

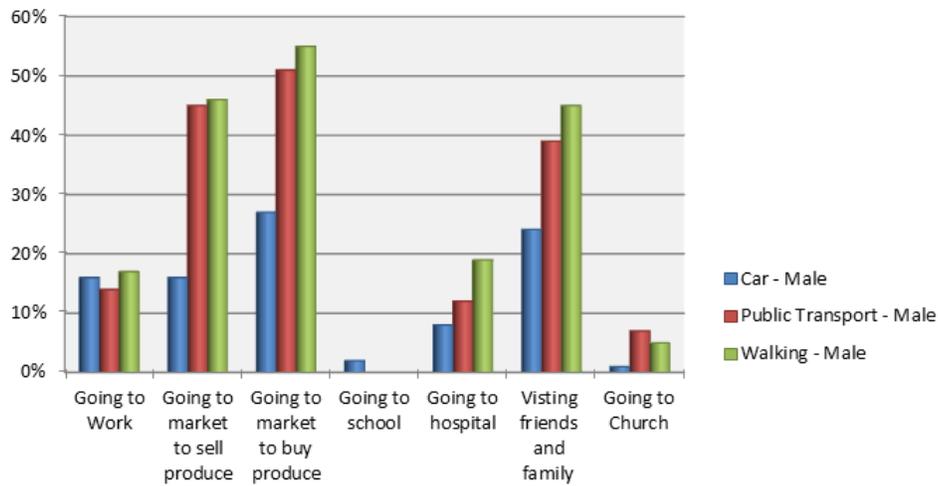


FIGURE 2. Male Trip patterns by mode of transport in Timor Leste

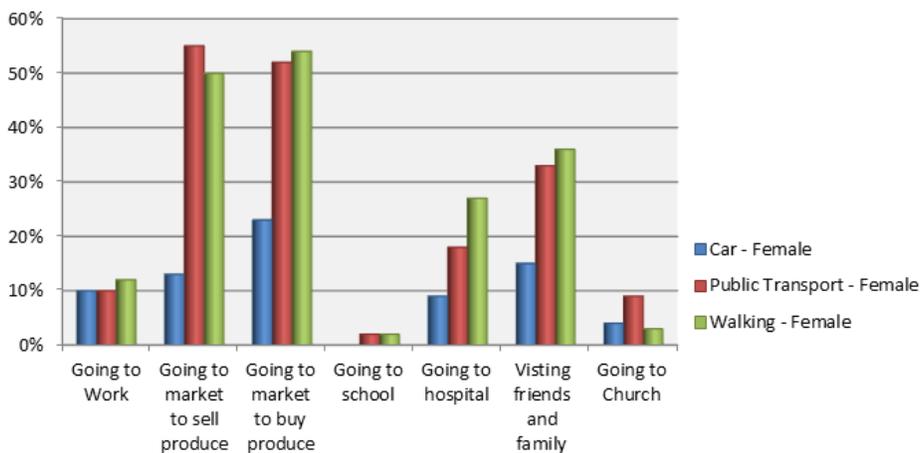


FIGURE 3. Female trip patterns by mode of transport in Timor Leste

Gender differences exist in both Kiribati and Timor Leste in the way transportation is used. Women are also more likely to walk and use public transport to get from one point to another. Men and women reported using all modes of transport to undertake their daily tasks, except for going to school where only men reported using a car and only women reported using public transport or walking. In general, more men reported using a “car or motorbike” to undertake their weekly activities, while women are generally more reliant on “public transport” and “walking”.

The results also demonstrate differences between men’s and women’s general purpose of weekly travel and highlight that there are differences between men’s and women’s preferred mode of transport used to execute their weekly activities. While a comparative percentage of men and women reported going “to market to buy produce”, more women reported using the Dili to Ainaro road to “go to market to sell produce”, and to undertake this task the women typically utilized “public transport” or “walking”, with 10 percent more women than men reporting using public transport for this purpose and at least five percent more women than men reported ‘walking’ (Figure 3). The results also demonstrated that more women reported using the Dili to Ainaro

road during the week to attend a “hospital or health center”, while more men reported using the road to “visit friends and family”.

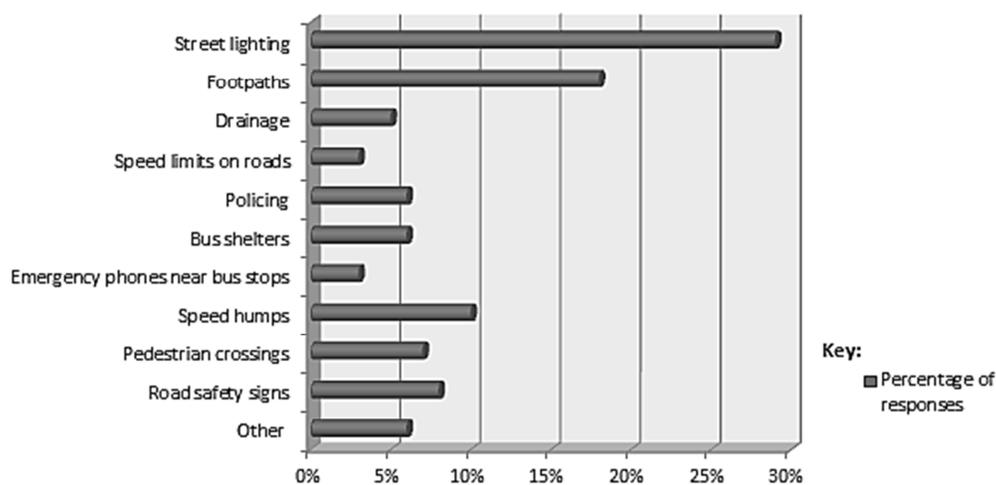
**Access to maternal health services.** The concern of maternal health and safety was raised in Kiribati and Timor Leste, with focus group consultations reporting that women’s maternal health is at risk due to poor road conditions and the subsequent poor level of comfort experienced while traveling on them.

The results from Timor Leste focus group consultations related to this issue of potholes, unprotected steep ravines and landslides and the impact that these can have on maternal health as women struggle to access to health care services and to access them in time to give birth.

When focus group participants in Timor Leste were asked how the improved road could benefit their household and access to essential services, several participants reported that road improvements would have a “positive impact to the pregnant women because they can access the hospital in the time of giving birth to their children”, while others reported that the rehabilitation of the road would facilitate easier access to these essential services in general. They also indicated that the condition of the road “made it worse for the pregnant women to travel” and “such condition of the road effects pregnant women all the time because it is not safe”, and “sometimes mothers give birth to their children on their way to hospital for they move too slow and because ambulance cannot come to our place”.

**Women and personal security.** Another significant concern raised by community groups in relation to roads was the lack of personal safety and, in particular, ways to improve the personal safety of women by adding street lighting along the main road. A related concern was the need for improving road safety and the need for improving road safety and mobility features such as through the provision of footpaths (Figure 4).

In Kiribati, the Anraei/Te Kawa ae Boou Village Focus Group in Bonriki village, a main point raised was that “their women are not safe because the buses don’t drive through their village so the people have to get off from the airport and walk about 300-500 meters back to their village”. The same focus group listed traffic lights, street lights, bus stop/shelter and drainage as the most important safety improvements that they would like to see on the main road. It was also stated that an advantage of an improved road would be that “women won’t have any problems because they won’t be walking a long distance to get home and won’t have any cases of rape.”



**FIGURE 4. Road safety features requested across gender in Kiribati**

**Access to education.** The poor quality of roads was also cited as a factor impacting the travel times and the duration of trips. While it only takes between five and thirty minutes to travel to school in the dry season for some 70 percent of children in Kiribati, it takes take half an hour to an hour for another 20 percent of the children, which is substantial considering the small size of South Tarawa atoll. In the wet season this number increases to over 30 percent.

Of particular concern for women is that poor road conditions also affect transport services, thereby limiting children’s access to schools. In Kiribati, the women’s focus group reported the problem of buses not picking up

school children, and it was suggested that designated school buses should operate to ensure school children get to school. Further, when children are waiting for the bus, there is no bus shelter to reduce the effect of the sun's heat or the rain. The women's focus group also identified the problem of children not being safe as there is no specific space for them to walk on or ride their bicycles to school. One focus group in Timor Leste commented that issues of students sometimes being in accidents because the Dili to Ainaro road is narrow and there is a lack of footpaths.

## 6. CONCLUSIONS AND RECOMMENDATIONS

**Why socio economic surveys matter.** The review demonstrates the importance of surveying local communities targeted by rural road projects. The survey and focus group discussions helped understand expectations of local communities in relation to the proposed road improvements.

The comparison of the findings from the surveys and consultations highlight several similarities and differences between the two beneficiary populations. There are similarities in the demographic composition of the survey populations, for example, and respondents from KI and TL emphasize the poor condition of the roads, and there is a correlation between the main problems and concerns with the road and the main safety problems reported by respondents.

The results from Kiribati and Timor Leste also emphasize the impact of periods of heavy rain and, during the rainy season, on the condition of the road. As a result, significant improvements to the road designs were made to ensure adequate drainage on the road in South Tarawa, Kiribati and along the Dili to Ainaro corridor in Timor-Leste.

In addition, the results demonstrate the impact that current road problems pose on the social and economic well-being of the surveyed populations. For example, respondents from Kiribati and Timor Leste both reported the impact of poor road conditions on their ability to access places of employment or essential services.

**Gender findings.** By focusing specifically on the concerns and needs of both men and women, allowing for specific consultations to take place with focus groups, the surveys provided critical knowledge for identifying and understanding issues that would have likely gone undiagnosed. Broad support for the road projects was expressed in both Kiribati and Timor Leste with the anticipation that improved road access will improve livelihood, access to employment opportunities and increase the level of personal safety for men, women and children.

The comparative analysis of the results reported generally poor conditions of the roads, with respondents raising concerns regarding pedestrian safety and the safety of women, in particular. There were also specific concerns in relation to access to schools for children, personal security and access to health care facilities for improved likelihood that women will get to the hospital in time to give birth.

**A first but limited step toward gender integration.** The survey results will help shape the policies and investments associated with the road rehabilitation programs to go beyond the traditional investments in road surfacing and maintenance programs. The results from Kiribati highlighted that providing bus shelters will benefit school children through reduced exposure to the elements and as a place where they can safely wait off the road for the bus. Likewise, in both Timor Leste and Kiribati, the provision of street lights will greatly improve the likelihood that women will feel safer to travel. In Kiribati, specific recommendations linked to the findings of the surveys have already been addressed: (1) Solar street lighting investments were increased; (2) 67 km of footpaths were included in the project; (3) 56 speed humps were added at key locations; (4) the provision of road safety signs was extended as well as the provision of equipment and support to police to improve speed enforcement; and (5) more frequent bus stops and shelters were provided along the road.

As there was no previous gender assessment of differences in transport access and mobility patterns, the surveys provided a good opportunity to elicit data and knowledge on factors that may influence gender access to transportation. Nonetheless, findings were limited. Despite the tailored questionnaires, the knowledge captured by the surveys remained insufficient to formulate deeper conclusions and recommendations on gender transport measures. Except for the focus group questions, data collected was not enough gender disaggregated for the majority of the survey questions raised in Kiribati. As a result, comparable data on men's and women's needs and experience about the same parameters was not available.

For both surveys, important development challenges that can particularly impact gender differently were not assessed. Differences in variables such as income levels and poverty status, availability of economic opportunities and linkages with the transport sector were not captured. As a result there is not enough data to capture the importance of transportation for women in relation to the development challenge of providing access to employment and economic resources.

Further investigations on how other specific improvements linked to the transportation aspects of the project could further help women achieve better economic and social well-being. In both countries, women are more likely to be poor and unemployed, relying on agriculture and the informal economy for their livelihoods. Further investigation, either in the context of a gender country or social assessment, could help in investigating both the direct and indirect effects that roads and transportation in general may bring to women.

The implementation challenges encountered in the context of the project surveys are not unique. Very few transport projects in medium to low income countries provide evidence of good practice for capturing gender differences and the impact of projects on specific gender needs. In fact, the majority of rural transport projects do not tend to collect gender disaggregated data or, if they do, the results from the surveys may also not be well integrated into the formulation of interventions. The example from the two projects demonstrates that conducting surveys for improving interventions in the transport sector is not an easy exercise, and that results may also be difficult to interpret to meaningfully inform road design and transport policy more generally.

**Moving the project forward sustainably.** Overall, the surveys and focus group consultations have been successful in capturing baseline data for the survey population. The findings highlighted common concerns, problems and experiences of beneficiaries from two divergent Pacific Island nations. Following the completion of the civil works, follow-up surveys and focus group consultations are being planned to focus on measuring and assessing the level of user satisfaction and impact of the projects,.

The studies reflect a renewed commitment by the World Bank and the development community more generally to focus on gender mobility issues and differences between men and women in accessing transportation. As further rounds of surveys are being planned in the context of the projects, it will become imperative to collect both male and female transport data. The identification of specific gender data can support the design of transport investments and related policy decisions. Relevant data can then be used to improve the mobility of all users in rural areas and to ensure a most effective use of services such as health which are often most needed by women.

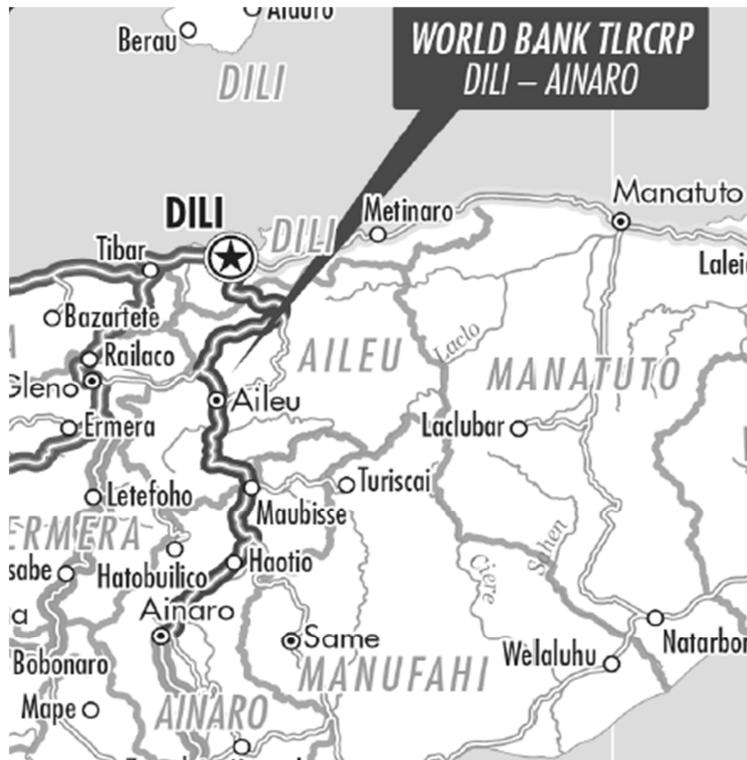
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Annex 1. Project area maps



The area of Kiribati Road Rehabilitation Project on South Tarawa



The area of Timor Leste Road Climate Resilience Project

## Annex 2. Focus group discussions

### Main concerns about the road condition across focus group consultations in Timor-Leste

Focus Group	Main Concerns Raised
Suco Ainaro	<ul style="list-style-type: none"> <li>- Gaping holes (potholes)</li> <li>- Gutters are in bad condition</li> <li>- Water collects and stagnates on the road in the wet season and the street is dirty in the summer that affects passengers health</li> <li>- Failed/broken bridges</li> <li>- Dusty, especially in the summer</li> <li>- Water stagnates in the middle of the street during the rainy season</li> <li>- There are no gutters for water to flow through</li> </ul>
Suco Fatu-Besi	<ul style="list-style-type: none"> <li>- Landslides, especially during the rainy season</li> <li>- Water is stagnated on the road</li> <li>- A lot of dust in the summer and muddy and slippery road in the rainy season</li> <li>- Full of gaping holes</li> <li>- Street is too narrow</li> <li>- Steep road edges not protected by barriers or safety bars</li> <li>- The street fills with water so that it destroys the road, big drains are required to wash away the water</li> </ul>
<i>aldeia</i> Hularema	<ul style="list-style-type: none"> <li>- There is a lot of water stagnated on the road</li> <li>- A lot of dust along the way or very dusty along the road, companies which are responsible for fixing this problem just put soil in the gaping holes so it results in dust</li> <li>- Road is full of gaping holes</li> <li>- Road is too narrow</li> <li>- There are steep road edges that are not protected by barriers</li> <li>- There are landslides</li> <li>- There is a lot of water stagnated everywhere during the rainy season because the road is full of gaping holes</li> </ul>
Suco Madu-Benu	<ul style="list-style-type: none"> <li>- There are no proper gutters, sometimes there is landslide covering the road in the rainy season and the road is broken</li> <li>- Gaping holes along the road, so that the public transportations operating are not many</li> <li>- There are landslides, rocks slide in the middle of the road around the sharp turns</li> <li>- Drains are not good so that water cause landslide and cover the street during the rainy season</li> <li>- Street is very dirty, especially in the summer season</li> <li>- Water gathers on the road and becomes stagnated</li> <li>- Road is too narrow, many sharp turns</li> <li>- No barriers around ravines</li> <li>- The road is muddy and slippery in the wet season and water stagnated in the middle of the road so that it is hard to get to my destination faster</li> </ul>

**Main concerns about the road condition across focus group consultations in Kiribati**

Focus Group	Main Concerns Raised
Anraei/Te Kawai Ae Boou Village Focus group	<ul style="list-style-type: none"> <li>- Potholes in the road</li> <li>- Road is narrow should be widened like the one in Betio</li> <li>- Dust is a huge problem where it causes a lot of flu/cold/diarrhea</li> <li>- Red eyes/sore eyes</li> </ul>
Mini Store Owners Focus group	<ul style="list-style-type: none"> <li>- Dust is a huge problem causing health problems</li> <li>- Expensive to transport cargoes from port to their office</li> <li>- There are quite a lot of curvy roads that have caused accidents like the Mackenzie road, Dr Airam (Eita), KPC (Eita) and Ionatia (Bikenibeu)</li> <li>- Trees overlaying onto the road should be cut down.</li> </ul>
Big Store Owners Focus group	<ul style="list-style-type: none"> <li>- The road is narrow</li> <li>- Should have a parking space for delivery cars to park</li> <li>- The road where lots of people live or shop should have a traffic sign</li> <li>- No parking space for delivery trucks</li> <li>- Lots of potholes will slow truck to deliver goods from place to place and will consume lots of fuel meaning more expenses</li> </ul>
Women Focus group	<ul style="list-style-type: none"> <li>- Children are not safe because there is no specific space for them to walk or ride their bicycles to school</li> <li>- There is no school bus and no bus stop with shelters to reduce the effect of the sun's heat and if there is rain they risk being wet</li> <li>- Drunk driving and sleep driving causing a lot of accidents</li> <li>- Fast drivers and lots of potholes caused women to miscarry babies and abdominal pain to people</li> <li>- No motorcycle or bicycle lane</li> <li>- Narrow road</li> <li>- No sign on speed bumps or near it to signal for on-coming vehicles</li> <li>- Cars/buses are easily damaged from riding over the potholes</li> <li>- There are no street lights and some mischievous kids can throw stones at the bus causing damages and injuring people on the bus</li> </ul>
Catholic Youth Focus group	<ul style="list-style-type: none"> <li>- Too many accidents from curvy roads like Mackenzie and Otintaai Hotel roads</li> <li>- Tanaea and Ananau causeways are too narrow</li> <li>- The road to the KPA is dangerous because there is no wall and is very narrow as well</li> <li>- Where there are a lot of people, pedestrian crossings should be build like one opposite MOEL in Betio and other crowded places like the Bairiki square and many others</li> <li>- Travelling in the night is not safe because the road has lots of potholes and you will have a bumpy ride all the way to your destination</li> <li>- Students mostly travel to school by bus or on foot</li> </ul>
Bus Driver Focus group	<ul style="list-style-type: none"> <li>- There are quite a lot of curvy roads that have caused accidents like the Mackenzie road, Ngaalu Bar (Bikenibeu)</li> <li>- Ananau causeway is very narrow</li> <li>- The damaged road causes a lot of problems to the bus especially the bearing and shock absorbers</li> <li>- More potholes equals more expenses</li> <li>- Proper design of speed bumps because the ones like in Abarao and Eita opposite Moroni High school are bad. The most appropriate speed bump design is like the ones in Betio</li> <li>- Trees along the road are dangerous because they can deter visibility or fall onto any vehicles causing accidents</li> </ul>

**Annex 3. Aggregated household survey questionnaires**

Questions Common to Both Surveys	Questions only asked in one Survey
<b>Household Information</b>	
What is your relationship to the head of the household?	<b>Questions asked in Kiribati but not in Timor-Leste</b>
Total number of people who sleep ere on a regular basis?	Approximate combined monthly income of the household?
How many Junior Secondary School and below who sleep here on a regular basis? - In Timor-Leste this question read ‘how many people aged 18 years or below sleep here on a regular basis?’	Three biggest weekly household dollar expenses? Approximate how much on each.
Main source of income of the household?	Approximately how much does the household spend on transport every week?
Approximately how long have you lived here?	<b>Questions asked in Timor-Leste but not in Kiribati</b>
What islands are you originally from? - In Timor-Leste this question read ‘where are you originally from?’	Do you live on the Dili-Ainaro road? Approximately how far do you have to travel by foot to go to the Dili-Ainaro road?
<b>Road Transport Overview</b>	
Description of the general condition of the main road in Tarawa? - In Timor-Leste this question read ‘how would you describe the general condition of the Dili-Ainaro road?’	<b>Questions asked in Kiribati but not in Timor-Leste</b>
Three most serious problems concerning the main road?	Rate the condition of the access (small) roads in your village Do you live on the main road? Approximately how far do you have to travel on the access road to get to the main road? What is the access condition of the road during the year?
Description of the main road when it rains? - In Timor-Leste this question read ‘description of the Dili-Ainaro road in the wet season’	<b>Questions asked in Timor-Leste but not in Kiribati</b>
Description of the condition of the main road in the dry season? - In Timor-Leste this question read ‘description of the Dili-Ainaro road in the dry season’	How would you rate the experience of traveling the Dili-Ainaro road by motorized vehicle during the dry season? How would you rate the experience of traveling the Dili-Ainaro road by motorized vehicle during the wet season? What is the access condition of the Dili-Ainaro road during the year? If the road is impassable, could you please tell us where the road is usually impassable? During the weekdays what is the main purpose for traveling along the Dili-Ainaro road in a motorized vehicle or car? During the weekend what is the main purpose for traveling along the Dili-Ainaro road in a motorized vehicle or car? During the weekdays what is the main purpose for traveling along the Dili-Ainaro road by public transport? During the weekends what is the main purpose for traveling along the Dili-Ainaro road by public transport? On average how many times per day do you travel along the Dili-Ainaro road by foot or other means of non-motorized transport? On average, how long each day do you spend traveling on the Dili-Ainaro road by foot or other means of non-motorized transport? What is the main purpose for traveling along the Dili-Ainaro road by foot or other manes of non-motorized transport?
Description of the general level of traffic on the main road - In Timor-Leste this question read ‘description of the level of traffic on the Dili-Ainaro road during the weekdays’ and ‘description of the level of traffic on the Dili-Ainaro road during the weekend’	
During the school term, and during the weekdays, how many times per day do you usually travel on the main road in a motorized vehicle or on a motorbike? - In Timor-Leste this question was asked according to mode of transport: a) car and motorbike and b) public transport	
Over the weekends, how many times per day do you usually travel on the main road in a motorized vehicle or on a motorbike? - In Timor-Leste this question was asked according to mode of transport: a) car and motorbike and b) public transport	
On average how many times per day do you spend traveling on the main road – walking, in a motorized vehicle, on a motorbike or bicycle? - In Timor-Leste this question was asked for the weekdays and weekends and according to mode of transport: a) car and motorbike and b) public transport	

**Annex 3 (continued). Aggregated household survey questionnaires**

Questions Common to Both Surveys	Questions only asked in one Survey
<b>Traveling on the main road/Household Transport</b>	
What is your household's main form of transport?	<b>Questions asked in Kiribati but not in Timor-Leste</b>
Do you, or anyone else in your homestead, own a car or motorbike?	Do you or anyone in your household own a bicycle?
How much do you spend on average per week on petrol?	Does the condition of the main road affect your decision to have a car/bicycle/motorbike?
How much do you spend on average per year on car repairs?	What method of transport do you use to get to work?
If you don't own your own car or motorbike, how much does a one way trip to your work cost?	How long does it take you to get to work in the dry season?
- In Timor-Leste the question was asked 'if you don't own a car or motorbike, how much do you spend on average per week on public transport'?	How long does it take you to get to work in the wet season?
	How do you rate the experience of traveling the main road by motorized vehicle?
	How often do you travel to town i.e. either Betio, Bairiki or Bikenibeu?
	Do you think the main road would benefit from street lightening?
<b>Safety/Safety on the Road</b>	
Do you consider safety on the road an issue?	<b>Questions asked in Kiribati but not in Timor-Leste</b>
- In Timor-Leste the question was asked 'Do you consider safety on the Dili-Ainaro road an issue'?	How would an improved main road affect you and your household the most?
What, in your opinion, causes the most safety concerns on the road?	<b>Questions asked in Kiribati but not in Timor-Leste</b>
Which of the following road features are important to you?	How safe would you rate the experience of traveling the Dili-Ainaro road by car or motorbike?
Do you ever receive information about road safety?	How safe would you rate the experience of traveling the Dili-Ainaro road by public transport?
Have you ever been involved in an accident or been injured on the main road?	How safe would you rate the experience of traveling the Dili-Ainaro road by foot?
Has anyone in your household ever been involved in an accident or injured on the main road?	When were you, or anyone in your household, involved in the accident?
- In Timor-Leste these two questions were combined to ask 'have you, or anyone in your household, ever been involved in an accident on the Dili-Ainaro road	Do you know anyone, not including your or anyone in your household, who has ever been in an accident on the Dili-Ainaro road?
	Approximately when was this person in the accident?
<b>Environment</b>	
Describe the level of dust on and around the main road?	<b>Questions asked in Kiribati but not in Timor-Leste</b>
Has the level of dust on the main road ever caused you health problems?	Do you have a well for water at your homestead?
How would you rate the general rubbish levels around your village?	Is your well affected by the runoff or dust from the road?
- In Timor-Leste the question read 'how would you rate the general rubbish level <i>around</i> the Dili-Ainaro road'?	
How often is garbage collected in your village?	
- In Timor-Leste the question read 'how often is garbage collected <i>along</i> the Dili-Ainaro road'?	
What happens when the rubbish is not collected regularly?	

**Annex 3 (continued). Aggregated household survey questionnaires**

Questions Common to Both Surveys	Questions only asked in one Survey
<b>Health</b>	
How easy did you find it to travel to the hospital/health centre?	<b>Questions asked in Kiribati but not in Timor-Leste</b>
How frequently do you visit a hospital/health centre over the course of a year?	Have you had to visit a hospital/health clinic in the last 2 months?
For what purpose do you usually visit the hospital/health centre?	How frequently did you visit a hospital/health centre last year?
How long does it take you to travel to the nearest hospital/health centre?	<b>Questions asked in Kiribati but not in Timor-Leste</b>
What mode of transport do you use to travel to the nearest hospital/health centre?	In which town or village is the nearest hospital/health centre located?
How much would a one way trip to the nearest hospital/health centre cost in a minibus/taxi?	Is the nearest hospital/health centre only accessible from along the Dili-Ainaro road?
<b>Schooling</b>	
Do you have children in the household who attend school?	<b>Questions asked in Kiribati but not in Timor-Leste</b>
How do they travel to school?	Is the nearest school only accessible from along the Dili-Ainaro road?
How much does the trip cost?	How safe is it for the children to get to school?
Approximately how long does it take them to get to their school in the dry season?	
Approximately how long does it take them to get to school in the wet season?	
If there are school aged children in the house who are not attending school, please ask why not.	

# Gender sensitive-policies in the area of urban transport; between research and international institutions

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## ABSTRACT

Increasingly, in cities around the world, women work or study away from home.

This article presents an overview of some gender-sensitive initiatives to facilitate the increasing number of journeys, and to make them safer. Following on an introduction of 'Gender and Development', some policies by the World Bank and the UN together with the notion of sustainable transport are discussed. The policies stress different aspects of women in transport, but they converge in support of women's mobility and equal access in cities, although they differ in 'why' and 'how' women's issues should be handled.

The nexus of the economic and political initiatives, the local context of mobility in cities, and how women act, and interact, in traffic and transport, are viewed in the perspective of 'gender and development'. The tools in 'gender and development' enable a critical reflection of the top-down policies, and in this way, science and policy cross-fertilize.

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**KEYWORDS:** Gender and Development; Cities; Traffic; Policy; Development Banks; Sustainable Transport.

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## 1. INTRODUCTION

A growing number of families are dependent on female breadwinners and more women work further away from home in cities around the world than ever before. The conditions for women vary, and how they "juggle domestic responsibilities, marital relationships and paid work" imply varying levels of constraints (1). In many cities access to the selection of resources requires more and longer travel, and women have to spend time travelling on buses and trains or walking and bicycling.

Modern transport facilities are seen as a prerequisite for cities to develop as well as for families to have a reasonable quality of life. In order to meet the need for access and mobility of people and goods, systems of transport have undergone dramatic processes of modernisation, including gentrification. In most cities roads and infrastructure are improved and connectivity for important actors is facilitated, but less so for low-income families.

A look at women's experiences and gender issues in traffic and transport shows that policies and infrastructure do not respond equally to women's and men's mobility needs (2, 3). Urbanisation is often associated with increasing opportunities for women and girls but "most urban women experience profound disadvantages compared to men in their daily life" (2). However, we know that transport policies become gendered through multiple mechanisms related to socio-economic conditions, traditional ways of life, religion as well as women's legal status, position in the labour market, and participation in decision-making (4). The suppressed demand for access to work, education, healthcare, recreation, social interaction is presumed to be considerable. The male way of relating to travelling has been, and still is, the prevailing norm in planning, and more studies of access and mobility for women are required to disentangle local complexities in cities around the world.

Rapid changes in cities have put enormous pressure on the infrastructure to accommodate greater numbers of people and to meet their basic demand for access and mobility. The problems associated with traffic and transport in cities in emerging economies are overwhelming or even insurmountable (5). National and local traffic and transport policies vary widely, but, in general, they stress the role of transport in economic development, as illustrated by the policies in China and Vietnam (4) where almost 50 percent of the women are formally employed and depend on an urban supply of transport. In the Millennium Development Goals (MDGs) poverty reduction was a priority, but the problems that low-income women and men face in traffic impede on

the achievements. The World Bank and the UN propose that urban renewal and poverty reduction programs shall influence the goals and tools in urban mobility.

## **1.1 Issues and Aim**

This overview includes arguments of why gender-sensitive policies in urban mobility are important, and how further studies will add to policy development. This means that science and policy will cross-fertilize to make it possible to take informed decisions. The gender-sensitive initiatives presented below target different aspects of women's role in development (poverty reduction, social cohesion, sustainability) but, interestingly, they converge in support of women's mobility and equal access in cities, albeit, for very different reasons. Urban journeys are not end means by themselves, but seen as an enabler of women's choices to improve their standard of life. The travels are embedded in political, economic and social structures in specific natural environments. Trivial understandings of the structural conditions and the complex relations of gendered mobility are not helpful in defining new policies and this overview provides ways to further explore women's issues in transport.

Some of the difficulties in real life are also described below to show how women act, and interact, with the technical features of transport systems, the natural environment as well as the socio-economic and traditional context of their urban journeys. The black box of gendered mobility is opened up by the tools and methods of 'gender and development', GAD. As we shall see, GAD is apt to analyse the complexity of women's issues in transport as well as to develop gender-sensitive policies in traffic and transport based in a comprehensive *verstehen* of the gendered mobility.

Women's travels are known to have lower environmental impact than men's (6), and the sustainability perspective with its ecological and social dimensions, includes ways to improve mobility (7) and well-being of females. The notion of sustainable transport promotes safety and security aspects of crucial importance for women in traffic systems. This notion is also appropriate to explore the adversities of current masculine systems of transport and to meet the challenges of vulnerability, adaptation and mitigation defined by UNIPCC (8).

As we shall see the World Bank and the various UN organisations have developed mainstreaming and conflating initiatives and a window of opportunity is opened by means of sustainable transport in support of equal access and gender-sensitive policies. This overview explores the nexus of research and policies by the financial institutions and the UN, and its linkages to gender-sensitive approaches in policy.

## **1.2 Previous Research**

Conditions for women in developing countries emerged as a research field decades ago (9). The points of departure were, *firstly*, the freedom from colonialism and women's liberation, and *secondly*, the concern with the social impact of the structural adjustments program in the emerging markets in the 1990s; *thirdly*, the second wave of feminism as manifested in the UN women's conferences (Nairobi, Beijing) and, *fourthly*, the discourse of civil society, participation, poverty reduction programs and critical view on the development practices (opposed to the non-reflective mainstream development) and rights (10). The early studies, called 'women in development', emerged into a body of knowledge and the 'Gender and Development' approach, GAD. This research included in-depth knowledge about the conditions for women: 'Women's Empowerment Framework' (11); Undoing internationalized oppression (12); 'Ability to make choices' (13-15) and so on.

The concept of equity, with its call for gender issues in urban transport plans, lies at the heart of several policies and the notions of 'gender equality', and gender mainstreaming'. They are often used by the UN and the development banks, although sometimes in 'light versions'. The concepts of empowerment/disempowerment; strategic life choices; resource management; agency are part of the toolbox. Equality involves ensuring that the perceptions, interests, needs, and priorities of women and men shall have equal weight in planning and decision-making (3). Equity and gender are also core issues in sustainability in transport, as discussed below.

The normative tradition in the interlinked area of urban research dates back to *e.g.* Henri Lefebvre (16) and David Harvey (17). The latter, in his book *Social justice and the city*, claimed that the principle of justice has profound relevance for urban development and for the link between spatial form and social processes. In this linkage, transport plays a vital role by removing barriers for equal access to a selection of resources such as spatial distance.

A number of scholars in geography, feminist and urban studies from the US, Europe and India have added to the research and highlighted the cross-cultural features of gendered mobility. The issues are complex, and the way in which gender shapes mobility and how traffic and transport systems shape gender (18) in different parts of the world unveil the research challenges.

### **1.3 Mobility fundamentals: gendered patterns**

Earlier research has identified differences in men's and women's *attitudes* as well as in their travel behaviour. Gender differences in travel behaviour are related to the kind of work a woman takes on, if she is self-employed or pursues part-time jobs (7) might set the agenda for distance, means of transport, cost of journey and the extent to which several journeys are linked together. Other determinants influencing journeys are the caring dimension of household management; childcare; care for the elderly or physically disabled (7). A woman usually makes more and shorter travels, and at off-peak hours, than men do, and women's mobility patterns also influence their household. Notably, the gendered order is related to household practices, the position in the labour market, access to vehicles, and other conditions having an impact on travel options and choices (19-22). Research has also shown that variables such as gender and employment status, that describe a person's role within the household, have a greater impact on individuals' travel than do measures of social status (social group, income) (7).

Later studies have targeted the differences between men's and women's attitudes to travel in relation to concern for environment (23, 24). Rätty and Carlsson-Kanyama found that men use more energy for transport than women do (25). Lindén showed that women are more critical of car use than men are (26). Finally, Swedish researchers have noted differences between men and women regarding their transport choices, namely that they are *chosen* rather than *caused* by economic status or some features of the systems (6).

In general, women have lower incomes and suffer more often from spatial constraints and suppressed mobility since costs of safe and secure transport are too high (27). In Delhi, for example the relocation of squatter communities to the outer periphery of the city has been especially damaging to women's ability to earn a living. Female unemployment in these locations rose by 27% compared to 5% for men (28). To save money women might walk instead of taking a bus. Usually they try to work closer to home than men do, even at the expense of better work or incomes, as suggested by ongoing research in Jakarta by Thynell. Women and men also respond differently to policies and technological advancement.

The complex interplay between socio-economics and the physical and technical environment makes it important to bring in quantitative and qualitative studies from various geographical and socio-economic contexts around the world.

In the next section common local features having an impact on women's options and behaviour are presented.

## **2. TRAVEL CONDITIONS IN RAPIDLY CHANGING CITIES**

An ever-increasing amount of the global population live in cities (29) and the majority in developing cities (30). The urbanisation is desired and seen as attractive, but housing and infrastructure are rarely planned for. Traffic and transport are predicted to increase considerably beyond the control of governments. Access and mobility in cities will continue to be a critical aspect (31) often dealt with by informal operators. In absolute numbers more and more women will commute, and examples from rapidly changing cities in Asia illustrate the relations between the urban form, technical and natural environment and the socio-economic conditions having an impact on women's travel options and choices.

Besides, as stated by financial institutions, "[a]lmost 25% of Asia's urban population is poor, and the rate is increasing, as there is a continuous influx of poor people into cities" (32). In 2030, 5 billion people will live in cities motivating the need for poverty reduction (32). In Cambodia, Bangladesh, the Philippines, and Mongolia some 40% of the population subsist below the poverty line.

Notwithstanding their enormous disparities – historical, economic, sociological, political, and cultural – the problem of worsening transport conditions has become a generic feature in urban Asian cities like Jakarta, Hanoi, Delhi, Mumbai, Metro Manila, Bangkok, Kuala Lumpur, and Beijing all exemplify the problems of staggering congestion (33). Transport planning lags behind and law enforcement is commonly neglected. Some features are:

- In Asia bicycles play a pivotal role, along with other non-motorised vehicles (NMVs) and motorcycles, in transporting people and goods.
- Non-motorised means of mobility are not planned for, and funding for construction and maintenance of footpaths, bus stops, and streetlights are severely restricted.
- A large proportion of women are dependent on public transport (formal and informal) which is often inefficient, uncomfortable, dirty, smelly, unreliable, poorly maintained, and sometimes also dangerous.
- Rates of traffic-generated air pollution and noise are soaring.
- High rates of traffic injuries and fatalities, the majority of which involve unprotected road-users: pedestrians, passengers (all ages) drivers of NMVs, or motorcyclists.

As for women’s transport needs, access to a variety of destinations is crucial to make it possible to cope with a mixed agenda and to keep up with social networks to provide for families. The costs of journeys and unsafe roads are often a strong deterrent for access.

Traffic and roads are usually less of a problem for men, whereas women state that roads do not meet their needs (34). Growing cities mean longer distances and more time on roads. Informal or newer areas often suffer from shortages of infrastructure and roads can be dangerous: too narrow, badly maintained; lack of drainage; lack of traffic management; and with a hazardous traffic mix. Road characteristics have a bearing on safety and security issues for women. In Shanghai 7.4 percent of urban space is used for roads, in Seoul 20, in Paris 25, whereas in Calcutta, Xian and Hanoi only 6 percent of all the space (4). In Dhaka, for instance 75 per cent of the people in the streets are men, which reflects the lack of safety and security for women (35). Hence, current conditions impede on equal access to the selection of resources in the city.

In some cities, men and women travel separately in taxis and public transport. The practices called ‘lady services’ or ‘the pink solution’ began more than a hundred years ago in New York City. Nowadays, they apply during rush hour on trains and buses and have spread to mega cities: Mexico City, Cairo, Tehran, Dhaka and Tokyo. The ‘pink solution’ is based on the gendered order and adopted to solve acute problems of harassments. However, it is an anti-equity solution that closes around the problems. Seemingly it does not bring about long-term changes based on an understanding of gender inequality as a relational and structural issue to be addressed through policy. This old practice can be seen as another expression of the masculine prevailing norm.

## **2.1 Public Transport: the women’s perspective**

Public transport is an environmentally friendly mode of mobility and a pillar of sustainable transport, as stressed in the reports from UNIPCC (8). The social parameters of public transport policies can be summarised in five As: Affordability, Availability, Acceptability, Accessibility (36) and Appropriateness (37). It is known that public transport can be a preferred mode by women whenever safe and secure. Views of appropriateness are related to local meanings and practices and might vary.

For passengers without travel choices, the so called ‘captive riders’, fare price, safety, security, reliability, information are crucial (37). Even if a bus stop is close-by it might not be reachable because of unsecure surroundings. Accessibility can also be low if bus stops offer no shelter in bad weather conditions, or if there is no seatings. Hence, accessibility is related to the overall transport environment, but it often begins with the public transport facilities themselves and how they interact with local perceptions of gendered mobility.

## **2.2 Some other problems on roads**

The travel patterns of low-income urban families are mainly shaped by their income, social activities and where they live. For instance, their travel behaviour often mirrors their occupations (formal, informal, part-time, unskilled jobs) (38). Sometimes families live in central slum areas to avoid spending time and money on work-related journeys. Because of their *modus vivendi* and structural discrimination, women and children in low-income families are more exposed to the risks when travelling or walking. And “[f]or a very large number of women in urban areas the constant threats, from verbal harassment to outright violence whenever they leave the home are an unwelcome reality” (1). Some women spend their days on dangerous roads as sales persons; cooking; working with road construction or cleaning the streets. Furthermore, their vulnerability is aggravated due to lack of nutrition, health preventive measures and health care. Roads are public arenas and

street life mirrors policy, planning, economic and social trends. Women's experience of daily traffic may include:

- Long travelling distances and long hours spent on roads;
- Heterogeneous modes of mobility;
- Shortage of walking space (no footpaths, zebra-crossings, signalisation) and vehicles parked on footpaths;
- Irregular bus and train services. Overcrowded vehicles; staggering congestion; careless drivers; dismal bus stops;
- No traffic priorities (lanes for buses, separation for NMVs or pedestrians);
- Routes not being synchronised and networks not fitting the re-location of activities;
- Exposure to humiliation and sexual harassment while travelling;
- Security issues: drug dealers and purse-snatchers;
- Excessive levels of noise and pollution (37).

Many of the risks that women experience in rapidly changing cities have disappeared in cities where policies and budgets are effective and a successful shift to reasonable traffic and transport conditions has been implemented.

### **3. POLICY FRAMEWORK**

This section focuses on discourses and policies in three areas: *Firstly*, the research which provides the analytical tools and methods to study women and gender issues; *secondly*, the financial institutions that fund systems for transport; and *thirdly*, the UN agencies that provide information, recommendations and influence state and international organisations working in gender and traffic and transportation. These three different perspectives act and interact with each other in asymmetric ways.

#### **3.1 Research perspectives in 'Gender and Development'**

In 1995, at the Fourth UN World Conference on Women in Beijing, President Zemin stated: "Attaching great importance to the development and advancement of women, we in China have made gender equality a basic state policy in promoting social development. ... We are resolutely against any form of discrimination against women" (39). A core idea then was how to conceptualise the nature of the problem that shaped unequal access and how to transform the positions of women relative to men. With this in mind measures were taken to integrate targeted projects and stand-alone initiatives that ignored the embeddedness of the issues in the local, cultural, political, economic and social relations. Later on an elaborated framework emerged including visions, needs and interests of women and men. Manifold studies by Kabeer (53); Moser (2, 9, 28, 40, 41) Roberts and Soederberg (42); Chant and Sweetman, (43) and many more contributed to a new paradigm called 'gender and development', GAD. These studies were based on equal rights of women and girls – regardless of age, or the extent or nature of their economic contribution. The participation, commitment and co-operation of men were seen as critical in transforming gender relations, as follows "[g]ender and development should also involve the inclusion of other social actors vital in supporting the empowerment of women – including, most importantly, men and boys" (42). Amongst other things GAD argues that structural inequality is a relational issue to be addressed by all stakeholders; institutions, governments and wider society (42). The transformation of unequal gender relations through the empowerment of both women and men means that "focus was not centred on women, but on the social, political and economic relations as well as the structures and processes that create, reinforce and sustain inequality on one hand, and, the result in different outcomes for both women and men on the other" (44). The underlying assumption of the GAD approach is that women as well as men may be privileged, or disadvantaged by social and economic structures, and a thorough understanding of women's as well as men's perceptions, position and scope for changing gender relations is seen as indispensable. The main objective is to bring gender issues to the centre stage in policy making.

The GAD approach recognizes that improvement in women's position requires analysis of the relations between women and men traffic and transport.

It underscores the need to understand the ways in which the unequal gender relations contribute to the extent and forms of exclusion of women in transport. To remove the barriers for continued development and

for women to participate in societies, the black box of women's experiences and demands will have to open up. The complexity of mobility can be broken down into a number of variables that interplay; social, cultural, age, relation to technical systems (vehicle ownership) environment and sustainability issues, all influencing gender and vice versa. The gender analysis of women's mobility practices, needs, priorities, opportunities and constraints as well as income, age, disabilities, ethnic minorities all will have to be surveyed in order to design well-informed policies (35). The character of the supply side and model for transport plans also needs to be analysed. The academic research has approaches and methods for in-depth research and capacity building on gendered mobility and to explore the geographical, cultural and economic aspects shaping transport conditions in different parts of the world. Furthermore, GAD "seeks to take account of the link between culture and development in particular to the cultural-specific forms of social inequality" (46).

According to scholars of international relations, the achievements at the Beijing conference were later on marginalised and excluded from the agenda with the introduction of MDGs and with the shift in 'aid modalities' putting a stronger focus on efficacy, and managerial and corporate to become policy oriented (14). Another explanation for the marginalisation of gender mainstreaming was offered by new security agenda after the post-9/11 regime and the War on Terror that affected large parts of the world (45).

We now turn to policy responses by some of the influential global economic and political actors.

### **3.2 Development bank policies**

Motorized mobility is a global transport business with huge global and economic institutions managing investments. In the years 2005 to 2009 the Asian Development Bank, ADB, invested 11.3 billion US dollars in Asia (46). However, in 2013 another 2.5 trillion US dollar investments were seen to be needed alone in Asia (47).

Policies to improve transport conditions for women have been launched, for instance:

"For the World Bank Group, promoting gender equality is a central component of fighting poverty. Therefore we need to focus on mainstreaming gender in non-social sectors that support shared growth ---such as infrastructure, energy and transport---and improve data collection to understand women's participation in these sectors. ... Creating opportunities for women is clearly smart economics" (48).

Funding of transport systems is highly valued since it spurs economic growth and development of cities and countries. Besides, suppressed access in cities due to shortage of transport is simply missed economic opportunities. So far, the cost of loss of production, city development and of constraint impeding on a higher quality of life for some 60 percent of urban population are not estimated. There are win-win initiatives with even greater welfare implications for poor families than for wealthy families (32). Good transport systems, safer and more secure travel exerts a positive impact on families and enables poverty reduction and improved life prospects for a huge number of women and low-income families.

In the MDGs empowerment is presented as a 'quick fix' and the prospects for achieving the MDGs are improved by enhancing gender equity. Hence there are close links between the reduction of both gender inequality and the various forms of poverty. The Human Development Index shows that developing countries with less gender inequality also tend to have lower poverty rates (49).

The World Bank policy targets poverty reduction directly by generating income-earning opportunities for the poor, and indirectly through meeting their basic needs. Transport projects are important policy instruments for poverty reduction and target the transport needs of the poor, and/or generate employment opportunities. In any of these ways, the project contributes to poverty reduction (50). But the ADB recognizes that investment policies are not sufficient to improve welfare: "we need complementary measures to help translate growth into better living standards. The way to do that is to include those on a lower income in the growth process" (32) and opens up for gender and equity policies.

In the ADB strategy for 2013-2020, gender equity was defined as a top driver of change to remove barriers and unleash the socio-economic benefits of public transport. Some 1.7 billion people in the region are poor and unable to access essential goods, services, assets and opportunities to which every human is entitled (32) Six out of ten of the world's poorest people are women (51) and they are less mobile than men in the same socio-economic group.

The 'Smart economics' by the World Bank simplifies gender issues and reduces women's roles in development to facilitate economic growth: "[w]omen are enlisted as foot soldiers to serve in battles whose aims are not related directly to their interests" (52). It was also dismissed as the 'business case for gender equality' (42). Such top-down initiatives neglect the complexity of gendered mobility and lack the relational and structural perspectives inherent in 'gender and development'.

Travelling is an enabler facilitating women's choices and, beyond the policies of financial institutions, remain the rights issues. The 'smart economics' was "concerned with building women's capacities in the interests of development rather than promoting women's rights for their own sake. ... Going forward, it is necessary to reassert the primacy of gender justice and rights in a manner which eschews the notion that it is only worth investing in women if they can 'fix the world'" (43). The notion of empowerment stresses the gendered divisions in urban mobility, and "[t]o be disempowered means to be denied choice, while empowerment refers to the processes by which those who have been denied the ability to make choices acquire such an ability" (53). The bank policies about women's issue in transport challenges the leadership and the ability to voice concerns and to exercise choice. The development banks suggest ways to view the role of women in societies and their policies become the litmus test for 'true' empowerment (52, 54).

### **3.3 The UN, the notion of sustainable transport and the Bali Declaration (47)**

In tackling challenges of rapid motorization and the dramatic increases in movements of goods and people, the modernisation of transport basically focused on technical and economic development. Sustainable transport developed as a discourse and the environmental, technical and economic aspects are more developed than topics related to gender and equal access. It is in the early stages of capacity building and implementation and 'the basic access needs of individuals and societies to be met safely' (55) awaits more attention to be consistent with ecosystem and health issues. Transport should be affordable, operate efficiently and offer a choice of transport mode, and support a vibrant economy (55). Equal access and gender mainstreaming is part of the agenda to improve safe and secure access for women.

In 2013 the UN Secretary-General, Mr Ban Ki-Moon, declared: "Transport is a key building block for sustainable development. Access to goods and services through efficient means of transport and connectivity is essential for poverty reduction. On a global scale it is essential to design and build safe and environmentally friendly transport infrastructure and to minimize vulnerability to climate change and natural disasters" (56). The UN goal is to bring about a paradigm shift in transport and mobility. The Bali Declaration (47) was the outcome of a process based on the understanding that the transport sector calls for zero tolerance towards congestion, pollution and road accidents. The declaration also called on countries to devise and implement appropriate policies, programmes and enforcement measures to protect their citizens, environment and property while strengthening the socio-economic sustainability in Asian countries. Topics include: a) Public health, b) Land-use planning, c) Environment- and people-friendly urban transport infrastructures, d) Public transport planning and transport demand management (TDM), e) Non-motorised transport (NMT), f) Social equity and gender perspectives, g) Road safety and maintenance, h) Strengthening roadside air quality monitoring and assessment, and, i) Strengthening the knowledge base, awareness, and public participation (57, 58).

The transition to environmental sustainability means that gendered mobility will have to be analysed in relation to environmental and technical aspects. There are gender differences in relation to both transport infrastructure and to eco-systems services as presented in 1.3. Therefore, by means of the methods of GAD, studies of how women and men interact with the physical environment; urban form, street design; city density; accessibility issues (distances and time) and how they relate to the local issues of sustainability (energy, pollution, climate) will bring added information. Gender issues will have to be further developed and strengthened. The concepts like empowerment, risks and agency can spur changes towards 'equal access' and the transition towards sustainable transport practices and policies as put forward by the UNIPCC (8).

## **4. CONCLUDING ANALYSIS**

The gendered mobility is intertwined with the future of cities and societies. The growing adversities and problems that women face in transport are recognised by the global and influential institutions. Several gender initiatives have been launched, but they never become top priority. Or as Marchand and other scholars of International Relations noted "[a]lthough gender mainstreaming is a major concern of the UN ... gender

specialists had to ensure that gender was being ‘mainstreamed’ into each of the MDGs (45) since it was excluded in the first version. The various levels of societal development are interlinked and improvements for women, families, parts of cities can make a difference for entire cities and countries.

The messages put forward by GAD, the World Bank and the UN bring us back to the question of a window of opportunity for gender mainstreaming or gender-sensitive policies through sustainable ways of defining traffic and transport conditions. The nexus between research, economic and political organisations shows that arguments for gender-sensitive policies in traffic and transport are already ‘on the table’. Although, the reason why varies from one stakeholder to another. The top-down international and national approaches target the economic role of women in poverty reduction, whereas the sustainability discourse stresses equity, social cohesion and livable cities.

Furthermore, the institutions and the concept of sustainable transport respond differently to ‘why’ and ‘how’ gender-sensitive policies should meet the women’s need for mobility. But the economic and political institutions, being global or national, do not respond well to local conditions and to the needs of women in the different socio-economic groups.

This overview concludes that the top-down initiatives to mainstream gender policies conflate, and that research can disentangle the role of women in development (and hence the mobility needs), women’s mobility patterns and the norms of gendered mobility. For instance, the GAD perspective is apt to inquire into the geographical and social variation around the world together with local views of women’s mobility. In this way GAD contributes with a critical reflection of women’s issues in transport. Whenever linked, the various contributions from research, financial institutions and political organisations interact, and move forward, gender-sensitive policies in the area of transport. In this way science and policy cross-fertilize and contribute to informed decisions.

Methods and tools to include travel experiences from around the world, local views on safety and security, comfort of female users defined by age, income, ethnic or religious groups and so on, in different geographical areas are already developed. Therefore, women’s empowerment, and to make visible demands through agency and voice is, more likely to bring about desired shifts in the long run than the practices of ‘the pink solutions’. A comprehensive understanding slowly finds a foothold, and the Bali Declaration (47) is unique in that it builds on a broad and societal transport development. Policy and planning based on new knowledge and capacity building can make a difference in cities with staggering transport problems, where women find it difficult to make a required journey and to provide for their families.

Different ways to operationalize policies build on societal, social or cultural structures and can always be shifted “to reflect a concern for more holistic ideas of human development (epitomised by Amartya Sen), rights-based development, or notions of human well-being and happiness” (59).

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# MOBILITY AND POLICY

## ***Mobility: identifying the gap and new trends***

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# Gender appraisal of mobility patterns and instances of exclusion for working population in Delhi

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## ABSTRACT

Internationally many studies have brought to light the differences in mobility patterns of men and women, but the nature and scale of differences however depend on continent, country, culture and context. Studies examining these differences are still scarce in India. The paper is based on an ongoing study undertaken by Central Road Research Institute (CRRI) and School of Planning and Architecture (SPA), Delhi. The project aims to understand if mobility differences, among male and female workers, are symptomatic of gender based transport exclusion.

The first part of the study explored how key mobility indicators vary for men and women belonging to the formal workforce. Comparisons were also made for respondents across the entire socio economic spectrum to understand how the interaction of gender and income impacted mobility. The second part of the study used these findings to diagnose instances of transport related exclusion among the female workforce of Delhi.

The study found that on an average, female respondents had limited access to private modes of transport, used slower modes of travel and their work-home distance was significantly less. Interestingly, these differences between males and females were found to be more significant in lower and middle-income households. The study also concluded that a cocktail of exclusions due to lack of time, opportunity, affordability, security and poor geographic location exists against women. These forms of exclusions, originally discussed by Church et al. (1) are interlinked and debilitate women, especially in lower and middle-income groups, from pursuing a better career.

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**KEYWORDS:** Gender; Economic status; Exclusion; Career.

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## INTRODUCTION

An increasing body of evidence suggests that men travel differently than women across the world. Various studies conducted worldwide have established that women travel differently than men (2, 3). It is well known through studies conducted in UK, US and Sweden that travel patterns for women are more complex, as trips made by women are shorter, more frequent and may include chaining in line with their diverse roles. However, these differences vary from continent to continent and culture to culture. In developing countries, these trends remain more of a tacit understanding, with evidence trickling in slowly. Rosenbloom and Fraissard (4) articulate

*'Our review of gender and travel in developed and developing countries reveals two versions of the same story, across time and space, women often have unequal access to better transport services, display very different travel patterns, and face more fear and anxiety in traveling than do comparable men. These differences reflect both cultural values and norms and the heavier family and sustenance obligations that women often assume or are assigned.'*

In developing countries, inequality between genders is evidently higher and so is the importance and absence of transport options. The role of urban women in India is changing and about one-fifth of them are engaged in paid work (5). International evidence suggests that when women take up paid work, the responsibilities at home do not get shared. Instead, their role expands and they end up taking a wide array of responsibilities both at work and home. While this situation may be easier to navigate for women who are better off financially, economically weaker women may be more severely excluded than their male counterparts. In India, a fast developing nation, with its ever-increasing gap between the rich and the poor, it would be safe to assume that mobility patterns would also vary greatly across the economic spectrum. Research by Anand (6) and Roy (7) has brought to light issues related to gendered mobility of the economically

weaker women. There is, however, a dearth of a comprehensive study of mobility of Indian women ranging from all economic classes, comparing them to their male counterparts. This study, through extensive surveys, will try to bridge that gap. This study attempts to question the 'obvious facts' regarding gendered mobility in urban India, specifically Delhi. In order to draw a fair comparison across genders, the study is limited to men and women with fixed income and jobs. The first part of the study checks if there is a significant difference between males and working females regarding trip lengths, travel time and mode choice for their work commute.

The second objective of the study was to unravel if and how transport related exclusions might be affecting working women in Delhi. The study questions how gender and economic status, together, create exclusionary circumstances for women. This exclusion puts the leashes of 'paucity of time', 'commute distance' and 'safety concerns' on the career of women and limits their choices in several ways. These dimensions of transport based exclusion have been discussed in detail in the paper.

## **BACKGROUND**

### ***Transportation Needs of Women***

In a study of an informal settlement in Delhi, Anand & Tiwari (6) concluded that 'women of lower-income households experience greater transport deprivations as compared with men.' She goes on to explain that these women are 'time poor' as they shoulder all household responsibilities and also use the most ineffective modes of travel. Roy (7) explores the 'relationship between gender, poverty, and spatial disadvantage'. She studies the case of the domestic workers of Calcutta for whom a ticketless daily commute in an overcrowded train is the only way to survive. These women, captive users of inefficient modes, form a substantial part of the informal workforce and earn the lowest wages. They are informal workers who shoulder all the responsibilities at home, do a full day's worth of backbreaking work to earn a livelihood and then take the long way home, dragged into a vicious trap. They are the worst affected in this environment and, most importantly, often do not have a choice. However there is another set of women whose capabilities are not so severely debilitated. Some of these women own private modes of travel, or aspire to do so, while they make their way home in a bus or metro. These women, who have fixed formal jobs and incomes, are the subjects of this study. Some of these women may even have substantial support in household duties with the availability of cheap labour from the previously discussed set of 'poor women'.

A recent study reports that Delhi has a car ownership level of 157 cars per 1,000 population, the highest in India (9). With average trip lengths catapulting upwards and sexual crimes against women being reported everyday in Delhi, use of public transport is challenging for women. Although improvements in public transport are trickling in, several problems such as lack of last mile connectivity, poor walking environment (10), and inequitable allocation of road space take the sheen off the sustainable options. Hence, a lot depends on how these working women wield their CHOICE to buy a car, soon or in the near future or never. Car ownership, the great middle class aspiration, is increasingly being seen as a 'necessity' in Delhi. In such an environment are working women seeing a car as the ultimate saviour of their honour, freedom and quality of life, making them more likely than their male counterparts to acquire one?

### ***Gendered Mobility and Exclusion***

Transport inequality and associated exclusion form a very important pillar of transportation research today. In her work Lucas (11) discusses how transport disadvantage and social disadvantage interact directly and indirectly to create a situation where certain services, life chances, goods, decisions or social networks are inaccessible to certain groups, thus creating instances of social exclusion. She talks about the role played by National Travel Surveys in identifying transport inequalities and links them back to poverty and backwardness. India, unfortunately has no system of National Travel Surveys, debilitating serious and consistent research in this subject. Church et al. (1) provide a conceptual framework for social exclusion and transport and group all factors into seven categories. The following section attempts to understand which of these factors could be applied for gendered mobility research in Delhi.

*Physical Exclusion:* Design of vehicles, fixed infrastructure and information barriers may not be usable by certain groups. Church explains that this usually affects people with serious physical limitations, cognitive

disabilities or language problems. As an example, the overcrowded buses of Delhi certainly present a serious test of muscle during peak hours often leaving women at a loss.

*Geographical Exclusion:* This type of exclusion occurs when people residing in isolated, peripheral or inaccessible locations find it difficult to participate fully in the socio-economic sphere. Lack of access to cars and a rickety public transport system could debilitate women from travelling far enough to take part in desired activities. Hence home to work distance could be considered an indicator of this type of exclusion.

*Exclusion from Facilities:* This type refers to how the distance of key facilities, such as shops, schools, health care or leisure services, from where a person lives prevents their access. This type of exclusion is a function of urban planning, access to private modes of transport and affordability for other modes.

*Economic Exclusion:* Certain groups may find travel unaffordable, hence limiting their chance to access opportunities and facilities. If household and personal income patterns and expenditure priorities are studied in detail there could be a few important lessons in economic exclusion of women.

*Time-based Exclusion:* This is probably the most discussed factor regarding transport exclusion in gender studies. It is a tacit understanding in India that women shoulder the majority of the household and child care duties. While some women may opt to hire support, in the form of cheap informal 'maids' or domestic workers, others grind woefully through the day. Either way these responsibilities reduce the time available for travel, hence creating a scenario of time poverty. This factor of exclusion may vary for women across the socio-economic spectrum and will be studied in detail in this paper.

*Fear-based Exclusion:* This is where fears for personal safety prohibit the use of transport services and public spaces. This factor is of specific relevance to our case study city of Delhi. There is a need to understand if the fear of venturing out at a certain time of day or using a certain mode of travel is seriously affecting the personal or professional lifestyle of women.

*Space Exclusion:* This type of exclusion occurs where certain parts of a city are inaccessible to certain groups. With the increasing role of private participation in the development of public and quasi-public spaces in Delhi, this is an emerging issue for those who 'do not fit in'. Gender inequalities have limited impact on such factors.

In the case of Delhi, geographic exclusion, economic exclusion, time based exclusion and fear based exclusion are specifically important.

## METHODOLOGY

In all 3,000 respondents were surveyed across Delhi. A team of twelve surveyors visited various types of offices and establishments and conducted one to one interviews with the respondents. Offices and establishments of all types, such as schools, hospitals, corporate offices, public offices, colleges, markets, salons etc., were chosen for survey spread across all the districts of Delhi. On an average 70% of the people approached agreed to participate in the survey.

Gender and income were the two key dependent factors considered in this study. Monthly household income was used as an indicator, as it gives the better picture of the economic status of an individual, especially in the case of married couples. The income categories chosen were as follows:

- <Rs 10,000
- Rs 10,000-25,000
- Rs 25,000-50,000
- Rs 50,000-80,000
- Rs 80,000-150,000
- >150,000

During analysis and discussion income categories up to 25,000 Rupees per month have been referred to as lower income category, 25-80,000 Rupees per month as middle-income category and over 80,000 Rupees per month as higher income category. This categorization has been done in accordance with the norms prevalent in economic research in the country. For comparison across six income categories and both the genders, all samples were divided into twelve subcategories. Equal number of samples was used for each subcategory to ensure a representative sample, reducing the sample size to 2400, from 3000. This may have led to under

representation of lower and middle-income groups and over representation of the high-income groups. Similarly, there may be an over representation of women in the survey sample since work force participation of women in formal workers is about 8 percent against a male average of over 70 percent. Yet, of the total number of 2,400 samples, 1,200 samples were collected for males and females respectively in order to get a wide sample and enough data for a dependable statistical analysis. When possible, care was taken to choose respondents from all subcategories in each office.

To avoid any bias in transportation connectivity, development density, policing activity and perceptions regarding security, data was collected from all nine districts of National Capital Territory of Delhi. In order to tap workers with varying travel needs, workplaces with fixed and flexible work hours were selected. All age categories ranging from 15 to 65 years were adequately represented in the sample (5). The survey was conducted using a very detailed questionnaire for the purpose of a wider research project. Only certain data items, as detailed below, were used for the purpose of this study.

#### *Personal and Family Characteristics*

- Age/Sex
- Monthly Household Income
- Private Vehicle Ownership
- Driving License Ownership
- Working hours-flexible or fixed
- Time spent on household chores

#### *Travel Characteristics- for Home to Work One Way Trip*

- Home Location
- Work Location
- Mode Used
- Commute Distance
- Commute Time

#### *Perceptions About Security*

- Locations or modes perceived as unsafe, instances of harassment
- Willingness to travel alone after dark
- Precautions taken by respondents
- What improvements would make the respondents feel safer

#### *Others*

- Does the length and quality of commute affect your quality of life?
- Have you declined/never tried for a job due to commuting distance?
- Do you plan to buy a car in the next one year/two years/five years/(never)?

## **EMPIRICAL RESULTS: DIFFERENCES IN MOBILITY PATTERNS AND EXCLUSION**

The comparisons in select mobility indicators have been made across the twelve gender and income sub-categories to understand travel trends across the socio economic spectrum for men and women. Any significant differences have been tested as symptoms of the four types of exclusions being discussed. In some cases, the causative factors behind these exclusions, whether cultural or policy-based, have also been discussed. The study tries to take the work of Church et al. (1) forward by analyzing how some of these exclusions may be linked with one another.

### ***Difference in access to private modes***

The access to private modes is a contentious issue. On the one hand, private modes are actively discouraged in planning discourse and to some degree in practice in India. On the other, even with a major overhaul of the bus system and a rapidly increasing metro network, private modes do actually promise more comfort, security and time efficiency in Delhi. Without doubt, access to private modes is an 'opportunity' many in Delhi strive for. Church et al. emphasize the low car availability of low-income households as a major factor

in their inability to access goods and services and participate fully in society. Studies by Buhr (12) and Heine and Mautz (13) prove, on the basis of qualitative studies, that the car allows women to achieve more autonomy, which is often a precondition for women to do any work besides their family work. The study compares car ownership, car use and number of driving license holders between male and female respondents.

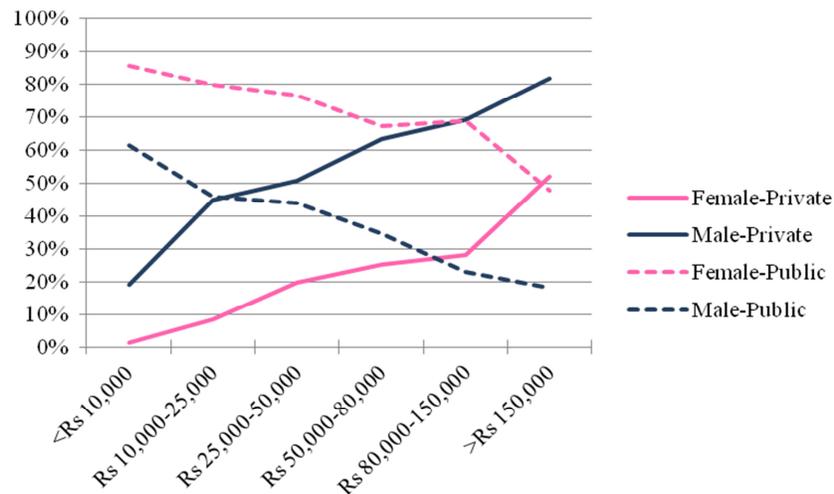
#### Mode Usage

In the study modes were divided into three categories:

- Private– including cars and two wheelers;
- Public– including bus, metro, auto;
- Non motorized transport (NMT)– including pure walking and cycle rickshaw trips.

A comparison of the mode usage for home to work trips across the gender and income categories revealed the following (see Figure 1):

- The use of private modes goes up for the higher income categories for both genders. Within all income categories, the percentage of women using private modes for home to work travel is significantly less than men.
- The difference in private vehicle use between men and women in the lower and middle-income groups is noteworthy (see Figure 1).
- The use of public transport is significantly less among males across all income categories.
- There is a marked difference in public and private mode usage due to the interaction of gender, and income category, income being the stronger influence. A two way ANOVA test returned very strong evidence corroborating that income affects the use of public modes ( $F = 127.6, p = 0.0005 < 0.05$ ). The test result also returned strong evidence suggesting that gender affects the use of public modes ( $F = 15.6, p = 0.011 < 0.1$ ). Similar significant results were seen for the use of private modes.



**FIGURE 1. Mode Used For Home to Work Trip**

- Use of non-motorized modes including walk and rickshaw trips is very low for both genders, but marginally higher for women.

Detailed analysis revealed that the higher percentage of private mode use among men could also be linked to the higher use of two wheelers. The use of two wheelers is very high among males in the income categories ranging from Rupees 10,000 to 80,000 per month. Use of two wheelers by women is very low. In Delhi, most of the two wheelers driven by men have engine sizes ranging from 100cc to 500cc. These motorcycles are affordable, easy to ply through traffic and ideal for a time and fuel-efficient long commute. The 'feminine' version of two wheelers, called scooties, have engine sizes ranging from 100cc to 200cc. Interestingly, not many women in Delhi use these scooties for their commute. These scooties are very popular among women in smaller towns and cities across India and provide women with mobility and freedom. The survey revealed that young women considered scooties unsafe, unsecure and uncomfortable for commuting in Delhi. Hence, these

women prefer to use public transport and graduate to using cars when they want to use a private mode of transport.

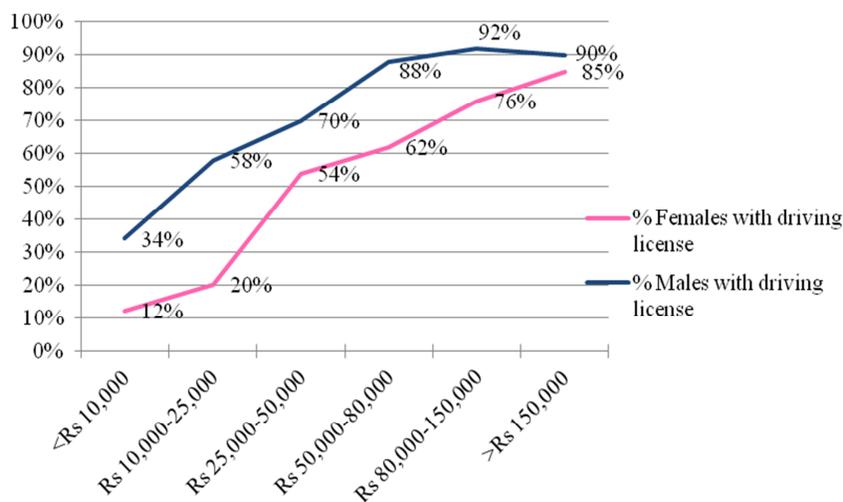
**Car Ownership vs Car Use**

Literature suggests that access to private modes of transport could be considered as an opportunity, specifically for women. This part of the study compared if women from car-owning households had equal access to cars for their work commute. 65% of males from car-owning households used cars as their commuting mode. On the other hand, only 26% of women from car-owning households used it for their daily commute, on an average. These figures indicate that in car-owning households, men are the primary users of the private vehicles. In many car-owning households women, even those who work and contribute to the household income, may be deprived of its use.

**Driving License**

The table below, showing percentage of respondents with valid driving licenses, reinforces the findings of the modal share displayed by the two gender categories. The following points can be concluded:

- A Two Way ANOVA test reported very strong evidence that both income ( $F = 20.35, p = 0.002 < 0.01$ ) and gender ( $F = 21.6, p = 0.006 < 0.01$ ) affect the likelihood of owning a driving license.
- Significantly lesser women own a valid driving license, especially in the lower and middle-income categories.
- On comparing Figure 1 and Figure 2 we find that, of all the driving license holders, only 2 in 7 women use cars for their work trips on an average. On the other hand, among males 2 in 3 male driving license holders use cars for their work trips.



**FIGURE 2. Respondents With a Valid Driving License**

**Exclusion due to lack of opportunity**

As discussed earlier access to private modes of transport could be considered an opportunity in a city like Delhi where the public transport system is significantly lacking comfort, safety and flexibility. The three indicators analysed above suggest that working women in Delhi do not have equal access to this opportunity due to various reasons. These findings resonate the trends reported by Rosenbloom et al. (4). In the lower income categories, it was seen that men found ‘motorcycles’ as their passport to cost effective and flexible mobility. The same was not true for women. In most tier-2 cities of India, scooties are the increasingly popular mode among working women. Hence, would it be too far fetched to say that the hostile nature of traffic in Delhi, and rising rate of crimes against women, are all acting together to keep Delhi women away from accessing a cost effective and environment friendly mode of transport?

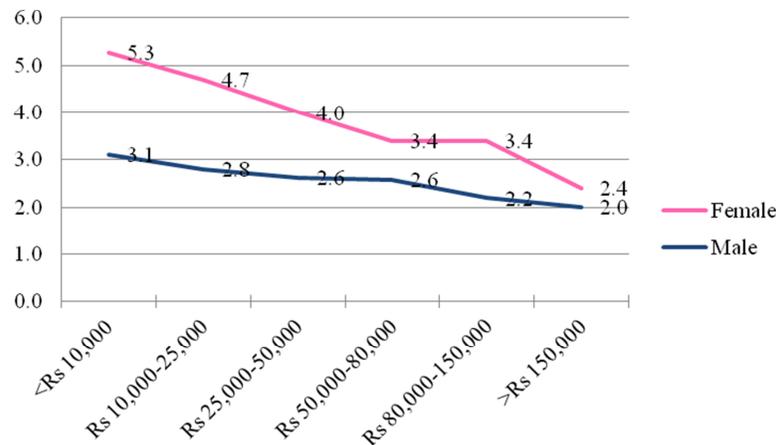
Even in households that could afford car ownership, only a quarter of women respondents used it for their work commute. On the other hand more than two thirds of the men from car-owning households were the

primary car users. Data revealed that, especially in lower and middle income household, which have single car ownership, men seem to be claiming right to the car. These working women contribute financially to running the household, but when it comes down to 'who will take the car today?' they end up commuting by bus. It can be concluded that these women suffer from exclusion from the opportunity to have a smoother, safer and quicker ride home.

### ***Difference in Travel Time***

On computing average one way commute distance and travel time across gender-income subcategories the following observations were made:

- In case of both gender categories, monthly household income has a very significant impact on the average travel time per kilometer. As the income goes up, travel time per kilometer goes down (Figure 3). A two way ANOVA revealed very strong evidence showing the interaction between income and average travel time per kilometer ( $F = 5.2, p = 0.002 < 0.01$ - 99% confidence).
- The travel times for study exclude time taken for trip chaining stops. Hence, on combining the findings of Figure 3 and Figure 1, we can safely conclude that any difference in travel time per kilometer is dependent upon the mode used and time taken for interchange.



**FIGURE 3. Travel Time (Minutes) per Kilometer**

- In general, women seem to be making slower trips than men. The two way ANOVA revealed suggestive evidence for interaction with gender ( $F = 0.22, p = 0.08 < 0.1$ , 90% confidence).
- Figure 3 shows that the data line for females is steeper. Hence, the impact of monthly household income on travel time per kilometer is more pronounced for women than men.
- The difference between average travel distance of men and women is more pronounced in the lower and middle income categories. This coincides with the higher use of public transport and non motorized modes by women in the lower and middle income categories as shown in Figure 1.

### ***Time-based Exclusion***

When we discuss time-based exclusion, there are two sides of the story to consider. The first is about the higher travel time per unit distance for women. This can be linked to the use of slower modes by women as discussed under 'exclusion due to opportunity'. Women, especially in lower and middle income groups, use more public transport than men. These modes are definitely slower than cars and require several interchanges and walking to and from stops. Hence, women are spending more time than men in the unpaid task of commuting. Crane (14) also reports similar differences in an American study where the difference in travel time varied by gender and ethnicity. He links this to modal split citing that, over the years, decrease in transit use among women has made their journeys faster.

The second face of time-based exclusion is about the availability of time for 'paid work'. Extensive research shows that women from dual earner households from across the world, even in the most egalitarian countries, are often loaded with the lion's share of household responsibilities, which seldom get shared (3, 15, 16). The

study questioned the respondents about the time they spend daily in household chores. No significant difference was found among various income groups. However, women spent 3.5 hours per day on household work while men spent only 1.5 hour on an average workday. Women respondents spent over 15 hours per day on office work, commuting and household work all combined together. For men this figure was also similar at 16 hours per day. This means that while women spent more time in unpaid tasks such as commuting and household work than men, they spent considerably less time at paid work. Due to the limitation of time these women also remain excluded from participating in better jobs that require them to work longer or travel longer. These women may not be able to maximize their earning potential as much as men. To corroborate this, we found that the number fixed one was significantly higher ( $\chi^2 = 54.8612, P = 0 < 0.01$ ). As opposed to 40% of the women respondents, only 26% of the males were engaged in flexible jobs. In addition to this, with a paucity of free time available, these women face a form of exclusion that limits them from pursuing leisure activities and affects their quality of life. Over 75% of the female respondents thought that the time and effort required by their work commute severely affects the quality of their life.

### ***Perception About Safety and Security***

Of late, Indian cities, specifically Delhi, have become infamous regarding unsafe travelling conditions for women. Local newspapers, replete with news about incidents ranging from 'eve-teasing' and 'chain-snatching' to severe crimes like rape with commuting women, are bound to affect the female psyche. The survey revealed that:

- Over 90% of women respondents had experienced some form of harassment while travelling.
- On an average only 15 percent of the women respondents are willing to travel alone after dark in Delhi. This is significantly less than 92% of men who are willing to travel alone after dark. 28 percent of women would consider traveling alone after dark 'only if necessary', while 57 percent of women do not travel alone after dark. Willingness to travel alone after dark was marginally higher among women from higher income categories, probably due to higher use of car as the mode of transport.
- 82 percent of women feel that they need to dress differently when they take public transport. This includes dressing more conservatively and avoiding wearing expensive jewelry items. Detailed talks with respondents revealed that they do this to avoid undue attention from stalkers, eve-teasers and potential 'chain snatchers'-all of whom are common nuisance factors on Delhi roads. On the other hand, only 18% of men feel the need to dress differently when they take the public transport. The freedom to choose the way we dress without fear is a basic right, which all should be able to enjoy. Any system which does not allow a certain section of people to do so, is exclusionary.
- The survey revealed that over 65% of the women take some form of precautionary measure to 'be safe' during their commute. These attempts include keeping a can of pepper spray handy, travelling with small knives in their handbags and, very surprisingly, sporting long and sharp nails for self defence.

### ***Fear Based Exclusion***

If the fear of getting stalked, robbed, stared at, commented upon, groped or raped keeps women from travelling longer distances and wearing what they like, freely during the day and evening, to all areas of the city, we can conclude that this form of exclusion is occurring. Women, especially in Delhi, are so attuned to the idea of taking measures to ensure their personal safety that the same becomes a critical factor in making decisions about their career and the commute it requires. Literature suggests that security concerns may limit women from using certain transit services (3). Although this study does not provide enough evidence to conclude this, many women may be purging certain job options specifically because of safety concerns related to commuting. This may be leading to a situation of fear-based exclusion that then gets combined with all the other forms of transport-based exclusion.

### ***Home to Work Distance***

A cross tabulation of home to work distance was done for males and females across the six income categories. Figure 4 below shows the average distance from home to work computed for each gender cross tabulated against the monthly household income categories. It revealed that the average distance between workplace and home ranged from 6.0 to 14.1 kilometers for women, from the poorest to the wealthiest households respectively. For male respondents, the average distance ranged from 10.1 to 14.8 kilometers.

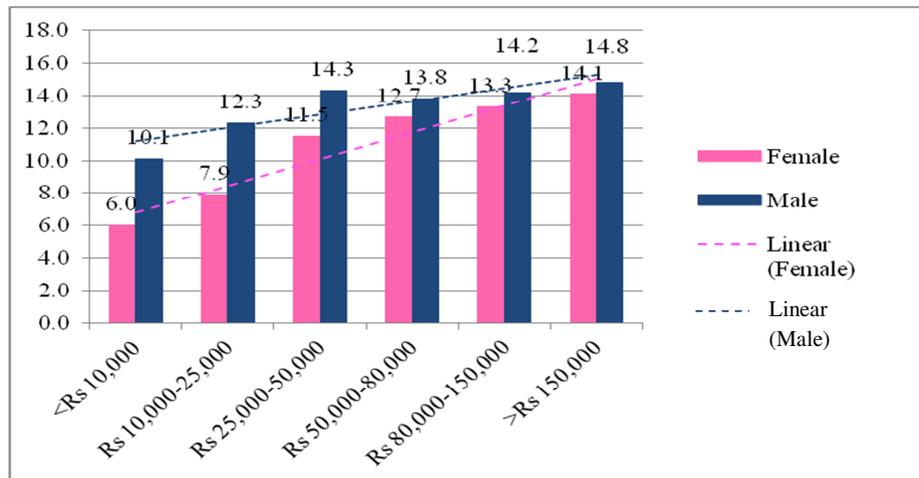


FIGURE 1. Average Distances for Home to Work Trip (In Kilometers)

A two-way ANOVA test was run to find whether (and how) the distance from home to work depended upon gender and household income. It showed that there is very strong evidence that the distance depended upon household income ( $p = 0.009 < 0.01$ ). However, it also showed that moderate evidence existed to suggest that home to work distance is not independent of gender ( $p = 0.03 < 0.05$ ). Hence, men seem to be making longer work trips than women. As the work distance statistic for women respondents show a greater variance than their male counterparts, we can conclude that change in financial condition of the household has a greater impact on women.

#### Geographic Exclusion

This trend is a symptom of geographic exclusion of women, specifically women belonging to lower income categories. Church et al. (1) enunciate that distance travelled is a valid indicator of transport related exclusion. This form of exclusion debilitates women from participating in job locations farther way from home. In order to derive conclusive evidence regarding this form of exclusion, respondents were asked if they had ever declined or given up a better job because of the commute distance. The study results show that the instances of declining a job due to commuting distance were significantly higher among women ( $\chi^2$  (df = 2, N = 2400) = 249.35,  $p = 0 < 0.01$ ). While over 70% of the female respondents had at some point in their life declined or given up a better job due to commuting distance, only 40% of males had to do the same. This strongly proves that geographic exclusion may be a reality for many women. The results also show that this form of exclusion is higher for lower income women, possibly because:

- less available money to choose more efficient modes to increase their radius of movement;
- lack of time, due to heavy household responsibilities, to commute farther; and
- greater security concerns as they travel by public modes making them more vulnerable.

## IN CONCLUSION

The mobility patterns of men and women are a reflection of their social position. In the strictly patriarchal society like Delhi, the study found a marked difference between the two sexes in terms of modes used, length of commute and average time spent per kilometer. The impact of monthly household income on all three indicators was found to be significant. The impact of income was more pronounced in the case of women than in the case of men. Although women in higher income categories have mobility patterns that are not very different from their male counterparts, these differences get magnified in the case of lower and middle-income households. Women with higher incomes are able to break the cultural clichés and exert their rights. These women enjoy lives not very different than their male counterparts. They possess the freedom to travel longer distances to work their desired jobs and move around efficiently and safely.

In order to understand the impact of gender and income on transport-related exclusion, we need to qualify what we mean by exclusion here. Exclusion would mean not getting to do what you want to do because you are a woman. It would mean not being able to participate in life, society and the world as a whole person.

Rather, your participation is limited due to factors governed beyond your control. It would mean that, while another person may be enjoying every freedom and possibility, you have only limited options because you wear a skirt, or are primary caregivers of your kids or have to cook the dinner.

When it comes to easy mobility, there is no doubt that personal modes of transport are better than the public transport options in Delhi. Hence, limited access to personal modes of transport would mean limited mobility. Women, especially those in lower and middle income households, remain excluded from exercising control on time efficient mobility resources' aka the family car. Households with two wheelers also see them being used primarily by men for their commute. The additional excluding factors in this case are safety and security concerns. The masculine motorbikes suitable for Delhi's traffic and flyover ridden terrain are difficult for women to ride. Women friendly two wheelers, locally called 'scooties', are considered unsafe by women of Delhi. In effect, due to these factors, women remain excluded from using flexible and time efficient modes of travel. This in turn breeds other forms of exclusion.

With women in low and middle income groups using less time efficient modes, as discussed above, they end up spending more time in public transport, or waiting for their spouses to pick them up. The study also revealed how women in low and middle income groups spend significantly more time in domestic work. With the combination of these two factors, these women may be having less time available, excluding them from opportunities to engage in paid work and personal recreation.

Owing to less available time and use of less efficient modes, it is not surprising that women are not able to travel as far as men do for work. It is interesting how the gap between distance travelled between men and women reduces as we move up the economic ladder. Hence, women in the low and middle income group are able to travel only shorter distances which, in turn, limits their career options. This is reinforced by the fact that a significantly higher percentage of women in the lower and middle income groups have given up or not considered better job options owing to commuting woes. This clearly shows how transport related exclusion may be leading to exclusion from desirable economic activity for women. Similarly security concerns regarding travelling alone after dark may be excluding women from jobs and activities that require extended work hours and travelling freely to areas not perceived safe.

A careful scrutiny of the indicators of the four types of exclusion discussed above reveals that these exclusions are interlinked. For example, women may be travelling shorter distances due to paucity of time and lack of availability of car. On the flip side, women may not be able to claim their right on the sole car of the household, as their work place is closer to home. Some women may be spending more time on the unpaid task of commuting as they may be taking the bus, which they perceive to be safer and more secure than using a scooty in Delhi. Each link between these various forms of exclusion are worth exploring and need detailed research. A cocktail of these factors severely debilitates women and limits their working potential, especially in the lower and middle-income groups. Data corroborates this, as a significantly higher percentage of women (than men) have given up better careers to stay close to their homes.

Several factors may be exacerbating transport related exclusion of women. Does a certain section of women put their domestic identities before any professional ambitions? Is gender based, transport related exclusion worsened by the patriarchal family structure and unquestioned supremacy that males enjoy in certain households? In addition to this, the ideals of women regarding their 'most important role', whether professional or personal, may also be affecting their decisions to travel less. Although not discussed in this paper, it would be interesting to see how these factors differ from culture to culture.

Research shows that over the years, car ownership among women has risen very quickly, sometimes even faster than men (17). Even in India, as the female automobile consumer is an emerging market with infinite demand. With double incomes, easier car loans and snail-paced improvements in transit services women seem eager to buy their own cars (9, 15). Our study results revealed that over 65% of female respondents (against 56% male respondents) in the lower and middle-income categories aim to buy their own four-wheeler in the next two years. If this is true, Delhi is sitting on a congestion time bomb! With the National Urban Transport Policy of India pushing to 'move people, not vehicles', efforts are afoot in Urban India to limit the rise in private car use. This is the time of change in India, when millions are being pumped into public infrastructure such as Metro and Bus Rapid Transit systems. It is important, if men and women have specific transportation needs, they are met and met quickly.

## NOTE

1 Euro = 81.53 Indian Rupees as on 14 July 2014.

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# Dynamics of car ownership and its use in France since the seventies: A gender analysis

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## ABSTRACT

Until the mid-70s the motorization was increased in France by household equipment (most generally with one car per household); since then it's the multi-equipment of the households that also goes with the individualization of the car use. Our analyses show the relationship between the pay employment and the motorization and the car use. Multi-adult (with a pay activity) households tend to be multi-motorized. In terms of car-use, the female still makes less mileage than the male but the gap between genders tends to decrease with the young generation. Our analyses are based on the French National Travel Surveys (FNTS). These surveys were conducted on five occasions between 1966 and 2007, giving five different pictures of mobility and car ownership for French households, allowing detailed analyses over the period 1973-2007 from the four most recent surveys, which were restored and standardized. The definitions and principles of these surveys have not been modified since the outset, which makes the measurement of structural changes easier.

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**KEYWORDS:** Dynamics; Car ownership; Car use; French National Travel Surveys.

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## INTRODUCTION

The diffusion of the household equipment in vehicles in the twentieth century explains part of the growth of the fleet. The demographic context in France also played a role in this evolution. For example, France's rural areas have witnessed a demographic upturn since the 1975 census (1). At first, it seemed that this movement affected only rural zones close to large towns. But the 1999 census revealed that there was also a positive migration balance towards isolated rural areas (2). Furthermore, it may be noted that the migratory balance has compensated the natural balance since 1975 (1).

Indeed, the increasing number of vehicles is also explained by the augmentation of: the number of households, the number of people of driving age and the rate of driving license holders. The dissemination of driving licenses according to gender and age and unequal access to driving licenses shall be dealt with.

By using an automobile more frequently to get to work, and because it represents a large share of commuting trips in number and distance, we chose to examine the effect of evolution of the household motorization on trips from home to work according to gender.

Our analyses are based on the series of the French National Travel Surveys (FNTS) conducted since the mid-70s.

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## **FRENCH NATIONAL TRAVEL SURVEY**

The knowledge of mobility in France is in part based on National Travel Surveys (NTS). These surveys have been conducted five times (1966-67, 1973-74, 1981-82, 1993-94 and 2007-08), which gives five snapshots of the situation regarding mobility and the car fleet for French households. The definitions and principles of these surveys have not been modified since the outset, which makes the measurement of structural changes easier (3).

This survey is the only French survey of mobility of a compulsory nature, and which surveys people living throughout mainland France about their daily, regular and long distance mobility. The ENT-D is the only national survey which describes all trips, regardless of their motivation, links, duration, mode of transport, the hour of departure and arrival, as well as the period in the year and the time of day. These surveys are conducted every 10 years by the Ministry responsible for transport with IFSTTAR (formerly INRETS).

The objective of the French NTS is the knowledge of households' trips and use of both public and private transport means. The NTS is the only survey in France that describes all household trips, whatever their purpose, length, mode, season or time of day may be. These surveys also emphasize the knowledge of the vehicle fleet, individuals' use of and access to public transport (including season tickets and discounted fares). These data are used in the present study.

## **THE DEMOCRATIZATION OF DRIVING LICENSE: MORE AND MORE WOMEN**

In France, the number of people holding a driving license underwent rapid growth, from 17.3 million in 1973 to 39 million owners in 2007. The number of owners increased an average of 1.9% annually for men and 3% annually for women in the period 1973-2007. The driving license has now become an essential requirement for social and professional life (4), but not all people are equal in terms of obtaining a license. A low level of education, reduced activity, low incomes and the increase in prices of driving instruction in recent years may be considered as obstacles to obtaining a driving license. Gender inequalities are not to be excluded and have existed since the creation of the driving license. If the introduction of the "certificate of capacity"<sup>24</sup> by the prefect of Paris Louis LEPINE in 1893 was once reserved exclusively for men<sup>25</sup>, there are more and more women who have a driving license in the last forty years: 38.9% of driving license holders were women in 1973 and 48.2% in 2007. Holding a driving license concerns generations: the younger the generation, the higher the number of driving license holders. But is the main cause of access to driving licenses always to do with generational issues? Can we observe an age effect in recent years?

Since the mid-sixties, the number of driving license holders has been on the rise. It was 41% in 1966 and doubled in 2007 to over 83% of people older than 18 years. The proportion of men holding a driving license is higher than women. About 70% of men held a license in 1973 and over 91% in 2007. But the major fact concerns the difference in variation between genders: this has reduced over the years from more than 37 points in 1973 to 15 points in 2007. Just over 32% of women held a license in 1973 and over 76% in 2007. The rate of the total number of people with a driving license by age is still higher for men in all periods and all ages. Gender differences are tending to fade, but men continue to represent the greater proportion.

The fact that only males are compelled to undertake military service may explain, in part, such a discrimination. During their service, young men could obtain a certificate of military conduct for free. This certificate was automatically converted into a driving license when the men returned to civilian life. After November 1997, marking the end of compulsory military service in France, a decrease in driving license holders among young men was pointed out, especially among the poorest and those living in rural areas (5). We also recorded this phenomenon through the study of national transport surveys. Access to driving licenses increases at all ages for both sexes with time, with one exception however. Young men were less likely in 2007 to have their driving license in comparison to 1993: down 1.6 point for men aged 18 to 24 and down 1.4 point for those aged 25 to 34.

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<sup>24</sup> The terms "certificate of capacity" have been replaced by "driver's license" in 1922 with the appearance of the traffic police and the highway code.

<sup>25</sup> Women will have access to the certificate of capacity in 1897.

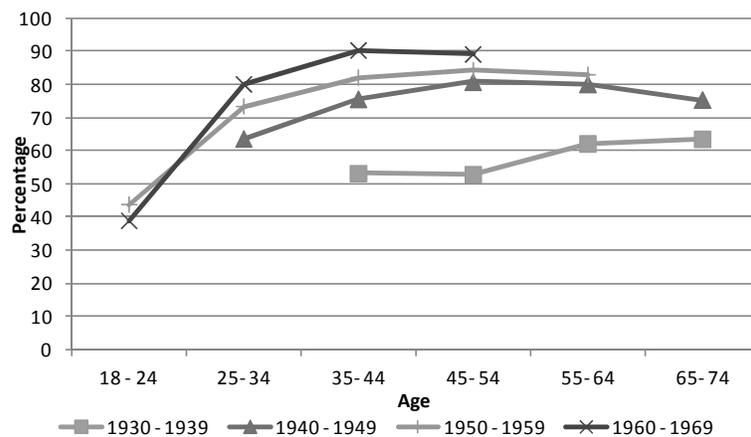
A longitudinal study by gender clearly suggests that access to driving licenses has evolved in various ways for both. The oldest cohorts of men are subject to a generational effect. The latter has given way to an age effect since the most recent cohorts merge (Figure 1). For women (Figure 2), at same age, the curves of the most recent generations are above the previous one, showing an effect of generation: the rate of driving license by age increases at each age for each generation.

For men, the rate of people holding a driving license is now mainly influenced by an age effect rather than a generational effect. For women, this rate is still dominated by a generational effect. We can note, however, that gender differences in rates of driving by age tend to decline with the most recent generations. Longitudinal analysis also shows lower rates of driving license under 25 years: the cohort 1960-69 at a rate lower than the cohort 1950-59.



**FIGURE 1. Changes in the rate of driving license holders by age and birth cohort, all surveys combined – Male**

Sources: INSEE, SOeS, IFSTTAR-DEST, National Travel Surveys of 1973, 1981, 1993 and 2007.



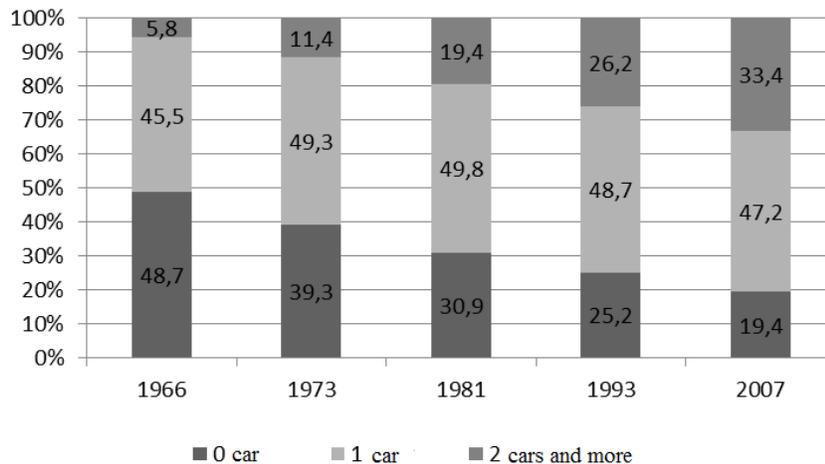
**FIGURE 2. Changes in the rate of driving license holders by age and birth cohort, all surveys combined – Female**

Sources: INSEE, SOeS, IFSTTAR-DEST, National Travel Surveys of 1973, 1981, 1993 and 2007.

The decrease in the age to obtaining a driving license, and the increase in the proportion of driving license holders in recent decades, are two phenomena that can be found for both genders. However, the amplitude of the phenomena is not the same for both genders. More men have their driving license and get it on average younger than women at all ages.

## THE PAID EMPLOYMENT OF WOMEN PARTICIPATE TO THE MULTI-EQUIPMENT OF THE HOUSEHOLD

Cars have penetrated our lifestyle in the last century. Household motorization is marked by two major evolutions (Figure 3). The first is linked with the acquisition or not of a car by the household. In 1966, slightly more than half of households had a car. This proportion is more than 80% in 2007. Motorization had a strong growth in the 60s and 70s. The new generations have replaced progressively older generations who had less access to the car and driving licenses. The second evolution is linked with the number of cars available in each household. The proportion of multi-car households increases continuously. In 1966, less than 6% of households had at least two cars. In France, multi-equipment experienced its strongest growth in the 1970s. Today, more than a third of households have at least two cars.



**FIGURE 3. Evolution of car-ownership by households**

Source: INSEE, SOeS, IFSTTAR-DEST, National Travel Surveys of 1973, 1981, 1993 and 2007 et (6)

The area of residence is the first cause of motorization of the household. The likelihood of having a vehicle is much lower when the residence area is densely populated (7). In 2007, the number of adults in the household and area of residence are priority elements taken into account by the household for having another vehicle in the household (7). The number of cars is more dependent on the number of assets in the household than the number of adults, the first having evolved over the past forty years. In 1973, 38% of households were composed of only one active against 29% in 2007. Two reasons explain this decline over time. Firstly, the increase of women in labor fosters the increase in the number of assets in the household (31% of households were composed of two assets in 1973 against 35% in 2007) and secondly, the proportion of households without assets increases due to the aging of the population (25% of households had zero assets in 1973 against 32% in 2007). The increase in paid employment of women and urban sprawl participated in multi-equipment households.

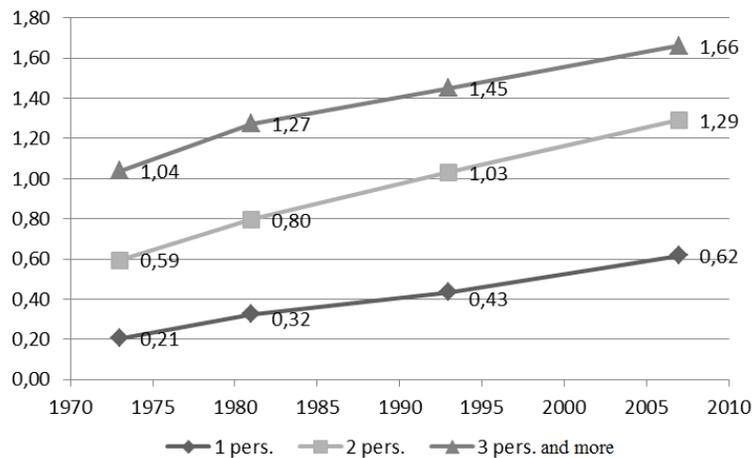
In addition, the dual activity of the couple, and the remoteness of the place of home to work, have fostered the purchase of a car for the wife to manage activities at home and go to her workplace.

## PERSONS ALONE ARE MORE AND MORE MOTORIZED

The larger the household the greater the average number of vehicles per household is important (Figure 4). Since 1973, the average number of cars per household, whatever its size, has increased. Over the period 1981 to 2007, the average number of cars per household has increased by 0.3 point, for one-person households and 0.6 for those of two persons and three persons and more. However, given the initial levels, the single-person households have the highest growth rates between these 2 dates: 90% of the overall of the period against 63% for two persons households and 31% for larger households size.

Since 1973, the population of single-person households has evolved<sup>26</sup>, in the same time that the lifestyles, which may explain the significant increase of the average number of vehicles for these households.

The evolution of the ratio "number of vehicles" to "number of people in the household" shows that whatever the size of the household, cars are used less collectively by their members. We see the same result with the ratio "number of vehicles" to "number of adults in the household". The measurement of the occupancy rate<sup>27</sup> of vehicles for trips from Monday to Friday is also in decrease. With French National Travel Surveys, Quetelard (8) showed that this rate was stable in 1981 and 1993 with 1.32 persons per car, but decreased in 2007 with 1.22 persons per car. The car, which was previously a family transport mode, tends towards a use more and more individualized.



**FIGURE 4. Average number of cars per household by household size at different period**

Source: INSEE, SOeS, IFSTTAR-DEST, National Travel Surveys of 1973, 1981, 1993 and 2007.

The analysis of rate of car ownership per household type (Table 1) reveals two distinct groups: households with a couple, where the rate of car ownership is much higher than one car (only since 1993 for childless couples) and households with one adult (single-person or single parent), where the rate of car ownership is less than one car per household.

When the household reference person is a woman, a household is much less likely to be equipped with cars compared to a man (0.65 car by household against 1.40 for men in 2007). One reason is that the average size of households with a reference person "woman" is smaller compared to a reference person "man": 1.5 against 2.6 in 2007. 70% of women, who are the head of their households, live in a one-person household, and 15% in a single-parent family, the latter being more motorized than women alone. It could be explained by the under-motorization of women in general and by an age effect. Women alone (because of widowhood in particular) are mainly older than 55 years. Even though their motorization increased with time and the renewal of generations, these women are less motorized compared to women alone aged between 25 and 54 years.

<sup>26</sup> According to national travel surveys, in 1973, the typical profile of a person living alone was a woman, her average age was about 60 years old, retired and widowed. In 2007, the typical profile of a single person is a female, her average age is over 54, active and single.

<sup>27</sup> The measurement of the occupancy rate is defined as the number of trips made by car divided by the number of trips made by car as a driver.

**TABLE 1. Evolution of the rate of motorization per 100 households, according to the type of household**

	1973	1981	1993	2007
Person alone	20,6	32,5	43,5	61,7
Childless couple	61,9	85,0	108,7	137,8
Couple with a child	100,9	125,8	148,7	174,4
Couple with 2 children	108,6	137,2	158,5	177,4
Couple with 3 children and more	104,6	128,7	142,4	168,6
One-parent family	NS	NS	80,9	91,6
Other cases	96,2	99,7	119,6	135,0
Ensemble	73,5	90,9	104,7	119,9

NS = not significant. Source: INSEE, SOeS, IFSTTAR-DEST, National Travel Surveys of 1973, 1981, 1993 and 2007.

## THE MOTORIZATION RATE ACCORDING TO THE HOUSEHOLD LOCATION

Motorization has increased for households in peri-urban areas, and predominantly rural areas outside Ile-de-France, with an annual average growth between 1981 and 2007 ranging from about 1% to just over 2% by area of residence (Table 2).

Outside Ile-de-France, households in predominantly rural areas are less motorized than households in peri-urban communes. This may be explained by the age structure of the population, which is the main cause. People of less than 65 years tend to live in more suburban communities, and people of 65 years and over live predominantly in rural areas.

The distinction “downtown or suburban” and “rural town” brings us additional information: residents of rural communities have a motorization rate higher than the inhabitants of the inner city suburbs or whatever the dominant space. This is due to a lack of supply of transit services and more scattered in sparsely populated areas. The same goes for the Ile-de-France: the more we move away from Paris, the more people are motorized. Our results reflect here what is called the “car dependency”.

From 1981 until now, the majority of households own only one car, whatever their area of residence. However, two exceptions: Parisians and inhabitants of suburban towns outside Ile-de-France. Parisians are those who least often have a vehicle available in their household. Since 1990, Parisians seem to sell their vehicles. Almost 6 out of 10 Parisian households do not have a vehicle in 2007. Residents of peri-urban towns outside Ile-de-France have the opposite strategy of household equipment in vehicles. From 1981 until now, they increased their rate of motorization. In 2007, it was more common for peri-urban households to have two or more cars than only one. The main reason is that vehicles in those areas are necessary to reach work or facilities. Public transport networks are indeed less developed than in urban centers.

Households in the suburbs of Paris have a motorization rate virtually unchanged since 1981: between 0.8 and 0.9 vehicles per household. The distribution of the number of vehicles per household is also, stable, nearly one-third do not have a particular vehicle, half have a single vehicle and the rest of the households two or more vehicles.

Area of residence plays an important role in household equipment in passenger cars. Over the population, density of the area of residence is low, most often in households with a car or more. Household car ownership is also related to the supply of public transport available near the place of residence. This offer decreases as we move away from city center, so households tend to be equipped with one or more vehicles based on the distance of their residence from the city center (9). The engine also depends on household size, because the size of households living on the edge is larger than that of households residing in the center.

We also note since 1993 a decrease of motorization rates in Paris and suburbs, as well as a slight slowdown in the spread of the automobile in greater Paris, and in small suburban towns outside Ile-de-France.

**TABLE 2. Rate of motorization in private cars for 100 households according to the residential areas. (considering the same statistical zoning from 1999)**

Residential area	1981	1993	2007	Average evolution 1981-93	Average evolution 1993-07
Île-de-France					
Paris	56,7	61,8	49,0	0,73%	-1,64%
Inner suburb	83,0	89,7	87,0	0,63%	-0,22%
Suburb	104,2	115,0	126,3	0,81%	0,67 %
Urban area without the Paris area					
Pôle urbain					
Urban center	85,8	92,2	98,6	0,60%	0,48%
Suburb	102,0	115,7	131,0	1,06%	0,89%
Monopolarized town					
Urban center and suburb	104,0	123,9	153,1	1,47%	1,53%
Rural town	106,6	130,7	157,9	1,72%	1,36%
Multipolarized town					
Urban center and suburb	90,4	118,5	135,7	2,28%	0,97%
Rural town	93,5	123,1	157,7	2,32%	1,78%
Rural areas without the Paris region					
Urban center and suburb	90,4	105,8	116,5	1,32%	0,69%
Rural town	91,5	109,5	138,1	1,51%	1,68%

Field: All the households, private vehicles. Source: INSEE, SOeS, IFSTTAR-DEST, French National Travel Surveys 1981, 1993, and 2007.

## YOUNG SINGLE MOTORIZED WOMEN TRAVEL ON AVERAGE ALMOST AS MANY KILOMETERS AS YOUNG SINGLE MOTORIZED MEN IN 2007

Between 1973 and 2007, the number of cars has increased substantially causing logically with this a strong increase in the circulation of the whole fleet (2.9% per year for the summation of the mileage of all cars) (Table 3), the most important increase of between 1982 and 1993 (4.1% per year). This increase has an impact on the average annual mileage per household and per household equipped. In contrast, the average annual mileage per car is subject to variations more or less strong. The oil crises of 1973 and 1979, causing the rise in oil prices, largely explain the lower average annual mileage per car between 1973 and 1982. The increase of mileage between 1982 and 1993 can be attributed to the decline in oil prices during the oil countershock occurring in 1986. But since 1993, we observe a decline in the average annual mileage per car, which can be explained by the increase in fuel costs, but also by the development of multi-motorization, individualization of the vehicle and the increasing number and types of use restrictions on the car.

**TABLE 3. Evolution of the average annual mileage per car**

Mileage ...	1973	1982	1993	2007
... of the whole fleet (billions of km)	149	197	305	390
... average per household (km)	8565	10111	13354	14683
... average per household equipped (km)	14109	14626	17848	18209
... average per car (km)	11659	11117	12751	12289

Field: all cars (used and non-used) available in the households.

Source: INSEE, SOeS, IFSTTAR-DEST, French National Travel Surveys of 1973, 1981, 1993 and 2007.

Whatever the year, couples with child(ren) travel on average more kilometers than other types of households (Table 4). Then follow childless couples, one-parent families and persons alone (men alone travel an average more kilometers than women alone, and whatever the age). The low mileage observed for one-parent families and persons alone is due to the fact that the average takes into account the households non-equipped with a car. But these two types of households have the lowest rates of car ownership.

The distinction with the average kilometers per household equipped highlights several heterogeneous populations that the general average hides, especially among persons alone and one-parent families (Table 5). We see that one-parent families travel on average almost as many kilometers as childless couples (except in 2007). In 2007, women less than 34 travel on average almost as many kilometers as men at the same age. With

increasing age, the differences are more important. It could be explained by an age effect. Young women alone use their car more in 2007 than previous generations who had a car later in their household. Women under 35 years in 2007 will likely use their car more in the advanced ages than women 50 and more in 2007.

**TABLE 4. Evolution of the average annual mileage per car, according to the type of household**

Average mileage per household (km)	1973	1982	1993	2007
Person alone...	2466	3602	4962	6619
...Man	4927	6755	7609	8604
...Woman	1310	1962	3412	5295
...Man - Less than 34 years	10285	9459	9691	8585
...Man - Between 35 et 49 years	5208	9755	8761	9667
...Man - 50 years and more	1993	3655	5572	7927
...Woman - Less than 34 years	5966	7331	6616	8080
...Woman - Between 35 et 49 years	4582	5428	8957	7859
...Woman - 50 years and more	412	681	1910	4037
Childless couple	6893	8670	12725	16072
Couple with child(ren)	12605	15156	20667	23408
One-parent family	5811	6988	10125	10816

Field: all cars (used and non-used) available in the households. Source: INSEE, SOeS, IFSTTAR-DEST, French National Travel Surveys of 1973, 1981, 1993 and 2007.

**TABLE 5. Evolution of the average annual mileage per car, according to the type of household equipped with a car or more**

Average mileage per household equipped (km)	1973	1982	1993	2007
Person alone...	12198	11409	11721	11364
...Man	12904	12975	13231	13148
...Woman	11122	9379	10201	9909
...Man - Less than 34 years	17909	15346	16095	14331
...Man - Between 35 et 49 years	10262	15348	14017	13865
...Man - 50 years and more	8670	8965	10501	11957
...Woman - Less than 34 years	14744	11903	12495	13312
...Woman - Between 35 et 49 years	11875	9607	12872	11518
...Woman - 50 years and more	7312	6454	7955	8294
Childless couple	12221	12014	15150	17404
Couple with child(ren)	15080	16676	21938	24306
One-parent family	12210	12599	15349	14642

Field: all cars (used and non-used) available in the households.

Source: INSEE, SOeS, IFSTTAR-DEST, French National Travel Surveys of 1973, 1981, 1993 and 2007.

## COMMUTING TRIP: INCREASE IN THE DISTANCES<sup>28</sup> TO GET TO THE WORKPLACE

In France, seven out of ten individuals work outside their municipality of residence in 2007; they were less than one in two in 1973. As a result, the average distance from home to fixed place of work has not stopped to increasing. It was an average of 7.7 km in 1973 and 14.6 km in 2007, an increase of nearly 1.9% per year (Table 6). The strongest increase was observed between 1981 and 1993, with longer distances traveled of 3.8% each year in average. Although women travel on average fewer kilometers to get to their place of work (they are more often employed in their municipality of residence), the distance that they cover has increased by 118% between 1973 and 2007 against 86% of men. The more frequent use of the car by women allows them to search for a job a remote distance from their home. The workers are looking for a job that matches their

<sup>28</sup> The distance is defined as that which separates the home to the place of work, taking into account any detours made along the way (Madre & Maffre, 1997).

qualifications, training or professional choice in larger employment areas and therefore distant from their residence.

People living in Ile-de-France have always travelled more kilometers to get to their place of work than people living outside the Paris region. However, the differences are diminishing: people living in Ile-de-France go 1 kilometer further than people living outside the Paris region in 2007, against 2-3 kilometers before 1981. In Ile-de-France, Parisians have the shorter trip distances (6.8 km on average in 1973 to 9.1 km on average in 2007) than people living in large ring, the longer (13.3 km on average in 1973 to 20.4 km on average in 2007).

**TABLE 6. Average distance to go from home to fixed place of work outside the home, in kilometers**

	1973		1981		1993		2007	
	Man	Woman	Man	Woman	Man	Woman	Man	Woman
Ile-de-France	10,3	8,3	12,4	9,7	16,3	12,0	17,4	13,6
		9,4		11,2		14,2		15,5
...Paris	7,4	6,0	7,8	7,8	9,4	6,6	11,3	6,9
		6,8		7,8		7,9		9,1
...small crown	9,9	7,4	10,7	8,6	12,1	10,0	13,5	10,5
		8,7		9,8		11,1		12,0
large crown	14,2	12,2	17,0	13,1	21,7	16,9	22,7	18,3
		13,3		15,3		19,5		20,4
outside the Paris region	8,3	5,0	9,7	6,5	17,4	10,5	16,0	12,9
		7,2		8,4		14,2		14,5
All	8,7	6,0	10,3	7,3	17,1	10,8	16,3	13,0
		7,7		9,1		14,2		14,6

Field: assets with a job and a fixed place of work outside the home.

Source: INSEE, SOeS, IFSTTAR-DEST, French National Travel Surveys of 1973, 1981, 1993 and 2007

The distribution of distances from home to the work place shows that, between 1973 and 2007, short trips (less than 5 km) are becoming scarce in favor of longer trips. The proportion of employed men and women going less than 5 miles to get to work was halved between 1973 and 2007. At the same time, the proportion of employed persons working 20 to less than 80 kilometers from home has doubled for men, and more than tripled for women.

The lengthening of distances from home to the work place is a consequence of the rarefaction of the model "live and work in the same city", actual for the last two decades of the twentieth century (10). According to the socio-professional category, the assets live more or less far from their fixed place of work outside the home. Farmers, followed by artisans, merchants and business leaders are those who are working closest to their home. Employees and laborers also travel fewer kilometers on average than executives and superior intellectual professions or intermediaries. By their more skilled jobs, they tend to be less evenly distributed over the territory than employees or laborers (11).

### ... BUT DURATIONS<sup>29</sup> OF DISPLACEMENT RELATIVELY STABLE

Although average distances to go to work have greatly increased, the average lengths have remained relatively stable: their report indicates that trip speeds have increased. The massive use of the car for this type of trip is one of the main reasons for the stability of time means trips. In 2007, women are as numerous as men using the car to get to the workplace (72%). In fact, the fastest modes of transport allow "conquer" space: the more we live far from the centers (and our employment), the more kilometers we go (this is also valid for other mobility, since people live in less dense areas) and most often it is by car, and as a result, the more we consume, the more we emit pollutants and greenhouse gas emissions (10). In 2007, the average travel time from home to a fixed place of work is extended by more than 2 minutes compared with 1973 (Table 7). Men are most affected: between 1973 and 2007, the duration of their commuting trip has increased by 13.5%,

<sup>29</sup> Duration is defined as the time between leaving home and arriving at the place of work, including the waiting when changing modes of transport (12).

against 7.6% for women. Women always take on average less time than men to reach their workplace. The average duration gap between the two sexes, which had tended to increase in 1981 and 1993, has reduced in 2007.

The distinction between people living in the Ile-de-France and those living outside the Ile-de-France highlights two heterogeneous populations, distinction that the general average hides. The people living in Ile-de-France take on average about 14 minutes longer than people living outside the Ile-de-France to get to work (for a time-budget stretched more than 75% for the first compared to the second). The longer transport time budgets of people living in the Ile-de-France (despite distances similar to those observed for people living outside the Ile-de-France) are due to slower travel speeds due to a greater use of public transport and of a high level of car congestion<sup>30</sup>.

**TABLE 7. Average time to go from home to fixed place of work outside the home, in minutes**

	1973		1981		1993		2007	
	Man	Woman	Man	Woman	Man	Woman	Man	Woman
Île-de-France	30,7	30,9	31,6	29,5	33,7	33,1	34,2	33,4
		30,8		30,6		33,4		33,8
...Paris	31,0	28,0	28,1	26,4	30,0	31,0	31,1	30,9
		29,7		27,3		30,5		31,0
...small crown	29,6	30,4	32,2	31,0	30,7	31,9	33,2	33,5
		29,9		31,6		31,3		33,3
large crown	31,5	NS	33,2	32,3	36,8	35,2	36,4	34,2
		34,1		32,8		36,1		35,2
outside the Paris region	17,6	15,9	17,9	16,4	20,8	16,9	20,2	18,6
		17,0		17,3		19,1		19,4
All	20,4	20,3	20,9	19,8	23,6	20,8	23,1	21,9
		20,3		20,5		22,3		22,5

Field: assets with a job and a fixed place of work outside the home.

Source: INSEE, SOeS, IFSTTAR-DEST, French National Travel Surveys of 1973, 1981, 1993 and 2007

## WOMEN TRIPS PROFILES REMAIN PARTICULAR

Using the FNTS, we constructed a typology (Ascending Hierarchical Classification) based on the data collected from 18,632 randomly selected individuals (56,172,951 weighted individuals). These individuals were asked to give precise information about their mobility the day before being surveyed. In other words, all their movements (duration, motivation, mode etc.) were recorded. Crossing types of mobility behaviour with the gender then made it possible to establish the spread of different types of behaviour according to the gender.

There are thus a total of 55,949,000 weighted individuals who are representative of the whole of France.

The Ascending Hierarchical Classification carried out here allows five groups of individuals to be established, which have similar behaviour in terms of mobility.

We have found 5 types of mobility. The types of mobility represented in the classification are as follows (all figures are expressed in averages):

- Individuals with very little mobility, who travel little and who have small distance budgets (Class 1);
- Individuals whose movements are similar to the national average (3 trips within the group, compared to the French average of 3.14 trips daily). These individuals travel at an average speed of 32.4 km/h, covering 5.3 km per trip (Class 2);
- Individuals whose movements are similar to the national average (3.14 trips per day, compared to 3.6 in this group), at a speed of 25.4 km/h, covering an average of 14.9 km per trip (Class 3);

<sup>30</sup> Note however that in the case of the Ile-de-France, the difficulty of circulation is not homogeneous in terms of the density and thus of covered distance in Ile-de-France.

- Individuals with high mobility (7.1 trips per day), but covering relatively short distances, compared to the number of trips (29.2 km per day) at a speed of 21.2 km/h (Class 4). The average trip of these individuals is 4.1 km;
- And, lastly Class 5, which includes individuals with greater mobility than the national average (5.5 trips per day), but covering larger distances (distance budgets being 133.6 km), at a speed of 57.7 km/h. The average trip for this group of individuals is 24.3 km.

Regarding these types of mobility, the literature, and results presented above, we may suppose that socio-economic differences between individuals cause different forms of mobility behaviour. Indeed, as shown on the table below, women, for example, are over-represented in Class 4 (58.14%, compared to 51.62% for the population as a whole) (Table 8).

**TABLE 8. A gendered analysis of the types of mobility**

Sex	Types of mobility					Share in the whole population (en %)
	Class 1	Class 2	Class 3	Class 4	Class 5	
Men	45.5	49.5	53.8	41.9	56.2	48.4
Women	54.5	50.5	46.2	58.1	43.8	51.6
Total	100	100	100	100	100	100

Field: Individuals considered in the classification. Source: FNTS 2007-2008.

This is a class in which most trips are carried out close to home. In contrast, men are over-represented in Class 5, which is characterised by relatively long and fast trips (56.2% of the class are men, compared to 48.38% of the overall population). That means that daily mobility patterns of women are different from those of men. This result is not surprising and may be put in line with the literature (Law 1999; Rodriguez Moya & Garcia Palomares, 2012).

We may also observe below (Table 9 and Table 10) that the type of mobility is linked to the household composition. Indeed, we may observe that persons living alone are over-represented in the first type of mobility (that means the classes with the lowest mobility). Persons living in monoparental families are over-represented in the fourth type of mobility, characterized by a high mobility (7.1 trips per day), but covering relatively short distances. This result is in line with research conducted for example in the U.S. Kostyniuk et al. showing that single parents make more trips than couples with children (1989). Among couples, we can notice a different repartition of households between couples without children, and those with at least one child. Having at least one child seems to influence daily mobility patterns, and persons living in such households are over-represented in the third and fourth type of mobility (individuals whose movements are similar to the national average (3.14 trips per day, and individuals with high mobility (7.1 trips per day).

**TABLE 9. An influence of the household structure on the types of mobility**

Household composition	Types of mobility					Share in the whole population (en %)
	Class 1	Class 2	Class 3	Class 4	Class 5	
Person living alone	19.7	16.0	13.4	12.1	12.5	15.49
Monoparental family	7.9	9.3	6.6	10	7.6	8.55
Couples without children	32.5	24.9	25.1	20.3	27.1	25.77
Couples with at least one child	35.5	45.8	51.6	54.6	49.1	46.5
Other households composition	4.3	3.9	3.2	3	3.6	3.7
Total	17.8	44.3	19.2	14	4.7	100

Field: Individuals considered in the classification. Source: FNTS 2007-2008.

Conducting the same analysis by focusing on women, we found similar results as for the whole population (Table 10). It is however interesting to notice that women living in a monoparental family are over-represented in the fourth and fifth type of mobility (individuals with high mobility (7.1 trips per day), but covering relatively short distances, and individuals with greater mobility than the national average (5.5 trips per day), but covering larger distances).

**TABLE 10. An influence of the household structure on the types of mobility**

Household composition	Types of mobility					Share in the whole population (en %)
	Class 1	Class 2	Class 3	Class 4	Class 5	
Person living alone	24.4	17.5	14.6	10.4	11.8	16.9
Monoparental family	9.4	11.6	8.2	12.5	12.9	10.8
Couples without children	30.6	24.9	25.8	18.7	26.6	25.2
Couples with at least one child	31.2	42.3	48.7	55.4	44.2	43.4
Other households composition	4.5	3.7	2.8	3.0	4.5	3.7
Total	18.8	44.3	17.2	15.9	3.9	100.0

Field: Women considered in the classification. Source: FNTS 2007-2008

Focusing on women, we observe a stronger influence of children on mobility behavior profiles than for the whole population. We may indeed observe strong differences between the couples without children, and those with at least one child.

## CONCLUSION

The increase in the number of women with a driving license is one of the consequences of the dissemination of driver's licenses. Their mobility behavior has changed over the last century.

Indeed, changing forms of employment and reintegration of women into the world of paid employment were a vector of mobility. The increase in the number of workers and the relocation of work outside the municipality of the place of residence increased the number of obliged trips. According to the National Travel Survey 2007, 72% of men and women have used the car to make trips from home to work. The diffusion of driving licenses to women and growing access to a second car in the household (that women help to finance) participated in the massive use of the automobile.

However, even if mobility patterns of women have changed over the last decades, we observe that their mobility behaviours are not similar to those of men. We may explain this by job preferences, and the time dedicated to care of children. Further research may include a comparison of time-use surveys among men and women. Our results also highlight the important of differentiated transport policies for men and women.

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# Gender and daily mobility: Did the gender gap change between 1996 and 2006 in the Quebec urban area?

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## ABSTRACT

Gender differences in daily mobility have been an issue in transportation studies in recent decades. Researchers are looking for potentially explanatory variables that can improve our understanding of the gaps between men's and women's daily travel patterns. Using data based on Origin-Destination surveys (O-D), this study analyzes the evolution of gender differences in the daily mobility of men and women in the Québec urban area between 1996 and 2006, with particular reference to trip chaining. Most of the results obtained were consistent with findings reported in the literature. Women make considerably more daily trips than men, but these trips are on average shorter in distance and travel time. Men, significantly more than women, drive cars or use bikes and make more work and education-related trips, whereas women tend to travel more as car passengers, use public transport or walk. Their daily mobility is more frequently for household necessities such as groceries, shopping and driving other people around. Moreover, women are more likely than men to trip chain, and their trip chains tend also to be more complex – with more intermediate stops – than those of men.

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**KEYWORDS:** Mobility; Differences; Gender; Quebec; Trips.

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## INTRODUCTION

Recent decades have seen a number of major changes taking place in our society, with growing numbers of women joining the work force, the tertiary sector playing an increasingly important role in the economy, and suburbs becoming not simply places to live but also to work. These changes have affected both city structures and the way people travel, as can be seen in the increasing use of cars (1). Yet the changes have not impacted on men and women in the same way, as illustrated by the fact that women's wages are still often lower than those of men and that women are more likely to hold part-time jobs (2, 3). The increased presence of women in the labour force has added work-related responsibilities to the family and household responsibilities they already shoulder (4, 5). In many cases, this dual role leads them to work closer to home to limit their travel time (6) so as to better respond to work, family and household needs. Access to cars – and possible better management of their trips – is more of a challenge for women because of their lower wages, lower numbers of driver's licences held and the greater use of family vehicles by the men of the household (3, 7, 8). However, there is no general agreement among researchers on what is known as the "household responsibility hypothesis" (2, 9-11) because of the difficulties inherent in measuring household responsibilities and taking into account every potentially explanatory variable (3, 12-16). Nonetheless, in spite of the differences of opinion, one fact is widely recognized: men cover greater distances and spend more time in work-related travel than women (2, 7, 8, 11, 14-22).

### ***What Do Recent Data Show?***

Gender differences in personal mobility are often analyzed using three criteria: the number of trips made, distance travelled and travel time. Both for North America and Europe, two prominent trends emerge from the literature. On the one hand, women make more trips than men (23-29) and are also more likely to trip chain (23, 26). On the other hand, on average, men travel greater distances and spend more time travelling than women (24, 26-28, 30-34).

Some travel modes and trip purposes are more characteristic of men, others of women. On the whole, men tend to drive cars or travel by bike, whereas women travel more often as car passengers, use public transport or walk (27, 28, 33, 35, 36). In addition, women make more trips for passengers (mainly children), for shopping or for personal and family errands (23, 25-28, 35), while men still make more work trips than they do (29, 35). There are however, some circumstances when men tend to make more daily trips than women. In Germany, single men travel on average more often than single women (27). This is also the case for British men between 50 and 60 years old (35).

If women generally make more trips than men, these trips remain shorter in distance and travel time (24, 26-28, 30-34). Work trips, which constitute a significant proportion of daily trips for both genders, are markedly longer for men than for women (24, 27, 29-35, 37-42). This is the kind of situation where different contexts can lead to different outcomes. In the United States, in 2000, unemployed women aged between 40 and 59 travelled, on average, greater distances than their male counterparts. Travelling greater distances was also the case for women living in households comprising of two adults or more, where the youngest child was aged between 6 and 15 (24). Furthermore, Crane (32) finds that, in the United States, increases in distances travelled for work between 1985 and 2005 were relatively greater for women than for men. The same situation was observed in Great Britain in the 'nineties (35).

### ***Trip chaining***

The international literature reveals that women tend to trip chain more than men, and that trip chains, composed of more than one intermediate stop (23, 26), are generally more complex for women. The data show that women stop on average 50% more often than men between their places of work and their residences. A proportionately higher number of women are likely to make at least one or two intermediate stops, for whatever reason. In fact, in every type of trip chain (home to home, home to work, work to work and work to home) women make more intermediate stops than men (23).

McGuckin and Nakamoto (26) report that the primary purposes of stops made between homes and work places are to 1) transport passengers, 2) do family and personal errands and 3) buy a coffee or a meal. On the return home from work, the main purposes are to 1) make purchases, 2) transport passengers and 3) run family errands. In all cases, it is the women who stop more often. Even when men added more stops to transport passengers while trip chaining, women are still the main group to engage in trip chaining behaviour. In fact, women in employed-couple households are twice as likely as men to drive children to or from school.

Since trip chaining is less often taken into consideration in travel patterns, the significance of the present study lies in its analysis of gender differences in the context of trip chaining.

## **OBJECTIVES AND HYPOTHESIS**

The primary objective of this study was to determine whether trends in gender differences in daily mobility were observable in the results for the Quebec urban area on the basis of mobility surveys for 1996 and 2006. More specifically, we analyzed daily mobility and its evolution for those years based on the number of trips, distance travelled and travel time, broken down by travel mode, trip purpose, age, occupational status, household composition, residential location and the number of cars owned by the household. We also analyzed and compared men's and women's trip chaining behaviour for both years with reference to distances travelled and travel times and the number of intermediate stops – these being the defining features of complex trip chains.

Our literature review led to our first hypothesis that gender differences still remained in 2006, but that the gap was less significant compared to 1996 in terms of travel mode choices, trip purpose, distance travelled and travel time. Our second hypothesis was that women are more likely to trip chain than men, and that these trip chains tend, in turn, to be more complex, in view of the number of intermediate stops made and distances travelled.

## **DATA AND METHODOLOGY**

For a more complete description of data and methodology used in this study, interested readers can consult the Master's thesis on which this study is based (43).

Data used in our study come from Quebec City O-D surveys of 1996 and 2006. Collected every five years since 1977 by the government transportation department (the *Ministère des Transports du Québec*) in collaboration with transit agencies, these surveys collect information about all trips made by residents of a given territory over a typical working day (Monday to Friday) in the fall. Data are collected by telephone interviews from a representative sampling of approximately 10% of households. Stratified systemic cluster sampling is the method used for the analyses. The sample is spatially stratified among a certain number of areas of analysis broken down on the basis of different criteria and by age group. Expansion factors defined by Statistics Canada can be applied to the samples to estimate mobility behaviours for the entire population. However, these expansion factors were not applied in the context of the present study as to avoid skewing the tests of assumption by increasing the number of degrees of freedom.

The surveys are in three parts. The first part collects household information, such as the number of vehicles and the geographic location of the residence. The second part identifies household data such as gender, age, occupation, location of the workplace. The last part collects details of trips made by members of the household: time of departure, trip purpose, travel mode choices, origin and destination data. Responses are provided by one of the adult members of the household, who describes trips made by all household members. Data on trips made by children under the age of 6 are not collected, since it is assumed that these children travel with an older person.

Some data used in our study do not come directly from O-D surveys. Household respondents are not asked about distances travelled and travel times. Information on the shortest routes between the place of origin and destination was derived by researchers at Université Laval's *Centre de recherche en aménagement et développement* and the *Accès à la Cité* research team using GIS transportation software. While these data clearly differ from real distances and travel times, they do provide a more realistic picture than Euclidean distance measurements and can be used to establish an overview of key trends, such as positive or negative changes in the behaviour patterns analyzed, when results are compared. Similarly, residential location was determined using cluster analysis based on ten census tract variables, while household composition was derived from data on the people in those households.

The original 1996 O-D survey contains 167,943 records representing 25,102 households, 60,940 people and 153,959 trips. After some filtering, the sub-sample used in this study refers to 21,773 households, 42,966 people and 137,293 trips. The 2006 O-D survey originally contained 224,639 records representing 33,859 households, 78,207 people and 209,849 trips. After some filtering in this case as well, the final sub-sample refers to 28,367 households, 58,067 people and 192,122 trips. Over the years, the size of the urban area under analysis has changed. To ensure that comparisons are valid and are not weakened by changes between 1996 and 2006 in the size of the urban area in question, the area covered by this study is the same as the one used for the 1996 survey on residential locations and commuting destinations.

Tests of proportion differences were used to compare and measure the significance of differences in travel modes and trip purposes. For the same reason, tests of mean differences were used to compare the number of trips, distances travelled and travel time for men's and women's trips. Multiple linear regression models were applied to explain variations in distances travelled and travel time for both sexes. In the trip chaining analyses, tests of proportion differences and mean differences were also conducted in reference to the number of trip chains and intermediate stops. A binary logistic regression model was used to measure the probability of men and women respectively undertaking at least one trip chain compared to none. For those who trip chained at least once, a second binary logistic regression model was applied to calculate the probability of their using complex trip chains with more than one intermediate stop, compared to simple trip chains with only one intermediate stop. Mean trip chain distances and travel time were analyzed using tests of mean differences. Lastly, the impact of the number of trip chains on total distances travelled and travel time for daily trips was measured using multiple linear regression models.

## RESULTS

The first section of the results described below presents a broad overview of the daily mobility of men and women: number of trips, distances travelled and travel time, whereas the second part shows the results in terms of trip chaining.

## **Number Of Trips**

Firstly, in considering the proportion of trips made by men and women, broken down by travel mode, we find that gender differences were significant for almost all travel modes in both 1996 and 2006 ( $\alpha = 0.05$ ). Men, driving their cars or using bikes made a significantly greater number of daily trips than women, whereas women travelled more than men as passengers in cars, or by walking or using public transport. The gender gap increased between 1996 and 2006 for those who walk or use bikes while it narrowed for the other travel modes, although the gap remains significant.

Men and women also travelled for different purposes, although the differences are significant for only a small percentage among them ( $\alpha = 0.05$ ). As reported in the literature, men travel markedly more than women for work or study purposes. Conversely, women make a far greater number of trips to transport passengers and for shopping purposes. Between 1996 and 2006, the gender gap decreased for work and recreational trips while it increased for studies, for shopping and for transporting passengers.

In 1996, there was no significant difference between the mean numbers of daily trips made by men and women: 3.21 and 3.18 respectively. In 2006, the difference became significant ( $\alpha = 0.01$ ), with women making more daily trips than men: 3.33 compared to 3.28.

In terms of age groups, some differences persisted between 1996 and 2006. Women aged between 25 and 44 made on average significantly more daily trips than men of the same age ( $\alpha = 0.01$ ) and the gender gap increased over this period. Men aged between 55 and 74 made more daily trips than women of the same age ( $\alpha = 0.01$ ), although the gap narrowed between the two survey years. The gender gap was particularly evident in 2006 for women aged between 20 and 24 and for men aged 75 or more ( $\alpha = 0.01$ ).

When they worked full time, or part time, only in 2006, women made on average far more daily trips than men. The converse stands for retired men for both 1996 and 2006 ( $\alpha = 0.01$ ). Between the two periods surveyed, the gender gap increased for people in the labour force and decreased for retired people. There was, however, no observable gender difference between the mean numbers of daily trips made for study purposes.

We found, in reference to household composition, that women in households with one employed adult, with children, or in single-parent families, made more trips than their male counterparts in 1996 ( $\alpha = 0.05$ ) and 2006 ( $\alpha = 0.01$ ), while this was true only in 2006 for women in households with two employed adults, with children ( $\alpha = 0.01$ ). Conversely, men in households with two employed adults, without children, and those living alone made significantly more daily trips than women in both survey years. The gender gap increased in households with two employed adults, with or without children, in households with one employed adult, with children, and in single-parent families.

When a household does not own a vehicle, there was no observable difference in the mean numbers of daily trips made. When a household owns one vehicle, men made more trips than women in 1996 only ( $\alpha = 0.01$ ). In the case of households with two vehicles, women made significantly more trips than men in the two periods surveyed ( $\alpha = 0.01$ ), although in 2006 this was the case only for households with 3 vehicles or more ( $\alpha = 0.01$ ). The gender gap narrowed in households with one or no vehicle and increased in households with two vehicles or more.

There were also observable gender differences, although primarily in 2006, in terms of place of residence. Women made, on average, significantly more daily trips than men when they lived in new suburbs or peripheral urban areas in 2006 ( $\alpha = 0.01$ ). This was also the case when they lived in old suburbs in 1996 ( $\alpha = 0.05$ ), but the situation had changed by 2006. When they lived downtown, men and women made similar numbers of daily trips, whereas the gender gap increased for people living in new suburbs and in peripheral urban areas.

## **Distances Travelled And Travel Times**

While women on average make more daily trips than men, the latter make significantly longer trips. Table 1 shows the average distances travelled and travel time for men and women in 1996 and 2006. Average distances travelled and travel times decreased between 1996 and 2006 for both sexes. The gender gap decreased for distances and increased for travel times.

**TABLE 1. Mean Distances Travelled and Travel Times for Men and Women in the Quebec Urban Area in 1996 and 2006**

	1996			2006		
	M	W	Sig.	M	W	Sig.
Distance travelled (km <sup>o</sup> )	<b>8.1</b>	7.3	**	<b>7.8</b>	7.0	**
Travel time (minutes)	9.6	9.3	*	8.9	8.6	**

\* Significant at 0.05; \*\* Significant at 0.01

<sup>o</sup> 1 km = 0.62 mile

The multiple linear regression model in Table 2 shows, after controlling for household composition, place of residence, number and age of children in the household, number of vehicles, occupational status of household members, times of departure, travel mode and trip purpose, that women travelled 8% less distance than men in 1996 ( $B = -0.082$ ;  $p < 0.000$ ) and 5% less in 2006 ( $B = -0.053$ ;  $p < 0.000$ ). It should be noted that the dependent variable (distance) was converted into the natural logarithm (ln) in order to express the coefficients as percentages; the same procedure was used for the travel time model. Women's travel time for trips was about 6% shorter than that of men in 1996 ( $B = -0.067$ ;  $p < 0.000$ ) and 5% shorter in 2006 ( $B = -0.05$ ;  $p < 0.000$ ). It should also be noted that the same variables were applied for the travel time model and that, in general, the results are similar to those for distance travelled.

**TABLE 2. Multiple Linear Regression Model for the Average Distance Travelled by Men and Women in the Quebec Urban Area in 1996 and 2006**

	1996					2006				
	R <sup>2</sup>	R <sup>2</sup> adj.	DF	n	Sig.	R <sup>2</sup>	R <sup>2</sup> adj.	DF	n	Sig.
	0.365	0.365	27	72,494	0.000	0.39	0.39	26	105,307	0.000
Dependent variable: Distance (ln)	B	E. S.	Beta	t	Sig.	B	E. S.	Beta	t	Sig.
Constant	8.874	0.018		480.21	0.000	8.729	0.016		543.361	0.000
Number of vehicles	0.115	0.006	0.073	20.47	0.000	0.035	0.005	0.023	7.68	0.000
Time of departure	-0.043	0.003	-0.054	-14.41	0.000	-0.040	0.002	-0.049	-16.10	0.000
Gender (0: Male, 1: Female)	-0.082	0.008	-0.033	-10.64	0.000	-0.053	0.006	-0.021	-8.34	0.000
Household composition (Ref: 2 employed adults with children)										
Single-parent family	-0.101	0.017	-0.020	-6.01	0.000	-0.029	0.015	-0.005	-1.94	0.053
Person living alone	-0.080	0.015	-0.021	-5.22	0.000	-0.029	0.013	-0.007	-2.17	0.030
1 employed adult with children	0.044	0.014	0.011	3.10	0.002	–	–	–	–	–
Other	-0.024	0.012	-0.009	-2.12	0.034	0.054	0.010	0.020	5.48	0.000
1 employed adult without children	0.029	0.019	0.005	1.51	0.131	0.036	0.012	0.009	3.09	0.002
2 employed adults without children	0.008	0.015	0.002	0.51	0.612	0.053	0.013	0.013	4.23	0.000
Residential location (Ref: Downtown)										
Periphery	0.235	0.015	0.056	16.00	0.000	0.551	0.012	0.157	45.65	0.000
New suburbs	0.064	0.011	0.023	5.77	0.000	0.345	0.010	0.128	33.08	0.000
Old suburbs	0.032	0.010	0.013	3.14	0.002	0.114	0.010	0.043	11.53	0.000
Number of children										
Between 6 and 15 years old	-0.094	0.006	-0.060	-15.94	0.000	-0.074	0.005	-0.049	-16.13	0.000
Between 16 and 20 years old	0.052	0.007	0.025	7.49	0.000	0.063	0.006	0.027	9.94	0.000
Up to 6 years old	–	–	–	–	–	-0.316	0.016	-0.049	-19.59	0.000
Occupational status (Ref: Employed full-time)										
Retired	-0.279	0.015	-0.068	-18.27	0.000	-0.147	0.011	-0.043	-13.24	0.000
Other	-0.082	0.015	-0.019	-5.36	0.000	-0.087	0.015	-0.016	-5.79	0.000
Employed part-time	-0.036	0.015	-0.007	-2.37	0.018	-0.097	0.016	-0.015	-6.02	0.000
Student	-0.025	0.016	-0.008	-1.60	0.110	-0.046	0.013	-0.014	-3.61	0.000

**TABLE 2 (continued). Multiple Linear Regression Model for the Average Distance Travelled by Men and Women in the Quebec Urban Area in 1996 and 2006**

	1996					2006				
	R <sup>2</sup>	R <sup>2</sup> adj.	DF	n	Sig.	R <sup>2</sup>	R <sup>2</sup> adj.	DF	n	Sig.
Dependent variable: Distance (ln)	0.365	0.365	27	72,494	0.000	0.39	0.39	26	105,307	0.000
	B	E. S.	Beta	t	Sig.	B	E. S.	Beta	t	Sig.
Travel mode (Ref: By car as driver)										
Walk	-1.892	0.013	-0.510	-140.44	0.000	-1.879	0.011	-0.495	-173.42	0.000
Bike	-0.894	0.048	-0.056	-18.61	0.000	-0.796	0.033	-0.059	-24.23	0.000
Public transport	0.172	0.015	0.039	11.13	0.000	0.296	0.013	0.061	22.32	0.000
By car as passenger	0.022	0.011	0.006	1.91	0.056	-0.061	0.010	-0.018	-6.38	0.000
Trip purpose (Ref: Work)										
Other	-0.388	0.012	-0.151	-33.49	0.000	-0.326	0.014	-0.070	-24.13	0.000
Transport of passenger(s)	-0.465	0.021	-0.076	-22.66	0.000	-0.479	0.011	-0.128	-42.31	0.000
Studies	-0.233	0.018	-0.067	-12.67	0.000	-0.295	0.015	-0.074	-19.32	0.000
Shopping	-0.135	0.017	-0.029	-7.93	0.000	-0.555	0.011	-0.174	-49.52	0.000
Recreation	-0.120	0.021	-0.020	-5.83	0.000	-0.240	0.012	-0.071	-20.38	0.000
-- = No data										

## Trip Chaining

Trip chaining is considered here as being a series of trips made between two anchors, generally the place of residence and workplace, with at least one intermediate stop. Table 3 shows that women on average made significantly more trip chains and more intermediate stops than men in 1996 and 2006. Mean numbers increased during that period and the gender gap narrowed for the number of trip chains and slightly increased for the number of intermediate stops.

**TABLE 3. Number of Trip Chains and Intermediate Stops made by Men and Women in the Québec Urban Area in 1996 and 2006**

	1996			2006		
	M (n = 20,760)	W (n = 22,206)	Sig.	M (n = 27,898)	W (n = 30,169)	Sig.
Number of trip chains	0.67	<b>0.78</b>	**	0.77	<b>0.85</b>	**
Number of intermediate stops	0.84	<b>1.00</b>	**	0.98	<b>1.15</b>	**

\* Significant at 0.05

\*\* Significant at 0.01

In fact, as can be seen in Table 4, the proportion of men doing no trip chaining was significantly higher than that of women in both 1996 and 2006, but a higher percentage of women made one or two trip chains. The respective proportion of men and women doing no trip chaining decreased between 1996 and 2006, but increased for men making one or two trip chains, decreased for women making one trip chain and increased for those making two trip chains. The gender gap decreased for those who made one or no trip chain.

**TABLE 4. Distribution of the Number and Proportion of Trip Chains made by Men and Women in the Quebec Urban Area in 1996 and 2006**

Number of trip chains	1996			2006		
	M	W	Sig.	M	W	Sig.
0	10,424 <b>50.2%</b>	9,172 41.3%	*	12,566 <b>45.0%</b>	11,836 39.2%	*
1	7,530 36.3%	9,604 <b>43.2%</b>	*	10,643 38.1%	12,623 <b>41.8%</b>	*
2	2,131 10.3%	2,680 <b>12.1%</b>	*	3,540 12.7%	4,388 <b>14.5%</b>	*
3	543 2.6%	602 2.7%		897 3.2%	1,026 3.4%	
4	104 0.5%	118 0.5%		190 0.7%	224 0.7%	
5	21 0.1%	25 0.1%		47 0.2%	58 0.2%	
6	5 0.0%	5 0.0%		12 0.0%	11 0.0%	
7	2 0.0%	0 0.0%		3 0.0%	3 0.0%	
Total proportion	100%	100%		100%	100%	
Expanded data	237,367	246,657		277,473	283,615	
Sample data	20,760	22,206		27,898	30,169	
Relationship between gender and number of trip chains	$\chi^2 = 351.693$ $p < 0.000$ $C = 0.09$			$\chi^2 = 205.183$ $p < 0.000$ $C = 0.059$		

\* Significant at 0.05

Table 5 shows that when trip chaining takes place (no intermediate stop meaning no trip chaining), a higher proportion of women than men in both 1996 and 2006 made at least one intermediate stop, although this was markedly the case only in 2006 for 5 or more intermediate stops. The proportion of trip chains generally increased between 1996 and 2006, except for women making just one intermediate stop. The gender gap narrowed for people making 2 or fewer intermediate stops and increased for people making at least 3 intermediate stops.

**TABLE 5. Distribution of the Number and Proportion of Intermediate Stops made by Men and Women in the Québec Urban Area in 1996 and 2006**

Number of intermediate stops	1996			2006		
	M	W	Sig.	M	W	Sig.
0 stop	10,424 <b>50.2%</b>	9,172 41.3%	*	12,566 <b>45.0%</b>	11,836 39.2%	*
1 stop	6,266 30.2%	7,730 <b>34.8%</b>	*	8,691 31.2%	9,713 32.2%	*
2 stops	2,396 11.5%	3,105 <b>14.0%</b>	*	3,769 13.5%	4,646 <b>15.4%</b>	*
3 stops	972 4.7%	1,285 5.8%	*	1,548 5.5%	2,079 6.9%	*
4 stops	377 1.8%	530 <b>2.4%</b>	*	694 2.5%	998 <b>3.3%</b>	*
5 or more stops	325 1.6%	384 1.7%		630 2.3%	897 3.0%	*
Total proportion	100%	100%		100%	100%	
Expanded data	237,366	246,656		277,474	283,615	
Sample data	20,760	22,206		27,898	30,169	
Relationship between gender and number of intermediate stops	$\chi^2 = 350.365$ $p < 0.000$ $C = 0.09$			$\chi^2 = 260.616$ $p < 0.000$ $C = 0.067$		

\* Significant at 0.05

Binary logistic regression models for trip chains and for intermediate stops show, after controlling for household variables (age group, occupational status, household composition, vehicle ownership rate, motorized household or not and the presence of children of different age groups), that women were significantly more likely to make at least one trip chain in 1996 and 2006 ( $p < 0.000$ ). Moreover, among those making at least one trip chain, women were also more likely to make at least two intermediate stops – so creating more complex trip chains – in 1996 and 2006 ( $p < 0.000$ ).

In the daily mobility section of the study, we found that men's average trip lengths were considerably higher than those of women. In trip chaining, while distances travelled remained significantly greater for men than women in 1996 (respectively 16.6 km and 15.2 km;  $\alpha = 0.01$ ) and 2006 (respectively 15 km and 14.3 km;  $\alpha = 0.01$ ), the gender gap decreased.

Finally, Tables 6 and 7 show that gender, the total number of daily trips, the number of trip chains and the residential location affect total daily distances travelled and travel times. In addition to again observing that women tend to travel shorter distances and for shorter travel times than men (about 15% less in 1996 and 10% less in 2006), readers will also remark that the number of trip chains tended to increase daily travel distances in 1996 by approximately 2%, but to reduce these distances by 4% in 2006. However, it is interesting to note that it is the number of trip chains that most influences the time spent on total daily travel. In fact, total time spent on travel tended to drop by 19% and 18% respectively in 1996 and in 2006 when the number of trip chains increased.

**TABLE 6. Multiple Linear Regression Model for Total Daily Distances Traveled by Men and Women in the Quebec Urban Area in 1996 and 2006**

	1996					2006				
	R <sup>2</sup>	R <sup>2</sup> adj.	DL	n	Sig.	R <sup>2</sup>	R <sup>2</sup> aj.	DL	n	Sig.
	0.093	0.093	6	42 959	0.000	0.209	0.209	6	58 060	0.000
Dependant variable:										
Total daily distance (ln)	B	E. S.	Beta	t	Sig.	B	E. S.	Beta	t	Sig.
Constant	8.969	0.017		512.72	0.000	8.262	0.015		545.11	0.000
Sex (0: Male, 1: Female)	-0.151	0.011	-0.07	-14.15	0.000	-0.103	0.009	-0.04	-11.90	0.000
Total number of trips	0.193	0.004	0.28	44.11	0.000	0.243	0.004	0.37	67.63	0.000
Number of trip chain	0.024	0.009	0.02	2.74	0.006	-0.040	0.007	-0.03	-5.45	0.000
Residential location (Ref: Downtown)										
Periphery	0.366	0.021	0.10	17.51	0.000	1.114	0.016	0.36	71.10	0.000
New suburbs	0.095	0.016	0.04	5.97	0.000	0.834	0.014	0.34	60.55	0.000
Old suburbs	0.059	0.015	0.03	3.96	0.000	0.425	0.014	0.17	31.01	0.000

**TABLE 7. Multiple Linear Regression Model for Total Daily Travel Times by Men and Women in the Québec Urban Area in 1996 and 2006**

	1996					2006				
	R <sup>2</sup>	R <sup>2</sup> adj.	DL	n	Sig.	R <sup>2</sup>	R <sup>2</sup> aj.	DL	n	Sig.
	0.151	0.151	6	42 959	0.000	0.178	0.177	6	58 060	0.000
Dependent variable:										
Total daily duration (ln)	B	E. S.	Beta	t	Sig.	B	E. S.	Beta	t	Sig.
Constant	2.285	0.013		171.56	0.000	2.293	0.012		186.73	0.000
Gender (0: Male, 1: Female)	-0.040	0.008	-0.02	-4.98	0.000	-0.032	0.007	-0.02	-4.58	0.000
Total number of trips	0.264	0.003	0.48	79.49	0.000	0.271	0.003	0.52	93.21	0.000
Number of trip chains	-0.193	0.007	-0.17	-28.73	0.000	-0.181	0.006	-0.17	-30.23	0.000
Residential location (Ref: Downtown)										
Periphery	0.157	0.016	0.05	9.88	0.000	0.131	0.013	0.05	10.32	0.000
New suburbs	0.044	0.012	0.02	3.65	0.000	-0.017	0.011	-0.01	-1.48	0.139
Old suburbs	0.034	0.011	0.02	3.02	0.003	-0.104	0.011	-0.05	-9.41	0.000

## DISCUSSION

In the first part of our study, the working hypothesis was that gender differences would continue to be found between men's and women's daily mobility in the Quebec urban area and that these differences would be less pronounced in 2006 than in 1996. Tests of proportion showed that, for travel modes and trip purposes, differences persisted in 2006 but that, in certain circumstances, the gender gap was narrowing. Men travelled significantly more than women as drivers of cars or by bike, while women travelled as passengers, used public transport or walked more than men. Men also made significantly more work trips than women, whereas the opposite was true for shopping and personal or family errands. Moreover, tests of mean differences showed that, whatever variable was considered (age group, household composition, occupational status, residential location or number of vehicles owned), gender differences continued to exist in 2006, notably in terms of the number of daily trips, distances travelled and travel time. Women made significantly more daily trips than men between the ages of 25 and 44, when they worked full time, lived in a household of one employed adult with children or in a single-parent family and when they had easier access to the household car. However, in practically all cases, except when the women were students, their daily trips were significantly shorter in terms of distance travelled and time spent. When the variables of household composition, residential location, the number and age of children in the household, the number of vehicles, occupational status, time of departure, travel mode and trip purpose are held constant, multiple linear regression models confirm these findings.

This seems to suggest that women's dual roles in the form of work-related and household responsibilities still influence their daily mobility patterns. Besides their work trips, which increased in number between 1996 and 2006, women continue, more than men, to assume responsibility for household needs such as chauffeuring children, buying groceries and carrying out errands. Our observations on travel modes, trip purposes, the mean number of daily trips and the distances and time spent in travel are in line with what is sometimes described as "women's spatial entrapment", as well as the household responsibilities hypothesis, which suggests that women work closer to home so as to better manage work and household related trips, most often when there are children in the household.

A particularly interesting aspect of this study comes from the analysis and comparison of male and female trip chaining behaviour. The hypothesis in this regard was that women are more likely to trip chain than men, and that they are more likely to make more complex trip chains, in light of the number of intermediate stops they make and the distances they travel. The results show that women on average made significantly more trip chains and more intermediate stops than men in both 1996 and 2006. It also would appear that the situation could be changing. We found a drop in the proportion of men making no trip chains, relative to women, and an increase in the proportion of men making one trip chain, while the proportion of women decreased. Women still make more trip chains than men, but the gap seems to be narrowing. The same holds for the number of intermediate stops. The gender gap decreased for people making one or two intermediate stops even though it increased in the case of women making at least three intermediate stops.

Binary logistic regression models confirm these observations while controlling for age, occupational status, household composition, residential location, level of household motorization and the presence of children under 6, between 6 and 15 and between 16 and 20. These models also show that the presence of children, regardless of age, tends to reduce the probability of trip chaining and of making complex trip chains. Contrary to what might be expected, having children does not seem to increase the likelihood of trip chaining. Except in the case of single-parent families, it appears instead to *reduce* this propensity. In all probability, because people in single-parent households, unlike those in two-adult households, cannot count on a second person to carry out different family tasks, they have no choice but to trip chain and to make more complex trip chains to boot. Readers should be reminded that while these are valid models for the years in question, they should not be interpreted as providing the full picture. Fundamentally, the models should be understood as exploratory, since O-D surveys are not normally designed with this kind of analysis in mind. A final observation that can be drawn from the models of the effects of trip chaining on total distances travelled and travel time is that linking trips may indeed be an effective means of reducing total daily travel time.

## CONCLUSION

In summary, the findings in this study allow us to confirm that a number of gender differences in daily mobility and trip chaining remained significant between 1996 and 2006 in the Quebec urban area. As the literature shows, gender is not the only variable affecting daily mobility; other sociodemographic variables also come into play. Globally, the purpose of this study, far from being wide-ranging, was simply to derive an up-to-date picture of the gender gap in daily mobility using data rarely broken down for further analysis as we did. In particular, the results pertaining to trip chaining behaviour shed some light on an aspect of daily mobility that is less often analyzed. Nevertheless, two caveats must be kept in mind. The first is the survey data collection method, which relies on one person answering for all members of a household. The trip chaining results could be particularly sensitive to this method of data collection as interviewees may not be fully aware of all the details they are being asked to describe. Also, the trends observed between the two survey years cannot be considered to be statistically significant, as the models were not designed for that purpose. Further modelling and inclusion of results from statistical tests on differences between the two survey years could usefully complete the analysis.

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# Urban nomads, mobility and gender

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## ABSTRACT

In the 1980s Jacques Attali used the term “urban nomads” to predict an age when rich and uprooted elites would jet around the world in search of fun and opportunity, and poor but equally uprooted workers would migrate in search of a living. What is certain is that today new ways of communicating, relating to other people, working and living are getting more and more close to nomadic uses. How will the new nomadic society be structured? Will it still refer to traditional roles and family structures or will it be made of “individuals” relating to each other on a less permanent relationship? What will be the role of women in the new “urban nomadic society”? Will there be significant differences in life-styles/mobility patterns due to social/economic position? How will it impact e.g. on transport demand and commuting? Which are the trends to be considered for a better decision-making in urban planning, consumers’ production and mobility schemes?

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**KEYWORDS:** Gender; Societal changes; Mobility patterns; Urban nomads.

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## 1. INTRODUCTION

The aim of this paper is not to present research results, but to launch a discussion around a hypothesis, whose demonstration requires further foresight studies. The paper aims at giving some possible guidelines to steer the formulation of possible scenarios. The expected results will contribute to creating a vision of possible societal developments complementing other studies on the changes in mobility trends, and giving input to policy making in order to steer technological and regulatory developments in a way that will be beneficial to the society as a whole.

## 2. WOMEN'S MOBILITY FROM CAVES TO MODERN AGE

The first human beings had no stable living place. They were nomads led by the necessity to secure food. They were the hunters/gatherers who lived in caves and other precarious shelters that they abandoned when they changed their hunting territory. Their displacements were done by walking; the distance was measured by the time needed to cover it.

When 10,000 years ago the climate change stabilized, the populations started settling in areas with a temperate climate: it was the beginning of the sedentary society of cultivators/breeders. At that time our ancestors trained horses and invented the wheel. This first revolution in mobility was made possible by the drastic societal change and is considered to be the beginning of “civilization”. Wheel and horses made possible the transport not only of human beings, but also of different goods.

Women since the nomadic time have been segregated in to the role of „housekeeper“ and „child-minder“. They have never been “protagonists” even when travelling: they had to follow the man, head of the family/group.

Ever since mankind has developed different mobility patterns and means, until the travel to the moon.

But our society has had mainly a sedentary structure, based on the principles of family, group, and ownership. Hunting is no longer the driver for mobility: it was mainly economic interest that induced mobility. Merchants remained, for a very long time, a special travelling group inside the society, led by trading interest, and able to guarantee wealth and power through exchanges with other regions and cultures. The goods and knowledge they brought back home raised the curiosity of other individuals who, pushed by hunger of knowledge, started to travel to discover new parts of the world. These two figures (the Merchant and the Explorer) guaranteed the expansion and the economic growth of their countries. For their travels it was

essential to have adequate infrastructure: in the XII and XIII centuries, port cities were the pivot of the merchant economy, based on transport accessibility.

Women as well, pushed by a natural intellectual curiosity, started to travel. But they had to be disguised as men when they were travelling alone. Their limitation in travel and mobility was similar to that of the poorer and weaker (elderly, children, disabled).

A different role for women started at the time of the Frontier conquest in the New Continent:

- the need to populate the newly conquered territories made the presence of women
- indispensable for the most impressive wander of modern time. At the same time a new figure
- emerged: the “solitary nomad”, the cowboy. If survival of nomadic populations always
- depended on the group, now a new strongly masculine ideal of independent, autonomous
- and individualist nomad emerges at the margins of the compact and conservative Frontier society. The cowboy followed working opportunities, carrying with him his extremely reduced properties, and having no attachment to any specific place to come back to.

### 3. TODAY’S TRENDS

Curiosity has continued to push people to discover new places and civilizations. The growing globalization has also allowed an easier movement of people and goods around the globe.

In the last decades mobility has hugely increased in many layers of the (Western) population; the number of driving licenses has been constantly growing, and the gap between genders was closed; the extended average life duration has also led to more travelling for leisure among the elderly – where women represent the majority – and their extended participation in productive life together with a rise of their weight in the decision-making process, thus aligning policies with their needs and preferences... Main factors allowing such development were an improved economic situation and better accessibility and affordability of transport means.

Working independence and autonomy in life management have also generated a much higher mobility among women. One of the indicators is the number of driving licenses issued to girls and women since the 80s, for the first time higher than those issued to boys and men.

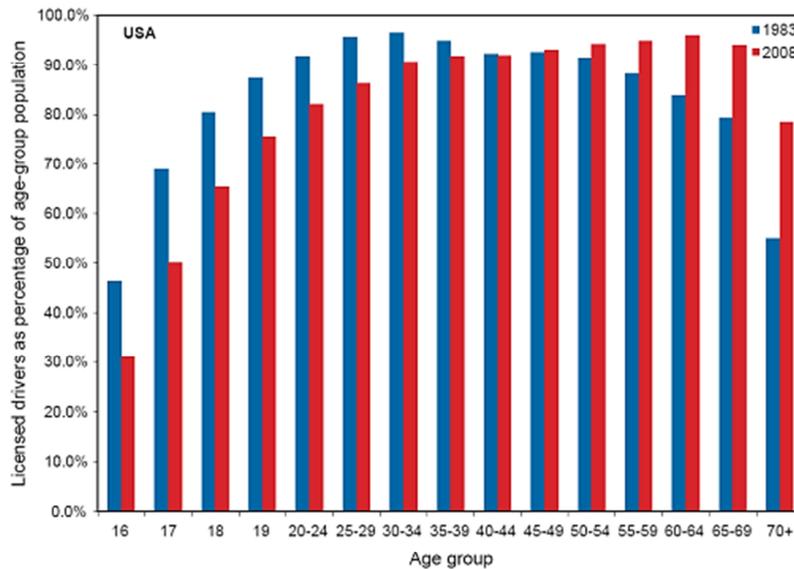


Figure 1. U.S.A.: Licensed drivers as a percentage of their age-group population (FHWA, 1984, 2009).

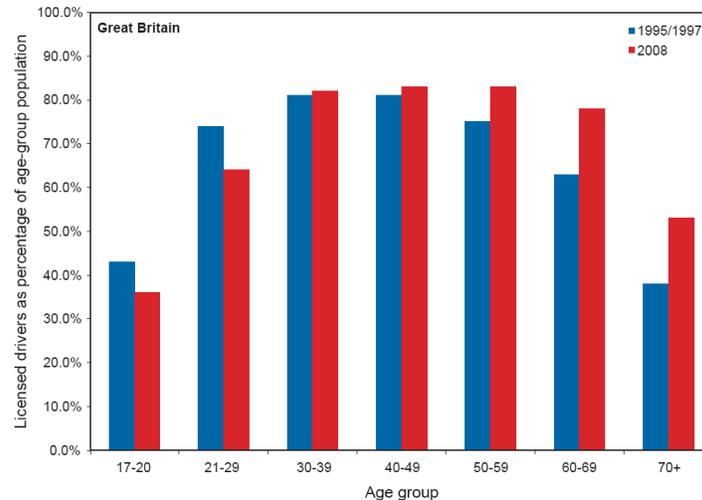


Figure 5. Great Britain: Licensed drivers as a percentage of their age-group population (Department for Transport, 2011).

This trend has continued until early 2000. But lately, there seems to be an apparent reversal, at least as far as the use of personal cars is concerned.

A significant drop in population growth, an increased urbanization, rising social inequality and unemployment seem to have contributed to an important change in passengers' choices in many Western countries.

It is commonly agreed that in the economic crisis can be found the main reason for such a shift in mobility patterns. Nonetheless the decline of car usage started well before the recession, and therefore other factors deserve to be investigated to understand the main factors causing the change.

Attaining the limits of car ownership and the impact of policy that are more favourable to alternative transport means, together with a higher social acceptance of public transport, could be at the origin of this shift.

It would be worth investigating other major societal changes to assess whether they also have an impact on mobility behaviour, and what could be the consequences for policy-making.

In the recent time of crisis, accessibility to transport also allowed a new form of "hunting" among the urban population: the hunt for jobs. The growing precariousness of working positions has imposed on the younger generations – but not only – the necessity of being ready to move where job opportunities arise. Often these modern "hunters" move alone, thus returning to the model of the "solitary nomad" of the XIX Century in the New Continent.

Are we having today in our urbanized society a return to this prototype of wanderer?

"A meaningful planning should not only be limited to the extrapolation of trends, but should aim at understanding underlying factors affecting future travel demand".

Women are indeed today the real protagonists of this societal change: they are actively participating in the "nomadic movement" by travelling for study and work; they influence life-styles; they can contribute creatively to the generation of new consumption patterns (sharing is more congenial to women than men) and to the creation of a different governance of data information/communication. A womanly approach to the management of data could modify the perspective from "control" to "participation", increasing public acceptance of increasingly invasive IC technologies.

As Beattie (2008) noted "boys are less likely to share than girls and ... in order to resolve problems of sharing girls were more inclined to negotiate whereas boys were more likely to be aggressive. This reflects the evolutionary gender difference that males are interested in personal gains and females in maintaining group harmony. Many studies have found that women are more co-operative and generous than men, ...".

## 4. A NEW NOMADIC SOCIETY

Several symptoms give evidence of the emergence of a new nomadic society:

- Sedentary living is abandoned since the training period; programmes like Erasmus facilitate exchanges of students and are becoming more and more popular, as much as a period of study abroad is now almost considered a necessity;
- New entrepreneurial structures no longer provide a long-term employment security and imply a high availability moving to other places to secure a job;
- The Nation-State structure (originated at the time of first sedentarization) is now dismantling and is losing its original role of identification of a group; smaller and smaller local organizations are replacing the central government, whereas a global super-national governance makes living conditions more and more equivalent across the world;
- The traditional family is becoming quite unusual among urban populations: mono-parental, reconstructed, multiple families are growing in number and imply a totally different organization and management of daily life in comparison to what we were used to;
- The model of “throwaway” consumption is becoming the most usual, even if not the most sustainable; dismissing instead of repairing is natural in a very mobile life-style;
- Eating habits as well are changing: family meals are no longer common in many of the Western societies; each individual comes home – if not eating out – and “grabs” food before leaving again;
- Holiday patterns changed from a long-term, short-distance pattern to long-distance/short-term trips during the year;
- The language itself is facing a sort of “compression” becoming poorer and less precise; it might be due to the modern communication means (texts and mails), but it is also a characteristic of nomadic societies who do not “have time” to reflect and speculate;
- The baggage of the modern traveler is reduced to the minimum: it could in some cases be limited to an iPad!
- Investments in housing estate (once the most secure form of saving) become seldom, not only because of the non-affordability of such goods, but also because they become a “burden”, tying a person to a geographical location which might not be suitable after a few years;
- “Short-rent” offices are more and more available for companies with moving seats and time-limited business in different locations;
- Taxation of individuals who are not stable in one place becomes a major problem for National Authorities who have to decide between the place of residence and the place of production of the income. If a business is not entirely in a country of residence, the income can be structured to be partly taxed in other countries where the taxation rate is lower.

All these factors have of course a great impact on mobility and travelling schemes:

- Displacements increase, but they are “lighter” not implying a real movement of persons (family) and goods;
- If there is a reduction in short, urban trips, we face a significant increase in long-distance travel and this affects mainly air transport;
- The switch from ownership to use – like in housing – applies as well to transport means: it is much more convenient to have the availability of the transport means more suitable to a certain situation than to have to care for and maintain one’s own non multiple-usage vehicle!
- As it was the case for ports in the Middle Age, today AIRPORTS are the pivot of growth and economy;
- The measure of distance in time is coming back: travel speed is one of the major elements for modal choice. Today road congestion is pushing strongly toward a multimodal approach for a rapid transfer from departure to arrival. A paradigmatic example is given by the aviation sector that targets to 4 hours trips door-to-door everywhere in Europe by 2020;

- Fast growing ICT infrastructure is indispensable for allowing the “light” and seamless displacements but is intruding more and more in the privacy sphere and creating ethical problems for its governance.

## 5. TWO DIFFERENT GROUPS OF NOMADS

This nomadic style of life will not be homogeneous throughout society layers.

On one side we will find the “productive” individuals who will travel long distances for business or leisure, without losing their links and contacts with their companies. They will be able to manage their affairs, follow financial transactions and have high level meetings from any distant resort, making use of advanced telecommunication technologies. For this group of people the model of “rented” or “leased” vehicle will be the most convenient one, together with long distance public transport.

On the other side we will find the growing mass of underpaid, unemployed workers who will not be in the position to afford any private transport means (with the exception of two wheelers, motorized or not) and who will be in the need of frequent displacements in search of job or affordable accommodation allowing accessibility to cheap transport means and work.

This group will be constituted by the weaker and poorer (immigrants, disabled, unemployed...). They will form a societal layer that risks being more and more emarginated from economic activities, but that could also represent a dangerous threat for social stability. It is important that this aspect is taken into due consideration and that mitigating measures are put in force. Gender-related aspects must be taken into due consideration when planning those measures.

Another significant difference will be between the urban and the rural populations. In cities the accessibility to multi-modal, public or alternative (walking and cycling) transport will be present and will allow mobility to an acceptable extent for everybody. On the contrary, in rural zones, private transport will remain a necessity, unless alternative modes will be implemented, in particular demand-responsive services.

Location will also increase the gap between privileged and “emarginated” population groups, between the “rich middle-aged” and the “poor older” people, among which the gender difference adds another layer of discrimination.

It will be imperative to find policy measures that will contrast this gap and that will contribute to the achievement of a more inclusive and equalitarian society. The use of technology alone will not be sufficient to achieve the goal; a strong public participation – including the right proportion of women’s representation – in decision-making and new paradigms will be as important as the technological development of solutions.

Furthermore, it will be paramount to avoid the risk of technological gaps between layers of the society, due not only to affordability of the products on the market, but also to the capability of use by some parts of the population who are de-facto excluded from certain developments, due to their economic status, education, age, accessibility etc.

## 6. THE RESPONSIBILITY OF PRODUCERS AND POLICY MAKERS

Transport OEMs and operators should consider the possible evolution in mobility patterns due to the new urban nomadism and adapt their business model to the new reality.

It is no longer viable to continue business as usual, grounding production and planning choices on the assumption of a growing demand for private means of transport. “Sharing” models should be considered, an increase in two wheelers use should be taken into consideration, especially in urban planning, schemes of demand-responsive transport services should be investigated, and innovative, creative solutions shaped. Investments in infrastructure should also foresee a decline in congestion, thus avoiding expensive enlargements of corridors that soon risk being over-sized, and in cities softer modes (walk and cycle e.g.) should be facilitated by the creation of transport infrastructure more adapted to the variety of users’ needs. Specific attention to women’s requirements in terms of comfort, safety and security is a must.

Policy measures, such as incentives and disincentives, limited accessibility to specific areas, increased peripheral services, will be essential for a proper deployment of a new mobility system responding to the needs of a society in rapid evolution, and will contribute to the achievement of social equity objectives.

A strong women's participation and contribution to the definition of such actions is essential to guarantee a more harmonious, shared, accepted and sustainable development of the modern transport system.

## 7. FUTURE RESEARCH NEEDS

More research to investigate these societal changes is needed in order to increase our knowledge of changing mobility demand. The rising heterogeneity of patterns is the reason for a rising uncertainty in predictions. We will need to develop policies that will result robust to uncertainty, i.e. able to fit a wide set of possible scenarios. As a baseline, one can consider that those policies that match gender-specific needs tend to rely on alternative multi-modal solutions, and that the implementation of such solutions will be virtually beneficial for the whole population, including the socially disadvantaged, thus contributing also to the achievement of social peace.

The development of scenarios that consider, under a gendered point of view, new life styles and unprecedented mobility patterns should be included in transport research programmes in order to better assess the impact of present technological development and investments, and provide a stronger scientific basis for decisions to be taken to achieve a long term, sustainable transport system.

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## DISCLAIMER

The opinions expressed in this paper are those of the author and do not reflect necessarily the position of the European Commission.

# Are millennials really the 'Go-Nowhere' generation? Divergent patterns between men and women<sup>31</sup>

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## **ABSTRACT**

News reports and academic articles have contended that Millennials are different from previous cohorts in their consumption and travel patterns. Declines in licensure and travel have been documented in the United States and other industrialized countries. This paper investigates the travel behavior of young adults aged 20 to 32 and compares the behavior of Millennials to those of previous generations, using data from the 1995, 2001, and 2009 National Household Travel Surveys, and focuses on differential changes for men and women. We found that while trips and travel distances declined for all cohorts between 1995 and 2009, the declines were largest for 20 to 32. Among young adults, men's travel declined significantly more than women's and has therefore led to a decrease in the travel gender gap among young adults. Analysis showed that the decline in the travel gender gap came from the elimination or narrowing of the gender gap in key influences of travel such as employment and licensure, as well as unobserved factors likely related to societal gender roles.

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**KEYWORDS:** Millennials; Travel patterns; Licensure; Mobility; Gender.

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# Gender differences in the travel behaviour of adolescents and young adults in Denmark

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## ABSTRACT

This study explores longitudinal trends in the travel behaviour of adolescents and young adults in Denmark in terms of mode choice, kilometres travelled, travel time, number of trips, and driving license holding. The analysis explores gender differences in travel behaviour for four age groups: 16-19, 20-24, 25-29, and 30-34 year-olds. Data are obtained from the Danish National Travel Survey between the years 1995 and 2012. The results suggest that in Denmark, in cases that there is gender-related gap in transport behaviour, the gap progresses across age groups and is different for rural and urban areas. Regarding the number of trips and the proportion of trips by purpose, the gap is greater for the older age groups and is more pronounced in rural areas. Regarding the travel distance, the gap over time diminished more rapidly in rural than in urban areas, and currently the gap is significant only for the oldest age group in urban areas. Regarding the trip proportion by mode, the difference is more pronounced in rural areas, and it diminishes with the lifecycle progression.

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**KEYWORDS:** Adolescents; Young adults; Mobility trends; Mode choice; Driver's license; Longitudinal travel trends.

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## 1. INTRODUCTION

Gender equity is considered as a fundamental value of the European Union that is essential for continuing growth (European Institute for Gender Equality, 2013). Within this framework, monitoring the gender gap in travel across time is important in understanding the ability of men and women to equally benefit from transport provision. On the one hand, transport provision facilitates economic growth and social participation and increases the opportunity space for employment, networking and leisure. On the other hand, transport is associated with relatively high burdens of monetary costs and time depletion at the individual level, and negative environmental and health externalities at the societal level (Jones and Lucas, 2012). The existence of a gap between the travel patterns of men and women has been established by extensive research since the late 1970s, and while the gender gap is decreasing with respect to automobile use and miles travelled due to a higher involvement of women in the workforce (Rosenbloom, 2006), gender differences persist. Women still have shorter commuting distances (Crane, 2007) and engage in extensive child chauffeuring with respect to men (Yarlagadda and Srinivasan, 2008; Scheiner and Holz-Rau, 2012; Siren and Haustein, 2013). On the bright side, women are more inclined to use sustainable transport modes relative to men (Polk, 2003). This study analyses the gap in the travel of young men and women in urban and rural areas. In particular, this study provides information regarding two key research questions recently raised by Rosenbloom (2006). The first question concerns expanding the knowledge about the gender gap in the travel patterns of young adults, and its importance is twofold. Firstly, changing societal trends towards higher involvement of women in the workforce, the widespread phenomenon of dual-earner and dual-career households, and changes in household composition induce changes in the travel of today's young women in comparison with previous decades (Rosenbloom, 2006). Secondly, studies have shown that, while in some countries car dependence is growing, in many OECD countries 'generation Y' sets new trends in reducing car travel and dependency, and increasing multi-modality and the use of sustainable modes (Kuhnimhof et al., 2012; Sivak and Schoettle, 2012; Frändberg and Vilhelmson, 2011). These trends may have an important impact on women's travel patterns and the gender travel gap in terms of individual benefits and societal impact.

This study focuses on investigating whether the gender gap relates to the role of women as workers and household members with respect to the task allocations in the household, or is already formed in the transition from adolescence to adulthood. The question is raised because, while for adults travel gender differences persist despite converging trends in male and female travel, for children's travel the evidence is inconclusive, for example with respect to active modes to school (McDonald, 2012). The second question concerns

identifying gender differences in travel associated with land use and community designs with different transport options. In the current study, the question concerns the gender gap in travel opportunities and burdens in rural versus urban areas. Differentiating between urban and rural areas in the analysis of gender-related gaps in travel trends is important because of the long-term interest in rural accessibility and mobility, in particular with respect to disadvantaged population groups due to deeper social inequalities (Nutley, 2005).

To answer these questions, the current study explores longitudinal trends in the travel behaviour of adolescents and young adults in Denmark, which along with Sweden and Finland, scores the highest on the Gender Equality Index among 27 European Union member states (European Institute for Gender Equality, 2013). While much of the previous research on the gender gap in travel focused on highly car-oriented nations such as the United States (e.g., Hanson and Johnston, 1985; Gordon et al., 1989; Rosenbloom, 2006; Crane, 2007), exploring the gender travel gap in Scandinavia can serve as an outer-marker for reducing the gap between males and females while also promoting sustainable transport (Carlsson-Kanyama et al., 1999; Polk, 2003). The investigated travel trends are car accessibility and driver's license holding, daily trips, daily travel distance and time, mode choice, trip purpose and the commuting time and distance. The analysis explores gender differences in travel behaviour for four age groups: adolescents (16-19), young adults in their early twenties (20-24), young adults in their late twenties (25-29) and young adults in their early thirties (30-34). These groups allow observing the changes in the gender gap related to travel behaviour in the transition from adolescence to adulthood. The Danish Rural Development Index (RDI) served to differentiate rural from urban areas. The travel data are obtained from the Danish National Travel Survey between the years 1995 and 2012.

## 2. DATA

The data source for the analysis is the Danish National Travel Survey (Transportvaneundersøgelsen – TU). The survey is conducted on a yearly basis from 1992 (apart from a short discontinuation between the years 2004 and 2006) and consists of 24-hour travel diaries collected from a representative sample of the Danish population between 10 and 84 years of age. The travel diary, completed on a randomly assigned day, elicits information regarding activity purpose, location and duration, and the trip description includes primary and secondary trip purposes, joint versus solo trips, intermediate stops, travel modes, travel distance and in-vehicle and out-of-vehicle travel time. The diary is accompanied by socioeconomic information such as age, gender, education, employment status, income, household structure (i.e., residence with parents, marital status and the presence of children in the household), residential location, driver's license holding and car ownership. Christensen (2013) provides a detailed description of the survey.

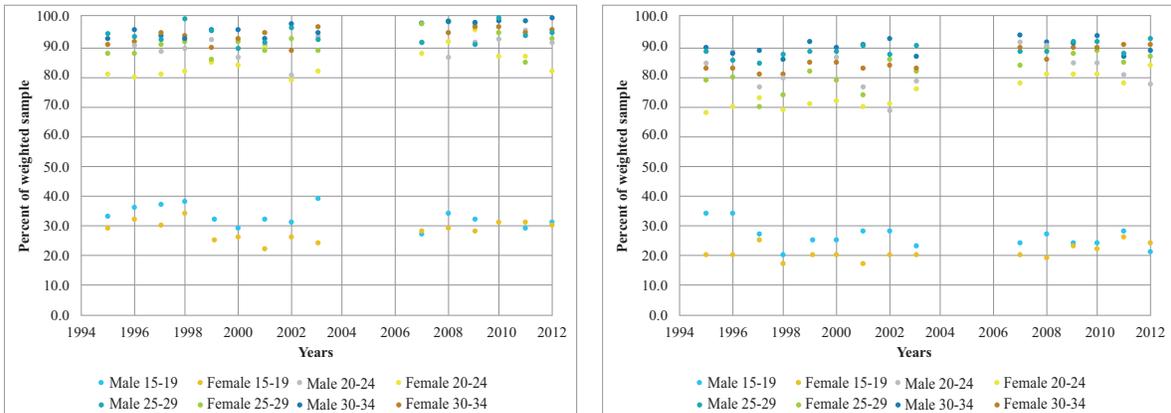
The current study focuses on adolescents and young adults; therefore, the sample includes only respondents between 15 and 34 years of age. The considered travel modes are cars, motorcycles, public transport (including buses and trains), bicycle and walk. The trip purposes are aggregated to mandatory activities, shopping activities, escort activities and other non-mandatory activities. Trips by air and maritime transport and by heavy vehicles are not considered because of the interest in land-transport trips conducted by non-professional drivers. The sample size, after excluding non-relevant trips, outlier records, and records with missing values included between 2,200-4,800 observations per year representing around 110,000-120,000 young adults per year. The number of yearly trips in the sample ranges between 7,400 and 16,100 trips representing between 3,677,000-4,484,900 yearly trips.

The Danish Rural Development Index (RDI) served for differentiating rural from urban communities. The index includes 14 equally weighted criteria including population density, proportion of rural areas in the jurisdiction, employment supply and population share employed in agriculture, share of children and elderly population, share of highly-skilled workers, accessibility to motorways and job supply, and taxation per capita (Danish Ministry of Food, Agriculture and Fisheries, 2011).

## 3. RESULTS

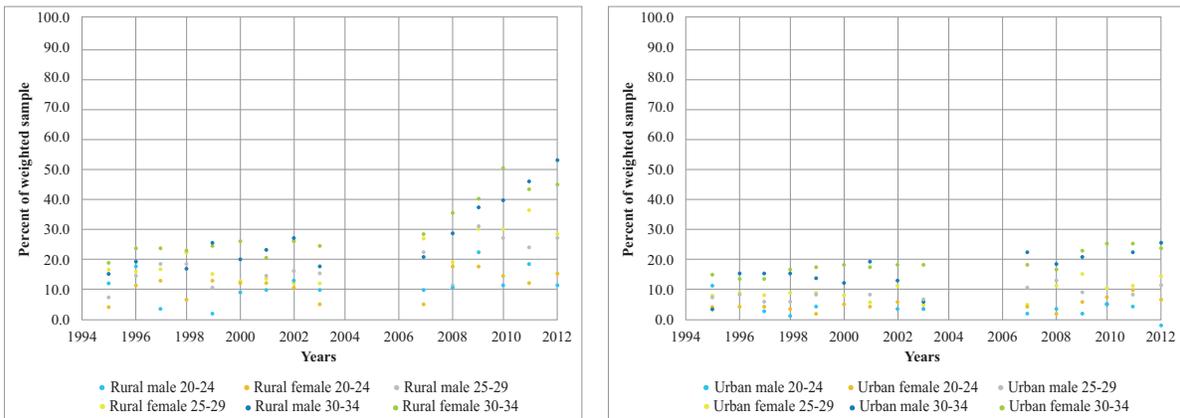
### 3.1 *Driver's license holding and car accessibility*

Figure 1 and Figure 2 present the driver's license holding and car accessibility, respectively, for the four age groups in rural and urban areas over time. Car accessibility refers only to young adults that do not reside with their parents. Pearson's chi-square tests assessed the significance of the gender difference at each year.



**FIGURE 1. Driver's license holding by males and females in rural (left) and urban (right) areas**

Across both genders, driver's license holding and car accessibility are higher in rural areas versus urban areas. The last five years have witnessed a steep increase in car accessibility in rural areas, in particular for young adults in their thirties. In rural areas, the share of driver's license holders is below 40% for the youngest age group, but exceeds 80% for people in their twenties and approaches 99% for people in their thirties. In urban areas, the shares are about 10% lower. In rural areas, a gender gap is non-significant for the youngest age group. For people in their twenties in rural areas, the gap became non-significant in the beginning of the millennium, and reappeared in the last four years. For people in their thirties, only the last three years are characterized by a significant gender gap, but because the share of driver's license holders is above 95%, the gap has no practical implication. Regarding driver's license holding in urban areas, since 2003 there is no statistically significant gender gap. Adolescent girls 15-19 years old were the first to close the gap already in 1997, followed by young women in their twenties in 2001, while a further two-year delay is associated with the older age groups. In rural areas, for young adults in their early twenties there is no systematic gender gap in car accessibility, while for young adults in their early thirties a significant gap appeared in the first decade of the millennium with higher car accessibility for women. In urban areas, there is no significant gender gap in car accessibility in any of the age groups.

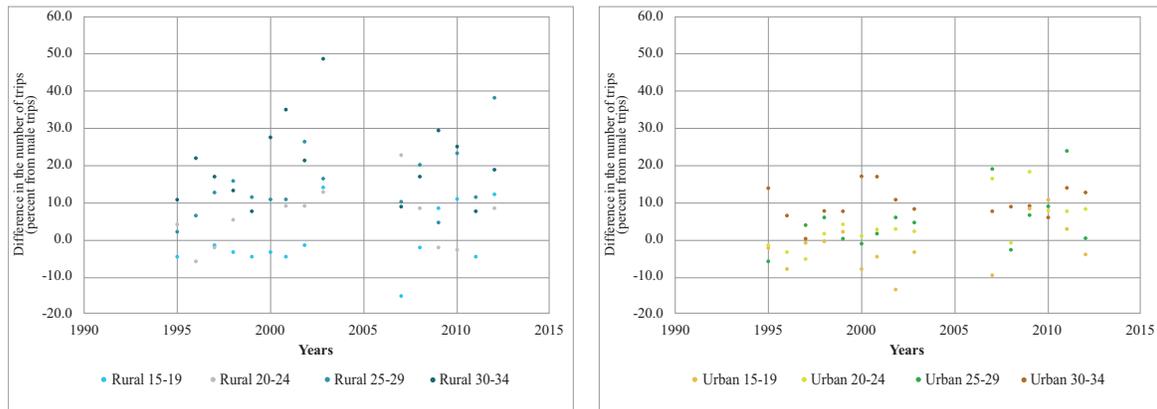


**FIGURE 2. Car accessibility of males and females in rural (left) and urban (right) areas**

### 3.2 Daily trips

Figure 3 presents the gender differences in the total daily trips as the percent difference from the male trips in rural and urban areas for the four age groups. Table 1 presents Student's t-tests for comparing the means across males and females in each group. Significant yearly differences at the 0.05 confidence level are marked in grey.

For the youngest age group, during the 1990s the gender gap in the number of trips was not significant. Both in rural and urban areas a gender gap systematically appeared in the first decade of the millennium in 15-19 years females making more trips than males. The gap was significant at the 0.10 significance level until 2009 and 2011 in urban and rural areas, respectively. For 20-24 year-olds, the gap in rural area is non-significant across the two decades. In urban areas, the gender gap was non-significant until 2003, but a systematic gap appears since 2007 with females having a higher number of daily trips. For 25-29 year-olds, in rural areas there is a systematic gender gap over time in the number of trips, with females having a higher number of trips. In urban areas, the gap has been systematically significant only since 2007. The gap is systematically larger in rural areas compared to urban areas. The oldest group of young adults shows the most pronounced systematic gender gap both in rural and urban areas, with females having a much higher number of trips. The gap systematically appears across the two decades, and it is larger in rural areas compared to urban areas. The gap in rural areas is significant at the 0.05 significance level, while the gap in urban areas in some years is only significant at the 0.10 significance level.



**FIGURE 3. Gender differences in the number of daily trips (percent difference from male trips)**

**TABLE 1. T-statistics for the comparison between the daily trips of males and females by age and region**

Year	Rural 15-19	Urban 15-19	Rural 20-24	Urban 20-24	Rural 25-29	Urban 25-29	Rural 30-34	Urban 30-34
1995	-0.85	1.58	-0.52	0.27	0.66	1.44	-1.65	-2.97
1996	0.06	0.10	0.82	0.88	-0.91	-1.31	-3.62	-1.18
1997	0.28	0.08	0.15	1.37	-1.88	-0.82	-2.69	-0.15
1998	0.71	-0.48	-0.79	-0.46	-2.28	-1.58	-2.12	-1.95
1999	0.48	1.59	-1.16	-0.92	-1.69	-0.19	-1.31	-1.87
2000	0.73	1.15	0.52	-0.15	-1.49	0.17	-4.00	-3.38
2001	0.31	2.75	-1.04	-0.70	-1.37	-0.58	-4.50	-3.30
2002	-1.64	0.66	-1.39	-0.73	-3.12	-1.64	-3.00	-2.17
2003	2.00	1.66	-1.55	-0.45	-1.87	-0.90	-5.43	-1.94
2007	0.31	-1.74	-2.88	-2.90	-1.28	-3.29	-1.24	-1.48
2008	-1.52	-1.71	-1.03	0.22	-2.20	0.55	-2.20	-1.95
2009	-1.89	-2.45	0.38	-3.75	-0.68	-1.66	-4.82	-2.16
2010	-2.21	-0.57	0.59	-2.49	-3.19	-2.54	-3.79	-1.78
2011	-2.13	1.04	-1.64	-1.67	-2.46	-5.17	-3.07	-3.29
2012	-0.01	0.12	-1.03	-1.66	-3.31	-0.01	-2.00	-2.22

### 3.3. Daily travel distance

Figure 4 presents the gender differences in the total daily trips in rural and urban areas for the four age groups. Table 2 presents the Student's t-tests for comparing males and females in each group. Significant yearly differences at the 0.05 confidence level are marked in grey. For the youngest age group, the gender gap in the travel distance is non-significant. For 20-24 year-olds in rural areas, the gender gap related to the daily travel distance is non-significant, but in urban areas a significant gender gap systematically occurred in the 1990s with urban females travelling shorter distances. The gap became non-significant since 2003 due to a steady increase in the travel distance of females. For 25-29 year-olds, in rural and urban areas during the 1990s the daily distance travelled by females was significantly shorter, and the difference was significant at the 0.05 level. With the steady increase in the travel distance of young women during this period, the gap became non-significant

in 2003. For the oldest age group, in rural areas the travel distance increased over time for both males and females, and because of a greater increase in the travel distance of females, the gender gap became non-significant since the mid-1990s. In contrast, in urban areas the travel distance of both males and females in their thirties remained rather steady over the years, with a consistently significant gender gap of roughly 20% shorter daily travel distance for females. The difference is significant at the 0.05 level.

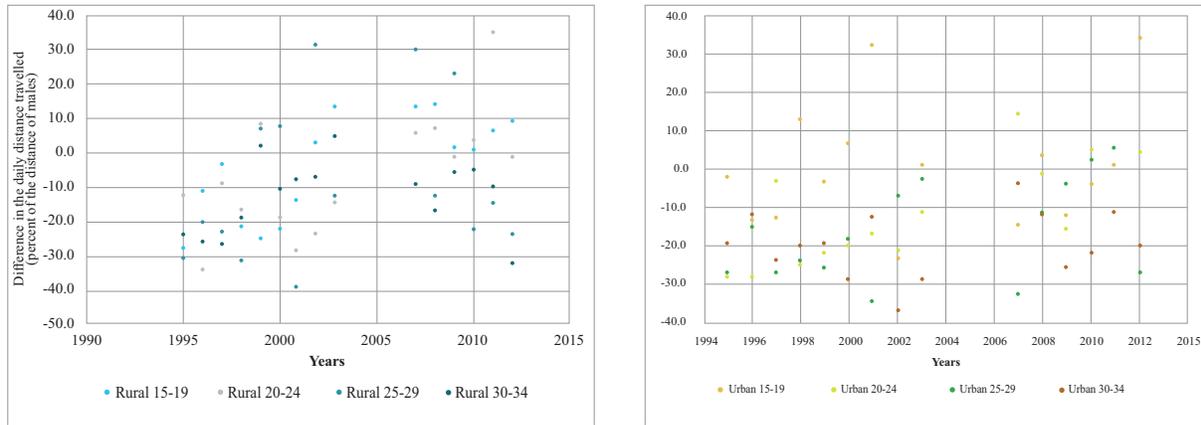


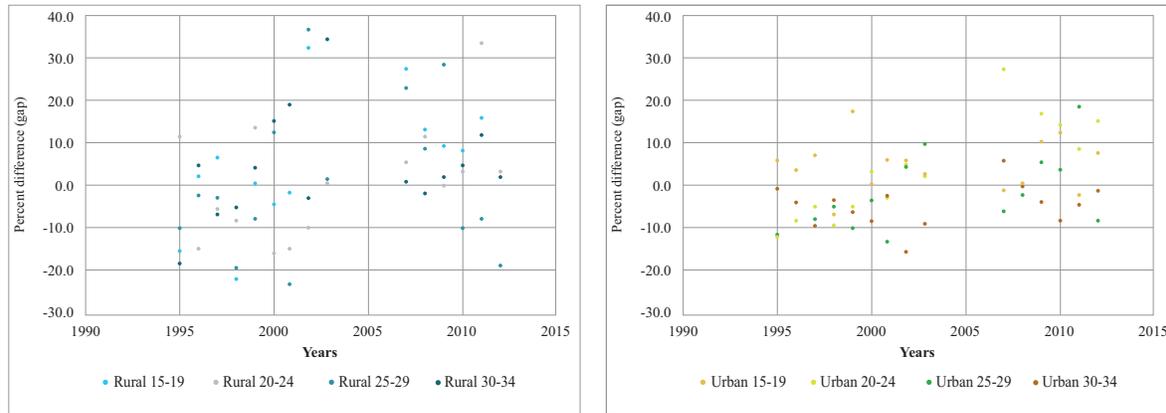
FIGURE 4. Gender differences in the daily distance travelled

TABLE 2. T-statistics for the comparison between the travel distance of males and females by age and region

Year	Rural 15-19	Urban 15-19	Rural 20-24	Urban 20-24	Rural 25-29	Urban 25-29	Rural 30-34	Urban 30-34
1995	2.14	0.27	0.97	4.22	3.09	4.37	1.95	2.84
1996	0.80	1.32	2.74	1.92	1.80	2.29	2.19	2.00
1997	0.31	1.42	0.68	0.64	1.96	4.17	2.22	3.54
1998	1.57	-1.50	1.34	3.45	2.97	3.33	1.49	2.91
1999	-0.50	0.48	-0.62	2.75	1.88	2.76	-0.18	2.85
2000	1.51	-0.79	1.30	2.25	-0.44	2.45	0.90	3.99
2001	1.15	-3.91	2.23	1.84	3.40	4.45	0.59	1.65
2002	-0.17	1.71	1.28	2.35	-1.84	0.82	0.63	3.65
2003	-0.72	-0.09	0.90	1.08	0.79	0.30	-0.36	3.03
2007	-0.67	1.65	-0.32	-1.56	-1.54	3.21	0.49	0.45
2008	-0.72	-0.28	-0.45	0.11	0.73	1.26	0.98	1.11
2009	-0.07	1.32	0.09	1.76	-1.25	0.20	0.36	3.85
2010	-0.04	0.67	-0.20	-0.63	1.95	-0.24	0.28	3.36
2011	-0.53	-0.15	-1.55	1.13	0.97	-0.54	0.69	1.51
2012	-0.42	-3.92	0.04	-0.32	1.12	2.56	2.00	1.90

### 3.4. Daily travel time

Figure 5 presents the gender differences in the total daily travel time in rural and urban areas for the four age groups, and Table 3 presents Student’s t-tests for comparing males and females in each group. Significant yearly differences at the 0.05 confidence level are marked in grey. In urban areas, the difference in travel time between males and females is approximately 10%, which is smaller than the difference of 30-40% in rural areas. For 15-19 year-olds, the gender difference in travel time is non-significant at the 0.10 significance level both in rural and urban areas. For 20-24 year-olds, the gender difference is not significant in rural areas, but it is systematically significant in urban areas since 2007, with females spending between 10-20% more time in their daily travel. For the group of 25-29 year-olds, the difference between the travel time of males and females is not systematically significant. For the group of 30-34 year-olds the difference in the travel time of males and females is non-significant across the two decades.


**FIGURE 5. Gender differences in the daily travel time**

### 3.5. Travel related to activity purposes

Figure 6 presents the gender differences in the total daily travel time in rural and urban areas for the four age groups, and Table 4 presents the Pearson's chi-square tests for comparing males and females in each group. Significant yearly differences at the 0.05 confidence level are marked in grey. The youngest age group (15-19 year-olds) does not exhibit a significant difference between males and females. The group of people in their early twenties (20-24 year-olds) does not systematically exhibit a significant difference both in urban areas, although a difference appears in some years in rural areas. For people in their late twenties (25-29 year-olds), the difference between males and females is significant only in rural areas, where males engage in more mandatory activities and females in many more escort activities. The oldest age group (30-34 year-olds) exhibits significant differences with respect to the proportions of trips by purpose, both in rural and urban areas, with the main difference being that males engage in more mandatory activities and females in more escort activities.

**TABLE 3. T-statistics for the comparison between the travel time of males and females by age and region**

Year	Rural 15-19	Urban 15-19	Rural 20-24	Urban 20-24	Rural 25-29	Urban 25-29	Rural 30-34	Urban 30-34
1995	1.47	-0.33	-0.96	2.11	1.25	2.14	2.26	0.05
1996	-0.16	-0.63	1.39	1.50	0.11	0.49	-0.30	0.64
1997	-0.58	1.06	0.47	0.94	0.24	1.53	0.59	1.71
1998	2.17	-2.08	0.86	1.81	2.22	0.86	0.47	0.50
1999	-0.01	0.03	-1.06	0.98	0.66	1.63	-0.41	1.22
2000	0.50	-0.72	1.46	-0.38	-0.67	0.80	-1.43	1.47
2001	0.17	-0.58	1.57	0.65	2.40	2.34	-1.35	0.65
2002	-2.31	-0.24	0.76	-0.62	-2.71	-0.66	-0.62	2.38
2003	-0.06	0.10	-0.06	-0.24	-0.15	-1.36	-2.89	1.47
2007	-2.04	-0.04	-0.57	-3.26	-1.57	0.88	-0.08	-0.69
2008	-1.01	-1.13	-0.82	0.29	-0.66	0.34	0.22	0.03
2009	-0.98	-1.64	0.02	-2.29	-2.32	-0.52	-0.18	0.95
2010	-0.84	0.35	-0.29	-2.28	1.20	-0.67	-0.56	1.59
2011	-1.48	-1.16	-2.25	-1.26	0.71	-2.57	-1.04	0.68
2012	-0.23	-2.10	-0.25	-1.64	-0.12	1.13	1.45	0.23

**TABLE 4. Pearson chi-square (p-value) for comparing the proportion of trips by purpose of males and females by age and region**

Year	Rural 15-19	Urban 15-19	Rural 20-24	Urban 20-24	Rural 25-29	Urban 25-29	Rural 30-34	Urban 30-34
1995	0.17	0.93	0.24	0.90	0.02	0.47	0.00	0.13
1996	0.48	0.81	0.82	0.75	0.01	0.30	0.00	0.03
1997	0.84	0.89	0.41	0.98	0.00	0.33	0.10	0.17
1998	0.94	0.80	0.24	0.49	0.00	0.22	0.00	0.00
1999	0.99	0.89	0.00	0.25	0.00	0.12	0.00	0.00
2000	0.49	0.22	0.03	0.48	0.00	0.29	0.00	0.00
2001	0.01	0.56	0.44	0.25	0.00	0.02	0.00	0.00
2002	0.13	0.16	0.28	0.30	0.00	0.12	0.00	0.06
2003	0.57	0.32	0.02	0.51	0.07	0.29	0.02	0.01
2007	0.71	0.69	0.01	0.33	0.00	0.00	0.02	0.00
2008	0.94	0.56	0.26	0.76	0.00	0.05	0.00	0.02
2009	0.84	0.00	0.55	0.18	0.00	0.11	0.00	0.14
2010	0.21	0.17	0.61	0.08	0.00	0.07	0.00	0.26
2011	0.21	0.88	0.00	0.48	0.00	0.01	0.00	0.07
2012	0.49	0.03	0.04	0.30	0.00	0.54	0.00	0.00

### 3.6 Mode choice

Figure 7 presents the gender differences in the trip proportions by mode in rural and urban areas for the four age groups and Table 5 presents the Pearson's chi-square test for comparing males and females in each group. Significant yearly differences at the 0.05 confidence level are marked in grey. For the two oldest age groups (25-29 year-olds), for both males and females, while the car remains by far the dominant mode in rural areas, car use is declining in urban areas and the use of non-motorized modes is steadily rising across the investigated time period. Regarding the gender gap, for the youngest age group there was a systematic and significant difference in the trip proportions by mode until 2007, with males conducting a higher share of trips by motorized private modes and females conducting a higher share of trips by bicycle and public transport. The difference is no longer significant in rural areas, although in urban areas a significant difference re-appeared in 2011-2012. For young people in the early twenties (20-24 year-olds) during the 1990s and the beginning of the millennium, there was a significant difference in the mode choice, with males conducting more trips by car and females travelling more by bicycle and public transport. The difference became non-significant in rural areas from 2003 and in urban areas from 2007. The difference re-appeared again in rural areas during 2010-2011. For young people in their late twenties (25-29 year-olds), in urban areas there is no significant difference in the proportion of trips by travel mode, while in rural areas there is a systematic and significant difference with males travelling more by car and females more by bicycle. For the oldest age group (30-34 year-olds), there is no significant difference in proportions of trips by travel mode for most of the period investigated.

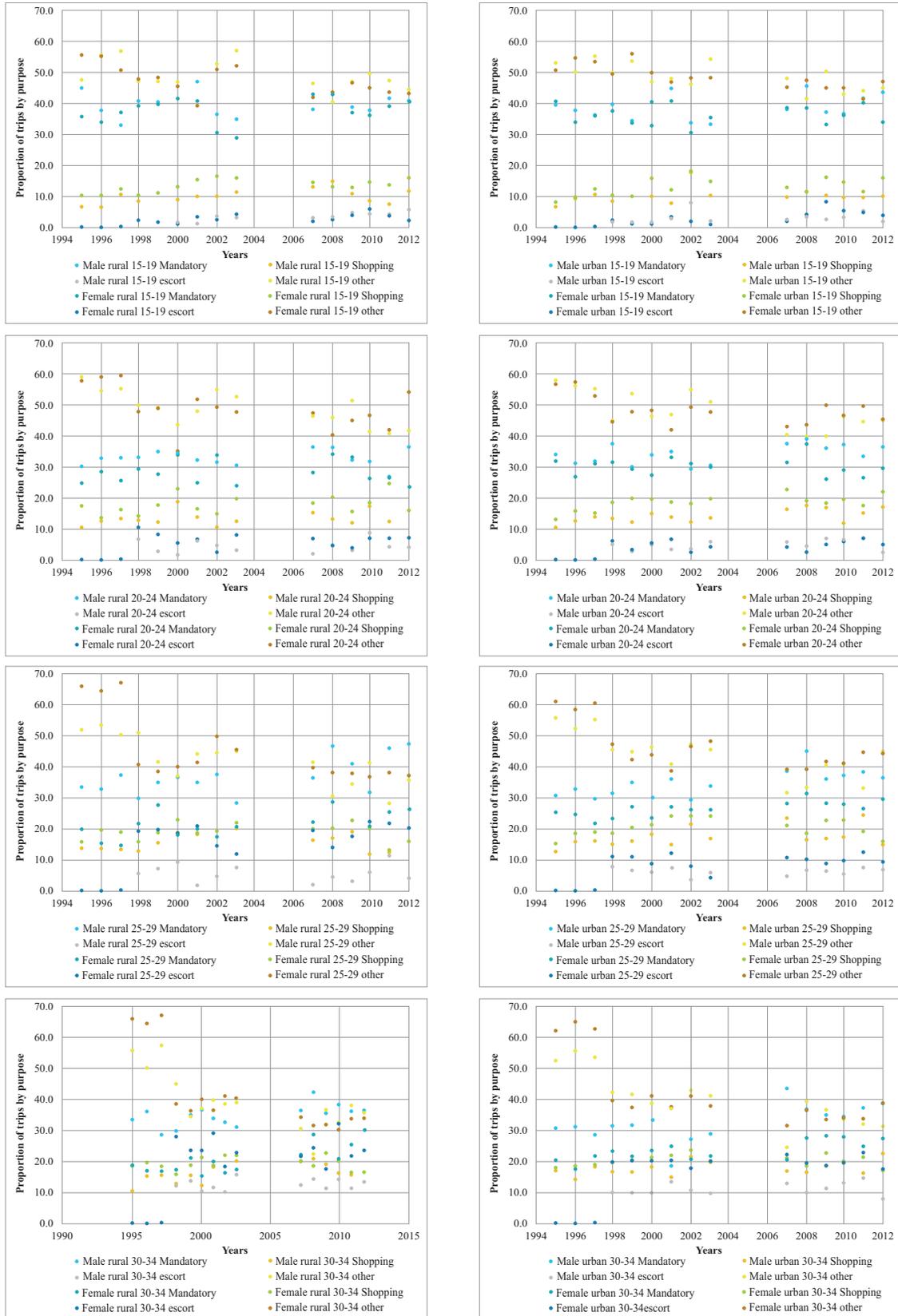


FIGURE 6. Gender differences in trip purposes

Gender differences in the travel behaviour of adolescents and young adults in Denmark



FIGURE 7. Gender differences in mode choice

**TABLE 5. Pearson’s chi-square (p-value) for comparing the mode shares of males and females by age and region**

Year	Rural 15-19	Urban 15-19	Rural 20-24	Urban 20-24	Rural 25-29	Urban 25-29	Rural 30-34	Urban 30-34
1995	0.03	0.02	0.02	0.05	0.86	0.64	0.54	0.39
1996	0.00	0.01	0.00	0.12	0.65	0.24	0.18	0.02
1997	0.01	0.03	0.00	0.01	0.87	0.46	0.04	0.05
1998	0.08	0.46	0.00	0.10	0.00	0.17	0.93	0.72
1999	0.71	0.54	0.00	0.09	0.96	0.19	0.03	0.05
2000	0.03	0.16	0.37	0.05	0.01	0.08	0.75	0.59
2001	0.10	0.00	0.01	0.12	0.00	0.04	0.89	0.24
2002	0.00	0.05	0.00	0.25	0.29	0.40	0.14	0.04
2003	0.07	0.04	0.57	0.01	0.00	0.23	0.28	0.38
2007	0.00	0.63	0.21	0.02	0.85	0.70	0.78	0.37
2008	0.64	0.79	0.38	0.26	0.03	0.35	0.02	0.64
2009	0.76	0.33	0.48	0.10	0.08	0.29	0.80	0.73
2010	0.61	0.79	0.02	0.23	0.96	0.67	0.46	0.18
2011	0.17	0.01	0.01	0.49	0.34	0.11	0.01	0.54
2012	0.28	0.04	0.43	0.13	0.02	0.62	0.60	0.50

## 4. CONCLUSIONS

The current study focuses on analysing the gap in the travel of young men and women in urban and rural areas in Denmark in the years 1995-2012. The main research questions concern (i) the change in the gender difference with the lifecycle progression, and (ii) the gender difference in rural and urban areas. The first question is raised because, while for adults consistent gender differences in travel are found in the literature, for children the findings are inconclusive. The second question is related to the gender difference considering the availability of different transport options and the socioeconomic gap between rural and urban areas.

Results show the following trends in Denmark. In terms of driver’s license holding, there is no systematic gender gap in urban areas across all age groups. In rural areas, a gender gap is non-significant for the youngest age group, but is significant for young people in their twenties, with males having a higher licensure rate. The gap is irrelevant for young people in their thirties since almost all have a driving license by this age. Hence, while women exhibit a delay in obtaining the license compared to men, most of them acquire a license by their early thirties. Regarding car accessibility, in urban areas there is no significant gender gap, while in rural areas young women in their thirties enjoy a slightly higher car accessibility compared to men. The gender gap in the number of trips increases with age, with 30-34 year-olds exhibiting the most pronounced systematic gender gap both in rural and urban areas, with females having a much higher number of trips. In terms of daily driving distance, while in the 1990s female young adults travelled significantly shorter distances than males, the gap became non-significant since the beginning of the millennium and even earlier in rural areas. The gap remains significant only for 30-34 year-olds in urban areas, with females travelling shorter distances. The difference in travel time between males and females is consistently non-significant across the two decades and it is around 1 hour a day, although it has increased by 10-20% for both males and females across the two decades. With respect to travel purpose, the two youngest age groups do not exhibit a significant gender difference in the trip proportions by purpose, but the two older groups exhibit a significant difference, with males engaging in more mandatory trips and females engaging in more escort trips. For 25-29 year-olds, the difference is only in rural areas, while for 30-34 year olds the difference is both in urban and rural areas. With respect to gender differences in mode choice, for the two younger age groups there was a significant difference in the 1990s, with males travelling more by car and females travelling more by non-motorized modes, but the difference became non-significant in the last few years. For people in their late twenties, the difference is significant in the rural areas but not in urban areas, and for the oldest age group there are no significant differences in mode use.

The results suggest that in Denmark, in cases where there is a gender-related gap in transport behaviour, the gap progresses across age groups and is different for rural and urban areas. Regarding the number of trips and the proportion of trips by purpose, the gap is greater for the older age groups and is more pronounced in rural areas. Regarding the travel distance, the gap over time diminished more rapidly in rural than in urban areas, and currently the gap is significant only for the oldest age group in urban areas. Regarding the trip proportion by mode, the difference is more pronounced in rural areas, and it diminishes with the lifecycle progression.

## ACKNOWLEDGEMENTS

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## **S**AFETY AND SECURITY

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# Sex differences in cortical thickness in first-time DWI offenders: A preliminary MRI study

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Running head: Sex differences in first-time DWI offenders.

## ABSTRACT

**Background:** Driving while impaired by alcohol (DWI) is a persistent yet preventable public health problem. Recent evidence indicates an increasing number of females engaging in DWI behaviour and distinct sex-based trajectories, though sex-based analysis is infrequent in DWI research, especially with respect to role of cognitive processes. The current study investigated associations between sex, cortical thickness analysis using high resolution Magnetic Resonance Imaging (MRI) and psychological functioning in DWI offenders. It was hypothesized that male offenders possess brain features consistent with impaired executive control, while female offenders show more signs of alcohol misuse and psychological dysfunction.

**Methods:** 31 male and 16 female DWI offenders, and 31 male and 31 female non-DWI drivers were recruited. All subjects underwent T1 high resolution MRI scanning and cortical thickness analysis using the CIVET pipeline and assessment on sociodemographic, alcohol misuse, impulsivity, and psychological adjustment.

**Results:** Male DWI offenders, compared to male non-DWI comparators, showed reduced cortical thickness in the posterior and ventral anterior cingulate cortex, the parahippocampal gyrus and anterior insula, areas associated with decision making, error monitoring and emotional processing. Female DWI offenders, compared to their female non-DWI comparators, showed no signs of structural anomalies, but stronger signs of alcohol misuse and depression and anxiety-related dysfunction.

**Conclusions:** These preliminary results suggest that sexual dimorphism contributes to the heterogeneity of the DWI offender population, the trajectory to DWI behaviour, and the uncertain effectiveness of generalized approaches to prevention.

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**KEYWORDS:** Driving while impaired; Driving under the influence; Sex; Alcohol; Magnetic resonance imaging; Executive control; Personality.

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## INTRODUCTION

An emerging neuropsychological literature into DWI indicates that DWI offenders are likely to show compromised executive control when sober [1, 2]. Specific shortcomings in decision-making, inhibitory control, working memory and emotional information processing have been detected [3-6]. Such functional limitations, and the brain features that accompany them, have been observed in other risk-taking groups including problem gamblers, substance abusers and sexual risk takers [7-12]. In addition, acute alcohol intake may magnify their influence on risk taking [13].

Most of the above observations have been made in male DWI offenders. On the whole, the preponderance of DWI convictions among the male driver population [14] has limited investigation of female DWI. Nevertheless, recent evidence indicates not only an increase in female DWI behaviour [15-17], but hints at distinct sex-based trajectories as well. Younger age, and greater sensation seeking, aggression, reward sensitivity, and disinhibition from acute alcohol consumption have been associated with male DWI [13, 18-21], while alcohol misuse, intrapersonal and interpersonal maladjustment, and susceptibility to alcohol's psychomotor-impairing effects may characterize female DWI [17, 22-24]. These findings imply that male DWI offending reflects externalizing behaviour from reduced executive control, while female DWI is consonant with psychological dysfunction. No DWI study has verified this possibility through objective measurement of brain morphology related to executive control.

The present study compared male and female first-time DWI (fDWI) offenders with their same-sex non-DWI comparators on cortical thickness measured by MRI across the cerebrum and on measures of psychological functioning. We hypothesized that male fDWI offenders possess more cortical thinning in the PFC and hippocampal regions. We further hypothesized that female offenders would show greater signs of psychological dysfunction. If these hypotheses were supported, a strong rationale for a sex-based approach for both understanding and preventing DWI behaviour would emerge.

## METHODS

*Study sites.* The Douglas Hospital Addiction Research Program (DHARP) was the main study site. MRI data acquisition was performed at the Montreal Neurological Institute (MNI), and MRI data analyses were undertaken at the Douglas Brain Imaging Research Consortium facility. All sites are affiliated with McGill University.

*Participant inclusion/exclusion and recruitment.* Participant recruitment was drawn from a larger longitudinal study investigating the role of neurobiological factors in the transition from fDWI to recidivism status. For fDWI offender recruitment, inclusion criteria were: i) age 18 to 44; ii) a fDWI conviction within the previous 24 months with no subsequent DWI arrest; and iii) consent for access to their provincial driving record. For non-DWI driver recruitment, inclusion criteria were: i) ages 18 to 44; ii) a valid driver's license; and iii) a DWI-free driving record. For all participants, exclusion criteria were: i) reading skills of less than 6<sup>th</sup> grade level (either in French or English); ii) significant medical contraindications; iii) large torso or head tattoos (a risk for MRI); and iv) being under the acute influence of alcohol or drugs during laboratory visits. Study participation was solicited by advertisements in local newspapers, Facebook<sup>®</sup> and the DHARP's webpage. Pamphlets were also placed in correspondence to offenders from Quebec's designated re-licensing authority. Ethics boards of both the Douglas Hospital and MNI Research provided ethical approval and oversight of all recruitment, informed consent and experimental procedures.

*Procedures.* When study candidates telephoned the laboratory, an initial interview was conducted to establish eligibility based upon inclusion/exclusion criteria. On arrival to the laboratory, eligible study candidates were asked to present picture identification and proof of DWI status. Candidates then received Informed Consent forms to read, discuss and clarify any questions of the protocol, and sign if acceptable. Participants then underwent: i) a Breathalyzer<sup>®</sup> test; ii) medical examination by a research nurse and a clinical evaluation by the team's research physician (JT) to confirm study inclusion if the nurse detected any signs of medical risk or substance-induced intoxication; and iii) sociodemographic, alcohol, drug and psychological assessment. MRI of participants, if consented to as a separate facet of the overall protocol, occurred during a separate session was carried out within 14 days of the initial session.

## Measures

*MRI acquisition and cortical thickness analysis.* MRIs were acquired on a 1.5-T Siemens SonataVision (Siemens, Malvern, Pennsylvania). Participants were scanned with a high-resolution T1 three-dimensional magnetization-prepared Flair sequence (slice thickness = 1 mm isotropic; repetition time = 22 ms; echo time = 9.2 ms; flip angle = 30°). Cortical thickness analyses were completed using the automated analysis pipeline developed at the Montreal Neurological Institute [25]. All images were corrected for non-uniformities and registered into standard stereotaxic space [26]. The corrected and registered MRI scans were then segmented into gray matter, white matter and cerebrospinal fluid using a neural-net classifier [27]. Laplacian anatomical segmentation was used to determine white and gray matter surface boundaries using a surface

deformation algorithm [28], which yields 40,000 vertices of linked gray and white matter surfaces. Cortical thickness was then computed as the distance between the linked gray and white matter vertices. Once completed, individual cortical thickness data were smoothed using a blurring kernel of 20 mm.

*Sociodemographics and psychosocial functioning.* Information about age, marital status, education, and employment was obtained using the Addiction Severity Index (ASI) [29, 30].

*Substance use severity and diagnosis.* The Michigan Alcoholism Screening Test (MAST) [31] provided a index of lifetime alcohol problem severity and related negative consequences, while the Alcohol Use Disorder Identification Test (AUDIT) [32] screened for alcohol problems in the previous 12 months. The Drug Abuse Screening Test (DAST) [33] provided a index of drug problem severity. The Timeline Followback protocol (TLFB) [34] measured the frequency of risky drinking days over the previous 180 days. The structured, computer-assisted Composite International Diagnostic Interview (CIDI) [35] provided diagnostic classification of alcohol and drug use disorders. The ASI provided family history of alcohol problems. A Breathalyzer® test detected recent alcohol use.

*Personality and Psychological Characteristics.* The Barratt Impulsivity Scale version 11 (BIS) [36] measured three impulsivity dimensions: cognitive, behavioural and planning. The Sensation Seeking Scale (SSS-V) [37, 38], validated 19-item questionnaire, measured three dimensions: i) thrill and adventure seeking; ii) experience seeking; and iii) disinhibition and boredom susceptibility. The Millon Clinical Multiaxial Inventory III (MCMI) [39, 40] provided validated information regarding probable Axis I and/or Axis II disorders, specifically anxiety, dysthymia, depression, and antisocial traits. Its validity index provided an indicator of respondent test taking attitude.

## **Analytic strategy**

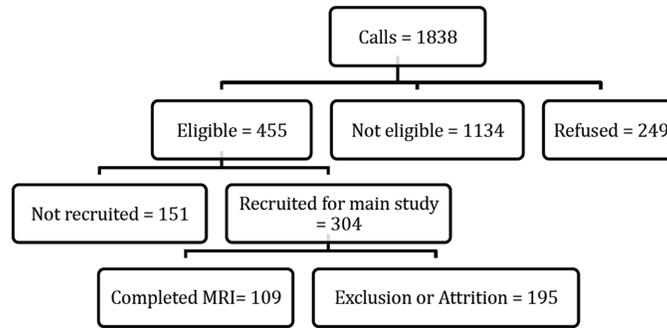
*MRI data.* Logistic regressions were performed at every vertex, with cortical thickness as the dependent variable and recidivism status as the independent variable for only male subjects, only female subjects and all subjects combined, in three separate analyses. All regressions were controlled for age and handedness. All cortical thickness results were thresholded by applying the false discovery rate at a q value of 0.05 [41] and only considering results that met the criteria of being  $F > 6.0$ .

*Sociodemographic and psychometric data.* T-tests were used with continuous sociodemographic and psychological variables to detect group differences between male and female DWI offenders and their non-DWI controls. In the case of significantly non-normally distributed data, Mann-Whitney U statistic was used for continuous data. Group differences on categorical data were detected by tests of independence. Alpha for all inferences was set at  $p < .05$ .

## **RESULTS**

*Sample recruitment.* Figure 1 describes the participant recruitment from a larger study from which the present sample is drawn. Full data for the present study were collected from 31 male fDWI offenders and 31 male non-DWI comparators and 16 fDWI offenders and 31 female non-DWI comparators. Some difficulty in recruiting female fDWI offenders was encountered due to a relatively fewer calls (13%) compared to the male offenders (33%).

*Sociodemographics.* Table 1 summarizes the sample sociodemographic characteristics. Analyses to detect group differences found only one: male non-DWI comparators were more likely to be cohabitating with their partners than the male DWI offenders ( $\chi^2(1) = 6.27, p = .012$ ).



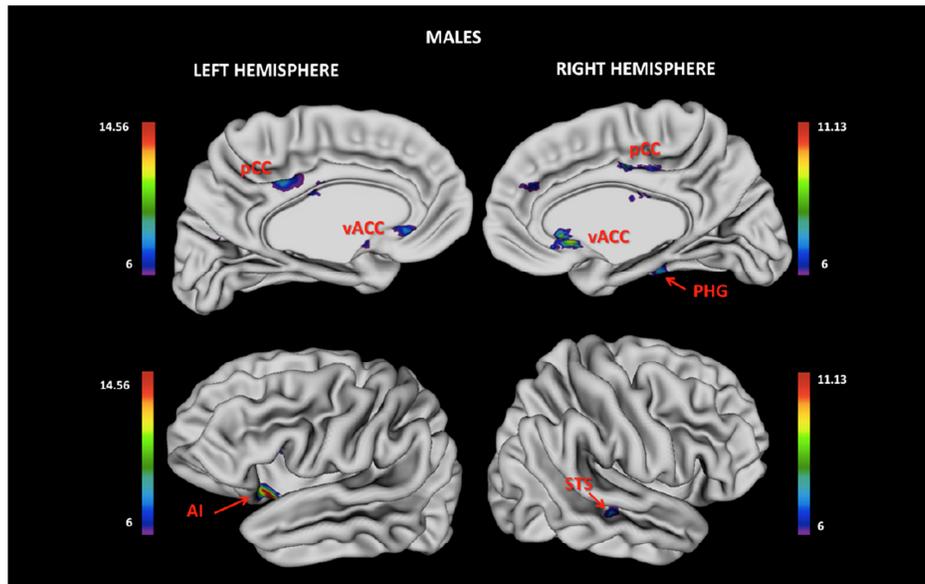
**FIGURE 1. Recruitment flow chart from initial call, screening for eligibility, recruitment, attrition and completed data collection**

**TABLE 1. Sociodemographic and substance use characteristics of male and female fDWI offenders and their non-DWI comparators**

	Male				Females			
	Non-DWI (n=31)		fDWI (n=31)		Non-DWI (n=31)		fDWI (n=16)	
	M (%)	SD	M (%)	SD	M (%)	SD	M (%)	SD
<b>Age</b>	30.0	8.0	28.5	7.0	30.8	7.7	32.6	8.8
<b>Education (years)</b>	14.5	2.8	13.9	2.8	16.1	2.4	15.4	2.3
<b>Annual Revenue</b>								
≤ \$11,999	(30.0)		(32.3)		(22.6)		(12.5)	
\$12,000-29,999	(30.0)		(29.0)		(35.5)		(43.8)	
\$30,000-\$49,999	(26.7)		(32.3)		(35.5)		(37.5)	
≥ \$50,000	(13.3)		(6.5)		(6.5)		(6.3)	
<b>Marital Status</b>								
Married or cohabitating	(40.7)		(19.4)		(25.5)		(25.0)	
<b>Occupation</b>								
Working full time (≥35h)	(58.1)		(61.3)		(45.2)		(62.5)	
Working part-time	(12.9)		(3.2)		(19.4)		(6.3)	
Student	(29.0)		(25.8)		(32.3)		(25.0)	
Unemployed	(0.0)		(9.7)		(3.2)		(6.3)	
<b>Right handedness</b>	(80.6)		(80.7)		(93.6)		(93.8)	
<b>Substance Use</b>								
AUDIT	5.7	5.9	7.4	4.5	3.5	3.4	6.4	
MAST	4.4	7.1	9.7	7.5	3.5	5.7	15.6	
DAST	1.2	1.6	1.9	3.0	0.8	1.4	1.6	
<b>Substance Use (last 90 days)</b>								
Alcohol use days	23.5	33.8	48.7	40.5	22.8	30.4	35.3	
Risky drinking days	4.0	7.1	10.3	11.6	4.5	7.1	7.6	5.3
Cannabis	9.4	26.9	7.8	21.9	7.4	22.5	9.1	11.8
Alcohol Dependence (lifetime)			(25.8)				(56.2)	
Family history of alcohol problems			(64.5)				(56.3)	

Figure 2 depicts differences on cortical thickness between male fDWI offenders versus their non-DWI comparators. Significant differences ( $p < .05$ ) between the fDWI offenders and their non-DWI comparators were found laterally in the right hemispheric regions of the superior temporal sulcus of the temporal lobe ( $F = 7.75$ ,  $r^2 = 0.11$ ), medially in the right hemispheric regions of the ventral ACC ( $F = 9.54$ ,  $r^2 = 0.13$ ) and posterior cingulate cortex ( $F = 8.86$ ,  $r^2 = 0.12$ ), and the parahippocampal gyrus ( $F = 7.89$ ,  $r^2 = 0.11$ ). Laterally in the left hemisphere, differences were found in the anterior insula ( $F = 14.49$ ,  $r^2 = 0.19$ ), while medially in the

left hemisphere, differences were detected in the posterior cingulate cortex ( $F = 9.07$ ,  $r^2 = 0.12$ ) and ventral ACC ( $F = 8.44$ ,  $r^2 = 0.11$ ). The x y z MNI space coordinates for these findings are shown in Table 2. In females, no significant differences in cortical thickness were found between fDWI offenders and their non-DWI comparators.



pCC= posterior cingulate cortex  
 AI = Anterior Insula  
 STS = superior temporal sulcus  
 vACC = ventral anterior cingulate cortex  
 PHG = parahippocampal gyrus

**FIGURE 2. MRI of cortical thickness in male first-time DWI offenders (n = 31) versus their male non-DWI comparators (n = 31)**

*Substance Use.* The lower portion of Table 1 summarizes group substance use characteristics. In males, fDWI offenders, compared to their non-DWI comparators, reported significantly greater proportion of risky drinking days (i.e.,  $\geq 5$  standard drinks for males;  $U = 280.00$ ,  $p < .01$ ) via the TLFB, lifetime symptoms and consequences of alcohol misuse via the MAST ( $U = 186.50$ ,  $p < .001$ ), and symptoms and consequences of alcohol misuse in the past year via the AUDIT ( $U = 337.0$ ,  $p = .04$ ). In females, fDWI offenders, compared to their non-DWI comparators, reported more symptoms of lifetime symptoms and consequences of alcohol

**TABLE 2. Significant differences in cortical thickness between fDWI offenders (n=31) and controls (n=31) in male subjects (region, MNI space coordinates, effect size)**

Region	x	y	z	F	p
Left					
Posterior cingulate cortex	-3.2	-23.9	40	9.0	<.01
Subgenual anterior cingulate cortex	-2.6	27.5	-8.8	9.3	<.01
Anterior Insula	-31.3	13.2	-17.1	14.6	<.001
Right					
Subgenual anterior cingulate cortex	2.6	16.5	-5.3	10.2	<.01
Posterior cingulate cortex	5.8	-7.6	39.9	8.9	<.05
Parahippocampal gyrus	29.7	-35.7	-25.0	7.2	<.05
Superior temporal gyrus	53.9	-29.4	-6.0	7.3	<.05

misuse than controls via the MAST ( $U = 65.00$ ,  $p < .001$ ), and symptoms and consequences of alcohol misuse in the past year via the AUDIT ( $U = 151.50$ ,  $p = .03$ ). Direct comparison between male and female DWI offenders revealed females reporting more alcohol symptoms and consequences than males on the MAST ( $U = 158.00$ ,

$p = .04$ ) but not on the AUDIT or DAST. Analyses of family history of alcoholism failed to detect sex differences in the proportion of male versus female fDWI offenders identifying one or more family members (parents, grandparents, aunts, uncles, siblings). Test of independence indicated that female offenders were significantly more likely to have had a lifetime alcohol dependence diagnosis than the males ( $\chi^2(1) = 4.24, p = .04$ ). Of those fDWI offenders with a diagnosis of alcohol use disorder, a significant sex difference on mean age of onset was detected with males reported younger age ( $M = 22.63, SD = 7.01$  vs.  $M = 32.56, SD = 7.81; t(15) = 2.74, p = .02$ ).

*Personality and psychological adjustment.* Table 3 summarizes the means and standard deviations of participants' scores on the BIS, SSS-V and the clinical subscales MCMI. On the BIS, female fDWI offenders reported more motor impulsivity than their non-DWI comparators ( $F(1, 45) = 5.84, p = .02$ ). No differences were detected on cognitive and non-planning impulsiveness. In the males, no differences between fDWI offenders and their non-DWI comparators were detected. No differences on the subscales of the SSS-V between fDWI offenders and their non-DWI comparators were detected in either males or females.

On the MCMI, preliminary analyses were conducted on data from the validity subscales, namely social desirability and disclosure. Analysis revealed a high probability of test invalidity in three fDWI and three non-DWI male participants, and in no fDWI and seven non-DWI female participants. These cases were removed from subsequent analyses of clinical subscales. Analyses then compared fDWI offenders and their non-DWI controls on validity-adjusted scores. In the males analyses revealed a significant difference on the anxiety disorder scale ( $U = 291.0, p = .03$ ) with fDWI offenders reporting more severe characteristics. In females, significant differences between fDWI offenders and their non-DWI comparators were found on the dysthymic ( $U = 149.5, p = .03$ ), anxiety ( $U = 149.5, p = .03$ ), and antisocial ( $U = 126.0, p < .01$ ) scales, and a trend for significance on the depressive scale ( $U = 166.0, p = .06$ ) scale; female fDWI offenders consistently reported more severe characteristics on these measures.

	Males				Females			
	Control (n = 31)		fDWI (n = 31)		Control (n = 31)		fDWI (n = 16)	
	M	SD	M	SD	M	SD	M	SD
<b>BIS</b>								
Planning	23.84	5.70	24.32	3.93	23.90	4.04	25.88	4.00
Motor	22.94	6.87	21.71	3.81	20.35	3.13	23.00	4.29
Cognitive	17.55	4.08	17.35	3.00	16.61	2.73	16.88	2.47
<b>SSS</b>								
Thrill	6.90	2.87	6.61	2.75	6.03	2.40	6.00	3.03
Experience	6.58	1.88	5.90	1.80	6.58	2.06	6.88	2.09
Disinhibition	4.87	2.77	5.03	2.47	3.71	2.18	4.38	2.47
Boredom	3.26	2.24	2.74	2.39	2.51	2.06	2.94	1.91
<b>MCMI*</b>								
Dysthymic	24.80	30.91	24.69	26.98	13.16	23.90	31.00	30.91
Depressive	34.87	32.51	38.79	31.52	18.87	26.85	35.19	30.75
Anxiety	31.00	34.47	48.62	30.98	28.06	28.27	53.00	30.29
Antisocial	50.07	25.40	52.38	20.56	44.19	18.12	61.88	19.75

Based upon 28 male fDWI offenders and 28 male non-DWI comparators, 16 female fDWI offenders and 24 female non-DWI comparators, invalid tests removed. BIS: Barratt Impulsivity Scale; MCMI: Millon Clinical Multiaxial Inventory; SSS: Sensation Seeking Scale-V.

Table 3. Means (M) and standard deviations (SD) on personality and psychological characteristics of male and female fDWI offenders and their non-DWI comparators.

## DISCUSSION

In support of our first hypothesis, we found that male offenders compared to their male comparators showed evidence of reduced cortical thickness that was not observed in the female offenders. Affected regions were the ventral anterior and posterior cingulate cortex and the ventral ACC, the parahippocampal gyrus and the anterior insula. These areas individually have been associated with executive control and are also parts of the limbic system involved in emotion regulation [42, 43]. This suggests involvement of both cognitive and emotional self-regulatory processes. In support of our second hypothesis, female fDWI offenders showed more signs of heavier alcohol misuse and greater psychological difficulties, but no detectable differences in cortical thickness.

Both posterior and ventral divisions of the cingulate have been implicated in error detection and monitoring, reward-related processes, decision making, and inhibition [44, 45]. The posterior cingulate cortex is thought to serve multiple roles as a cortical hub integrating information across different brain networks. These include the control of responses to rapidly changing environments and gain-specific activation, specifically evaluation of the positive valence of arousal through episodic and autobiographical memory, and salience detection related to reward [46] [47]. Greater activation to alcohol cues has been seen in relation to disordered alcohol consumption, possibly indicating distortion of reward processes related to alcohol [48]. Moreover, posterior cingulate atrophy has been associated with treatment refractoriness [49]. In driving simulation research, posterior cingulate activation, possibly related to spatial attention and monitoring, has been associated with driving speed [50].

The ventral ACC has been associated with identification of the emotional significance of environmental stimuli and the creation of affective states [51]. Its activation has been linked to risky decision-making in adolescents [52]. In pragmatic contexts, ACC activity has been associated with relapse to criminal behaviour [53] and to weak appraisal of driving-related risk [50]. In driving simulation research, ACC activity is attenuated by alcohol, resulting in alterations in driving speed [54]. The parahippocampal cortex, in particular the right parahippocampal gyrus, has been associated with encoding and maintenance processes of working and long-term memory, a key component of effective learning from past experience [55, 56].

Along with sex differences in brain morphology associated with executive control, sex differences in the anterior insula signal a possible role for emotional control in their offending. The anterior insula is posited to be an important node in the brain networks that underlies both emotional and cognitive control [57] as well as emotional decision making [58] – through the integration of information from the somatosensory cortex and limbic areas, and then by feeding this information to cognitive control areas such as the posterior cingulate cortex, the dorsal ACC, and the dorsolateral PFC. Deficits in decision-making under risk have been seen in male DWI offenders performing the Iowa Gambling Task [4, 6, 59, 60]. Another study has also found that reduced gray matter volume in the anterior insula was correlated with decreased interoceptive accuracy and subjective ratings of visceral awareness [61], processes related to the ability to translate bodily responses to stimuli (e.g., increased heart rate in response to threatening stimuli) to feelings (i.e., fear) [62]. Behaviourally, the anterior insula has been associated with decreased harm avoidance and anticipation of aversive events [63], and disruption in decision making under risk [58, 64]. Finally, alcohol consumption blunts activation of the anterior insula to an emotional processing task [65], a finding that links intoxication to decreased interoceptive awareness. Hence, structural weakness in this area and its behavioural correlates (e.g., risky decision making) could be further compounded by acute alcohol consumption.

Female fDWI offenders presented with significantly greater alcohol misuse, dysthymia and impulsive and antisocial personality traits, and trends for greater anxiety and drug abuse, differences not seen to the same degree in the males. These sex differences are generally consistent with previous studies [66, 67]. Such findings have led to a gender-based interpretation of the meaning of DWI behaviour, especially related to the role of alcohol. In males, heavy drinking is generally perceived as more socially acceptable, with DWI being an unintended or irresponsible consequence. In females, heavy alcohol use is frequently perceived as deviant behaviour and a maladaptive coping response to psychosocial, interpersonal and mood dysfunction [22, 68].

Additional exploratory analyses were undertaken to inform speculation about the origins of observed sex differences in brain morphology. Significantly earlier onset of alcohol dependence was detected in male offenders compared to female offenders (i.e., on average 22 years vs. 33 years respectively). Earlier maladapted alcohol consumption, especially in adolescence, is associated with disrupted brain development [69]. The present results are also congruent with mounting support for distinct female etiologic pathways to alcohol misuse and its consequences [70], with mood-related dysfunction playing an antecedent role [67, 71].

*Limitations.* This study presents novel yet preliminary MRI data on fDWI offenders, with some noteworthy limitations. Sample sizes were unbalanced, thereby potentially limiting statistical sensitivity to detect subtler group differences. This was particularly the case of female fDWI offenders who were less numerous, which could have resulted in less power in analyses in the females. The difficulty in recruiting female DWI offenders is known, and reflects not their under-representation in the DWI population, but possibly the greater stigma attached to female alcohol misuse [72]. The decision not to correct alpha level in repeated analyses was an attempt to reduce the possibility of Type 2 error in this preliminary study due to limited sample size. Relatedly, exclusion because of body tattoos may have limited the representativeness of the sample to the population of DWI offenders. Finally, a DWI conviction as an index for group membership is confounded by several individual

(e.g., socioeconomic status, the ability to retain competent legal representation) as well as environmental (e.g., regional laws and per se BAC criteria for DWI convictions, enforcement policies and vigour) factors [73, 74]. These circumstances vex the DWI research and may have influenced the representativeness of the present sample and the generalizability of the findings to other jurisdictions.

*Conclusions.* The present study provides preliminary evidence for sexual dimorphism in the heterogeneity in behaviour observed in DWI offenders. Areas in males where cortisol thinning was uncovered are consistent with shortcomings in executive control capacities involving in reward-related processes seen in other neuropsychological studies. Female DWI seemed to follow a trajectory consistent with that frequently observed in female alcohol misuse, where alcohol misuse is an outgrowth of psychological dysfunction. These preliminary findings provide rationales for confirmatory replication of the results, and exploration of sex-specific approaches to DWI prevention.

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## FINANCIAL DISCLOSURE

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# Gender differences in risky driving in presence of young passengers

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## ABSTRACT

Men account for most of the traffic fatalities in the US. Current data show, however, that the prevalence of women in fatal motor vehicle crashes is rising. This may be reflecting the increasingly complex roles that women are playing in our society, as well as changes in risk taking. Although most adult drivers, male and female, are aware of safe-driving benefits there are many factors that induce drivers to participate in risky driving behaviors. For many adult drivers, however, the presence of a child in the car may serve as a cue to engage in safe-driving behaviors. The aims for this study included assessing whether the presence of a child passenger in a vehicle cues adult drivers to adopt safe-driving behaviors and whether the driver's gender affected this association. In an effort to determine whether risk-taking behaviors by drivers in vehicles with children have changed, we also estimated trends in the prevalence of alcohol-involved, speeding, and red light running to fatal crashes over time. We used the 1982-2010 Fatal Accident Analysis System. Only drivers at least 21 years old were included in the analyses. Results indicate that after taking all other variables into account, the presence of a child in a car does in fact have a protective effect on the likelihood of crashes. Interestingly, when looking at female drivers with fatally injured children, who were alcohol positive, running a red light, or speeding, we found that the percentage of women who were drinking and driving with children in the car showed a constant increase. Compared to men, the proportion of women who were drinking and driving with children in the car has increased over time, from about 30% in 1982, up to 41.2% during 2006–2010. Similar increases over time were also observed for speeding and red light running. Thus, our findings seem to confirm that, although most drinking drivers are still men, and children play a protective role regarding traffic safety, female drivers have become increasingly involved in crashes when they were driving young children.

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**KEYWORDS:** Wreckless driving; Child endangerment; DUI; DWI.

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## INTRODUCTION

Men account for most of the traffic fatalities in the United States (1). Current data show, however, that the prevalence of women in fatal motor vehicle crashes is rising (2). To a large extent, this increase may reflect the evolution of social roles, in that women are increasingly embracing roles formerly assigned to males. Nevertheless, ample evidence indicates that women are safer drivers than men (e.g., [2-7]) and tend to drive less (e.g., [4, 8]).

A traditional male role in the United States has been earning an income to support the family. Since the introduction of the automobile and because of social norms prevailing at the time, men traditionally drove more frequently, while women stayed at home to care for children and the household. However, as social norms changed, women's participation rate in the labor force grew and men's participation in household tasks increased (9, 10). At the same time, women's reliance on cars increased (11). Yet, despite women spending more time at work and less time at home, many women continued to perform the traditionally female household roles. As such (12) women, including those who worked fulltime outside of the home, continued to bear the main responsibility for housework, child care, and even elderly care (13-17). Such roles still prevailed over a decade later (18, 19). Not surprisingly, the total number of vehicle-miles traveled (VMTs) by women, as well as the frequency and length of the trips, has risen (20).

In addition to the increase in motor vehicle crashes and VMTs among women, women may be engaging in riskier driving behaviors, such as impaired driving. For example, recent research suggests that women currently are more at risk of impaired driving than in previous decades (21, 22). The Traffic Injury Research Foundation (TIRF; [23]) reports that driving-while-intoxicated (DWI) arrests of women have climbed almost 30% from 1998 through 2007, and the proportion of males-to-females arrested for alcohol-related violations has decreased from 10-to-1 in 1980 to almost 3-to-1 in 2007 (23).

Because women remain the main caretakers of the family and the transporters of children, and because statistics suggest that women are increasingly involved in crashes, driving exposure, and risky-driving behaviors, the issue of child endangerment may be of concern. In a recent study, Kelley-Baker and Romano (2014) found that the presence of a child induces adult drivers to take less driving risks. It is unclear however if the size of such influence varies with the drivers' gender. It will be interesting to examine if, compared with men, female drivers (who overall tend to be safer drivers than male drivers) also are safer drivers when driving children. One goal of this effort is to conduct such examination. Moreover, if that is the case, then it would be interesting to examine how this gender-related difference has evolved over time. As women's roles in society continue to approach parity with men's, with increasing dual work and home demands, any gender-based protective role that the presence of children may have had on their drivers could erode. Also of particular interest in this study are possible changes in driving behaviors among women and their role as caretakers, specifically, whether risky-driving behaviors occur while transporting children.

The media has highlighted several stories involving mothers' endangerment of child passengers. For example, one extremely sensationalized story in 2009 reported that a Long Island, New York woman, with a BAC twice the illegal limit, drove her minivan the wrong way on a highway and crashed head-on into another vehicle. She died instantly, along with her 2-year-old daughter, three young nieces, and the driver and passenger of the vehicle she struck. In 2011, a Pennsylvania mother veered off the side of the road and crashed, killing her 14-year-old son. Two beer bottles, an empty vodka bottle, and prescription pills were found in the mother's van. Though these incidents are tragic, they are not isolated.

Alcohol is not the sole factor that increases children's danger in vehicles. For example, speeding and red light running are also often identified as risk-taking or reckless driving behaviors. Although generally most studies show that women are more risk-averse than men (24), as women's roles in society change, their behaviors may also change and approach parity with men's. Rushing to work after dropping kids off, rushing to meetings, then rushing to pick up the kids can lead to speeding, red light running, and other risky driving behaviors, which may be compounded by binge-drinking episodes at social events or heavy drinking related to stress or depression. Thus, children traveling with these drivers may be at increased risk.

Although most adult drivers are aware of safe-driving benefits (e.g., defensive driving techniques), factors such as stress, differences in personality traits, the performance of repetitive driving tasks, and the availability of music or other distractions may entice drivers to participate in risky driving behaviors. We hypothesize that, for many adult drivers, the presence of a child in the car may serve as a cue to engage in safe-driving behaviors. In this study, we began testing this broad hypothesis.

This study's aims included assessing whether the presence of a child passenger in a vehicle cues adult drivers to adopt safe-driving behaviors. We evaluated this by comparing fatal crash types (alcohol-involved, speeding, and red light running) with the presence of a child in the vehicle. Second, we examined whether the driver's gender affected this association. Finally, we estimated trends in the prevalence of alcohol-involved, speeding, and red light running to crashes over time.

## **METHODS**

### ***Data Sources***

Data used for this analysis came from the 1982–2010 Fatality Analysis Reporting System (FARS). Maintained by the National Highway Traffic Safety Administration (NHTSA), the FARS is a record system for all police-reported motor-vehicle crashes on public roadways that result in the death of at least one road user within 30 days of the event. FARS provides detailed information about the driver's gender, age, level of alcohol consumption, and maneuvering skills. FARS also contains information about the number of vehicles involved in the crash and the number of passengers. The dataset provides information that allows us to confidently make inferences at the national level, as well as on changing trends over time.

Given the extensiveness of the FARS data set, we limited our sample by excluding buses, farm equipment, snowmobiles, and construction vehicles. Only passenger vehicles, minivans, pickups, sports utility vehicles, and 15-passenger vans were retained. We also excluded drivers who were mentally challenged or died while driving from a non-driving condition (e.g., from a heart attack), police chases, and nonmoving traffic violations. Although information on race/ethnicity is available in the FARS, this information comes from death certificates (i.e., it is available for fatally injured occupants only) and is available only since 1999 (25). Therefore,

race/ethnicity was not studied in this effort. The age, gender, and injury severity (if injured) of both drivers and passengers is, however, recorded in the database.

The FARS also records the drivers' blood alcohol concentration (BAC). However, only a fraction of the drivers are tested for alcohol consumption. In 1982, only 54% of the fatally injured drivers were tested for alcohol. That figure climbed to 65% in 2002 (26). For those with no actual measure available, the FARS provides imputed BAC measures developed using a multiple imputation technique by Subramanian (27). Because such imputation took into account some variables central to this study (e.g., the time of the crash and the presence of passengers in the vehicle), imputed measures of BAC were not included in this effort. Only vehicles in which the driver was tested for alcohol were considered.

Among all drivers in the data set (1,501,589), a total of 148,365 fatal crashes involved at least one child aged 0–14 years. In 33,587 cases (21.8%), at least one of the drivers tested positive for alcohol. A total of 54,665 children were involved in these alcohol-related crashes; of these, 10,877 (about 20%) were fatally injured.

For drivers transporting children, we included in our analysis only those aged 21 years and older. This was to ensure that the child (defined in this study as an individual 14 years of age or younger) was driven by someone old enough to be a parent or guardian (aged 21 years or older). This ensured a minimum of 7 years between driver and passenger, reducing the chances that the driver and passenger were peers.

## **Measures**

Our study variables of interest included the following:

*Age.* There is ample evidence that the driver's age influences the likelihood of impaired driving (e.g., [22, 28]), with adolescents and the elderly being at a higher crash risk per miles driven than other drivers (e.g. [29–32]). For drivers younger than age 21, crash risk is highly exacerbated by the presence of other teenagers in the vehicle (e.g., [33]); thus, to avoid confounding the risks associated with teens driving teens with that of adults driving children (the focus of this study), only drivers aged 21 and older were included in this study. To systematize the analyses, the following age categories were examined for drivers: 21–25, 26–45, 46–65, and 66 years and older.

*Gender.* There is also ample evidence that gender affects the overall likelihood of engaging in risky-driving behaviors (e.g. [2, 30, 34]). The role the driver's gender contributes to the crash risk of a child passenger is suspected (33), though severely understudied. We hypothesize that women driving children will be more protective (take less driving risks) than their male counterparts.

*Time of day.* There is also ample evidence that single-vehicle crashes, particularly at night, are more closely associated with impaired driving than any other crash type (e.g. [35, 22]). It would therefore be logical to presume that time of day would affect (mediate and/or modify) the association between driver, children, and drinking and driving. However, drivers of children could be expected to follow driving patterns differing from those in the general population, thus making the association between single-vehicle crashes and alcohol noticed in the general population of drivers disappear. Such possibilities are examined in this manuscript. To do so, we examined crashes as they occurred in the following periods: daytime (6:00 a.m to 7:59 p.m), and nighttime (8:00 p.m to 5:59 a.m).

*Alcohol.* As mentioned, we limited our analyses to lab-tested BAC measures only. We examined drivers at BAC > .00, with child passengers.

*Risky driving behaviors other than alcohol.* Impaired driving per se is not the only way in which drivers can endanger children. In this effort, we examine drivers' speeding and failure to obey a traffic signal (e.g., red light, stop, or yield). We identified speed-related crashes as suggested in the FARS Analytic Reference Guide (36); page V-81). As such, the comparison group was established by drivers with the proper "Driving Condition Factor" (until the year 2008) or using the variable SPEEDREL (for 2009 and 2010). Following the FARS' handbook suggestions, we also used the "Driving Condition Factor" code to identify drivers who failed to obey a traffic signal.

## ANALYSES

We first used descriptive statistics to estimate and compare the contribution of the studied factors to alcohol-positive, speeding, and red light running violations. We estimated 95% confidence intervals to make those comparisons and to examine the role of adult drivers of different genders and ages, and crashes that occurred at daytime and at nighttime, on crashes that occurred while driving with a child. Next, we applied logistic regression to account for the simultaneous contribution of all explanatory variables to the likelihood of involvement in an alcohol-positive, speeding, and red light running crash while driving a 0-14 year old child. Of special interest was the examination of the gender and “presence of a child” variables. Finally, we examined trends: annual variations in alcohol-positive, speeding, and red light running prevalence among adult drivers with a child in the car at the time of the crash. We used SAS version 9.3 for these estimates.

## RESULTS

Table 1 shows the bivariate associations between the variables of interest. More specifically, Table 1 shows the gender, age, time of day, being alcohol-positive, speeding, and red light running at the time of the crash, and the distributions for three alternative types of driving situations at the time of the crash: driving alone (with no passenger), driving with at least one child, or driving with a passenger aged 15 years or older.

Almost 48% of drivers involved in a fatal crash while transporting a child younger than age 15 were women. This prevalence is higher than among those driving alone (31% were women), or among those driving with passengers aged 15 or over (28% were women). Although not shown in Table 1, the percentage of women driving with children (48%) goes up to 51% when considering only drivers of children from birth to 8 years old. Also, this prevalence rate was higher than for all women drivers in the FARS file (women represented 34% of all fatal crashes). This might reflect the role and responsibilities of women as primary caretakers and as transporters of children.

The age of the drivers with children tends to be concentrated around the ages 26 to 45 years old. About 69% of the drivers with children were of that age, while 44% of those driving alone and 42% of those driving with a passenger 15+ were of that age).

**TABLE 1. Fatal Crashes. Distribution of Driver and Situational Characteristics when Adult Drivers (aged 21 Years Old or Older) were Driving Alone, Driving with a Child (Age 0-14 years old), or with a Passenger 15-years Old or Older**

		Driving alone		Driving with a child		Driving with a passenger 15+	
N		928,183		148,365		425,041	
Gender	Male	69.4%		52.4%		72.1%	
		69.3%	69.5%	52.2%	52.7%	72.0%	72.3%
	Female	30.5%		47.5%		27.8%	
		30.4%	30.6%	47.2%	47.7%	27.6%	27.9%
Age	21-25	18.1%		15.2%		23.8%	
		18.0%	18.2%	15.0%	15.3%	23.6%	23.9%
	26-45	44.4%		68.5%		42.0%	
		44.3%	44.5%	68.2%	68.7%	41.8%	42.1%
	46-65	23.1%		13.5%		20.6%	
		23.1%	23.2%	13.3%	13.7%	20.4%	20.7%
66+	14.4%		2.9%		14.4%		
		14.3%	14.5%	2.8%	3.0%	14.3%	14.5%
Time of day	Daytime	69.9%		84.6%		66.1%	
		69.8%	70.0%	84.4%	84.8%	65.9%	66.2%
	Nighttime	30.1%		15.4%		34.0%	
		30.0%	30.2%	15.2%	15.6%	33.8%	34.1%
Alcohol positive	Yes	25.0%		9.8%		26.1%	
		24.9%	25.1%	9.6%	9.9%	25.9%	26.2%

**TABLE 1 (continued). Fatal Crashes. Distribution of Driver and Situational Characteristics when Adult Drivers (aged 21 Years Old or Older) were Driving Alone, Driving with a Child (Age 0-14 years old), or with a Passenger 15-years Old or Older**

		Driving alone		Driving with a child		Driving with a passenger 15+	
N		928,183		148,365		425,041	
Red light	Yes	5.2%		4.8%		5.4%	
Running		5.2%	5.3%	4.7%	4.9%	5.3%	5.5%
Speeding	Yes	19.0%		13.2%		21.9%	
		18.9%	19.1%	13.0%	13.4%	21.8%	22.0%

Driving alone, driving with a child, and driving with a passenger 15+ denote a driver with no passenger, with a passenger aged 0-14 years old, and with a passenger 15 years old or older, respectively. Alcohol-positive denotes a driver with a BAC > .00. Daytime and nighttime correspond to the 6:00 a.m to 7:59 p.m, and 8:00 p.m to 5:59 a.m time periods, respectively.

The prevalence of drivers aged 26-45 among those with children might reflect the age of the parents and primary caretakers. Perhaps not surprisingly then, compared with “driver alone” or “driver with passenger 15 or over” crashes, the prevalence of crashes involving children is highly concentrated during daytime (85% of crashes).

Although not shown in Table 1, of all the drivers tested for alcohol, approximately 22% were alcohol positive (20% BAC  $\geq$  .08), with 35% being women. When we compared these figures to those specific for the three driving situations depicted in Table 1 (driving alone, driving a child, driving with a passenger age 15+), driving with a child played a protective role regarding alcohol involvement, in that only about 10% of the drivers transporting a child were alcohol positive, a prevalence significantly lower than that registered for drivers driving alone (25%) or with a passenger aged 15 or older (26%). The presence of children was also found to have a protective impact on speeding (13% driving with a young child, 19% alone, and 22% with a passenger 15 years and older), but not as dramatically with red light running (5% across all three situations).

**TABLE 2. Logistic Regression Modeling the Likelihood of the Driver being Alcohol-positive, have been Speeding, or Running a Red Light at the Time of the Fatal Crash**

Main Effect		Alcohol-positive	Speeding	Red-light Running
		OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender	Female	0.52	0.69	1.12
(Ref. Male)		(0.51 – 0.53)	(0.68 – 0.70)	(1.10 – 1.13)
Age	21-25	1.24	1.55	1.20
(Ref. 26-45)		(1.22 – 1.25)	(1.54 – 1.57)	(1.78 – 1.23)
	46-65	0.52	0.57	1.01
		(0.51 – 0.53)	(0.55 – 0.57)	(0.99 – 1.04)
	66+	0.21	0.33	2.23
		(0.21 – 0.22)	(0.32 – 0.33)	(2.19 – 2.83)
Time of the day	Daytime	0.16	0.49	1.28
(Ref. Nighttime)		(0.15 – 0.16)	(0.48 – 0.49)	(1.25 – 1.30)
Presence of a passenger	Child	0.35	0.71	1.01
(Ref: Alone)		(0.34 – 0.36)	(0.70 – 0.72)	(0.98 – 1.04)
	Passenger 15+	0.94	1.11	1.04
		(0.93 - 0.95)	(1.09 – 1.12)	(1.02 – 1.06)
Dual Interactions (P<.01)		Estimate	Estimate	Estimate
	Female * Child passenger	0.078	0.162	0.066
	Female * Passenger 15+	-0.042	-0.099	-0.039

Alone, child, and passenger 15+ denote a driver with no passenger, with a passenger aged 0-14 years old, and with a passenger 15 years old or older, respectively. Alcohol-positive denotes a driver with a BAC > .00. Daytime and nighttime correspond to the 6:00 a.m to 7:59 p.m, and 8:00 p.m to 5:59 a.m time periods, respectively.

Table 2 shows the outcome of the logistic regressions. These results confirm that certain well-known factors, such as gender, age, and time of day, play a role in traffic safety and that women and drivers aged 46 years and older were less likely to be involved in an alcohol-positive, speed-related, or red light running episode at the time of the crash compared to men and younger drivers aged 26–45. However, drivers aged 21–25 were more likely to be involved in any of these three types of crashes than drivers of any other age group. Interestingly, women appear to be overrepresented in red light running crashes. The time-of-day variable shows that most crashes tend to occur at daytime. The dual driver’s gender and child passenger interaction shows once more that, compared to men, female drivers are more likely to be found driving a child aged 0-14, but less likely to be driving a passenger aged 15 years old or older. Table 2 also shows that, as observed in Table 1, even after taking all other variables into account, the presence of a child in a car has a protective effect on the likelihood of any of the three types of crashes under consideration.

The evolution of these behaviors over time is examined next. Figure 1 shows the annual evolution of the percentage of drivers with fatally injured children who were alcohol positive, running a red light, or speeding. The prevalence of drinking and driving for the three types of drivers under study (i.e., driving alone, with a child aged 0-14, or with a passenger 15 years old and over) decreased sharply until the mid-90s, when it leveled off. This pattern mimics that of the general population of U.S. drivers, which also registered an initial decrease followed by a leveling off since the mid-90s (e.g., [37]). The changes over time were minimal for red light running and speeding.

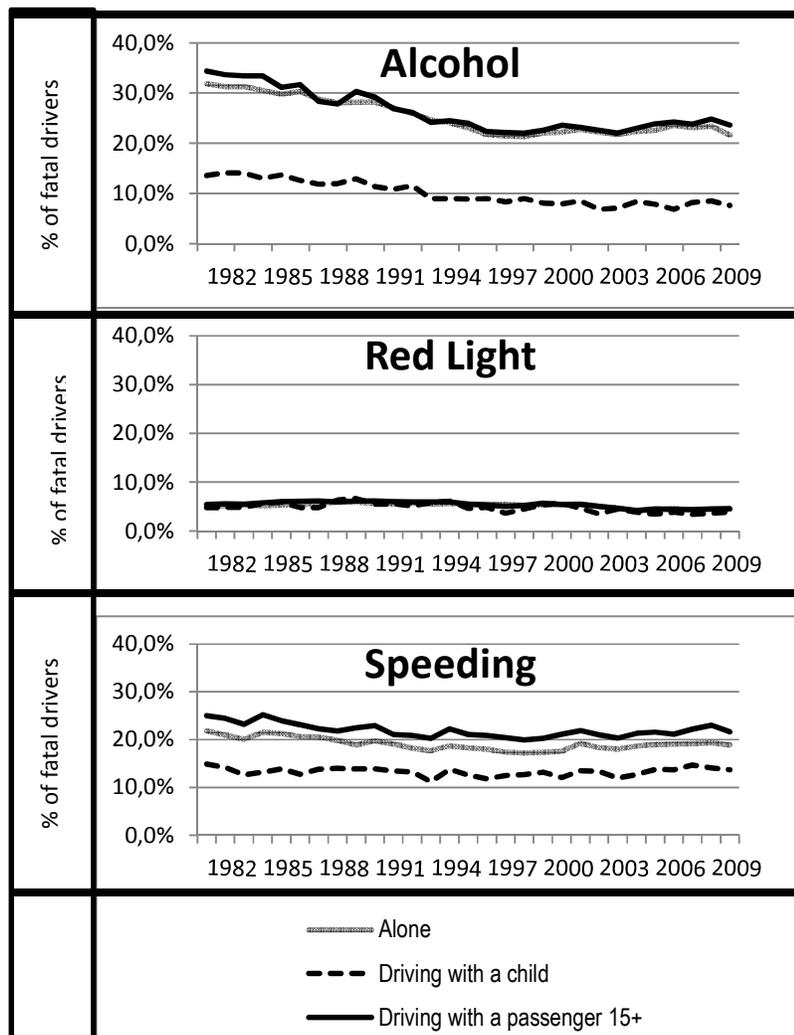
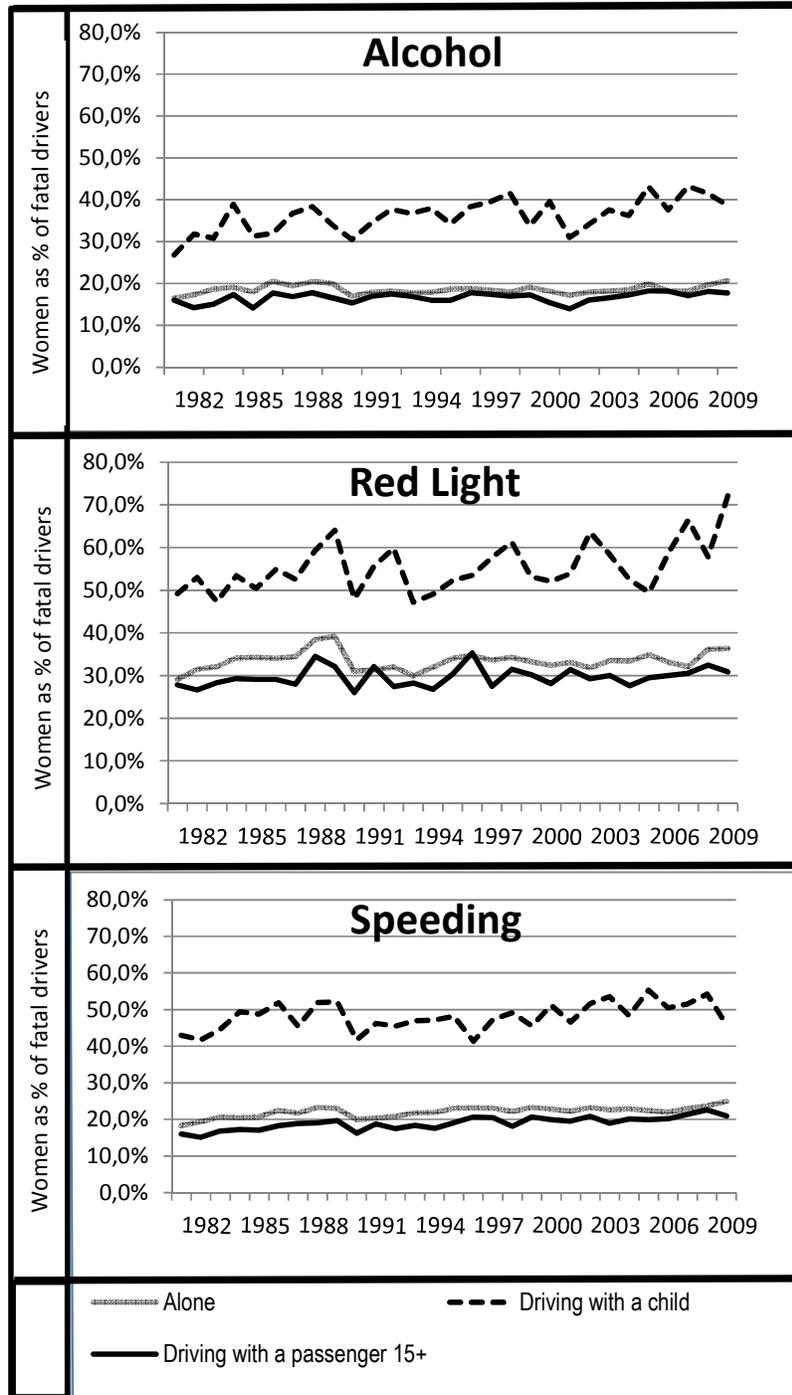


FIGURE 1. Annual percentage of drivers who were alcohol-positive, speeding, or running a red light with fatally injured children, 1982-2010



**FIGURE 2. Annual percentage of female drivers who were alcohol-positive, speeding, or running a red light with fatally injured children, 1982-2010.**

Figure 2 focuses on the relative prevalence of women among those drivers who were found positive for alcohol, running a red light, or speeding. While the annual proportion of women who were drinking and driving while driving alone followed a pattern mimicking that of the general population of U.S. drivers (i.e., an initial reduction with posterior leveling off), the percentage of women who were drinking and driving with children in the car showed a constant increase. Although not included in Figure 2, we also estimated a 95% confidence interval (CI) for each annual prevalence estimate, and used the CI to test the significance of the parameter

evolution. Compared to men, the proportion of women who were drinking and driving with children in the car has increased significantly over time, from 31.9% on average between 1982-1986, up to 41.2% during the 2006-2010 period. Significant increases over time in the prevalence of women with children were also observed for speeding (from 45.5% in 1982-1986, to 51.6% in 2006-2010) and red light running (from 50.8% in 1982-1986, to 60.4% in 2006-2010). Note, however, that Figure 2 also shows that the proportion of women in crashes where there was no child, also rose over time when considering drinking and driving and red light running crashes, but less dramatically (although statistically significantly).

## DISCUSSION

One aim of this study was to begin assessing if the presence of children in a vehicle cued drivers to adopt less risk-taking driving behaviors. To do this, we compared fatal crash types (alcohol-involved, speeding, and red light running) with the presence of a child passenger in the vehicle. We then examined whether the gender of the driver affected this association.

The outcome of this effort confirmed that, in general, having a child in the vehicle does play a protective role for most drivers. As mentioned, although to some extent this “made sense” (i.e., parents/adults taking care of children), it has not been previously examined using any epidemiological study. Such confirmation that children do tend to elicit a positive behavioral response from their drivers should bring some relief to researchers and policy makers worried by media reports.

The evaluation of whether children play a protective role on their driver’s driving behavior highly depends on the driver’s gender and yielded to more or less conclusive results according to the driver’s gender. We also found some evidence that gender does play a protective role, but the evidence is unclear. On one hand, the protective role of gender seems to vary depending on the driver’s age and the type of risky driving. Women and older drivers were less likely to be involved in alcohol-positive and speed-related crashes, compared to men and young drivers. However, it is possible that the protective role of children by female drivers also could be explained by the progressive increase in women’s crash exposure. In other words, women may be more associated with driving children not because compared with men, women are more likely to protect them, but just because they are those most often in charge of driving children. Clearly, although our study confirms that children do indeed play a protective role on their driver’s behavior, such a role is not uniform, and it is more complex than the initially postulated. In summary, we found that the protective role of children varies depending not only on the driver’s gender, but also on the type of risky-driving behavior incurred by the drivers; with further insights into the role of women as drivers of children requiring the availability of sound measures of driving exposure.

Given that women continue to be the main caretakers and are often transporting their children, and given the trend analyses suggesting women increasing their involvement in crashes, the issue of child endangerment may be of concern. As noted in our results, compared to men, the proportion of women involved in drinking and driving crashes with children in the car has increased over time and similar increases over time were also observed for speeding and red light running crashes. Thus, our findings seem to confirm that, although most drinking drivers are still men, and children play a protective role regarding traffic safety, female drivers have become increasingly involved in all crashes, even those in which they were driving young children.

It is unclear, however, if such an increase in women’s crashes is due to changes in risky driving behaviors, driving exposure, or both as evident by the trend analysis also indicating a slight increase in crashes by women with no child in the car. There is evidence in the literature suggesting that both driving exposure and changes in risk taking are responsible for this evolution (2, 38). Unfortunately, a limitation to our analyses is that we can not adjust for crash exposure (e.g., by vehicle miles travelled or VMT) because information on VMT in the U.S. is provided by the Department of Transportation’s National Household Travel Survey (NHTS), which occurs only about every 3-8 years, with little information on the VMT for drivers with children, and with no information on the VMT for drinking drivers (which have been shown to follow patterns of driving different from other drivers). Because the limitations of the VMT database are central to this effort, we decided not to adjust our estimates by drivers’ VMT.

It is important to note some additional limitations to this study. This study examines associations between the presence of children and some aspects of risky driving in fatal crashes. The analyses do not show causal relationships. This data set only accounts for fatal motor-vehicle crashes, not cases of less severity. These data do not represent a random sample of persons driving on the roads, but rather a sample of those who were in

fatal crashes. As noted, 46% of the drivers involved in a fatal crash while transporting a child are women, whereas women drivers are only involved in 34% of the fatal crashes in FARS. However, to gain precision in our estimates, we only reviewed drivers that were tested for alcohol. Therefore, our counts of children's deaths and injuries due to drinking drivers are likely lower than they actually are.

The relevance of this effort should not be trivialized. Understanding traffic-related child endangerment is a timely need. It is the parent's or the adult's job to protect children, even in a vehicle. With speeding and other reckless driving behaviors on the rise, risk exposure for child passengers may increase as well. We cannot assume that women, the traditional caretakers, will continue to be the safer drivers compared to their male counterparts. Women are in more fatal vehicle crashes than ever before, are driving more miles than in years past, and are engaging in more potentially risky behaviors (e.g., DWI). A recent study by Kelley-Baker and Romano (unpublished data), using FARS data spanning similar years as this study, found that, in the United States, 553 child passengers die each year in alcohol-related and reckless crashes in which the driver was old enough to be their parent. These figures do not appear to have changed despite improved vehicle technology and safety apparatuses. It may be time to consider addressing this concern, and to design and implement effective interventions to prevent child endangerment from occurring or, at the very least, begin to reexamine child endangerment laws.

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# Gender identity and risky behaviors among young drivers

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## ABSTRACT

Globally, men, and particularly young men, are involved in more road traffic crashes than women, which may be due to a greater tendency to engage in risky behaviors. Understanding and explaining this "gender specificity" in risky behaviors, specifically among young drivers, has become a major public-health issue. The present study extends research on the effect of gender identity on risky driving behaviors by investigating the effect of sex, sex-stereotype conformity and gender group identification on self-reported driving behaviors among young drivers. 75 young drivers (28 males, 47 females) filled in a form including a series of scales assessing gender group identification by measuring three components of gender identity (typicality, contentedness and centrality), a French version of the Bem Sex-Role Inventory, an extended version of the Driver Behaviour Questionnaire (assessing violations, dangerous and inattention errors and positive behaviors) and questions about mobility and accident history. The effects were tested on outcome variables by using hierarchical regression analysis. It was found that sex (being female) only predicted the inexperience errors, while the femininity score negatively predicted the number of accidents. No effects of maleness and masculinity were observed in other driver behaviors, contrary to what was expected. Gender identity variables only had an effect among males, with typicality positively predicting dangerous errors and contentedness negatively predicting positive behaviors. Lastly, results showed that gender identification appears to be associated with low conformity to feminine stereotypes among males. Hypotheses were not confirmed but results underlined the importance of taking gender identity variables into account when explaining risk-taking differences between and within gender groups. Implications of these results are discussed.

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**KEYWORDS:** Gender identity; Sex stereotype conformity; Gender roles; Risky driving behaviors; Young drivers.

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## 1. INTRODUCTION

Gender differences are well known in accidentology and manifest themselves very early on in different types of accidents, and in particular in traffic injury rates. Men are involved in more road traffic crashes than women. In most Western countries, male drivers are 2 to 3 times more likely to die in road traffic crashes than female drivers (1, 2). In France, men were nearly four times more likely to die and twice as likely to be injured for the same number of miles travelled, in 2007 (3). Male drivers also commit more traffic offenses than females (4), which is associated with active and passive accidents (5, 6). This sexospecificity in accidents and offenses is particularly noticeable among young drivers. Studies underline several variables behind the high accident rates among young drivers, like life style, driving inexperience, lack of skills, risk perception, drinking and driving and risk taking (7–11). Risk-taking would also explain gender differences in accident rates. Generally, males tend to engage significantly more than women in high-risk activities (12). More particularly, young male drivers are more prone to taking risks (13), engaging in aggressive driving behaviors, driving fast, and committing more violations than other age groups (14, 15), which contributes to increase the frequency and extent of trauma in this population.

Men's tendency to take more risks has been generally explained in the past by biological theories and notably by the effect of testosterone, a male steroid hormone, that has been associated with sensation seeking (16), aggression (17) and venturesomeness (18). However, according to recent research, these relationships could be influenced by socialization (19).

Recent studies have explored social environment influences on adults' gender differences in risk-taking behavior and transgression, taking into account the effects of gender roles, that is social expectations in terms of behaviors, personality traits and activity, depending upon the individual gender group (20). The majority of people's beliefs regarding male and female behavior can be summarized in terms of differences on two dimensions, the communal and the agentic (21). Women are expected to be friendly, unselfish, concerned with others, emotionally expressive, sensitive and caring, whereas men are expected to be assertive, directive, instrumentally competent, autonomous, adventurous and independent (22–27). Gender roles are based on gender stereotypes, which can be defined as the set of beliefs regarding what it means to be a male or a female in a given society (23). In particular, risk-taking is characterized as a typically masculine type of behavior (28), which is consistent with risk-taking gender norms; while females are expected to be passive and non-competitive, and to not take risks, males are encouraged to be more aggressive and to take risks (29). Thus, gender roles, through differential socialization, could lead to gender differences concerning compliance with traffic regulations (29) and risk taking (30, 31). Nevertheless, an individual can conform to stereotypes associated with both sex groups (28), thus gender roles could explain differences in risk-taking between and within sex groups.

Most of the studies showed the deleterious effect of masculinity on risky driving behaviors. For example, men who have been primed with the concept of masculinity exhibit more risky driving behaviors, particularly in terms of speed (32). Men who exhibit a macho personality have been showed to report more aggressive driving behavior than other men (33). Conformity to masculine stereotypes has been shown to predict self-reported injury risk behavior and driving style, with masculine people reporting more violations and offenses than feminine people (34), overestimating their driving skills (35) and perceiving themselves as having better perceptual-motor skills (36), which is associated with a risky driving style and road accidents.

On the other hand, femininity seems to have beneficial effect on risky behaviors. In driving, femininity has been shown to negatively predict the number of accidents and offenses, aggressive and ordinary violations, and errors (34). Plus, high levels of femininity buffer the effects of masculinity on accidents and aggressive violations (34). Özkan and Lajunen (36) highlighted the link between femininity and skills in terms of safety that are negatively related to the number of accidents. Thus, although masculinity seems to reinforce risky driving behaviors, femininity seems to be negatively associated with risky driving behaviors.

Research showed that sex-stereotype conformity would be a better predictor of declared injury-risk behaviors than biological sex (31, 37). For example, in a study about risky driving behaviors, Özkan and Lajunen (34) showed that being male positively predicted only self-reported ordinary violations, while masculinity positively predicted the number of offenses, and aggressive and ordinary violations. Sibley and Harré (35) showed that gender role identification fully mediated the effect of gender on driving self-enhancement that is linked to risk-taking. Other research assumes that there may be a double risk factor for men due to both biological and social gender (38).

Studies investigating the link between gender roles and risky behaviors generally used the Bem Sex Role Inventory (28). In BSRI, masculinity and femininity are independent dimensions constituted with male-typed and female-typed traits, according to their social desirability in society. That is to say, masculinity consists of traits evaluated to be more suitable for males than females, whereas femininity consists of traits evaluated more acceptable for females than males in the society. Masculinity is "an instrumental orientation, a cognitive focus on 'getting the job done'; and femininity has been associated with an expressive orientation, an affective concern for the welfare of others" (28, p. 156). Studies using the inventory have found masculine sex role orientation – that is to say, conformity to agentic traits such as competition, assertiveness or self-confidence – to be associated with sensation seeking (39) aggression (40) and self-enhancement (35), which have been linked to risky driving (41, 42). On the other hand, conformity to communal traits appears to be linked to lower hostility (43).

Most studies that have examined the relationship between gender roles and risky driving behaviors focus on the effect of masculinity and femininity on risky behaviors, considering gender identity in terms of gender stereotype conformity only. However, gender identity is now viewed as a multidimensional construct (44), including not only the traditional dimensions of gender identity, that is to say, sex-stereotype conformity, but also other dimensions, such as the perception the individual has of his/her own gender identity. Egan and Perry (45) developed a multidimensional series of scales to assess the gender identity of 9-10 years-old and 13-14 years-old. These scales include traditional measures of gender identity (two scales assessing male and female-typed traits and two scales assessing male and female-typed activities), but also take into account other

dimensions of gender identity: typicality (feeling one is a typical member of one's gender group), contentedness (satisfaction of belonging to the sex-group to which one has been assigned), feeling under pressure (felt pressure from peers, parents and oneself to conform to gender roles associated with one's gender); and intergroup bias (feeling that one's gender group is superior to the other group). Researchers studied other dimensions of gender identity, such as centrality, that is the importance of gender identity in their self-concept (46, 47).

The present study extended research on the effect of gender identity on self-reported risky driving behaviors among young drivers. More particularly, the aim was to replicate studies showing the effect of sex and sex-stereotype conformity on driving behaviors, including positive behaviors, which has not been studied yet (34), and to investigate the effects of gender group identification by assessing different dimensions of gender identity (typicality, contentedness and centrality), which has not been studied in the area of driving to the best of our knowledge. Plus, it is assumed that, depending on the feeling of being a typical member of one's gender group, the contentedness with one's biological gender group and the importance of gender in the self-concept, individuals will try to conform either more or less to stereotypes associated with their group and, thus to behaviors associated with their group such as risky behaviors in driving.

In particular, the following hypotheses were examined:

Hypothesis 1: Male drivers report more risky driving behaviors than females.

Hypothesis 2: Drivers who highly conform to masculine stereotypes report more risky driving behaviors, whereas drivers who highly conform to feminine stereotypes report fewer risky driving behaviors.

Hypothesis 3: Gender group identification, through centrality, typicality and satisfaction levels explains risky driving behaviors, a strong identification among male group leading to more risky behaviors.

## 2. METHOD

### 2.1 Material

#### Gender Identity

*Sex-Stereotype Conformity.* Sex-stereotype conformity was measured by using a French version of Bem Sex-Role Inventory which contains three scales (masculine, feminine and neutral) (28, 48). The masculine scale (9 items) includes characteristics that are perceived as male characteristics in society; that is, agentic traits (e.g., authoritarian, strong personality, dominating, etc.). The feminine scale (9 items) includes characteristics that are perceived as female characteristics in society; that is, communal traits (e.g., understanding, affectionate, sympathetic, etc.). The rest of the characteristics (9 items) consisted of neutral items that are perceived as neither male nor female characteristics (e.g., conscientious, frank, serious, etc.). Participants were asked to indicate the degree to which each of the 27 personality characteristics described their own personalities on a 7-point scale (from 1 = almost never true to 7 = almost always true).

*Gender Identity Variables.* Gender typicality, that is, feeling one is a typical member of one's sex, and gender contentedness, that is, feeling content with one's biological sex, were measured by using scales adapted from the French series of scales validated by Jodoin & Julien (49) among eight to 16-year-olds. The series of scales was originally validated by Egan and Perry (45) with an American sample. Items were adapted to adult people and were either for men or for women. Gender typicality scale includes four items (e.g. "I feel annoyed that I'm not supposed to do certain things just because I am a man/a woman"). Gender contentedness scale includes six items (e.g. "I think I'm like all the other men/women of my age"). Gender centrality, that is the importance of gender as part of the self-concept, was measured by using the centrality subscale from Luhtanen and Crocker's collective self-esteem scale (47). The scale includes four statements that were modified to assess the centrality of being a man or a woman to their self-concept (e.g., "My sex group is an important part of what I am"). For each scale, participants were asked to indicate the degree to which they agree with each item on a 7-point scale (from 1 = strongly disagree to 7 = strongly agree). The scale had been previously pre-tested and validated on an adult population.

## Driving Behavior

Driving behaviors were measured by using an extended version of the Driver Behavior Questionnaire (4) validated among a large population of French drivers (50). The new extended version of DBQ differentiates between six types of behaviors. The tool includes two types of violations: aggressive violations (3 items), which refer to behaviors of aggressive interpersonal violence, and ordinary violations, which refer to deliberate deviations in driving but without any aggressive purpose (6 items). Dangerous errors (6 items) contain unintentional behaviors that deviate from the planned action and are potentially dangerous. The tool includes two types of lapses: inattention errors (7 items) that refer to unintentional and slightly dangerous behaviors that appeared to be due to a lack of attention, and inexperience errors (4 items) that refer to unintentional and slightly dangerous behavior that appeared to be caused by the individual's lack of driving experience. Lastly, the tool includes positive behaviors (9 items), that is, pro-social behaviors intended to facilitate interactions with other users. Participants were asked to indicate on a 7-point scale how often they committed each of the 35 behaviors in the previous year (0 = never to 7 = very often). Even if lapses and positive behaviors are not critical for safety and not related to accidents, the whole tool was used in order to explore the link between gender identity and different types of driving behaviors.

## Demographic Variables

Participants were asked to indicate their age, sex, frequency of driving and kilometers driven per week, the number of years as a fully licensed driver, and number of accidents and offenses since holding a license.

## 2.2 Population and Procedure

The data reported in this study was collected from 75 undergraduate students (28 males and 47 females) between 18 and 25 years of age (mean = 20.75 years, SD = 1.9). All individuals had a license B with a range of 0-8 years of driving experience (mean 2.2, SD = 1.6) and half the sample had less than 2 years of driving experience. 53.33% of the sample learned driving with AAC (early driver training). Concerning driving frequency, 20% of the sample declared that they drive every day, 28% stated that they drive four or five times a week, 45.33% stated that they drive one to three times a week, and just 6.67% of the participants said that they never drive. 34.33% of the sample drove a car less than 50 km a week and 32% drove 50 to 150 km. 30.66% of the sample drove more than 150 km a week. Finally, as shown in Table 1, the number of accidents since obtaining the category B driver's license ranged from 0 (69.33%) to 3 (4%), with 20% of the sample having had one accident and 6.67% having had two accidents since obtaining the category B driver's license. The number of offenses since obtaining the category B license ranged from 0 (78.67%) to more than 3 (2.67%) with 12% of the sample having had one offence and 6.67% having had two offenses since obtaining the category B driver's license. Characteristics for the whole sample, as well as for male and female drivers separately, are presented in Table 1.

They were recruited at the University Library for an online survey. The link to the questionnaire was sent to all students by mail. They were guaranteed anonymity and confidentiality. The participants filled out a French version of the DBQ, after which they filled out a tool measuring different aspects of gender identity, and items related to demographic variables. The questionnaire took about 20 minutes.

## 2.3 Data Treatment

The data were analyzed by using reliability analyses, Pearson correlations, linear regression analyses and hierarchical regression analyses.

TABLE 1. Sample characteristics

		Total	Males	Females
N		75	28	47
Age	Mean	20.75	21.43	20.34
	SD	1.9	2.12	1.66
Years holding a license	Mean	2.2	2.67	1.94
	SD	1.6	1.77	1.45
Number of accidents	Mean	.45	.36	.51
	SD	.79	.56	.91
Number of offenses	Mean	.39	.43	.36
	SD	1.01	.74	1.15

### 3. RESULTS

#### 3.1 Reliabilities of scales

##### Sex-stereotype Conformity and Gender Identity variables

Reliability analyses of the French version of the BSRI answers indicated that Cronbach's alphas for the masculinity and femininity scales were 0.74 and 0.84, respectively. Reliability analyses have also been carried out for each cognitive dimension of gender identity. Cronbach's alphas for typicality, contentedness and centrality were .69, .83 and .72, respectively. Thus, the reliability of the masculine and feminine stereotypes and of the gender identity variables can be considered satisfactory.

##### DBQ

Cronbach's alphas have been calculated for each DBQ scale: "positive behaviors" ( $\alpha = .50$ ), "dangerous errors" ( $\alpha = .54$ ), "inexperience errors" ( $\alpha = .64$ ), "inattention errors" ( $\alpha = .70$ ), "ordinary violations" ( $\alpha = .73$ ) and "aggressive violations" ( $\alpha = .43$ ). A general score of violations including ordinary and aggressive violation items has been calculated ( $\alpha = .75$ ).

#### 3.2 Correlates of DBQ and Gender Identity variables

Pearson's  $r$  correlations between background variables, the scores of DBQ and gender identity variables and sex-stereotypes conformity were calculated for men and women separately (see Table 2).

As regards background variables and the number of accidents and offenses among females, the number of years holding a license correlated positively with the number of kilometers driven per week and the number of accidents and offenses. The number of kilometers driven per week correlated negatively with contentedness. The number of accidents correlated positively with the number of offenses and violations, and negatively with positive behaviors and feminine-stereotypes conformity. Regarding DBQ scores, the inattention errors score was positively correlated with inexperience and the dangerous errors scores. Lastly, as regards gender identity variables, typicality was positively correlated with centrality. Correlations were moderate.

As regards background variables and the number of accidents and offenses among males, the number of offenses was positively correlated with violations. Correlation was relatively high. Regarding DBQ scores, inexperience errors, inattention errors and dangerous errors were positively inter-correlated. Correlations were relatively high. Furthermore, the dangerous errors score was positively correlated with typicality. Violations correlated positively with centrality. Positive behaviors were negatively associated with centrality and contentedness. Correlations were moderate to relatively high. Finally, as regards gender identity scales and sex-stereotype conformity, contentedness correlated positively with typicality and centrality, whereas feminine-stereotype conformity was negatively associated with contentedness and centrality. Correlations were moderate.

Correlations among the three measures of gender identity and sex stereotype conformity were either modest or insignificant, confirming the utility of a multidimensional approach to gender identity.

**TABLE 2. Correlates among DBQ scores, Gender Identity variables and Background variables, by sex**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<b>Sex-stereotype conformity</b>														
1. Masculine traits	-	-.02	.15	-.09	.08	-.01	-.17	.09	-.21	.14	.20	.12	-.08	.05
2. Feminine traits	-.11	-	.04	.12	.10	.07	-.15	-.10	.18	-.16	-.3*	-.27	-.01	-.14
<b>Gender identity</b>														
3. Gender contentedness	-.13	-.52**	-	.03	-.15	.06	-.15	.04	-.21	.26	.02	-.21	-.29*	.06
4. Gender typicality	.06	-.21	.37*	-	.49***	.16	-.03	-.17	-.10	.01	.19	.04	-.11	-.09
5. Centrality	.01	-.44*	.5**	.20	-	.27	.02	-.04	-.13	.04	.26	.04	.02	-.08
<b>DBQ scales</b>														
6. Inexperience errors	.22	-.05	-.24	.25	-.27	-	.34*	.13	.07	.10	.05	-.18	-0.04	-.13
7. Inattention errors	-.11	.14	-.14	.24	-.20	.63***	-	.42**	.09	.20	.14	-.09	0.22	-.07
8. Dangerous errors	.21	.08	-.20	.40*	-.02	.73***	.44*	-	-.07	.28	.09	.05	0.15	.10
9. Positive Behaviors	.14	.20	-.62***	-.28	-.46*	.27	.18	.19	-	-.26	-.36*	-.22	-0.00	-.11
10. Violations	.13	-.29	.30	.08	.44*	-.03	-.01	.16	-.25	-	.31*	.11	-0.14	.25
<b>Background variables</b>														
11. Number of accidents	-.06	-.19	-.08	-.35	.03	.06	.08	-.14	.13	-.00	-	.42**	.04	.39**
12. Number of offenses	-.26	.02	.15	.12	.17	.14	.07	.18	-.07	.50**	-.13	-	.22	.34*
13. Kilometers driven weekly	.14	.11	-.09	.16	-.27	.27	.36	.19	.20	.06	-.16	.07	-	.29*
14. Years holding a license	.15	-.06	-.15	.07	-.03	.31	.14	.29	.19	.25	.09	.29	-.23	-

Note: Correlations for females are above the diagonal; correlations for males are below the diagonal. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .00$

### 3.3 Effect of Gender Identification on Sex-stereotype Conformity

Linear regression analyses were carried out to observe the effect of gender identification on sex-stereotype conformity. Two analyses were carried out among males and females separately: the first one tested the effect of gender identification on the masculine-stereotype conformity; the second one tested the effect of gender identification on the feminine-stereotype conformity. A global score of gender identification was calculated by averaging the scores of items constituting the three specific scales: centrality, contentedness and typicality. A low score indicated weak gender identification and a high score indicated strong gender identification.

Results showed no effect of gender identification on masculine stereotype conformity among females and males. No effect of gender identification was observed on feminine stereotype conformity among females, but gender identification negatively predicted feminine-stereotype conformity among males (see Table 3).

**TABLE 3. Linear regression analyses of Gender Identification on Sex-stereotype Conformity, by sex**

	Females						Males					
	Masculine traits			Feminine traits			Masculine traits			Feminine traits		
	R2	F	béta	R2	F	Béta	R2	F	béta	R2	F	Béta
Gender identification	-.02	.14	.06	-.01	.8	.13	-.04	.00	-.01	.24	9.63*	-.52*

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

### 3.4 Effect of Sex

#### Effect of Sex on Sex-stereotype Conformity

T tests were carried out to discern sex differences among masculine and feminine stereotype conformity scores. Results showed no effects on masculine and feminine traits. Means and standard deviations by sex are present in Table 4.

**TABLE 4. Means and standard deviations of Sex-stereotype Conformity, by sex**

	Males		Females		t
	Mean	SD	Mean	SD	
Sex-stereotype conformity					
Masculine traits	4.01	0.92	3.94	0.82	0.3
Feminine traits	5.14	0.99	5.33	0.86	-0.9

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

### 3.5 Effect of Sex and Gender Identity on DBQ scores, Accidents and Offenses

#### Effect of Sex and Sex-stereotype Conformity on DBQ scores, Accidents and Offenses

In order to examine the effect of sex and sex-stereotype conformity on driving behaviors, accident involvement and traffic offenses, seven separate hierarchical regression analyses were performed on each of the outcome variables (inexperience errors, inattention errors, dangerous errors, violations, positive behaviors, number of accidents, number of offenses). In each of these regressions, years holding a license, kilometers driven weekly and sex were entered in the first step to initially control for their effect, and masculine and feminine stereotype conformity were entered in the second step.

As presented in Table 5, the number of years holding a license positively predicted the number of accidents and offenses. Kilometers driven weekly positively predicted the inattention score. Finally, sex significantly predicted the inexperience and inattention errors' score, suggesting that females declared more inexperience and inattention errors than males. The variance accounted for by these variables was 8% for inexperience errors, 11% for inattention errors, 6% for dangerous errors, 4% for violations, 3% for positive behaviors, 9% for accidents and 12% for offenses.

After controlling the effects of kilometers driven weekly, number of years holding a license, and sex, the results of the regression analyses in the second step showed no effect of masculine stereotype conformity on driving behaviors, number of accidents and traffic offenses. Nevertheless, feminine stereotype conformity negatively predicted the number of accidents. The proportion of variance accounted for by masculine-stereotype conformity and feminine-stereotype conformity was 1% for inexperience errors, 3% for inattention errors, 2% for dangerous errors, 6% for violations, 3% for positive behaviors, 7% for accidents and 3% for offenses.

**TABLE 5. Hierarchical analyses on DBQ scales, number of Accidents and number of Offenses**

	Inexperience errors			Inattention errors			Dangerous errors			Violations			Positive Behaviors			Number of accidents			Number of offenses		
	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta
1. License (years)	.08	2.15	.04	.11	3.02	.08	.06	1.39	.10	.04	0.98	.17	.03	.69	-.01	.09	2.29	.29*	.12	3.23	.31**
Weekly km			.06			.25*			.16			-.07			.06			-.04			.16
Sex <sup>1</sup>			.28*			.24*			.15			-.13			-.15			.15			.05
2. Masculine traits	.01	1.33	.06	.03	2.38*	-.17	.02	1.01	.11	.06	1.78	.08	.03	.96	-.07	.07	2.38*	.09	.03	2.29	-.02
Feminine traits			.03			-.08			-.04			-.17			.18			-.23*			-.15
Total R2	.09			.15			.07			.12			.07			.15			.14		

<sup>1</sup> males = 1 ; females = 2\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

### **Effect of Sex-stereotype Conformity and Gender Identity variables scales on DBQ scores, Accidents and Offenses**

Observing the effect of gender identity on the whole sample without taking the gender group of the individual into account would not be relevant and would not provide interpretable results, given that the effect of gender identity on driving behaviors is expected to be different according to the gender group. Thus, in order to examine the respective effects of sex-stereotype conformity and gender identity variables on driving behaviors and accident involvement and offenses, seven separate hierarchical regression analyses were performed on each of the outcome variables (inexperience errors, inattention errors, dangerous errors, violations, positive behaviors, number of accidents, number of offenses) among males and females separately. In each of these regressions, years holding a license and kilometers driven weekly were entered in the first step to initially control for their effect. Masculine-stereotype and feminine-stereotype conformity were entered in the second step and the three variables of gender identity, typicality, contentedness and centrality were entered in the third step.

*Effects among Males.* Regarding males, as presented in Table 6, the number of years holding a license positively predicted the inexperience errors score. Plus, although the model is not significant, results showed that kilometers driven weekly positively predicted inattention errors. The variance accounted for by these variables was 22% for inexperience errors, 18% for inattention errors, 15% for dangerous errors, 8% for violations, 10% for positive behaviors, 3% for accidents and 1% for offenses.

When entering sex-stereotype conformity into the model, results of the regression analyses showed no effect of masculine and feminine stereotype conformity on driving behaviors, accidents and traffic offenses. The proportion of variance accounted for by masculine-stereotype conformity and feminine-stereotype conformity was 1% for inexperience errors, 9% for inattention errors, 2% for dangerous errors, 8% for violations, 5% for positive behaviors, 4% for accidents and 21% for offenses.

Finally, when entering gender identity variables, although models were not significant, results showed that typicality positively predicted the score of dangerous errors and that contentedness negatively predicted positive behaviors. The variance accounted for by these variables was 15% for inexperience errors, 6% for inattention errors, 19% for dangerous errors, 18% for violations, 33% for positive behaviors, 16% for accidents and 9% for offenses.

*Effects among Females.* Regarding females, as presented in Table 7, the number of years holding a license negatively predicted the number of accidents and offenses, and although the model was not significant, negatively predicted violations. The variance accounted for by these variables was 2% for inexperience errors, 7% for inattention errors, 3% for dangerous errors, 11% for violations, 1% for positive behaviors, 16% for accidents and 13% for offenses.

When entering sex-stereotype conformity into the model, results of the regression analyses showed no effect of masculine-stereotype conformity on driving behaviors, accidents and offenses. Feminine-stereotype conformity negatively predicted the number of accidents. The proportion of variance accounted for by masculine-stereotype conformity and feminine-stereotype conformity was 0% for inexperience errors, 4% for inattention errors, 2% for dangerous errors, 3% for violations, 7% for positive behaviors, 9% for accidents and 7% for offenses.

Finally, when entering gender identity variables, results showed no effect of typicality, contentedness and centrality on the variables tested. The variance accounted for by these variables was 8% for inexperience errors, 0% for inattention errors, 2% for dangerous errors, 4% for violations, 6% for positive behaviors, 11% for accidents and 5% for offenses.

**TABLE 6. Hierarchical analyses on DBQ scales, number of Accidents and number of Offenses for Males**

	Inexperience errors			Inattention errors			Dangerous errors			Violations			Positive Behaviors			Number of accidents			Number of offenses		
	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta
1. License (years)	.22	3.44*	.4*	.18	2.67	.23	.15	2.15	.19	.08	1.0	.28	.10	1.28	.25	.03	.36	.06	.1	1.36	.32
Weekly km			.36			.41*			.19			.13		.25				-.15			.14
2. Masculine traits	.01	1.68	.09	.09	2.08	-.29	.02	1.09	.08	.08	1.06	-.05	.05	.97	.14	.04	.38	-.08	.21	1.52	-.35
Feminine traits			-.05			.09			.10			-.3		.20				-.19			-.01
Typicality	.15	1.71	.29	.06	1.36	.24	.19	1.51	.48*	.18	1.39	-.19	.33	2.49	-.11	.16	.8	-.37	.09	1.2	-.01
3. Contentedness			-.28			-.14			-.34			.25		-.54*				-.13			.17
Centrality			-.27			-.13			.07			.37		-.2				-.0			.26
Total R2	.39			.33			.36			.34			.48			.23			.31		

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ **TABLE 7. Hierarchical analyses on DBQ scales, number of Accidents and number of Offenses for females**

	Inexperience errors			Inattention errors			Dangerous errors			Violations			Positive Behaviors			Number of accidents			Number of offenses		
	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta	R2	F	béta
1. License (years)	.02	.35	.12	.07	1.65	.15	.03	.61	-.06	.11	2.74	-.32*	.01	.29	.12	.16	4.12*	-.41**	.13	3.36*	-.3*
Weekly Km			-.01			.27			.14			-.23		.03				-.08			.14
2. Masculine traits	.00	.2	-.01	.04	1.42	-.15	.02	.50	.10	.03	1.64	.11	.07	.93	-.2	.09	3.48*	.17	.07	2.59	.12
Feminine traits			.06			-.17			-.09			-.11		.17				-.25*			-.23
Typicality	.08	.6	.01	.00	.78	-.03	.02	.42	-.16	.04	1.22	-.02	.06	1.00	-.09	.11	3.13*	.15	.05	1.88	.13
3. Contentedness			.11			-.04			.09			.21		-.22				-.00			-.22
Centrality			.27			.04			.05			.11		-.13				.24			-.02
Total R2	.10			.12			.07			.18			.15			.36			.25		

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

## 4. DISCUSSION

The aim of the study was to replicate findings showing the effect of sex and sex-stereotype conformity on driving behaviors (34), and to examine the effect of gender group identification by investigating the effect of three components of gender identity (typicality, contentedness and centrality). It was assumed that, depending on the feeling of being a typical member of one's gender group, satisfaction with one's biological gender group and the importance of gender in the self-concept, individuals would more or less try to conform to stereotypes associated with their group and thus to behaviors associated with their group such as driving behaviors.

The results did not confirm the first hypothesis which expected an effect of gender on driving behaviors. Males did not report more violations, accidents and offenses than women, which is not consistent with literature (14, 34, 36, 51, 52). Nevertheless, being a female is associated with higher inexperience errors which is in line with the results of many studies that have shown a greater propensity among women to declare more lapses (4, 6, 36) and inexperience errors (51). This lack of effect of biological sex on other types of behaviors could provide the idea to take into account social variables in explaining gender differences, supporting the idea that gender differences are fully explained by gender roles, contrary to integrationist models that suggest that gender differences are due to both biological and social factors (38). Nevertheless, the rest of the results did not support that idea.

Gender-stereotype conformity was expected to be associated with driving behaviors, replicating previous findings that showed this relationship (34). No effect of masculine-stereotype conformity on driving behaviors was observed in the results of the present study. Nevertheless, feminine-stereotype conformity was negatively associated with the number of accidents. That is to say, after controlling the effect of sex, individuals who highly conform to feminine stereotypes report a lower number of accidents, which is in keeping with a previous study by Özkan et al. (34) among Turkish drivers. This effect also appears when looking at females separately. Previous findings on DBQ showed that accident involvement was predicted by violations, both retrospectively and prospectively (6), and in the present study, violations correlated with the number of accidents among females. Thus, the negative link between feminine-stereotype conformity and violation and error scores that can be observed in literature (34) was not observed in the present study, but the low number of accidents among individuals who highly conform to feminine stereotypes could nevertheless be due to a lower tendency towards risky driving behaviors. Thus, it could be argued that caring for others could lead to more careful driving, and thus, fewer accidents. The results showed no relationship between accidents and masculinity. This might be due to the fact that an accident is a relatively rare event, as not all risky behaviors result in an accident. In addition, the study was conducted among young drivers, with a relatively short driving history. Nevertheless, the percentage of variance explained by gender stereotype conformity was only weak, suggesting that other social variables must be taken into account in order to explain differences between and within gender group in risky behaviors.

The third hypothesis predicted that gender identification of males and females would have an effect on driving behaviors. More particularly, it was assumed that males who strongly identified with their gender group would demonstrate greater conformity to masculine gender roles and would report more risky driving behaviors than males who weakly identified with the male gender group.

Results showed no effect of contentedness, typicality and centrality on driving behaviors among females, whereas results showed effects of typicality and contentedness on driving behaviors among males. More precisely, the typicality 'score positively predicted the dangerous error 'score, whereas contentedness negatively predicted positive behaviors. In other words, the dangerous errors 'score increases as a function of the male individuals 'feeling of typicality within their group. Thus, it seems that gender identification leads to riskier driving and exhibiting more errors, in order to conform to gender roles, since risk-taking is seen as a typically masculine type of behavior (28). The positive correlation between centrality and violations among men seems to suggest the same. Furthermore, the positive behaviors' score decreases as a function of the contentedness of belonging to the group of males. Thus, it seems that high gender identification, as assessed by contentedness, leads to exhibiting less positive behavior that could be socially linked to feminine stereotypes. Indeed, results also showed that conformity to feminine stereotypes decreases as a function of the global gender identification' score among males. Additionally, among males, contentedness correlated negatively with feminine stereotype conformity, which negatively predicted the number of accidents. Thus, it can be suggested that high gender identification among males leads to lesser conformity to communal traits, which can lead to less positive behaviors as regards contentedness level. In terms of implications, it may be

helpful to attach feminine characteristics (e.g. “caring for others”), which were found to be related to more careful driving and fewer errors (34), to masculine characteristics through role models, in driver education and media campaigns.

The percentage of variance explained improves by adding variables of gender identity, showing the importance of taking gender identification into account. Indeed, studies investigating the effect of gender roles on risky behaviors used to focus on gender stereotype conformity, given the relationship between masculine attributes and variables associated with risk taking (39, 40). Although popular, the practice of assessing self-perceived gender typicality in terms of self-perceived personality traits thus has limitations. Sex typing is multidimensional (53, 54), meaning that there is only modest consistency in the degree to which people display male-typical or female-typical behavior across different domains (e.g., personality traits, activity preferences, academic pursuits, and occupational preferences). Thus, it could be hazardous to infer an individual's overall gender identity from self-perceived sex typing in any single domain. Furthermore, the degree to which one identifies with one's gender group may partly explain the conformity to attributes associated with one's gender group or the other one and the behaviors associated with it. That's why it is suggested to take gender identity variables into account rather than only sex-typed attributes in explaining differences between and within gender groups in risk-taking. Interestingly, the effect of gender identity variables on driving behaviors only appears among men, not among females. Plus, the proportion of variance explained obtained by adding gender identity variables to the model is greater among males than among females. In this type of activity, the effect of gender identity must be particularly relevant among males, given that risk taking is a masculine type of behavior and that driving is an activity associated with maleness.

Furthermore, those results highlighted the importance of taking feminine-stereotype conformity into account when investigating sex and gender differences in risky driving. Most of the studies investigated the effect of masculinity on risky behaviors because of the relationship that exists between attributes associated with masculinity and variables associated with risky behaviors, such as aggressiveness, self-enhancement and sensation seeking (35, 39, 40). But few studies investigated the effect of femininity on risky behaviors (34). However, it can be suggested that it is the lack of femininity that leads to taking more risks instead of high conformity to masculine stereotypes (37). Indeed, people can conform to both masculine and feminine stereotype and it can be assumed that femininity buffers the effect of masculinity as it has been shown by Özkan et al. (34).

The present study has some methodological limitations that have to be taken into account when planning future research. First, the data comprised of drivers' self-reported behaviors, which may have limits, notably concerning the negative impact of social desirability. It is possible that some respondents embellished their answers about aggressive driving, although the bias caused by social desirability has been shown to be minimal in the answers on the DBQ (55). Consequently, observational studies combined to surveys are needed, and would allow comparison between self-reported and effective behaviors. Second, the sample is relatively small, which can explain the lack of reliability of the scales and can impact the validity of the results. Plus, there were clearly more female drivers than male drivers in the sample, which is unbalanced. Besides, young male drivers are the most problematic drivers. Next, half the sample consisted of novice drivers, so they may not actually be active drivers, which can lead to less exposure to traffic situations and so explain the lack of expected results. Plus, the effect of inexperience may interact with the effects of gender identity. Finally, the study has been carried out on a student sample, which may not be representative of the young driver population, as psychosocial and cultural variables, such as level of education, can influence people's driving behaviors and gender identity. Thus, the study must be replicated in a wide sample equivalent in terms of sex, age and socioeconomic status.

## 5. CONCLUSION

In summary, the present study showed neither the effects of sex nor masculine-stereotype conformity on driving behaviors, but an effect of feminine-stereotypes on the number of accidents. Plus, this study showed the effect of contentedness and typicality, respectively on positive behaviors and dangerous errors among males. The proportion of variance explained by sex-stereotype conformity was low, but was increased by adding gender identity variables to the models. Thus, even if hypotheses are not confirmed, this study can highlight the importance of taking gender identity variables into account when explaining differences between and within gender groups in risk-taking, rather than only look at the effect of sex-stereotype conformity. Furthermore, it highlighted the beneficial effect of feminine-stereotype conformity on risky behaviors,

suggesting that lack of femininity might be one of the key factors behind high traffic accident mortality among young male drivers. Nevertheless, results need to be put into perspective, given the size of the sample.

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# Measuring the perception of men and women drivers among young adults

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## ABSTRACT

Gender differences in driving accidentology are actually particularly explained in the literature by the conformity to gender stereotypes, notably the association of risk-taking with social expectations concerning masculinity. To date, no research was interested in the effect of the perception of men and women drivers (PMWD) on driving behaviors. The aim of this research was to create a questionnaire measuring PMWD among young French adults. The PMWD was measured on 108 participants (33 men and 75 women), from 18 to 29 years old. Principal component analyses indicated that the organization and content of the perception of men drivers differed from the organization of the perception of women drivers. The results are discussed in terms of in-group/out-group relations in the PMWD.

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**KEYWORDS:** Perception; Gender; Driving; Questionnaire.

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## 1. INTRODUCTION

Worldwide, men are involved in about three times more crashes than women and young men are over-involved in these crashes (1). In 2007, for the same number of kilometers, French male drivers were nearly four times more likely to die, two times more likely to be injured, and twelve times more likely to be sentenced for driving offenses than women (2). Men drivers reported more driving injury risk behaviors (3) and more traffic offenses (4). This sex difference is actually explained by the sex and gender of individuals. Gender refers to characteristics and traits which are culturally associated to men and women (5, 6), whereas sex refers to biological and physiological differences between them.

Sex is a predictor of driving accidents (7). Indeed, compared to women, and whatever their age, men reported more driving injury risk behaviors (3), more violations and errors on the road (8), and higher scores on perceptual motor skills which are positively related to traffic accidents (7). In contrast, women reported more harmless lapses than men (8), and higher scores on safety skills which are negatively related to traffic accidents (7).

From another side, risk-taking has a greater social value for men than women. Masculinity is indeed stereotypically associated with risk-taking (9, 10, 11), whereas femininity is stereotypically associated with careful behaviors. In this way people adhering to masculine traits would have more risky practices than people adhering to feminine traits (12). Furthermore, studies show that in driving, high masculinity is associated with a high level of offenses, aggressive violations, ordinary violations, accidents, perceptual motor skills, and low inattention and inexperience errors (7, 13, 14). This association between masculinity and perceptual motor skills suggests that "being a skillful driver is seen as a masculine trait" (7). In contrast a high level of femininity is associated with high safety skills, few accidents, offenses, and aggressive and ordinary violations, and with low inattention, dangerous and inexperience errors and ordinary violations (7, 13, 14). Finally masculinity among French pedestrian adolescents results in a lower internalization of traffic rules and both are good predictors of declared risky behaviors (15).

Gender seems to be a better predictor of risk-taking than biological sex. Furthermore, for several years studies are interested in gender stereotypes associated with driving and their implications. The stereotype of

women drivers is that they are unable to manage stress when a quick decision is needed (16). Moreover, in stereotype definitions, women have to be passive, uncompetitive, and not risk takers, whereas men are encouraged to be aggressive and risk takers, which leads them to commit more traffic offenses (3).

In France, Granié and Papafava (17) explored the gender stereotypes associated with driving among French adolescents from 10 to 16 years old. Thereby they showed that adolescents define men drivers as skillful, involved in an activity consistent with their social roles although imprudent and committing more traffic offenses. In contrast they defined women drivers as careful, compliant with traffic rules and having less accidents although being unskilled, having a lot of accidents, and involved in an activity inconsistent with their social roles. They also showed that the stereotype of men drivers is stable from 10 years old, while the stereotype of women drivers appears to strengthen with age.

Based on this study, Degraeve, Granié, and Pravossoudovitch (18) analyzed the contents of gender stereotypes associated with driving among French adults (from 16 to 50 years old and over). They showed that people see men drivers as skillful although impatient, reckless, uncivil, committing offenses, and driving too fast, while they see women drivers as civic, careful, vigilant, and conforming to traffic rules, although unskilled, dangerous, inattentive, and driving slowly.

Based on this study on gender stereotypes associated with driving (18), the aim of this study is to develop a questionnaire designed to measure the perception of men and women drivers (PMWD) among young French adults. This could permit a study of the effect of the stereotyped image of men and women drivers on driving behaviors and provide a better understanding of risky driving behaviors.

## **2. METHOD**

### **2.1 Draft questionnaire**

The aim of the present study was to construct a questionnaire measuring PMWD among young French adults. To measure PMWD among young French adults, four main dimensions of driving behaviors were differentiated, as obtained by Degraeve et al. (18) for men and women drivers through a free association questionnaire: driving skills, compliance to traffic rules, courtesy behind the wheel, and risk avoidance in driving.

Eight items were developed for each dimension. These items were created from content that participants gave to describe men and women behind the wheel in the study from Degraeve et al. (18). These items were the same for men and women. The questionnaire was divided into two sections (men/women behind the wheel). In each section, items were alternated between each dimension (driving skills, compliance with traffic rules, risk avoidance, courtesy). The order of items was the same for both sections. For each item, participants had to indicate their degree of agreement with the statement on a seven points scale (1 = not agree at all to 7 = strongly agree).

### **2.2 Pretests**

The purpose of the pretests was to determine whether the items that make up the experimental version of the questionnaire are clear, unambiguous and expressed in a language that is understood by the target population. Several pretests were made to improve comprehension of items among the targeted population. In a first stage, 14 participants were asked to first complete a paper and pencil questionnaire and then were interviewed by the experimenter. During this interview, participants had to explain their impressions on the questionnaire, to explain what they have not understood and what they think should be changed to improve the comprehension of items in each dimension.

In a second stage, participants were asked to complete the questionnaire online. A principal component analysis (PCA) was then made to test the structure of the questionnaire. A new version of the questionnaire was finally made on the basis of the PCA results and proposed online to new participants. Thus several principal component analyses (PCA) were made to test the structure of the questionnaire. Between each PCA, changes were made on the questionnaires on the basis of these results in order to improve the structure and the differentiation between the four dimensions measured. Totally, this second stage was completed by 109 participants.

## 2.3 GSAD Questionnaire

### Questionnaire

Four dimensions were measured in the experimental version of the questionnaire, for each driver's gender. Dimensions concerning skills, compliance to traffic rules, and risk avoidance were each made up by seven items; courtesy dimension included six items. The questionnaire was proposed online in a counterbalanced order (i.e., half of the participants began with the men behind the wheel section and half of the participants began with the women behind the wheel section). In each section, items were alternated between each dimension. The order of items was the same for both sections. For each of the 27 items for each driver's gender, the response was classified on a discrete ordinal scale. Participants had to indicate their degree of agreement with the statement on a seven points scale (1 = not agree at all to 7 = strongly agree).

### Participants

The questionnaire was completed online by 108 participants (33 Men and 75 women), from 18 to 29 years old. Their mean age was 23.57 years old (SD = 7.78). Eighty six percent of them (93) had their driving license. Preliminary analyses treating the putative role of participant possession of a driving license found no main effects. As such, the role of possession of a driving license was not considered further.

## 3. RESULTS

### 3.1 Analysis of the questionnaire structure

To analyze the structure of the questionnaire, PCA with an oblimin rotation were performed on the 27 items of each section of the PMWD questionnaire for the whole sample. A first PCA was then performed with all the responses of the 108 participants on the 27 items of the perception of women driver section and a second PCA was performed with all the responses of the 108 participants on the 27 items of the perception of men driver section. Each item with eigenvalues < 1 was excluded as well as items with loading values < .30 or those which filled equally on several axes. Several *t* tests were then performed on final axis to test gender differences on each dimension of each section.

### Perception of women drivers

For women drivers, the scree plot indicated that the data best fitted with a four-factor solution which explained 77.52% of the total variance (See Table 1).

TABLE 1. Principal component analysis on perception of women drivers

Items	F1	F2	F3	F4
7 I think that women refrain from having dangerous behaviors behind the wheel	.897			
23 I think that women avoid dangerous behaviors behind the wheel	.888			
15 I think that women avoid to adopt a risky driving	.869			
3 I think that women avoid taking risk while driving	.838			
19 I think that women refrain from having risky behaviors behind the wheel	.758			
11 I think that women avoid risky behaviors behind the wheel	.752			
27 I think that women avoid engaging in risky situations behind the wheel	.688			
22 I think that women don't exceed the permitted alcohol limit for driving	.490			.420
6 I think that women respect the permitted alcohol limit for driving	.372			.324
17 I think that women are dexterous behind the wheel		.894		
25 I think that women know how to maneuver their vehicle		.883		
5 I think that women are skillful behind the wheel		.880		
13 I think that women have good driving abilities		.837		
21 I think that women have a good driving dexterity		.823		
9 I think that women have good driving skills		.811		
1 I think that women have a good mastery of their vehicle		.789		

**TABLE 1 (continued). Principal component analysis on perception of women drivers**

Items	F1	F2	F3	F4
8 I think that women are respectful of others road users			-.870	
20 I think that women show politeness behind the wheel			-.851	
16 I think that women show manners to others road users			-.814	
12 I think that women are civic behind the wheel			-.794	
24 I think that women show consideration to others road users			-.761	
4 I think that women are courteous drivers			-.760	
18 I think that women don't exceed speed limitations				.797
10 I think that women don't break speed limitations				.665
26 I think that women respect speed limitations				.657
14 I think that women never run red lights				.646
2 I think that women comply to speed limitations			-.313	.606

Both items of compliance with alcohol restriction in driving were removed because they equally loaded on axis one and axis four. A new PCA was performed without these two items and created the final factor structure. The scree plot indicated that the data best fitted by a four-factor solution which explained 79.31% of the total variance (Cronbach's  $\alpha = .96$ ).

The first factor (F1) concerning risk avoidance of women drivers was composed by seven items and explained 52.95% of the total variance (Cronbach's  $\alpha = .96$ ). The second factor (F2) concerning women driver skills was composed by seven items and explained 15.42% of the total variance (Cronbach's  $\alpha = .95$ ). The third factor (F3) concerning women driver courtesy was composed by six items and explained 6.85% of the total variance (Cronbach's  $\alpha = .96$ ). The fourth factor concerning women driver compliance with traffic rules was composed by five items and explained 4.09% of the total variance (Cronbach's  $\alpha = .88$ ). Table 1 shows the items that were included in each factor of the questionnaire of adherence to PMWD concerning women.

**Perception of men drivers**

For men drivers, the scree plot indicated that the data best fitted with a four-factor solution which explained 77.72% of the total variance (Cronbach's  $\alpha = .96$ ) (See Table 2). No items had to be removed (i.e., no item has loading value  $< .30$  on one axis or loaded equally on several axes).

**TABLE 2. Principal component analysis on perception of men drivers**

Items	F1	F2	F3	F4
11 I think that men avoid risky behaviors behind the wheel	.968			
23 I think that men avoid dangerous behaviors behind the wheel	.913			
27 I think that men avoid engaging in risky situations behind the wheel	.889			
3 I think that men avoid taking risk while driving	.879			
7 I think that men refrain from having dangerous behaviors behind the wheel	.860			
15 I think that men avoid to adopt a risky driving	.856			
19 I think that men refrain from having risky behaviors behind the wheel	.841			
2 I think that men comply to speed limitations	.625			
26 I think that men respect speed limitations	.600			
18 I think that men don't exceed speed limitations	.592			
10 I think that men don't break speed limitations	.494			.308
17 I think that men are dexterous behind the wheel		.937		
25 I think that men know how to maneuver their vehicle		.923		
5 I think that men are skillful behind the wheel		.886		
13 I think that men have good driving abilities		.877		
9 I think that men have good driving skills		.873		
21 I think that men have a good driving dexterity		.839		

**TABLE 2 (continued). Principal component analysis on perception of men drivers**

Items	F1	F2	F3	F4
1 I think that men have a good mastery of their vehicle		.794		
12 I think that men are civic behind the wheel			.913	
20 I think that men show politeness behind the wheel			.878	
8 I think that men are respectful of others road users			.874	
16 I think that men show manners to others road users			.863	
4 I think that men are courteous drivers			.825	
24 I think that men show consideration to others road users			.810	
14 I think that men never run red lights				.866
6 I think that men respect the permitted alcohol limit for driving				.631
22 I think that men don't exceed the permitted alcohol limit for driving	.359			.599

The first factor (F1) concerning risk avoidance and compliance with speed limitations of men drivers was composed by eleven items and explained 50.60% of the total variance (Cronbach's  $\alpha = .96$ ). The second factor (F2) concerning men driver skills was composed by seven items and explained 16.58% of the total variance (Cronbach's  $\alpha = .96$ ). The third factor (F3) concerning men driver courtesy was composed by six items and explained 6.19% of the total variance (Cronbach's  $\alpha = .95$ ). The fourth factor concerning men driver compliance with alcohol restrictions was composed by three items and explained 4.36% of the total variance (Cronbach's  $\alpha = .77$ ). Table 2 shows the items that were included in each factor of the questionnaire of adherence to PMWD concerning men.

### 3.2 Correlations

Four scores were calculated on the PMWD questionnaire concerning women drivers and four scores concerning men drivers. Correlations between scores of each item and the axis to which they belong were calculated. Analysis of the relationship between scores of PMWD for men and women drivers was made through Bravais Pearson " $r$ " (See Table 3).

#### Perception of women drivers

For women drivers the results showed that the items were highly correlated to their own factor ( $r > .80$ ) and were more strongly correlated to their own factor than to the others three factors.

**TABLE 3. Bravais Pearson correlations between scores of perception of women drivers**

	F2 : Driving skills	F3 : Courtesy	F4 : compliance with traffic rules
F1: Risk avoidance	.438***	.665***	.748***
F2: Driving skills		.557***	.27**
F3: Courtesy			.644***

The score of risk avoidance was significantly correlated with the score of courtesy and the score of compliance with traffic rules: the more the participants perceived women drivers as avoiding risk and complying with alcohol restrictions, and the more they perceived that they are courteous drivers and compliant with traffic rules (mainly speed limitations). The score of courtesy was significantly correlated with the score of compliance with traffic rules and the score of driving skills: the more participants perceived women as courteous drivers, and the more they perceived they are compliant with traffic rules (mainly speed limitations) and skillful drivers.

#### Perception of men drivers

For men drivers the results showed that items were highly correlated to their own factor ( $r > .80$ ) and were more strongly correlated to their own factor than to the others three factors (See Table 4).

**TABLE 4. Bravais Pearson correlations between scores of perception of men drivers**

	F2 : Driving skills	F3 : Courtesy	F4 : Compliance with alcohol restriction
F1 : Risk avoidance and speed restriction	.322***	.724***	.624***
F2 : Driving skills		.439***	.256**
F3 : Courtesy			.596***

The score of risk avoidance was strongly correlated with the score of courtesy and the score of compliance with alcohol restriction ( $r > .60$ ): the more participants perceived men drivers as avoiding risk and complying with speed limitations, and the more they perceived that they are courteous drivers and compliant with alcohol restrictions. The score of courtesy was almost strongly correlated with the score of compliance with alcohol restriction ( $r = .60$ ): the more participants perceived men drivers as compliant with alcohol restrictions, and the more they perceived them as courteous drivers.

For both men and women questionnaires, the correlation between driving skills and compliance to traffic rules is lower than the five others correlations.

### 3.3 Skills and courtesy scores differences

The perception of women and men drivers was compared through paired sample t tests on the driving skills and courtesy only, as the other scores were not composed by the same items for men and women drivers.

#### Skills scores differences

Concerning driving skills, results revealed that participants judge men drivers significantly more skillful ( $M = 35$ ,  $SD = 6.83$ ) than women drivers ( $M = 29.41$ ,  $SD = 7.50$ ,  $t(107) = -6.11$ ,  $p < .001$ ). They also show that men participants judge men drivers significantly more skillful ( $M = 34.82$ ,  $SD = 6.94$ ) than women drivers ( $M = 26.88$ ,  $SD = 7.85$ ,  $t(32) = -3.90$ ,  $p < .001$ ) and that women participants judge men drivers significantly more skillful ( $M = 35.08$ ,  $SD = 6.83$ ) than women drivers ( $M = 30.55$ ,  $SD = 7.10$ ,  $t(74) = -4.78$ ,  $p < .001$ ).

#### Courtesy scores differences

Concerning courtesy behind the wheel, results revealed that participants judge women drivers significantly more courteous behind the wheel ( $M = 26.56$ ,  $SD = 6.51$ ) than men drivers ( $M = 21.70$ ,  $SD = 6.06$ ,  $t(107) = 5.94$ ,  $p < .001$ ). They revealed that women participants judge women drivers significantly more courteous behind the wheel ( $M = 27.15$ ,  $SD = 6.56$ ) than men drivers ( $M = 20.61$ ,  $SD = 5.60$ ,  $t(74) = 7.28$ ,  $p < .001$ ). For men participants there is no difference between the courtesy of women and men behind the wheel.

### 3.4 Gender differences

Independent sample t tests were performed to analyze the differences between men and women participants on their scores on the different dimensions of the PMWD (See Table 5).

**TABLE 5. Mean and SD on PMWD**

		Perception of women drivers				Perception of men drivers			
		F1	F2	F3	F4	F1	F2	F3	F4
Entire sample	Mean	34.19	29.43	26.56	22.79	34.90	35	21.70	9.69
	SD	7.92	7.50	6.51	5.86	11.15	6.83	6.06	3.30
Women participants	Mean	34.71	30.55	27.15	23.01	32.56	35.08	20.61	9.28
	SD	7.63	7.10	6.56	5.71	10.41	6.83	5.60	3.06
Men participants	Mean	33	26.88	25.24	22.27	40.21	34.82	24.15	10.64
	SD	8.55	7.85	6.28	6.23	11.10	6.93	6.44	3.67

The *t* tests conducted on the dimensions of the perception on women drivers revealed no statistically significant differences between the scores of men and women participants on PMWD concerning risk avoidance, courtesy, and compliance with traffic rules. T test on score of perception of women's driving skills revealed that women participants ( $M = 30.55$ ,  $SD = 7.10$ ), more than men participants ( $M = 26.88$ ,  $SD = 7.85$ ) perceived women as skillful drivers ( $t(106) = -2.39$ ,  $p < .05$ ).

Independent sample *t* tests on the dimensions of the perception of men drivers revealed no statistically significant differences between the scores of men and women participants concerning perception of men's driving skills. T test on risk avoidance revealed that men participants ( $M = 40.21$ ,  $SD=32.56$ ), more than women participants ( $M = 32.56$ ,  $SD = 10.41$ ), perceived men drivers as avoiding risk taking and complying with speed limitations ( $t(106) = 3.45$ ,  $p = .001$ ). T test on courtesy revealed that men participants ( $M = 24.15$ ,  $SD = 6.44$ ), more than women participants ( $M = 20.61$ ,  $SD = 5.60$ ) perceived men drivers are courteous behind the wheel ( $t(106) = 2.88$ ,  $p < .01$ ). T test on compliance with traffic rules revealed that men participants ( $M = 10.64$ ,  $SD = 3.67$ ), more than women participants ( $M = 9.28$ ,  $SD = 3.06$ ), perceived men drivers are compliant with alcohol restrictions ( $t(106) = 2$ ,  $p < .05$ ).

## 4. DISCUSSION

Many studies are interested in the effect of gender and sex on driving risk taking, but rarely studied the perception of men and women as drivers. Measuring these perceptions is necessary before observing its effects on driving behaviors. The aim of this study was then to create a questionnaire designed to measure the perception of men and women as drivers among young French adults. Furthermore, gender differences between the scores of men and women participants on perception of women and men drivers were measured.

The variance explained by the axes determined by the PCAs and homogeneity indices are satisfactory, showing a good content validity and a good internal reliability. Results indicate that the organization of the perception of men drivers differs from the organization of the perception of women drivers. Indeed, in their perception of women drivers, participants differentiate between the skills of women drivers, their compliance to traffic rules (speed limitations mainly), their courtesy behind the wheel, and their avoidance to driving risk taking. Alcohol restrictions do not seem to clearly contribute to define the perception of women drivers however. From another side, perception of men drivers seems to differentiate driving skills, courtesy, alcohol restriction compliance, whereas speed limitations compliance and risk avoidance load both on a fourth dimension. It seems that for participants men drivers' risk taking is manifested mainly by violations of speed limits. These results are in line with the fact that men drivers are mainly defined by their risk taking and their fast driving (17, 18). Nevertheless these results should be confirmed in a larger sample.

Concerning driving skills dimension, results show that even if they perceived their driving skills as higher than male participants did, women perceived men drivers as more skillful than women drivers. As participants of both genders have a higher score on this dimension for men drivers than for women drivers, the stereotype of skillful men drivers seems consensual. These results are in keeping with that "being a skillful driver" is seen as a masculine trait (7).

However, results also reveal gender differences concerning PMWD. Indeed, men, more than women, perceived men drivers as avoiding risk, complying to speed and alcohol restrictions, and courteous behind the wheel, while women, more than men, perceived women as skillful drivers. Except for the dimension concerning driving skills, men participants do not attribute more negative characteristics to women drivers than women participants. However, men denigrate drivers from the out-group (i.e. women drivers) by weakly adhering to the most differentiating dimension: driving skills. Women denigrate drivers from the out-group, by attributing negative characteristics more strongly to men drivers. These results are in keeping with research on gender stereotypes and, more generally on intergroup relations, which have shown how individuals seek positive distinctiveness, by denigrating the out-group while promoting the in-group (19, 20, 21).

Power-based gender stereotype approaches (22) and the effects of social asymmetry between genders (23) can provide an additional understanding of these results. Thus, research has shown that the dominant position of the men group (24-26) leads members of the socially dominated women group to over-promote the in-group (27-29). It appears that associating the driving activity with men's role in society causes women to "defend" their gender identity more than men need to.

## 5. CONCLUSION

The aim of this study was to create a questionnaire designed to measure perception of men and women drivers among young French adults. These results showed that, despite the higher proportion of men involved in road accidents, both men and women think that men drivers are more skillful than women drivers. This could be used during driving training to make learner drivers aware of the discrepancy between their own perceptions of men's and women's driving and safety skills and the reality of women's and men's road crash risk. The results kept with previous work on driving stereotypes and on in-group and out-group relations. This tool can be used as a basis for further research on the relation of the perception of men and women drivers, the adherence to gender stereotypes, and risk taking behaviors on the road. Future studies should extend the research to all ages of the driving population to permit a better understanding of sex differences in risk taking and accidents in driving.

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# SAFETY AND SECURITY

## ***Security: identifying the gap and new trends***

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# Anti-harassment campaigns for mass transit in the 21st century US: A critique from history

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## ABSTRACT

This study uses the history of gender-based harassment in public spaces in the United States to evaluate anti-harassment campaigns recently launched in Boston, Chicago, and Washington, D.C. Historical sources, such as newspapers, oral histories, and organizational records, provide the foundation for a critical content analysis of sources related to current anti-harassment initiatives, including mainstream media and social media coverage, and anti-harassment advertisements, policies and public service announcements. American feminists in the 1970s identified “street harassment” as a persistent and systemic problem faced by women in public space, and particularly on public transportation. Their challenges led to scholarly research on the topic, growing awareness of the issue in the popular media, and, eventually, a revival of grassroots activism in the early twenty-first century. The current mass transit anti-harassment campaigns, which resulted from these recent grassroots efforts, are remarkably positive responses to a feminist-defined issue. They represent a more inclusive model for responding to gender-based harassment in public space than seen in many other countries today and they legitimate women’s long-standing complaints about harassment. For all that is positive, however, earlier generations of activists’ conceptualization of the problem point to a significant shortcoming in these current campaigns, particularly a failure to recognize the systemic causes and societal-level implications of gender-based harassment in public space.

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**KEYWORDS:** Harassment; Public transport; Grassroots; Gender; Women; Policy.

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## INTRODUCTION

In 2008, the Boston T launched a campaign to end harassment, particularly gender-based harassment, on the city’s major form of public transportation. Signs announcing the new initiative declared, “Rub against me and I’ll expose you.” The Chicago Transit Authority followed two years later, using the slogan, “If it’s unwanted, it’s harassment.” Washington DC got on board in 2012, declaring, “It’s not ok. Report Sexual Harassment on Metro.” (Figure 1) These efforts included advertisements in stations, buses, and trains; new reporting tools for victims; better staff training; and a commitment to investigating complaints. As a feminist, it would be easy to declare these efforts a victory for women and move on to other issues. But as a historian, I would like to suggest that looking back at how earlier generations grappled with the harassment of women in public space – particularly the work of activists and scholars who first defined and named the problem – offers useful tools with which to evaluate both the design and implementation of these recent institutional responses from American transit companies.



**FIGURE 1. Washington D.C. Metro public service announcement**

[http://www.wmata.com/about\\_metro/transit\\_police/harassment.cfm](http://www.wmata.com/about_metro/transit_police/harassment.cfm). Accessed 5 November 2013.

Beginning in the 1970s, feminists identified “street harassment” as a persistent and systemic problem faced by women in public space, and particularly on public transportation. In seeking to challenge it, they encouraged scholarly research on the topic, raised awareness of the issue in the popular media, and, eventually, inspired a revival of grassroots activism in the early twenty-first century. This study uses the history of challenges to

gender-based harassment in public spaces to evaluate current anti-harassment campaigns in Boston, Chicago, and Washington, D.C. and offers suggestions for future stages in the campaigns.

## **METHODOLOGY AND THEORY**

For the purposes of this study, “harassment” is an amorphous “group of abuses, harrings, and annoyances” that are unwelcome forms of touching, gestures, stares, or comments directed by one stranger toward another. (1) Archival methods based on historical sources, such as newspapers, magazines, movement newsletters, memoirs, oral histories, and organizational records, provide the foundation for a critical content analysis of current anti-harassment initiatives, including mainstream media, social media, and the anti-harassment, policies, and public service announcements (PSAs). While several attempts to gather statistics on harassment on mass transit have been made by various public agencies and advocacy organizations, they rely on non-scientific sampling techniques and are therefore unreliable measures of the prevalence of these experiences. (2) Numerical studies also tend to erase or flatten the ambiguity of a situation, but it is exactly the ambiguity that creates the vexing nature of street harassment. A fundamental assumption of this paper is that history and theory can help to shape public policy alongside data derived from surveys and quantitative studies. Qualitative sources can reveal the emotional texture of the experience of harassment and the social implications of how those experiences are represented in culture and policy. Perceptions of harassment, particularly on the societal level, matter more in this study than actual incidents. In line with Martin Wachs’ 2009 challenge at a WIIT plenary to integrate “social science analysis with broader theories of social change and gender in society,” the goal of this study is to perform a close read on qualitative sources related to mass transit anti-harassment campaigns to better understand their social meaning, as well as to historicize and contextualize them. (3)

The work of feminist theorists on gender and public space provides the theoretical grounding for this study. Nancy Fraser (4), Nancy Duncan (5), Joan Landes (6), and Linda McDowell (7), for example, rework the theories of Jurgen Habermas (8) to illuminate the ways in which space influences experience and identity, shapes ideas about authority, and structures power relationships. These social critics note that, in modern society, access to public space is a key factor in participating in the larger civic and political world, but social identity plays an important role in determining who has that access and under what circumstances. Judith Butler (9) frames gender as an active and negotiated category of social identity. Its meaning is fragile and slippery, and must constantly be performed. It is only through performance that the meaning is made. As sociologists Carol Brooks Gardner (1) and Elizabeth Stanko (10) argue, gender-based harassment is – or triggers – just such a performance of gender. Similarly, sociologist Erving Goffman posits that social interactions in public space are governed by a host of unstated rules that have to be learned and practiced – or performed to use Butler’s term – in order for one to earn civil treatment when in public space. (11) Gender-based harassment in public spaces functions in compliance with many of these unstated rules, rules that allow for members of certain social groups to become the targets of attention – to lose their privacy – when they appear in places to which members of dominant social groups do not think they belong. From these theoretical underpinnings, I argue that unchallenged and ubiquitous practices that keep women off-balance or on guard in cities’ public spaces, such as gender-based harassment on public transit, continue to undermine women’s access to the public sphere and their claims to rights in legal, political, and economic settings. In other words, what has often been written off as acts of individuals or experiences that are merely “annoying,” are not minor, individual, or isolated acts. Rather, they reflect and reinforce women’s position in society and therefore demand a more political interpretation and a societal-level response.

### ***Why look at the U.S.?***

Examining these campaigns in the U.S. is particularly important in light of the increasing international interest in the issue of gender-based public harassment. Considering the substantial legal, religious, and social barriers women in countries such as Saudi Arabia, Mexico, and India face, one might wonder what is the point of worrying over harassment in a country like the United States, where women have relatively easy access to public space. It is precisely because conditions are not so dire in the U.S. that it is an interesting place to experiment with ways to challenge harassment. While women’s presence in American public space is certainly not entirely unfettered, law and custom do acknowledge women’s right to be there. This pushes the debate in the U.S. toward how that right can be exercised and what must be done to protect it. There is also a history of problematizing gender-based harassment that has created a rich dialog on the issue and a legacy of activism,

both of which drive these current anti-harassment campaigns. In other words, there is a base from which current advocates and policy makers can work.

The United States also presents intriguing cases to study because the approach is markedly different than that being undertaken elsewhere. In the 21<sup>st</sup> century, a number of countries around the world are turning to “women only” options as a response to violence perpetrated against women in public space, an option discussed and often endorsed in several WIIT papers at previous conferences. (12-14) Exclusive train cars, buses, and sometimes even taxis are reserved, labeled, and often flagged in pink for women in Tehran, Mexico City, Tokyo, Rio de Janeiro, New Delhi, Cairo, Dubai, and Seoul. These efforts, while well-intentioned safety measures, are problematic. Not only are they ripe for ridicule (see examples of how women-specific parking spaces have been received), but they also reinforce ideas that women need special accommodations or even their own public space – so that if a space is not defined specifically FOR women, one might argue it must be male space. Segregated spaces, notes feminist author Jessica Valenti, “are mired in paternalism...hiding us behind closed (or sliding) doors.” “Just how equal (are) the sexes,” she continues, “if women’s safety relies on us being separated?” (15) The segregation of public space also reinforces rigid notions of gender propriety and a gender binary, creating potentially violent repercussions for non-gender-conforming, trans, and intersexed individuals who do not comfortably fit into categories of “men” or “women” but must exist in a public space that continues to be bounded by such designations.

What has been happening in the U.S. in the last few years, both in terms of a revival of grassroots activism and new mass transit anti-harassment campaigns, represents a very different model for responding to gender-based harassment in public space. The current initiatives in Boston, Chicago, and D.C. focus on the more controllable space of mass transportation as a means of tackling harassment in a way that assumes that public space should be for everyone – or at least everyone who follows the law and the rules of civil behavior. While not perfect, these policies and the campaigns behind them, then, have the potential to reinforce women’s right to equal access to public space. They might even be expanded to do the same for trans and gender queer people. They represent, then, an important counter to the segregation trends that have become so popular of late. If developed further, they might also have the as-of-yet unrealized potential to gain wider public recognition of gender-based harassment as a social, and not individual, problem.

### ***Why Look at Harassment on Mass Transit?***

Gender-based harassment, particularly that aimed at women, exists throughout public space. It happens on sidewalks, in parks, on the streets, in parking lots, on elevators, and anywhere else that space is relatively accessible and at least theoretically open to the general population. Public space has few economic, physical, or social barriers, it provides services to the broader population, and connects private elements of a city. Public transportation, which might be publically, privately, or jointly owned, is a particular type of public space with features that greatly contribute to the ubiquity of gender-based harassment. Trains, streetcars, and buses are confined spaces with limited entry and exit points, crowding patrons close together for short stints of time. Crowds and noise obscure individual actions. The physical design of stations, platforms, and cars can also offer cover to perpetrators and reduce avenues of escape or avoidance for victims.

Beyond the physical setting, the combination of anonymous crowds and conventions of public behavior allow harassment to go unrecognized or unchallenged. “It is extremely hard in a crowded subway station to tell right from wrong when somebody is up close to somebody else,” argued a defense lawyer in a groping case. (16) Modern etiquette instructs all individuals to mind their own business and not to make eye contact in public, which often translates into fellow riders not outwardly reacting to what might – or might not – be harassment happening around them. Women’s gender training (always being expected to act like the “nice girl”) further guides women, encouraging them to choose responses that would not embarrass or cause discomfort for those around them. They often will not confront a harasser or ask those around them for help. (11) These factors leave the targets of inappropriate touching, staring, and exhibitionism unsure of the intentions behind what they experience and even more uncertain that anyone around them will notice, care, or assist if they complain or ask for help. Not surprisingly, women often choose to exit a car or move away in an effort to stop the behavior without calling others’ attention to what was happening, perhaps not even sure themselves of what had happened. (1)

For as much as the design, conditions, and social customs might contribute to harassment on mass transit, public transportation systems also have several advantages as sites for intervening to stop such behaviors. Mass transit, for example, generally requires patrons to pay to enter a system with defined spaces (cars, buses)

and controlled entry/exit points, all of which makes surveillance physically and legally possible. As paying customers, and not just passersby or visitors, patrons feel more entitled to better service and a comfortable environment than in other public spaces. Transit companies also train and maintain staff and security officers. Most have also developed explicit rules for patrons' behavior. While public transportation might be particularly prone to gender-based public harassment, then, it is also conducive to implementing policies and practices to challenge such behavior in a way that more transient and open public spaces are not.

## WHAT CAN HISTORY TELL US?

### *Harassment Has a History*

What history tells us first and foremost is that gender based harassment in public spaces is not something unique to the 21st century city. Evidence of the harassment women experienced in urban America shows up in novels, memoirs, and letters that stretch back as far as the 18th century. Historian Patricia Cline Cohen argues, however, that only in the 1830s did “a rising preoccupation with sexual danger for women in public” emerge. “Women were not ‘out of place’ in public,” she concludes, but this new preoccupation meant that women “were not traveling on the same terms as were men.” (17) Historian Mary Ryan uses the 1840s as her “benchmark” for the emergence of a “gender geography of public urban space,” that was characterized, in part, by the harassment of women. (18) While these scholars differ from each other by a decade, they agree that the emergence of the industrialized city in the first half of the 19<sup>th</sup> century brought new and gendered interpretations of urban space that marked women's presence there as unusual and problematic, setting women up to be harassed.

Unease about women in public space increased with urbanization. New technology appearing in the latter half of the 19th century allowed urbanites to travel greater distances from home with relative ease and fed urban growth and the creation of new public spaces. Trains brought visitors and migrants into the city. Subways, elevated trains, cable cars, and streetcars moved them around within it. Women's particular vulnerability on these conveyances serves as the opening trope in Theodore Dreiser's turn of the century novel, *Sister Carrie*. The protagonist is accosted by a ‘masher’ – a man who preys on lone women in public – during her train journey from the rural heartland of Wisconsin to the big city of Chicago. This encounter was symbolic of the dangers many 19th century Americans came to believe awaited women, particularly those who were young, single, and searching for paid work in the nation's cities. As middle class women began to take advantage of new consumption and leisure opportunities downtown, similar concerns rose that they too would be “jostled” or “insulted” by working class men. (19)

Alongside these concerns over innocent country girls seeking honest work and respectable matrons out for a bit of shopping, however, existed narratives of ‘public’ women; prostitutes, of course, being the most recognizable threat and near universal symbol of “dangerous” women. The bifurcated image of women actually allowed for the toleration of some harassment of women, justifying it as behavior warranted by women's disruptive presence in the male spaces of 19th century urban America. If ‘good’ women could be protected, then harassment would police the behavior and presence of ‘bad’ women.

A smattering of laws and accommodations created in the 19th and early 20th centuries attempted to mitigate dangers and protect ‘respectable’ women. Some municipalities, for example, enacted ordinances forbidding insults against women in public, in an effort to curb the “dangerous and offensive” behavior of “ruffians” loitering in American cities. (18) Many cities and private organizations also began offering sex-segregated spaces where women might rest when away from home, and some American businesses sought to shield women by offering them separate ticket windows, sales counters, show times, and entrances. A few transit companies responded to gender-based harassment on public conveyances by offering ‘ladies only’ cars.

These measures quickly ran into difficulties, however. Women themselves did not help matters. With the ‘ladies-only’ subway cars, example, ridership patterns made it clear that women did not use the designated cars consistently or in great numbers. Women also did not behave in ways that made the distinction between well- and ill-bred women apparent. On the subways, for example, suffragist Harriot Stanton Blatch noted, “the women crowd as well as the men,” (19) reflecting the argument of many riders that women did not need or merit special accommodations.

Gender specific laws and most services were quickly abandoned in the 20th century urban U.S. In place of this short-lived practice of reserving cars for women, most transit systems instead offered commercial

amenities designed to allow travelers to purchase services. For women, these services would allow them to maintain their privacy from fellow travelers by obviating the need to sometimes allow (male) strangers to assist them with packages, luggage, directions, or tickets when traveling. (20) Since interaction with strangers could leave them vulnerable to unwelcome advances, commentary, or worse, women were advised to function independently while in public. (21) Women's magazines, newspaper articles, and etiquette manuals published throughout the late 19th and 20th centuries also evidenced continued harassment of women by advising women to be on guard; "a lone woman can't be too careful," female readers were advised. (22) As this advice and these services made clear, women who wished to protect themselves from potential harassment in public space needed to essentially buy the privilege of privacy in public. Those who could not afford to purchase services or their own private transportation would be less able to insulate themselves from the notion that at least some women deserved the ill-treatment they received in public – because they were alone, because of how they were dressed, because of where they were going. For these women, ventures into public space carried the possibility that they would be perceived of as not moral enough, not appropriately feminine, or not respectable. By the 1930s, buses would join subways and streetcars to round out the mass transit options available for American city dwellers. Public transportation supported the growing numbers of women in the paid labor force (upwards of 40% of urban women worked for wages by 1920), but it also offered few ways by which women could insulate themselves from scrutiny.

### ***Race and Gender: Intersectionality and Harassment***

For African American women, public transportation proved a crucial tool for transitioning away from live-in domestic work, common in the 19th century, to the increasingly common "day work" domestic positions of the 20<sup>th</sup> century. Racial residential segregation, common in all American cities, necessitated a reliable means of transportation if African American women, 90% of whom worked as domestics, hoped to get from their own homes to those of the white families that employed them. This almost daily reliance on public transportation, particularly in southern cities where blacks often represented a far greater portion of the population, exposed African American women to harassment driven by both the racialized and gendered practices of the city during the Jim Crow era (the period of extreme legal and social discrimination and violence toward African Americans that began in the 1870s and lasted until the 1960s). Despite their numbers, black women found themselves the target of harassment and outright attacks precisely because of the intersection of their race and gender. Black women traveling too freely into white spaces and the intimate setting of white homes created anxiety in whites who enacted their patriarchal racial domination on these independent women.

African American women, however, sometimes responded in surprisingly confrontational ways to both institutional and individual harassment on public conveyances. When a white conductor attempted to remove journalist and activist Ida B. Wells from the first class "ladies car" to the "Negro car," she sunk her teeth into the hand he placed on her shoulder and then sued the railroad company. (23) During the 1906 Atlanta, Georgia race riot, white mobs rampaged through the city's public spaces and black women traveling through the city's downtown became targets of white male violence. One woman was pulled from a car and stripped, while those who attempted to assist her were beaten away with barrel staves. Others, however, more successfully fought back. A black woman riding a streetcar defended herself like "a savage wildcat" with her umbrella; another wielded her hat pin as a weapon. (24) In the Southern city of Birmingham, black women bus riders suffered curses and punches from both drivers and white passengers. Focusing specifically on the women who fought back, historians have argued that these "daily guerilla skirmishes" served as a crucial foundation for the modern mass-based civil rights movement of the 1950s and 1960s. (25) These are the cases that make it into the historical record, they often led to arrests of the women and/or formal complaints against the transit companies, and they became the rallying cry for mass-based protest. By viewing these incidents as precursors to the civil rights movement, however, the gendered nature of black women's experiences – and the daily-ness of the slights, insults and humiliations women of color faced at the hands of men of any race – gets erased. In a rare moment of recognition, the editor for a black newspaper in South Carolina referenced the "commonplace experience" of women's harassment, saying "you can pick up accounts of these at a dime a dozen in almost any community." (26)

### ***Naming the Harm, "Street Harassment"***

Race, age, ethnicity, class, and other visible social groups shaped some aspects of public harassment, but gender links these experiences. The frequency with which women across the social spectrum experienced harassment actually meant that it generally went unrecognized as a social problem. As late as the 1960s, the

harm caused by harassment had not yet been explored, there was not yet language to connect groping, staring, and flashing as part of a systemic repression of women. As a woman commented on a recent online story about harassment, “My mother recounts being groped by men in business suits on a daily basis.” (27) Susan Brownmiller, a white author and long-time New York City resident, described mid-20th century harassment in this way in an oral history interview:

Furtive touching was so much a part of ... life. It was a part of the life on the subway. If you took the train in the morning, it seemed there was a molester in every car... And you'd move away, you'd scuffle, sometimes you *might* say something out loud but it was the experience of all young women and probably older women too that you step on to the train in the morning to go to work and somebody's in that car to give you a feel... It was part of ... life. (unpublished)

Brownmiller's recollections are indicative of the ubiquitous nature and blatantness of these types of experiences for urban women. She obviously found the encounters distasteful, threatening, and intrusive. She later mentioned she expected they were far worse for women of color, but she dismisses them all as merely “a part of... life,” something to be expected and endured.

Unlike the more overtly political and legal focus of first wave feminism (focused primarily on suffrage), second wave feminism sought to redefine issues that had been labeled “personal” as social and political issues. The emergence of second wave feminism in the late 1960s and 1970s, then, provided an opportunity for women to challenge harassment in public spaces collectively. Women did not come to feminism because they had been whistled at on the street or flashed in a subway station, but once in the movement, and once the issue was raised, women quickly tapped into the hurt from, in Brownmiller's words, “a lifetime's accumulation of these petty assaults” and eagerly added it their growing list of grievances. (28) The issue surfaced frequently in informal feminist discussions, poetry, art, essays, and organizational newsletters. They named it “street harassment” but they were keenly aware that it could happen in any public space from an elevator, to a sidewalk, to a subway car.

From these conversations, feminists learned to name the harms caused by gender-based harassment in public space. Once named, the practice could not remain invisible or be so readily dismissed as merely a petty annoyance or an individual aberration. Evidence of this conceptualization appears throughout radical feminist newsletters of the late 1960s and 1970s. Street harassment, wrote members of a Chicago women's group, “makes us consider, in ways that men never have to, where we go at night, with whom, how late we'll be and when and how we'll get home.” Feminists also learned that their own feelings of “suspicion and mistrust” caused by harassment in public space were widely shared. These discussions often triggered great wells of anger from women, who then declared their “rage” at the treatment they received from men in public spaces, and the way it made them “feel powerless and dehumanized” White Boston feminist Roxanne Dunbar captured the conclusions many feminists had reached: “Our oppression and suppression are institutionalized, all women suffer the ‘petty’ forms of oppression. Therefore they are not petty or personal, but rather constitute a widespread, deeply rooted social disease. They are the things that keep us tied down day to day, and do not allow us to act.”

From examinations of the individual toll women paid to be in public, feminists in the 1970s developed a three-pronged analysis. First, they declared that the intrusive and unsolicited comments, the leering, and touching to which women were prey objectified women. Secondly, feminists suggested the ways in which gender-based public harassment curtailed women's autonomy by forcing women to “choose the hours, and choose the circumstances that you can be out.” The implication behind this point was that limited geographic mobility in turn restricted women's political, social, and economic mobility and their ability to function as independent members of society. Finally, feminists placed touching, exhibitionism, and the verbal harassment women experienced on one end of a continuum of male violence toward women that, on its other end, included rape or even murder. (29)

This third line of reasoning resonated especially heavily with women – on the pages of movement newsletters women readily recounted the fear they felt when a man stared at them or spoke to them in public – but it also located the source of harassment and violence in a society that tolerated and even encouraged the subjugation of women. Recognizing both the individual harm of harassment and the larger societal underpinnings of the phenomenon, second wave feminists encouraged women to reject the behavior rather than seek to avoid or minimize its existence. They further advocated a crowd-level, public response to stop harassers and support victims: In one scene from the 1983 feminist utopian film “Born in Flames,” for example, a woman emerging from the subway is “checked out” by two men, who then start making comments to her

and eventually push her to the ground, presumably to rape her. The woman is rescued by a group of whistle-blowing, bicycling feminists who surround and drive off the perpetrators and then comfort the woman who had been attacked. The scene is earnestly feminist in its portrayal of how a verbal confrontation could lead to physical violence, but it also demonstrates how an aware, activated, society could successfully intervene in the moment to save someone from victimization.

By the 1970s, ending street harassment of all kinds had come to symbolize for feminists what NOW president Karen DeCrow defined as “the right to human dignity, the right to be free from humiliation and insult, and the right to refuse to wear a badge of inferiority at any time or place.” (unpublished March 6, 1971, NOW Collection, Schlesinger Library, Radcliffe College) In response, feminists in the 1970s and 1980s organized “ogle-ins” where women turned the tables and harassed men on the streets, created self-defense classes, and published handbooks encouraging women to resist and demand better treatment.

### ***Scholars and the Popular Press***

By the 1980s and into the 1990s, feminist scholars, mostly sociologists and legal scholars, began to research the issue. Their studies documented women’s experiences, analyzed the perceptions of both the harassers and the harassed, and interrogated the culture of fear that street harassment fueled among women. The resulting studies assessed the ramifications of the “sexual terrorism” that street harassment created and maintained a focus on the macro-level impact of how these practices produced a “ghettoization of women” in American society. (30, 31)

When the issue crept into the popular press in the 1980s and early 1990s, however, feminists’ critique of a culture of violence toward women was co-opted by a focus on the individual. Women were being told by women’s magazines not to tolerate harassment anymore and to actively challenge it. “Don’t ‘Hey, Baby’ Me,” announced *Glamour* magazine in 1992. (32) What female readers were not being told was that they might consider society’s permissive or dismissive attitude toward harassment as an expression of a larger structural inequality they faced as a result of their gender. African American commentators, who had been remarkably absent for earlier discussions, did join this part of the conversation. Calling attention to “the ugly sounds of summer,” one author reminded readers that even just ‘girl watching’ was “the kind of violation of black womanhood that black men had once died to prevent.” They admonished black men for practicing it, but cast the harassment of black women more as a reflection of racial inequality, continuing to overlook its gendered components.

## **21ST CENTURY ANTI-HARASSMENT CAMPAIGNS**

A new generation of feminist activists, coming mostly out of the third wave and transnational feminist movements, began a renewed grassroots campaign against gender-based harassment in public space at the turn of the millennium. Their campaigns were more conscious of race and Lesbian Gay Bisexual Trans Queer (LGBTQ) issues, and more connected to an international movement to stop violence against women than their predecessors in the 1970s. While they acknowledged many of the themes from that earlier generation of feminists, they pioneered new tactics for addressing harassment, taking advantage of new technology to foster communication and publicity. Hollaback!, an organization founded in New York City in 2005 that has since spread to over sixty cities in twenty-two countries, urged women to use their cell phones to take pictures of anyone who makes them “scared or uncomfortable” with anything from “comments (such as) ‘You’d look good on me’ to groping, flashing and assault” and post them to the web. Other groups created blogs where women could post their stories of harassment; some started interactive maps to identify ‘harassment zones’. These organizations then used these stories and their own research to target gender-based harassment on public transportation, in particular. Feminist grassroots organizations demanded that transit companies become more responsive to the problem. Collective Action for Safe Spaces, for example, a D.C. organization formed in 2009, conducted a “safety audit” around the city in 2011 and then, in early 2012, launched a successful campaign to lobby the Washington Metropolitan Area Transit Authority to address harassment on the city’s public transportation.

The responses of some transit officials and the general public to this work against gender-based harassment on mass transit is particularly revealing of how much there was (is) to be done. When sexual harassment was raised as a serious problem on the city’s transit system by the grassroots organization Collective Action for Safe Spaces, WMATA spokesperson Dan Stessel testified to the DC city council that “it really isn’t a big issue.” (33) Metro Transit Police Chief Michael Taborn’s testimony dismissed uninvited comments and leering stares as

being “not a crime,” leading one columnist who attended the hearings to conclude that he “seemed oblivious to the fact that many Metro riders, especially women, were feeling uncomfortable when riding the trains.” (34) Tabor further minimized the problem when he later told a local TV reporter, “One person’s harassment is another person’s flirtation.” (35) Local anti-harassment organizations jumped to exploit these gaffes and the public relations nightmare they created helped to launch the Metro’s official anti-harassment campaign.

In the largely anonymous realm of the internet, however, victim-blaming and individualization of the problem is harder to counter. On-line comments posted to a 2007 survey of harassment on NYC subways, for example, admonished women for “asking for” harassment through their clothing choices, while others faulted women for not reporting sexual harassment. Some called for better policing, but many expressed the belief that “catching these people is virtually impossible,” implying that it was a waste of resources to even try. A number of commenters used the forum to tell stories of being harassed on the city’s subways and name the emotional harm these incidents caused them, but just as many dismissed harassment as nothing more than the kinds of “odd occurrences” one should expect living in a city.

Pushed by feminist grassroots organizations, however, a few transit authorities in large U.S. cities finally began to directly address harassment on public transportation. Boston debuted its public service announcements and a press campaign in 2008; Chicago in 2010. WMATA, the entity in charge of D.C.’s bus and train system, created a new email and web portal for reporting harassment in March of 2012. Their PSAs drawing attention to the problem and encouraging victims to report incidents debuted a month later. The two waves of feminist organizing (1970s and 2000s) and the scholarly attention they generated help to explain why U.S. transit companies launched anti-harassment campaigns. Feminist grassroots organizing also offers a means for evaluating the structure and implications of these campaigns. Some aspects of feminist problematizing of gender-based public harassment have been incorporated, some have not. Probably the closest resonance between anti-harassment campaigns in Boston, Chicago, and D.C. and feminist analyses can be found in the rejection of negative feelings victims might experience. Next to the image of a lone, wary-looking African American woman, for example, one poster declares, “I’m not the one who should be ashamed.” Placards reassured riders that “no one should make you feel uncomfortable.” These messages hint at the psychological harm victims of harassment might experience, feeling guilty for being a target of harassment or feeling unsure that they had a right to challenge behaviors that left them ill at ease.



**FIGURE 2. Washington D.C. Metro public service announcement**

<http://www.collectiveactiondc.org/programs/wmata-anti-sexual-harassment-campaign/>. Accessed 5 November 2013.

Reflective of the most recent grassroots efforts on the part of organizations such as Hollaback! there is an obvious attempt on the part of transit companies to make the anti-harassment campaigns appeal to a diverse audience. While young women predominate in the posters and placards, some ads also feature older women, lone men, and people from many races. Five years after the campaign’s launch, the Boston T now displays two different ads featuring lone men and bearing the same text as the earlier ads featuring women, “Hey you, you are not entitled to my space. Sexual harassment is a crime and if you make me uncomfortable, I will...report you.” These posters do not clearly indicate who might be the source of the “sexual harassment,” and what might be motivating this harassment. This ambiguity suggests that anyone could be the target of harassment, but it does so in a way that de-genders the problem. The re-framing of an issue in a way that depoliticizes it is even more clear in a poster that debuted in the Spring of 2013: a picture of an attractive and fit-looking young man of color is even accompanied by the classic feminist anti-rape slogan, “No means no.”

Transit companies have also expanded their anti-harassment campaigns to include a host of other behaviors that trouble transit riders. Chicago, for example, uses the same slogan that originally called out gender-based harassment. “If it’s unwanted, it’s harassment,” appears on a second poster that specifies “bullying, soliciting, and panhandling.” (Figure 3) While these attempts to demonstrate the benefits of the campaigns to all transit patrons might lower resistance to recognizing gender-based harassment, they too depoliticize the issue by removing the connection to harassment motivated by the power imbalance between different social groups. Without a specific reference to individuals being targeted because they are a part of group that is perceived to be less powerful, it therefore severs the connection between harassment and hierarchies of power.



FIGURE 3. Chicago Transportation Authority public service announcement

The design of the campaigns and the content of the PSA signs suggest that, despite feminist arguments to the contrary, the “problem” being addressed is located primarily at the level of individual behavior. “Rub against me and I’ll expose you,” declares a poster developed for the Boston T and then licensed to the D.C. Metro. (Figure 4) Next to the image of a young woman pointing her finger into the camera lens, a slogan declares, “respect my space.” Both slogans stress the first person singular in their appeal. (Figure 5) In Chicago’s media campaign, multiple people, representing diverse backgrounds, stare squarely out of the frame, most with defensive postures of arms crossed, but all positioned as individuals rather than as part of a cohesive group. YOU should not do this – “touching, rude comments, leering” – is often the message, but the subtext is clearly that YOU, as an individual, should not have to take it if someone does this to you. The signs are meant to empower victims to reject behaviors they deem as unwanted (“say ‘no’”), and report incidents to authorities (“Tell a CTA employee immediately if you are a victim of harassment”).



FIGURE 4. Boston T (Transit) public service announcement



FIGURE 5. Botson T (Transit) public service announcements

The design of the campaigns and press coverage of these initiatives often direct the riding public to view harassment as a problem individuals face and one that should be addressed only by law enforcement officers. Transit riders were given new tools to report incidents through web sites, cell phone applications, email addresses, and phone numbers, so that transit police could respond and investigate. When Chicago Transit Authority signs intoned, “if you see something, say something,” they clearly meant a person should “say something” through one of these mechanisms or to a transit officer directly, not to the other people on the train or bus and not to the person they perceive as a harasser. Similarly, the public placed the responsibility for combatting harassment on transit officers. “It sure would be nice,” commented one reader in a newspaper article, for example, “if the transit police would do more about this problem – and not just every now and then, but constantly.” (27) One implication of leaving harassment in the individual realm in a space that has overtones of ‘consumer rights’ (patrons pay to ride most public transportation, after all) is that the problem is likely to then be dealt with through increased policing and state-sanctioned surveillance, rather than a sense of community engagement and civic responsibility. Nowhere in the transit authority messages, and only rarely in the public response to them, is there an expectation that individuals could count on those around them to offer assistance to a person who felt victimized and had challenged their harasser. Ultimately, then, individuals are left to determine for themselves if they are being harassed and to decide how to act. Even if their fellow passengers are texting pictures of perpetrators to transit officials, the target of the harassment could be completely unaware of how those around them are reading the situation. (36)

## CONCLUSION

The focus of this paper has been on how recent transit campaigns frame the “problem” that harassment poses and how they assign responsibility for how the problem can/should be addressed. These initiatives do represent a more inclusive model for responding to gender-based harassment in public space than seen in many other countries around the world today, and they legitimate women’s long-standing complaints about harassment. For all that is positive, however, earlier generations of activists’ conceptualization of the problem point to a significant shortcoming in these current campaigns, particularly a failure to recognize the systemic causes and societal-level implications of gender-based harassment in public space. What is still missing from

these campaigns are the larger political implications of gender-based harassment. Fully exploring these implications would require recognition that groping, flashing, and harassing commentary are more than just annoying behaviors. They are worth stopping precisely because they are connected to and representative of a host of other types of discrimination and, as researchers who have presented at previous WIIIT conferences have clearly demonstrated, they will discourage women from using public transportation. (13) The transit company campaigns in Boston, Chicago, and D.C. are not yet asking why we, as a society, have allowed these behaviors to develop. These campaigns are not yet presenting public harassment as a shared, societal-level problem. And while they acknowledge harassment as a problem that might cause victims shame and discomfort, they do not show a recognition of why this is. Early feminists articulated the relationship between street harassment and rape, offering an explanation for why “harryings” and “annoyances” could cause fear and lead women to curtail their presence in public spaces, but that argument has yet to surface in mass transit anti-harassment campaigns. While these transit companies have taken important steps in interrupting the victim blaming that has long accompanied street harassment, the individual psychological aspects of harassment continue to overwhelm the issue and thereby depoliticize it and overlook how and why harassment creates fear and limits mobility for its victims, particularly women.

Knowledge about how women have experienced and interpreted gender-based harassment in public spaces, particularly on public transportation, and how society has silenced these experiences is required if transit authorities, law enforcement, and municipalities wish to further advance travelers’ sense of comfort and safety. Feminist theories and histories, and other radical critiques of how power relationships are embodied in time and space, suggest how official responses to gender-based harassment in public space might continue to evolve. As public benefit corporations with missions to move people efficiently from point A to point B, transit authorities might not be viewed as having a responsibility to solve societal problems and might need to be convinced that doing so could help advance their missions. Campaigns against gender-based harassment on mass transit could be improved by approaching riders as a community, rather than as individuals. To do this, they would need to leverage the greatest strength of public transit, the public. PSAs that work to define harassment could frame the issue as a social or community problem, requiring a response at that level. This is where the continued involvement of grassroots organizations is needed to create pressure for this kind of reframing.

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# The risk estimate of being assaulted in public transport in Lille urban area

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Since January 1st, 2014, The French Ministry of sustainable development merged the 8 CETE, Certu, Cetmef and Setra into a new structure dedicated to risk, environment, mobility and planing called CEREMA.

## ABSTRACT

In France, several opinion surveys have pointed out the fact that the feeling of insecurity is an obstacle to the use of public transport (PT). In Lille, the PT network is structured around two metro lines which support more than 60% of trips but also, as fully automatic lines, lack human presence. From 1995 to 1997, insecurity was increasing while traffic was decreasing. Local authorities then reacted by implementing a local security contract.

The French Ministry of Transport has just completed a study about violence against women in public transport. This study shows that globally, men are more often assaulted in public transport than women. While men are mostly victims of assault and battery, women are especially victims of sexual assault. However, the insecurity statistics used in this study do not take into account duration of exposure and differences in mobility behaviour between men and women.

The key idea of this is to link HTS data with crime data in public transport from the operator. The main objective is to estimate the risk of being assaulted in public transport, linking the number of attacks to passengers to indicators estimated from mobility data: duration of exposure, number of trips and travel time.

The paper will focus particularly on gender issues, by analysing the risk depending on gender, time of the day, status, transport mode, type of criminal act... Then, these indicators will be compared to those from road safety, where a similar approach is under-way in Lille, in order to determine whether the feeling of insecurity in PT is overestimated or not.

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**KEYWORDS:** Security; Risk; Women; Assault; HTS; Mobility; Crime; Public transport; Malicious acts; Lille; Gender.

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## BACKGROUND

In France, the feeling of insecurity is a continuous electoral issue. In transport, several various opinion surveys have pointed to the fact that the feeling of insecurity is an obstacle to the use of public transport.

Within a global context of a general feeling of insecurity, the question of insecurity in public transport is particularly sensitive. Serious aggressions, such as assault with a weapon, are largely covered by the media, and public opinion is deeply and durably afflicted by them. This issue is even more important when dealing with women. For example, sexual harassment in India, also called "Eve teasing", is a big issue. About 66% of women commuters surveyed in Chennai (India) had been sexually harassed while commuting (1). In several countries in Asia and South America, specific bus or train services were allocated to women. In many other cities around the world, women-only taxis were developed. Most of them consider the fear of being assaulted as an obstacle to mobility, particularly in the evening and at night. Loukaitou-Sideris has shown (2) that, even if most US agencies believe that women have distinct safety and security needs, they don't have any program that targets women's security needs. For example, men prefer CCTV and radio contact from the driver, while women prefer that the driver prevents the boarding of people influenced by alcohol or drugs.

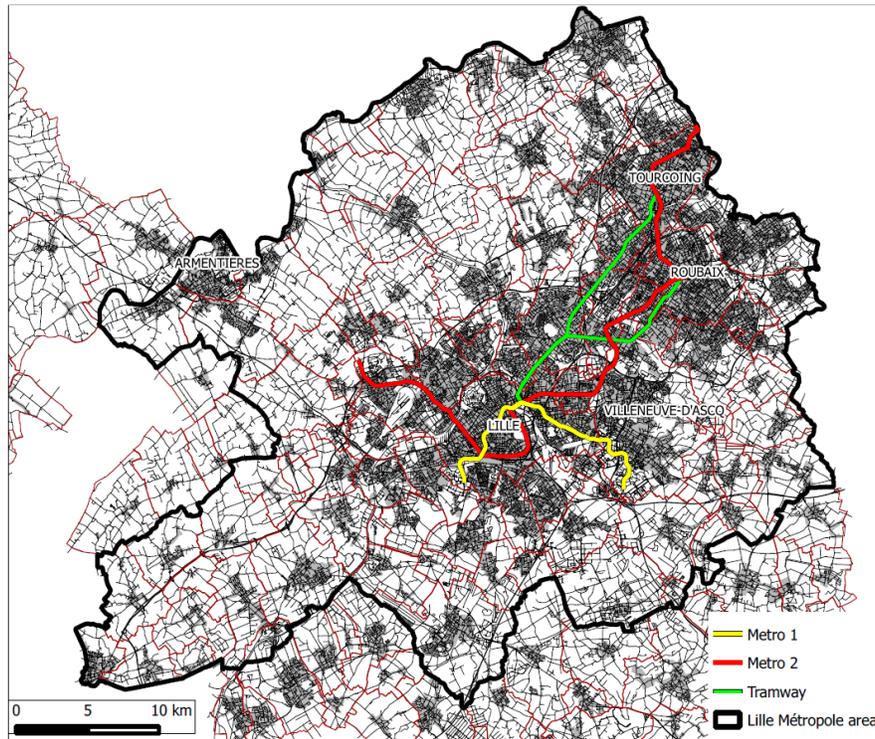
In the conurbation of Lille, the murder of a young father in a metro station in 2000 is remembered long after, and a large number of the city inhabitants assumed they should not take public transport for insecurity reasons. Concurrently, about twenty people are killed in the metropolis in car accidents each year with complete indifference.

In this context, this article proposes a method to develop objective indicators to evaluate the risk of being a victim of a crime in public transport, which could help policy makers to produce more efficient public transport security policies.

## THE TRANSPOLE NETWORK

Lille Metropole is a French local authority of 1,100,000 inhabitants close to the Belgium frontier. The 85 various municipalities within its territory range from large towns like Lille (200,000 inhabitants), Roubaix (100,000) and Tourcoing (100,000), to rural villages. Lille Metropole is responsible for public transport organisation and has delegated the operation to Transpole, a subsidiary of the international Keolis group.

The public transport network (see Figure 1) is structured around two fully automatic metro lines (VAL), supporting more than 60% of trips, 2 tramway lines, about 50 urban bus lines and some regional bus lines.



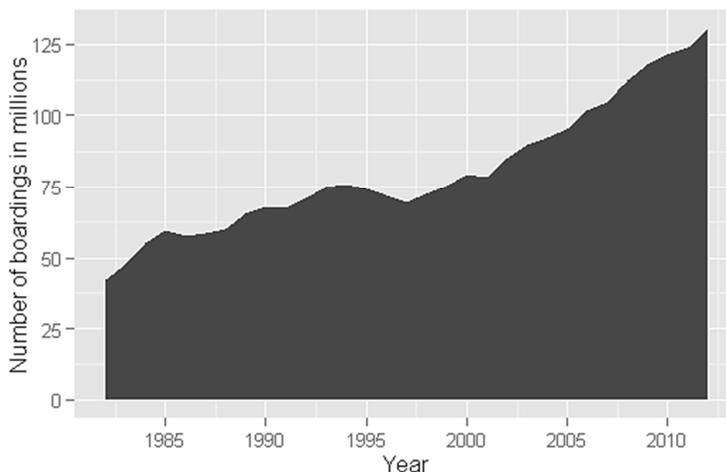
**FIGURE 1. Lille Metropolis and its 85 municipalities**

After continuous increase since its creation in 1983, metro use decreased from 1995 to 1997, while insecurity increased (see Figure 2).

In 1996, a survey involving 1,400 public transport users highlighted three key items:

- The lack of human presence;
- The fear of an assault;
- The lack of monitoring and alarm equipment.

The feeling of insecurity was strengthened in the metro as it is operated without a driver and without operator staff in stations. Local authorities reacted by implementing a local security contract in 1998, which was one of the first approved in France.



**FIGURE 2. Yearly evolution of Transpole's traffic**

(Source: Lille Métropole)

## THE LOCAL SECURITY CONTRACT (CLS)

Transpole already implemented a security policy since the early 1980s. It consolidated it in 1992 to improve security conditions. However, all these measures have had little impact, quantitatively speaking.

The decrease in the Transpole network use by passengers in the mid 1990s, especially in the metro, partly because of the rising feeling of insecurity, highlighted a few requirements:

- the necessity to reinforce present means;
- to coordinate the different agents interventions;
- to improve surveillance and means of communication;
- to enhance the database of the offences reported;
- to define more formal procedures;
- to congregate the different control centers, similar to the Safer Transport Command in London's transport.

In 1998 this diagnosis resulted in the Local Security Contract (3), whose priority interventions program and means have been implemented.

## TRANSPOLE CRIME DATABASE

One of the main measures set down in the Local Security Contract was to make a list of offences committed on the network as exhaustive as possible. Transpole created a database dedicated to offences committed on its network. The database is supplied by different sources: the Safer Transport Command, drivers, mediation officers, inspectors, etc. This list was filled out by Transpole's existing staff, and by new specialized agents hired to check and consolidate information about each offence.

Information collected gives details about the type of offence, the type of public transport concerned (metro, tram, bus...), the metro/tram/bus line, the stop or station, the place where the offence has been committed (inside a station or train...), date and time, the municipality, the modus operandi, with or without a weapon.

However, the only information given about the victims are their sex, exclusively in cases where there is one single victim, and if they live in Lille Métropole. Therefore, establishing a link between the risk of being assaulted and the victim's personal characteristics is extremely limited here. For example, the age or the social class of the victim could be a useful criterion.

The list of offences made by Transpole is composed of four levels of precision. The first level distinguishes three cases:

- offences committed on passengers;
- offences made on staff;
- offences on equipment.

As this report aims at assessing the risk of becoming a victim of an assault, it will focus mainly on the first case: assaults on passengers.

**TABLE 1. Transpole List of Offences Committed on Passengers**

Actual bodily injuries	Violence	Petty violence	
	Sexual violence	Sexual assault	
		Attempted rape	
		Rape	
	Robbery	Snatching	
		Other cases of robbery	
Emotional distress and damages on property	Outrage/Threat	Outrage/Insults	
		Threat	
		Sexual exhibitionism	
	Thefts	Pickpocketing	
		Petty theft	
	Theft by threatening		

In 2012, more than 4,641 malicious acts were reported on the Transpole network for those three general categories (offences made on passengers, staff and equipment).

The number of malicious acts decreased between 2006 and 2012 by 19%, while traffic increased by 29%. Offences on equipment represents 50% of the malicious acts, against passengers 30% and against staff 20%.

The number of offences against Transpole staff decreased from 2006 to 2012, while offences against passengers significantly increased. As traffic increased during this period, the risk of physical abuse (as a ratio) decreased slightly. However the risk of non physical abuse rose sharply. We can suppose that the growth of non physical abuse is mainly caused by smartphone thefts. The equipment rate of smartphones has considerably risen in recent years, and iPhones are particularly targeted by thieves.

In 2006, a household travel survey was undertaken and collected much valuable information on inhabitants' mobility in the Lille Metropole. Accordingly, the data analysis takes into account the figures of 2006

About 1,000 offences were reported in 2006. Bodily injuries and non physical offences are divided roughly into two halves.

The report of victims' gender is necessary in order to validate an analysis based on gender. Unfortunately, such information is missing part of the time: the gender of victims is not mentioned in 13% of the reported passengers offences.

In fact, it can sometimes be impossible to identify clearly the victim, especially in cases where multiple victims of different genders are involved in one offence.

Accomplishing quantitative analysis implies rectifying data in which the gender of the victim is unknown. We will distribute incomplete information in due ratio of categorized offences where the gender of the victim is given.

Concerning offenders, it was not possible to estimate the proportion of crimes committed by women in Lille, due to a bug in the database update process. However, Levine and Lee (4) found that in Manchester, only one crime in six are committed by women.

## **RAIL CRIME DATABASE**

While Transpole is the only public transport operator in the conurbation of Lille, the regional railway transport is operated by the SNCF under the supervision of the Nord-Pas de Calais Region. In order to establish an exhaustive diagnosis related to the feeling of insecurity on public transport, the Transpole crime database had to be complemented with the SNCF CEZAR database (Connaître l'Evolution des Zones A Risque). This nationwide database was created in 1998 after an accident caused by scrap metal items put on rail tracks.

It is extremely valuable because it reports detailed offences. A lot of information is also collected about interventions, arrested offenders, impacts on the company activity and characteristics of victims, as it was described in a study about weak signals in the rail transport system in France (5).

Precisely, data given on victims are the gender, the age bracket, the seriousness of offences, the potential number of temporary work disability days after an assault, place of birth.

Regrettably, the access to the database related to Lille Métropole is restricted for confidentiality reasons, and could not have been accessed.

## **INVENTORY OF VIOLENCE AGAINST WOMEN IN PUBLIC TRANSPORT IN FRANCE**

Beyond the urban area of Lille, a lot of public transport operators collect data concerning malicious acts committed on their network and create their personal database.

Unfortunately, each operator or local authority in charge of public transport determines its database content by itself. As a result, none of them has the same degree of precision and completeness. In a restrictive way, some of them provide little information on victims and the gender is not reported on each network. Similarly, the list of offences sometimes changes from one network to another.

The National Transport Crime Observatory (ONDT) (6) has implemented a process to cope with this heterogeneous situation. The ONDT is part of the Ministry of Ecology, Sustainable Development and Energy's services. Created in 2008, it works in collaboration with public transport authorities, operators and prefectures by providing support in engineering and exchanging best practices. At the European level, the observatory participates in the development of a legal framework. At the international level, it is a member of the International Centre for the Prevention of Crime (CIPC) and of the international network of Crime Observatories.

Its intervention consists in collecting data and statistics, undertaking analysis and research by conducting and supervising studies. The observatory's aim is to encourage public policy and to provide legal expertise.

Specifically, the national observatory has elaborated a unique list of offences granted to any national analysis or comparison between the different networks. Each operator must then respect the frame put by the observatory in their own database.

In 2012, the ONDT precisely undertook a study on violence toward women on French public transport (7).

This study comprised a quantitative approach based on delinquency statistics delivered by public transport operators in Ile de France and also a qualitative approach made by a sociologist. In a very detailed manner, she questioned people about their mobility in public transport, the way they plan their trips, and even about strategies put in place in pursuance of reducing risks of being assaulted. For example, it can be performed by not applying make-up for women, avoiding wearing attractive or revealing clothes, avoiding travelling alone...

This study shows that a slightly higher rate of men are victims of assaults, though the offence nature is completely different. Definitely, more men are victims of violence, whereas women are preferential targets of sexual offences.

The qualitative survey proves that a bigger proportion of women fear being assaulted, especially at night. Consequently, their mobility is limited or they adapt strategies in order to reduce the risk of being a victim. To a greater extent, women who ensured their not being afraid of this risk unconsciously adapted their behaviour, either changing their clothes or their hairdo for example.

In spite of this evidence, the study didn't succeed in confirming the potential high-risk in the evening for example, by lack of traffic data. As the use of public transport is by far lower in the late evening than during the day or rush hours, most offences are assuredly committed during peak hours.

In addition to a database of committed offences or counted victims, we need a risk indicator which would measure the exposure risk in an equation made of delinquency statistics and public transport usage.

## DEFINING A RISK INDICATOR

In risk evaluation, the risk is generally described as:

$$R_i = p_i \cdot e_i \cdot s_i$$

with:

- $R$ : the risk related to an “ $i$ ” event
- $p$ : the probability that the “ $i$ ” event happens (potential risk)
- $e$ : the level of exposure to risk
- $s$ : the importance or seriousness of the damages suffered

### ***The Probability of an Event***

Generally,  $p$  does not only depend on  $i$  which refers to the potential type of events that can happen, but on the geographic location and on the surrounding environment too. It is also influenced by temporal components such as time or type of day, and by personal traits of the victim exposed to the risk.

Thus, Transpole's statistics providing the nature of the malicious acts show that the risk of being a victim of a sexual offence is much more important for women than for men. A young and good-looking woman who puts on make-up and wears attractive clothes can probably be more at risk. Anyway, a lot of women put into action the strategy of avoiding eye-contact when using public transport at night and alone.

One of this report's main goals is to evaluate the potential risk variable and how it can vary depending on people's characteristics, (gender, status), on a temporal basis (time of the day) and on a spatial basis (mobility from the departure to the arrival places, and at larger geographic areas scale).

The potential risk may be difficult or even impossible to estimate. If the event occurs regularly, it can be measured through an indicator such as:

$$p_i = \frac{n_i}{N_i}$$

in which  $p$  refers to the probability that an event  $i$  might occur,  $n$  is the number of events reported, and  $N$  deals with the number of subjects exposed to the risk. For example, the probability of being the victim of an assault in the metro is calculated by the number of people assaulted in the metro divided by the number of passengers who took the metro at that time.

The number of subjects at risk has a manifold definition. Indeed, the risk of being assaulted can be estimated on the basis of:

- the number of passengers, how many passengers entered/left the train;
- the number of passengers per kilometer (if assumed that the risk is proportionate to the distance covered in public transport);
- the number of passengers per hour (here we consider that the risk is proportionate to the time spent in public transport).

Given enough delinquency data and the exact place where the offences were committed, it is possible to elaborate more complex indicators by sophisticating elements measured here. In fact, the risk can be defined as the sum of risks of being assaulted in the station or in the vehicle. The probability of an assault depends on either the number of offences committed in a station, or on the number of passengers that entered or left the train, or maybe the time spent in a station so as to get in, to and the waiting time.

In order to assess the risk over the entire mobility chain, we must also take into account the risk of being assaulted on the public highway when going to and leaving a metro station. Such information is not given in the operator data.

On the contrary, for very dramatic events that can have significant consequences, such as the 9/11 terrorist attack or dirty bomb, it is impossible to estimate the random variable as the event has never occurred. Nothing but a qualitative assessment can be done. In these cases, risk studies aim for the most part to minimize probable impacts. This approach has been implemented in the European project Counteract (8). In this project, a matrix of the terrorist risk in a transport network has been established. To do so, the probability that the event might occur was defined for each mode of transport and for each threat and put in parallel with impact levels. Both indicators supported a qualitative analysis during a workshop attended by different authorities in charge of the security in the public transport network.

### ***Risk Exposure Levels***

Risk exposure levels show how people's various mobility behaviours influence their risk of becoming a victim. In fact, we can assume that a person who travels twice as much as another person with similar characteristics will have a risk twice higher.

The exposure indicator is a crucial point for evaluating a risk level. Martha Smith presents different ways used to estimate the risk of victimisation (9), based on traffic counts, time spent on the PT network, and more complex indicators taking into account intermodality and the whole journey including access and exit walk trips. To deal with the risk of victimization Ouimet et Tremblay (10) introduced the concept of contact opportunities which depend on the density of people located in a particular place at a given moment of the day. It can be estimated through household travel surveys, or otherwise with traffic counts, which are applied a people turnover rate.

### ***Effects or Seriousness of the Damages***

Assessing the effectiveness of a safety policy implemented on transport networks also requires taking into account the effects or the seriousness of the damages suffered after an assault. Indeed, the consequences vary largely depending on the nature of the act and the victim. Three types of effects can be developed:

- Effects on the operator

They can be of different kinds, as they concern either the staff, aggressions on drivers or controllers, deteriorated trains or fixed furniture.

There are two types of effects possible on the staff: physical effects such as temporary work disability days or medical care, but also moral effects which can have indirect effects on the service like strike calling or request for a consolidated network.

Effects possible on the furniture and apparatus are twofold: financial effects because the damaged equipment must be replaced or repaired, and disruptions in the service such as delayed and suspended trains for an unknown duration on the whole network or only on a part of it.

- Effects on passengers

Like for the staff, damages suffered have physical effects on passengers (work disability days or medical care) and moral effects. Another effect is the influence of an abundant number of aggressions on the network image. This can decrease the use of the metro, as what happened in the metro in Lille in the 1990s.

- Effects on the environment

Effects on the environment can be directly linked to the malicious act itself like a deteriorated proximate environment, equipment, a fire, pollution, graffiti, decrease in the urban quality, squatness. Indirect effects can also be observed, mainly caused by disruptions in the service, implementation of a security perimeter, evacuation of areas at risk, congestion resulting in hyper-production of pollutants and in a modal report on cars, increase in noise nuisances.

### Assessment of Insecurity Costs and a Security Policy

After identifying and assessing the different effects of an aggression in public transport, these effects must be monetised. By establishing the probability that each event can occur, we can estimate the monetisation of the impacts in terms of safety on the transport network.

Thus, insecurity costs can be calculated and secondly, a classical cost-benefit analysis can be adopted so as to test potential answers to insecurity in the metro.

In order to calculate the random variable of risk regarding people characteristics, temporal and spatial factors, we must know the multiple mobility habits, and also Transpole passengers characteristics. A first method would be counting the number of people arriving and leaving the trains regularly on the network. Although this approach provides us with data related to the network usage, they lack details on trips operated. A better method, which will be used here, consists of analysing jointly delinquency data and mobility information reported by household mobility surveys.

### HOUSEHOLD TRAVEL SURVEYS IN FRANCE

Over the past forty years in France, 150 household travel surveys (11) have been done in more than 80 territories gathering approximately 60% of the French population. These surveys are based on a very rigorous and constant general methodology called the CERTU standard (12). The CERTU standard eases comparisons of the plentiful mobility results collected in surveys carried out in the same city, but can as well adjust itself to the changes that occur in mobility routines and the society’s evolution. Detailed in a guidebook, this method is based on an x-axis concerning the sample of households classified according to their geographical location, and a y-axis about daily trips. Anyone that applies this standard methodically can benefit from a State subsidy and assistance in project management which involves control and supervision over the survey.

Any person above 5 years old who is part of the household is surveyed about his or her trips made the day before. Further information is reported about the household, the housing, the car availability, car parking, and people characteristics such as age, gender, job, level of qualifications, social class, workplace or study place. Finally, an exhaustive and precise description of every trip made the day before is reported, including intermodality, arrival and departure times, modes of transport used, parking location at the end of the trip, walking time necessary to reach the final destination, activity patterns.

In the urban area of Lille Metropole, four household surveys based on the CERTU standard have been carried out in 1976, 1987, 1998 and 2006. Excepting the first one, all of them cover the territory of Lille Metropole.

Daily mobility evolution shows that the car market share increased until 1998, but has started to decrease in 2006 (13). Public transport mobility has slowly but continuously increased partly because of the implementation of two new metro lines.

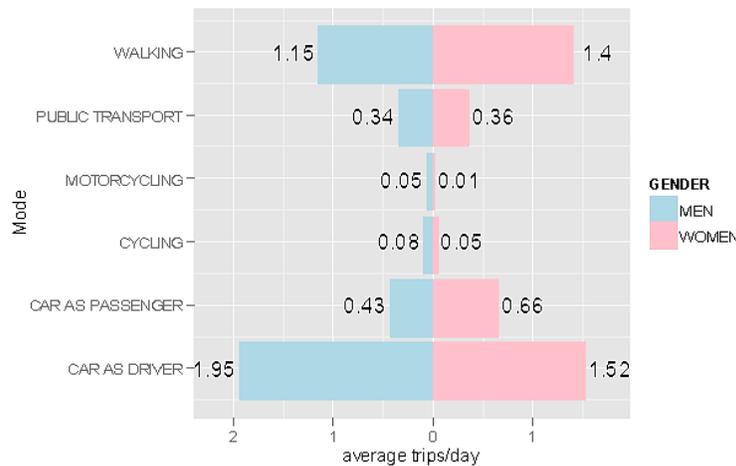
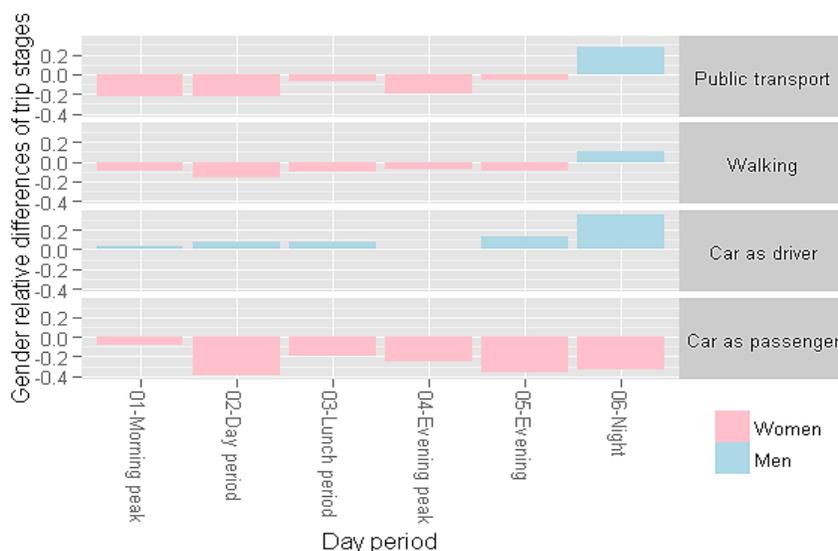


FIGURE 3. Mobility by mode and gender in Lille in 2006

To sum up, women generally use public transport while men prefer using a car or a bicycle. On the contrary, the survey carried out for the first time in part of the Belgian Flanders in 2006 reports that women who live there use the bicycle more than do men. Indeed, bike mobility in Flanders is ten times higher than in the Lille urban area.

The graphic indicates that mobility in public transport is always higher for women than for men regardless of the transport mode and the time of the day. However, the opposite situation is noticed at night: after 9 p.m, women’s mobility in public transport is remarkably low compared to men’s mobility. This result tends to confirm that women give up travelling at night because they are afraid of being assaulted. However, the lower mobility of women after 9 p.m is also observed for car as driver and walking. If insecurity is one of the possible reasons, it is not specific to public transport. The stability of mobility as a car passenger could mean that women don't go out more often being accompanied. These results show that in Lille, the driver is preferentially the man.



**FIGURE 4. Gender relative difference of number of stages during the day per mode**

A more accurate analysis of public transport mobility based on gender and status shows that mobility behaviours are strongly linked with the status and gender of public transport users. At night, after 9 p.m, male students and unemployed men are over-represented in public transport. On the other hand, many female students are travelling in the evening from 7 to 9 p.m. At night, public transport is an important issue for non-motorized shift workers. Women who mainly put up with part time jobs and shift work are particularly exposed when they have to travel at night using public transport.

Supplementary credibility would be brought to this report by showing the causes of this confined mobility. Therefore, if the feeling of insecurity might be one of the reasons why women do not take the metro at night, it would not only concern public transport but more widely any other mode of transport. Women's mobility behaviour during the day is similar in Lyon 2006.

These results are valuable for collecting delinquency data that mention the type of act and differentiated mobility behaviours between men and women. Consequently, they confirm how useful a risk indicator can be.

## RISK OF BEING ASSAULTED IN PUBLIC TRANSPORT

As the Transpole delinquency data base does not provide any concrete figures on the effects of assaults committed on the network, risk assessment is hence restricted to the estimated probability of being a victim of an aggression in public transport.

Three exposure indicators per stages can be performed:

- The number of trip stages is commonly used in household travel surveys, which correspond to the number of boardings for PT;

- The number of passengers x kilometer;
- The number of passengers x hour.

In household travel survey vocabulary, a trip refers to going from one place to another by using the public way in order to reach the destination where the targeted activity takes place. Accordingly, in order to reach the next planned activity, one must operate a trip composed of one or more stages. One stage is defined by the use of one means of transport. For example a worker executes one trip, but two stages, if he takes the bus and then the metro in order to go to work, as well as if he goes there by subway after being dropped off by a car driver to the station.

The stage is the basic unit, but it has many defects. Firstly, it does not take into account the distance or time spent in public transport. Logically, the risk of being assaulted in a transport is two times higher for a trip that is two times longer than the standard stage unit.

Secondly, distances covered in different modes of transport have not been reported by the household survey. They are in fact a posteriori restored before being added to the survey data source. Thirdly, differences between the commercial speed of the various public transport and the distances between each inter station tend to mislead the indicator.

The best indicator appears to be the third one: passenger x hour. Unfortunately, information collected in the survey is not available at the level of a trip, but only for single stages. Moreover, given information is not precise enough, as people usually round up or down their departure and arrival times. In order to adopt this indicator, we must estimate each stage duration. The measurement of each stage duration is based on the time necessary to reach and to leave public transport stations or stops, and waiting times between stages. This estimation is a tough task for trips composed of many stages.

## GENERAL RISK DEPENDING ON THE TYPE OF EXPOSURE

Household mobility surveys have been carried out during school days and the reported trips are limited to the trips made during the week.

In order to estimate the risk on school days from holidays and on Saturday from Sunday, a simple risk indicator could be calculated by putting in concordance the number of offences by type of day and the number of boardings obtained from Lille Metropole statistics.

**TABLE 2. Level of Risk per Type of Day per millions of boardings**

	Non physical offences	Physical offences	Sexual violence	Violence	Robbery	Total
Holiday period	2.6	3.6	0.1	0.8	2.8	6.2
School period	3.6	3.2	0.1	1.0	2.1	6.8
Saturday	4.5	4.8	0.3	2.4	2.2	9.3
Sunday	8.6	7.9	0.6	5.3	1.9	16.5

In 2006, it appears that the level of risk is higher on Saturday and even more on Sunday, especially for sexual violence which almost always affects women.

**TABLE 3. Risk by Transport Mode and Type of Exposure**

Mode	Offenses per million of stages		Offenses per million of km	
	Men	Women	Men	Women
Bus	4.0	3.1	0.8	0.7
Metro	9.3	8.0	1.7	1.5
Tram	5.7	5.5	1.1	1.0
Total	7.5	6.3	1.4	1.3

Concerning the risk by mode and gender, the number of offences is very similar for men and women. The risk is higher for men, because they made a lower number of trip stages. However, the risk difference is less pronounced regarding the risk per km due to longer trips made by men.

## RISK ASSESSMENT DEPENDING ON THE GENDER

**TABLE 4. Risk Assessment Depending on Gender and Type of Exposure**

Type of offense	Millions of trip stages		Millions of km		Millions of hours		Millions of trips	
	Men	Women	Men	Women	Men	Women	Men	Women
Snatching	0.5	0.4	0.10	0.07	1.2	0.9	0.7	0.5
Other cases of snatching	0.8	0.3	0.14	0.07	1.8	0.8	1.0	0.5
Petty violence	2.6	1.7	0.50	0.35	6.1	4.3	3.5	2.3
Attempted rape	0.0	0.0	0.00	0.01	0.0	0.1	0.0	0.1
Sexual assaults	0.0	0.2	0.00	0.05	0.0	0.6	0.0	0.3
Rape	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0
Pickpocketing	1.6	1.6	0.31	0.32	3.9	4.0	2.2	2.2
Petty thefts	0.6	0.6	0.11	0.12	1.4	1.4	0.8	0.8
Thefts with treatening	0.6	0.1	0.11	0.03	1.4	0.3	0.8	0.2
Insults	0.4	0.3	0.07	0.05	0.9	0.6	0.5	0.3
Threats	0.4	0.7	0.08	0.15	1.0	1.8	0.6	1.0
Sexual Exhibitionism	0.1	0.1	0.02	0.02	0.2	0.3	0.1	0.2
<b>TOTAL</b>	<b>7.5</b>	<b>6.2</b>	<b>1.44</b>	<b>1.24</b>	<b>17.9</b>	<b>15.1</b>	<b>10.1</b>	<b>8.3</b>

Globally, risk of being assaulted in public transport is higher for men than for women. Men are more concerned with violence and snatching and women with sexual assault and threats.

The smallish number of malicious acts is not sufficient to assess risk levels hourly. But at a larger scale, the risk assessment can be set on the basis of different periods of the day comprising the same number of trips and by assuming a higher risk at night.

**TABLE 5. Time Periods Definition**

Periods	Definition
01-Morning peak	06h-09h
02-Day period	09h-12h 14h-16h
03-Lunch period	12h-14h
04-Evening peak	16h-19h
05-Evening	19h-21h
06-Night	21h-06h

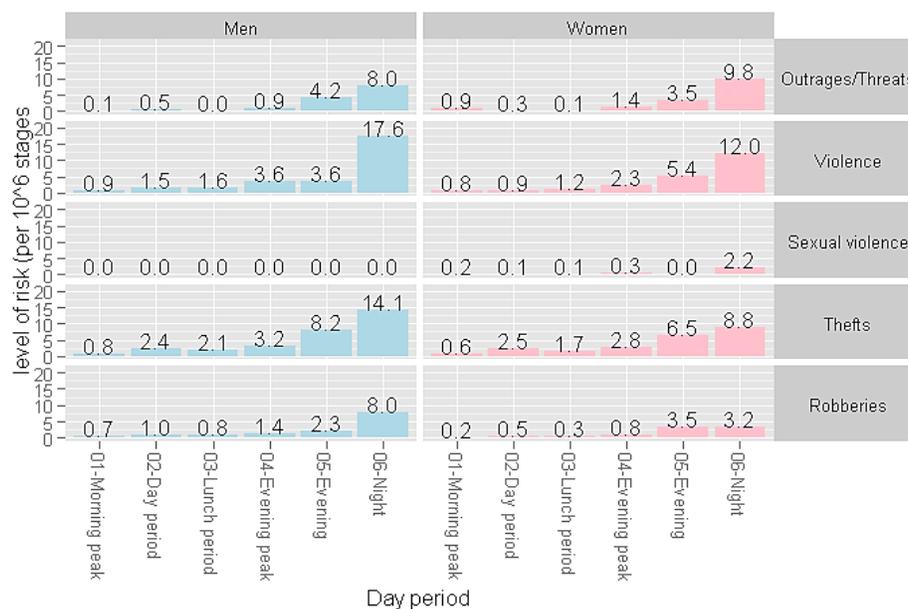


FIGURE 5. Level of risk by type of offence and period of day

The level of risk is increasing continuously from the evening peak to the night period. Risk for men is significantly higher at night for violence, robberies and thefts, while the risk of sexual assault is largely specific to the night period. This method objectively confirms that the strongest feeling of insecurity at night is corresponding to a real higher level of risk.

## GEOGRAPHIC REPARTITION OF RISK

In order to create an efficient indicator in a statistical approach, the territory of Lille Metropole has been partitioned in eleven large and homogeneous areas.

As the route is not mentioned for each trip and stage, it is often difficult to classify stages that start in one area and then finish in a different one. In these cases, we decided to split them in half between the two involved areas each time.

While the risk of non physical offence is higher in urban zones, the risk of physical offence is significantly higher in Tourcoing and Roubaix areas than in Lille. The risk is in general higher in metro areas except in the East of Lille (Hellemmes, Villeneuve d'Ascq).

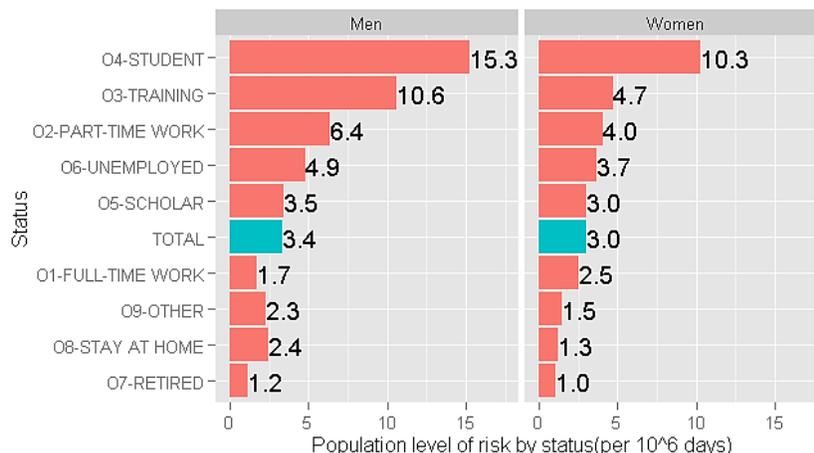
## FURTHER APPROACHES

No further approach (such as risk based on age, job, trip activities, or the possibility of using a car, status) was possible because the available crime data is limited to the mention of the victims' gender.

The unique suitable approach assumes that every man or woman has the same potential risk. Thus, only characteristics such as the transport used or the time of the day when it happened are analysed in order to demonstrate whether there is or is not a higher risk for each of the categories given.

For example, if we assume that the risk is higher after 9 p.m, and that public transport is essentially used by girl students at night, as a result, girl students will have a higher risk than any other category. It can be explained by their mobility structure, regardless of the fact that they are women or young.

A risk budget can also be brought out by dividing the sum of risk per stage by the total of trips per day. People who travelled several times a day are more exposed to public transport crime, and have a higher level of risk. This analysis shows that the daily risk of public transport users differs significantly with their status, due to their mobility profile, number of PT trips and period of travel. Male students who usually travel by PT are the most exposed, because of their mobility at night. Part-time workers are also exposed due to staggered hours.



**FIGURE 6. Global daily risk by population status**

If we analyse the risk of the complete categories of population depending on the status, whether they use PT or not, students are by far the most exposed. Indeed, most of them are regular users of public transport and travel at night. At the opposite, retired people have a very low risk. They travel mostly during the day, and only a few of them use public transport.

## COMPARISONS

The advantage of having a national general methodology about household surveys is to compare more easily the changes in mobility habits in different cities at any time. Assessing the risk between 1998 and 2006 is tempting, but the Transpole delinquency report is much more detailed today than before. The census is more exhaustive nowadays. Furthermore, the gender of victims was not mentioned at all and the organization of the list of malicious acts has changed in-between. The current report of the offences committed was implemented in 2003.

Transpole used to classify data by the type of act in 1998. A general risk assessment, mixing up men and women victims can be carried out, after making compatible recent data and data from 1998. Nevertheless, it is possible to follow the recent evolution of the level of risk by calculating the number of offences over the yearly number of boardings in the Transpole network.

**TABLE 6. Level of Risk Evolution (Number of Offences per Million of Boardings)**

Risk	Physical offences	Non physical offences	Total
2006	3.7	3.8	7.5
2012	3.4	4.9	8.3

The risk of being physically assaulted decreased slightly whereas the risk of non physical offence rose sharply, probably due largely to the thefts of smartphones.

Another asset of the standard household mobility survey is to be able to compare the level of risk from one city to another. However the relatively small number of offences identified in Lyon probably points out significant differences in data collection procedures of malicious acts. This should be analysed in more detail in a further study with complaint report statistics from the police.

A similar risk indicator is being developed in France (14) (15) in order to assess the risk of being a victim of a car accident depending on each road transport. This analysis contributes in pointing up a higher risk when using the bicycle, and even more about two wheeled motorcycles. Studying both indicators jointly allows us to assess and compare the risks of being a victim in car accidents and in public transport.

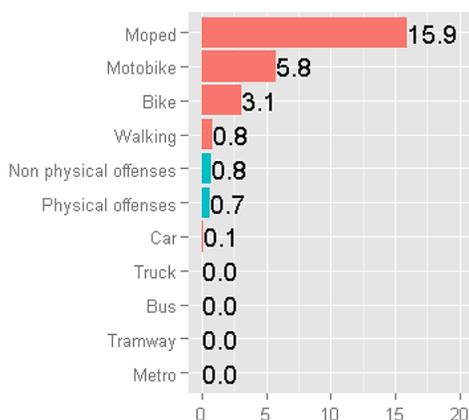


FIGURE 7. Comparison with road safety risk by mode per millions of km

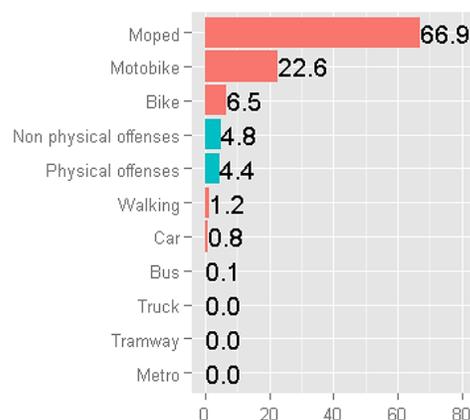


FIGURE 8. Comparison with road safety risk by mode per millions of trips

## PROPOSITIONS

This risk assessment method can be employed in other fields, such as assessing road safety risk, or operating the Environment Energy Assessment of Trips (EEAT) (16). To do so, results from household mobility surveys can become exposure indicators crossed with data collected in other fields. As a result, diagnosis and assessments undertaken could be enhanced by household survey data that provide mobility information, characteristics about people and their housings. Thus, the global assessment method is improved and a better comprehension is possible.

Moreover, it can participate in producing public policies after assessing insecurity costs in public transport. It can also help to complete local mobility observatories by adding a security part, in order to make sure they are efficient. Beyond risks for passengers, this method is an asset for transport operators who can now take the best measures and control them in order to reduce risk of assaults on their staff and any deterioration of their equipment. To do so, the database will have to be deepened by reporting the effects of delays, suspended services, assaults on staff such as temporary work disability days and the financial impact of deteriorated equipment.

The reduction of risk for passengers is possible by collecting more information concerning victims, especially their age, maybe the social class and their residential area. In the same way, reporting the injuries suffered by victims might improve the assessment of insecurity costs and give new and specific solutions.

Concerning passenger security, more precisely women's security, it was confirmed that the main gender specific risk for women was sexual assaults, while more men were victims of violent aggression and assaults in general.

In general, implementing specific services for women for example might restrain the number of sexual assaults by segregating victims from potential offenders. However, as the risk of sexual assaults in Lille is very low compared to other risks, like violence, such measures seem unsuited. On the contrary, diversity in public transport has a calming effect. The higher level at night matches with a lower diversity of users, with a higher proportion of male students and employed people, sometimes under the influence of alcohol and drugs, and virtually no more retired people and schoolchildren.

The implementation of ticketing and electronic payment will allow following the risk evolution, by having a better knowledge of public transport users' mobility and their characteristics.

Concerning future risk assessment studies, we propose introducing the level of security in household travel surveys at a disaggregated level, in a similar way as it was done with EEAT and environmental impacts.

We can notice that there is no proportionality between the number of offences and public transport usage, as the risk is higher at night and on weekdays when traffic is lower. Increasing the number of PT users will contribute to reducing the level of risk.

## CONCLUSION

This report proves how important it is to build up tools such as risk indicators to assess security policies in public transport. In fact, they provide a neutral risk assessment that takes into account victims' levels of exposure. Such assessment can be tracked over time and be compared to surveys carried out in other similar cities.

Furthermore, the information given about impacts and their monetisation contributes in assessing insecurity costs in public transport and implementing new safety policies.

About the risk depending on the gender, the report reveals that men in general have a higher risk than women. They have a larger probability of being the victim of a violent aggression, whereas sexual assaults are almost always committed on women.

This report also demonstrates that the risk is much higher at night after 9 pm. The risk is higher in urban zones, and significantly higher in Tourcoing and Roubaix than in Lille. But, the feeling of insecurity is overestimated as the risk of being assaulted in public transport is lower than being injured in a road accident as a cyclist or a motorbike rider, and only five times higher than a car driver.

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# Gendered nature of women's mobility: A gender perspective for analyzing women's issues in public transportation in Mexico City, Mexico

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## ABSTRACT

In the past few years we have been bombarded with news about women being violently attacked and harassed while using public transportation. While these attacks have created substantial debates on how to immediately address problems of violence, we still have very little explanation as to why they are occurring and if those solutions reach the heart of the problem. Previous research has tended to focus on men's and women's differences in physical mobility, which tells us a great deal about gender inequality in terms of travel, but very little as to how violence reproduces this inequality. As an alternative perspective, this paper asks, "why does gender-based violence in public transportation occur and how does it demobilize women?" To explore these questions, this paper looks at the case of Mexico City, drawing data from public opinions, surveys, and police reports that can help explain the persistent nature of gender-based violence in public transportation. This paper finds that transportation is a highly gendered place that promotes men's mobility over women's. This paper concludes with a discussion on violence against women in public transit within the context of gender inequality and the use of women-only transportation as a solution.

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**KEYWORDS:** Gender perspective; Women-only transportation; Gender-based violence; Mobility; Inequality.

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This paper explores the relationship between the gendered nature of mobility and violence against women in public transportation in Mexico City. It is well documented that women often face sexual harassment and violence during their daily commutes, particularly in countries with extreme levels of gender inequality (Chesney-Lind, 2013; Ghatak and Abraham, 2013; Mitra-Sarkar, 2009; Neupane and Chesney-Lind, 2013). The violence that women must endure has created several mobility differences between men and women, including women's avoidance of travelling alone, late at night, or long distances. But why are women stuck in vicious cycles of immobility?

Scholars unanimously agree that women are less mobile than men (Babinard and Scott, 2009; Mitchell, 2009; Romano, Keller-Baker, Torres, 2009). What is debated, however, is why these differences persist (Oxley, et al. 2009), or how gender-based violence in public transportation is related to them (Loukaitou-Sideris and Fink, 2008). Some argue that women are less mobile because they are taught to fear traveling alone or during certain hours (Hsu, 2009). Others, however, have focused on how gender roles in society affect women's mobility (Hanson, 2010). In any case, we know much less about how violence and harassment are factors which immobilize women. *How does violence against women in public transportation reproduce gender inequality in mobility?*

The approach taken in this article is to identify the gender norms that define men's and women's mobility and then to understand how gender-based violence in transportation is linked to those norms. It does this by first looking at the lingering attitudes that women's place is in the household and not as public mobile figures. Preliminary research to this study revealed that women's mobility is primarily defined by gender inequalities that begin in the home. For example, a study in 2010, conducted by the National Board for the Prevention of Discrimination (CONAPRED), found that 40 per cent of women in Mexico must ask their husband for permission to leave the house alone at night (Bucio Mújica and Fix-Fierro, 2010: 72). After exploring the traditional role of the woman, the second part of this paper explores how gender-based violence in transportation extends itself from these norms, focusing on how gender norms create a framework for blaming women for the violence. The final section in this paper considers how gender norms and violence are constantly at work to immobilize women. It then concludes with a discussion on how solutions to violence, such as women-only transportation, will affect the forced immobilization of women created by gender norms and gender-based violence.

## **METHODOLOGY**

This paper draws data from three sources. First, real statistics gathered by police reports, surveys among women which quantified the level of violence and sexual harassment against women within public transportation. The second was from short informal interviews conducted among women commuters in Mexico City. The third source was taken from 418 online comments that were posted in response to the media's coverage of the implementation of women-only transportation as a solution to violence against women in buses, taxis, and on the metro.

### ***Statistics***

The National Board for the Prevention of Discrimination (CONAPRED) and the National Institute for Women (INMUJERES) are two of Mexico's largest Federal institutions responsible for the collection of statistical data on violence against women. The statistics on the levels of violence against women are largely taken from the surveys and studies conducted by these two groups (see Bucio Mújica and Fix-Fierro, 2011; and Zermenño Núñez and Plácido Ríos, 2010 for more information on the details of the data collection methodology). These statistics are supported with testimonies from women who were sexually violated while taking a bus, metro, or taxi, giving a more personal and in-depth look at the levels of gender-based violence in Mexico City's public transportation system.

A second source of data came from a small survey conducted specifically for this paper and was designed to accumulate the following information from women riders: 1) What are women's attitudes towards public transportation? 2) How often and for what reasons do they choose women-only transit over mixed transportation? This survey was given to 125 members of our target audience, defined as female riders of public transportation in Mexico City. The participants were randomly selected using a convenience sampling approach. Around 20-22 participants were selected across 6 different transit points throughout the city, including bus and subway stops.

### ***Short informal interviews***

The second indicator used in this research paper looks for differences in women's travel behaviors as they are specifically related to the masculinization of public transportation. This data is taken from two sources. The first is from long-term collection of ethnographic data, where I rode public transportation for 4 years and conducted short informal interviews with other women travelers. I conducted short informal interviews with 20 women and follow-up interviews with 5 of them.

One of these latter interviews, that involved a follow-up session, is used here as a case study. This case study demonstrates the complexities that many women in Mexico face between their roles as a wife and mother and their limited mobility.

### ***Media's coverage of women-only transportation and the public's response***

Lastly, a supplementary source of qualitative data was collected from online comments posted by Mexico citizens on the topics of gender-based violence in Mexico City's public transit system, and the use of women-only transportation as a solution. Mexico's media did a vast online coverage of topics of women-only transportation and violence against women between the years 2007-2011, when Mexico City was increasing the number of women-only buses and taxis in response to the growing levels of violence. The newspapers in particular, including *El Universal*, *La Crónica*, *Animal Politico*, and *El Milenio* posted their online and created debate forums for readers to write in comments and opinions on the topics.

I found that the comments reflected the same language and attitudes towards women's mobility as in my interviews among women riders. For this reason the comments are used as a form of supplementary data, giving more depth to the feelings and attitudes towards gender-based violence in transportation and women's mobility.

While these comments are used as supplementary, there are several methodological issues with the online data that should be addressed here. First, these comments were taken from people who have access to the internet and who read the news. It is likely that lower-class voices or more marginalized groups are not a part of the population sample. Additionally, these comments are not independent of one another, but rather each thread tended to work like a focus group, where one comment led others to make similar comments or

responses. It is for this reason that these comments are primarily used qualitatively, in order to show feelings, opinions, and cultural justifications for violence against women in public transportation.

## LITERATURE REVIEW

### *The significance of places of transit*

To understand why gender-based violence is so prevalent in public transportation, as opposed to any other public area, we first must think about the reasons why social problems occur in any given place at all. Research on social behaviors and physical places has been around for a few decades, stretching back to the 1950s when French philosophers, like Henri Lefebvre, argued that there is a social element to geography. But it was really after Lefebvre's theory emerged that geographers in general, and feminist geographers in particular, elevated his theory into explanations for how inequality is spatially reproduced. There is perhaps no better example of this than Daphne Spain's book, *Gendered Spaces*. The book takes us through a handful of places throughout the world, from MIT's chemistry lab rooms to the dwellings in Turkey known as yurts. Spain shows how gender inequalities were reproduced and maintained through both formal and informal practices to exclude women from specific places. In the Mongolian Ger –hut dwelling– Spain writes, “books are kept in the male part of the traditional tent with the highest status –the *xoimor*. Because books contain religious and historical knowledge, Mongolian women historically have been forbidden to read them. Symbolic spatial distinctions within the tent thus reinforce Mongolian men's control of written knowledge and reduce women's access to positions of religious authority” (1999: 39).

As scholars grew more interested in gender differences in mobility –for example, vast differences in men's and women's travel patterns– this work was later extended to places of transportation. Specifically, scholars began looking at how the forced immobilization of women was produced in places of transit. Take for example, a heartfelt article published by Susan Hanson in 2010. Here Hanson goes into great detail to explore the relationship between gender and mobility, using the bicycle as an example of the place where these two issues intersect and play out socially. Within this body of work, transportation is seen as an institution through which hegemonic masculinity is maintained (Hsu, 2011; Loukaitou-Sideris and Fink, 2009). Its significance lies in women's right to travel and the benefits attached to uninhibited mobility, be it in women's confidence to pursue new ventures or their equal participation in society.

Similar to Hanson's works, another handful of studies around the world have popped up showing how men control mobility practices through their control over the purchasing and use of a family owned car, including in Pakistan (Odufuwa, 2007), South Africa (Venter et al., 2007), and India (Anand and Tiwari, 2006). These studies elaborate the relationship between car ownership and traditional gender roles (Babinard and Scott, 2009), where men are still the primary decision makers and users of the household vehicle. Likewise, Tim Schwanen focuses on persistent inequalities in car uses between men and women in the Netherlands. He argues that women's household responsibilities, employment, affect her access and need for a car differently than a man. Additionally, that car use is tied to middle-class norms of 'being a good mother' (Schwanen, 2011).

Like this work, this article too thinks about public transportation in Mexico City as a place where women's (im)mobility is defined. In Mexico specifically, family and marriage shape women's mobility. Although married women are not outright banned from places of transit they are expected to use it differently than men, particularly a woman who has a *familia*. In Mexico, to say 'she has a familia' means that she probably has a husband, but definitely has children. The word implies responsibilities in the home, emphasizing her job in the house as a wife and mother. From a more feminist perspective the familia can also confine women to a stricter set of gendered rules that do not apply to men. Women do almost all of the housework, but they are not traditionally considered the decision makers in the house (Navarro Ochoa, 2010). Women with familia are more likely to be renounced in the labor market than women without (Terán Covarrubias, 2012). And, as this paper shows, women with familia must negotiate their mobility with their husbands, especially when it interferes with her role in the home.

## TRADITIONAL ROLE OF THE WOMAN

As I have mentioned, there is a persistent perception in Mexico that women are household figures and not public ones. Jocelyn Olcott, historian of Mexican feminist movements, quotes from the newspaper of Mexican's ruling party in 1931, “But while she prepares herself and organizes herself, we men prefer to continue ceding

our seats on the buses, finding the soup hot in the household olla, and listening to the broom dancing under conjugal songs, than to hear falsetto voices in Parliament or to entrust the suffragist ballots to poetic hands” (2005: p. 5). Eighty years later, women continue to be praised for being a mother, wife, or daughter, but not as mobile or working woman. As Nancy, a 33 year-old woman told me in an interview, “There are two sides to the machismo culture. One that seeks to protect 'the virgin,' 'the mother,' or the 'idealized Mexican women.’” She brings her shoulders up to her chin, while running her hands from the top of her head down as if to wrap a scarf around her face, and explains, “as long as you look like 'the good woman' then men will protect you when you are coming home late at night or something like that. But if you don't embrace that image, then you are very likely to get harassed and no man will stick up for you if that happens.”

This section looks at women's role in Mexico, paying special attention to where it intersects with her free access to mobility. The data used for this section primarily comes from one in-depth interview, where Josefina –the interviewee– describes the subtle ways in which being a wife and mother defined her identity as a mobile, public figure with equal rights to urban opportunities. This interview is followed by several comments that were gathered online and frequently heard, among both men and women, as a way of explaining the boundaries that exist for women between the home and free mobility.

### ***The case of Josefina and her husband Poncho***

On the outskirts of Mexico City, lives a small low-income family. The mother, Josefina is a young women with indigenous roots, from Guerrero: a state just west of Mexico City. She lives her with husband Poncho, a short trim man who works hard, sometimes two to three jobs at the same time, and her two kids Brian and Celeste: a 16 year-old boy and a 5 year-old daughter. Josefina's mom –no longer married– lives a few blocks down the road, and her in-laws live a 15 minute bus-ride away.

Josefina relies a lot on the help of her mom and her in-laws, but she also finds herself in the same position of most women with a familia – caught between a world which demands mobility and another which binds her to the home. These forces keep her in a constant state of negotiating the two worlds, which manifest themselves in arguments with her husband, which always come down to two main factors: being at home to cook and care for the family, and generating income.

A woman in Mexico is viewed as the parent with the skills to raise children, whereas the man is largely seen as the one with the skills to financially provide for them. However, these roles do not fit neatly into reality. Consequently, Josefina's world is built out of contradictions, where what is expected of her is not always what she should be doing. On the one hand she must work. “We cannot survive on one income,” she says. “The money that my husband makes is not enough (el dinero no alcanza).” But on the other hand, she is expected to fulfill the social role of primary caregiver, putting the emotional care of the *familia* above everything else.

The result is compromised mobility, where her ability to travel is directly shaped by her need to be at home. The negotiation largely takes place between her and her husband. Her arguing for more mobility and him taking the side of less. “Any job that goes late I have to discuss with my husband.” Says Josefina, “To me, it's not a big deal, because my mom can pick-up Celeste from school and make her dinner. And I think that it's ok. I don't see anything wrong with my mom making Celeste her dinner and putting her to bed. My husband and I fight a lot about it. He says it's not good for me to have my mom do that. That Celeste needs her mother.”

The two always settle on the same time frame which allows Josefina to work during the day, but be home in the mornings and at night with the children. This means that Josefina turns down jobs that require mobility outside of this framework. And consequently follows a pattern that many women in her position tend to take after having children, moving from the formal labor market (where working hours are stricter) to the informal work sector.

The constant emphasis that mothers do not need to be mobile in Mexico also creates a space for arguing against women having their own transportation. This perception is particularly well noted when men are asked if women should have their own transportation for the purpose of providing women with a safe and secure way to increase their mobility. As Alejandro notes:

“No, because the woman has other important responsibilities, which include the education and care for the children, running the household, etc. –the woman should not replace men, but rather complement them– the

woman has her sacred rights, but it is not her role to replace or substitute the man – this is the natural order and we shouldn't change it.”<sup>32</sup>

Likewise, Raul says, “[Women should] stop breaking balls. They should stay in the kitchen, and let that be that. If they have to go out, they should go with their husband, boyfriend, lover, brother, or cousin. Soon there is going to be lanes or avenues just for the Pink Taxis [women-only transportation].”<sup>33</sup>

And when asked if women-only transportation is a good idea, Alfredo responds, “No. Because I don't want to contribute to the further destruction of the role of the woman as mother and caregiver of the children, which is her primary and natural role in life.”<sup>34</sup>

While gender norms are strong enough in Mexico to deeply influence views on the use of transportation, they are not enough alone to prevent women from increasing their mobility. As seen in the case of Josefina, shifts in the economy are forcing women into the workplace, demanding that they become more mobile than in the past. However, these economic shifts do not immediately break down traditional barriers that keep women in the home and restrict their mobility. Instead, scholars have been noting that violence and fear of violence is often used as a means to exclude women from equal access to public places. For example, in an article called, *The Gendered Nature of the Urban Outdoors*, Jennifer Wesely and Emily Gaarder show how women's fear of gender-based violence in public parks limits women's ability to use outdoor recreation to build their confidence. Wesely argues that outdoor and recreational activities have been heralded as empowering women. Yet women's feelings of vulnerability to sexual assault limit women's ability to places where she access natural spaces, such as parks, “temper[ing] the benefits and rewards of outdoor recreation for women” (2004:645).

The next section shows how, like Wesely and Gaarder's case, real violence against women in public transportation is also used as a tactic for limiting women's access to mobility. Looking at survey data, interviews and online commentary, it shows how extremely high levels of gender-based violence has been able to deter women from increasing their mobility, despite how much they may need it.

## **VIOLENCE AGAINST WOMEN**

In the 1990s, the Mexican National Institute for the Protection of Women (INMUJERES), and the Federal Institute for the Eradication of Violence Against Women (Comisión Nacional para Prevenir y Erradicar la Violencia contra las Mujeres CONAVIM) took part in three important global discussions on women's rights. These were the UN Fourth World Conference on Women held in Beijing in 1995; the Convention of the Americas on the prevention and eradication of violence against women, held in Brazil on 9 June 1994 (Convención de Belém Do Pará); and the CEPAL regional conference on gender inequality in Latin America and the Caribbean (Undécima Conferencia Regional sobre la Mujer de América Latina y el Caribe). Several conclusions were drawn from these meetings. First, that there was a deep contradiction in women's reality when it came to mobility. Women, because they had paid work and were still in-charge of almost all of the shopping, household errands, and shuttling the children around, were using public transportation 2 hours a day more than men.

Yet, women were still the primary target for sexual violence and harassment on public buses, subways and in taxis. A study conducted in 2008 by the National Institute for the Protection of Women (INMUJERES) reveals that nearly every single woman (90%) is a victim of some type of sexual violence while using public transportation in Mexico City (Zermeño Núñez and Plácido Ríos 2010). Additionally, the study found that in one year alone, 8 out of every 10 women had been sexually violated. Among the 80% of women who had been violated in past year, 43.8% reported having been attacked 4 or more times, and 10% reported being subjected to 7 or more sexual attacks while using public transportation (Zermeño Núñez and Plácido Ríos 2010:13).

The women that I interviewed, as well as the women who wrote in comments online, all shared stories of extreme violence that is taking place while using public transportation in Mexico City. The following are just

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<sup>32</sup> Comment posted online 10/11/2010, during a conversation on the use of women-only transportation in Mexico City.

<sup>33</sup> Comment posted online 8/10/2010, during a conversation on the implementation of Pink Taxis in Mexico City.

<sup>34</sup> Comment posted online 9/8/2010, during a conversation on the implementation of Pink Taxis in Mexico City.

two of hundreds of quotes from women who posted their story of being attacked while using public transportation.<sup>35</sup>

*“When I was going to school at the Escuela Comercial Cámara de Comercio, famous because then it was an all girls’ school, I boarded the metro (underground train) at the station Centro Médico, where in this particular station there was a lot of abuse towards us women. This station was already famous for the large number of women who boarded there and with a lot of strength everyday we had to get on the metro. Everyday you could see women getting to the station crying because some guy had already stuck his hands down her pants, or because when she was taking the escalator they’ve already reached out and started grabbing you. A very good friend, and I cannot even image how disgusting this man must have been, but he got behind her when she was going down the escalator and I guess started to masturbate. I don’t know if he already had his penis out or that it was hidden behind his case, but before they got off, he came all over this poor girls skirt and stockings!!! She noticed when she felt something wet on her backside and when she turned the guy had a sweater in front of him. She screamed, of course, the the guy took off running and the police never got him.”<sup>36</sup>*

*“Of course I have been a victim, and not just once, but many times. But the one time that stands out the most is this one day in the metro, San Cosme. I started to feel on my back something weird and hot and upon turning around to my surprise was a man behind me with his penis out. I could not believe it! There with so many people around and him doing this, to let go unpunished just because nobody cared, no. I went to the police and the only thing that happened was them saying, TELL ME HIS CHARACTERISTICS. I headed to work and just had to deal with the uncomfortable situation. Should I have to miss an entire day? All because, although a lot of people still don’t know, we live in a shit country.”<sup>37</sup>*

**TABLE 1. Reported Violence Against Women in Public Transportation, 2008 Survey by CONEPRED**

While using transportation in Mexico City have people...	Per cent of women who responded “yes”
directed offensive and disrespectful words to you in relations to your gender?	63%
stared sexually at your body?	74%
touched or manhandled you in sexual ways?	48%
touched their genitals or masturbated in front of you?	36%
pushed their body against yours in a sexual manner?	73%

\* Source: CONAPRED study on gender-based violence in Mexico City’s public transportation (Zermenño Núñez and Plácido Ríos 2010: 100).

## FORCED IMMOBILIZATION

During interviews with women commuters in Mexico City, it immediately became clear that women modify their travel behaviors, their clothes, and their reaction to violence in order to avoid danger and aggression. Women have expressed lower levels of confidence in being able to travel late at night, alone, or long-distances. Their reaction to violence has created a dynamic where women tend to self-restrict their own mobility, while simultaneously opening-up opportunities for others to impose those same restrictions. For example, in addition to women self-restricting their own mobility in reaction to violence, this research paper also found that employers also used issues of “security” to deny promoting women. In these cases women often did not object

<sup>35</sup> These two quotes come from one specific online forum that was created by El Universal. During this forum there were 168 comments posted. Be it in this specific forum or in the other comment threads that were created online by the media, in total over a 100 women posted a story about being sexually violated while using public transportation in Mexico City.

<sup>36</sup> Posted online on November 25, 2010 by Linix during an online forum created by El Universal asking if you have ever been manhandled while using public transportation in Mexico City.

<sup>37</sup> Posted online on November 25, 2010 during an online forum during an online forum created by El Universal asking if you have ever been manhandled while using public transportation in Mexico City.

to employers, because they too felt responsible for the violence, often times claiming that their body attracts the violence.

As this section will show, the moments where gender-based violence begins to define differences in men's and women's mobility really begins with women's need to protect themselves from real attacks while traveling. During a public opinion survey, asking women if they feel safe while traveling, more than half (66%) of the women surveyed reported no, claiming that they would prefer women-only transportation because they were too afraid to travel alongside men. Among the 44% who did not unwaveringly agree with this statement, 48% made a special notation on the side of the survey saying that they disagreed only because they felt that women-only buses and subway cars in particular were not well guarded. That is, they believe women-only transit to be safer, but only if the men were forced to respect it. Some of these comments included:

"It is still safe, even though sometimes men board the women-only sections and try to intimidate the passengers."

"It's supposed to be for women-only."

"There are many times when the women-only sections are not respected [by men]."

**TABLE 2. Safety Opinions of Women Transit Users**

	Agree		Disagree		Neutral		Total
	N	%	N	%	N	%	N
I feel safe in normal transportation	19	16%	83	70%	17	14%	119
Taxis driven by women are safer than taxis driven by men	59	53%	30	25%	16	13%	116
Streets are more dangerous for women than for men	63	53%	30	25%	16	13%	119
Women-only transportation is safer than regular transportation	76	66%	25	21%	15	13%	116

\* Survey taken in 2010 among women transit users. N = Number of respondents.

This violence has had detrimental consequences on women's opportunities in the city, limiting them to highly gendered roles. In more than half of the interviews that I conducted, women told me that they have turned down jobs because they require traveling during precarious times, such as late at night, long distances, or in unfamiliar places. But women also tended to see this as their responsibility. That is, that they could in fact reduce their risk towards violence by modifying their travel behavior.

As Beatriz, a young 30-year old research consultant once told me:

"Oh yes, women need to take care of how they dress so that they do not attract the wrong kind of attention." She says without hesitation. "In fact, Guadalajara there is a law that women are not allowed to wear revealing clothing on public transportation."

"That cannot be true." I respond.

"It is." chimes in Jannine who has been standing beside us, listening while she prepares some coffee. "It's not meant to be bad. It's to help them. Keep them from being attacked while traveling."<sup>38</sup>

As another girl says in a comment posted online:

*"The first thing you should do before you get into the taxi is look at the plates, second sit in the back, if you are wearing a skirt or if it is a low-cut blouse make sure to cover it with a sweater so not draw too much attention, and have the money ready to pay so that you can get out and get your change, and lastly don't go anywhere until the taxi has pulled away. These tactics work most of the time."*<sup>39</sup>

<sup>38</sup> I never found evidence that this law actually exists.

<sup>39</sup> Comment posted online on by Linda Chica on 15/12/2010 during a conversation on the use of women-only taxis as a means to increase security for women. In reference to the 'plates' she is describing a registered taxi vs. an unregistered one: an unregulated taxi.

In addition to women imposing travel rules upon themselves, gender-based violence also gave employers an opportunity to bypass women for job promotions if the job required travel. Alma is a 26 year-old investigative journalist who spends most of her day in the office. Even though the quality of her work would benefit from tracking down sources and talking to people in the streets, Alma spends most of her time inside of the office, hammering away on the keyboard and searching for data online. She is young and beautiful and a stylish dresser, with hair that is always neatly and purposefully fixed and a pair of high heels to go with every outfit. But while her stylish and feminine appearance gives her a professional look in the office, it also undermines her credibility as a reporter who can take to the streets. In the streets she is seen as too feminine, which means that she is seen as too vulnerable and susceptible to crime.

After following Alma's case for nearly 3 years, I called her up for one last final and formal interview, during which I asked her about how her limited mobility affected her ability to work. Her answer was, "in every way." The following is a brief excerpt from that interview:

Alma: *"I graduated 5 years ago from university with a degree in Communications, specializing in Journalism. In that time I have spent most of the time in the office, working as an assistant for other journalists, looking up information online and helping in that way. It was only in Expansión where Berto gave me my own column to write, where I frequently went out and conducted interviews.<sup>40</sup> But I never traveled alone. The companies that we covered sent a van or bus to pick a group of us journalists up and take us to their offices for press releases. I always traveled that way."*

Me: *"Are there differences in the way men and women report. If you were a guy would you travel more?"*

Alma: *"Definitely. It's easier for guys to travel. Women are put into more risky situations than men. Now with the situation in Michoacan, the majority of reporters there are men. Because it's complicated to have a woman<sup>41</sup>. Men are sent much more to areas with high risk than women."*

Me: *"Do you think that women want to go? If I was a reporter, I might want to go to Michoacan because it's a hot issue to cover right now."*

Alma: *"Sure, sure. Actually the correspondent that El Universal sent to Michoacan is a woman. So a woman did go, but only because she was traveling with a man. She wanted to do it, and they didn't have anyone else to send, they only had her on hand. But she wanted to cover it, she asked them if she could go to Michoacan. So they said, ok, go, but you have to go with a guy so that you can feel like you have more support."*

This article has shown that gender-based violence has grown out of traditional ideologies that define women's role in society. It has expanded into its own system for limiting women's mobility, where both women and men use it as a conduit for reinforcing boundaries on women's ability to travel. Gender-based violence in public transportation not only makes women fear physical mobility, but makes them also willing to avoid opportunities if they require more travel. One important question that has emerged since these problems have come to light is, 'what are the solutions to this problem?'

## CONCLUSION

With the media providing a daily flow of stories on women being attacked while using public transportation, we also hear that women-only transportation is becoming an increasingly popular response to violence against women in public transportation. Part of the reason for thinking about the gendered nature of mobility is to critically analyze what type of effects women-only transportation will have on women's ability to achieve equal right to mobility in the future.

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<sup>40</sup> Expansión is a business magazine in Mexico, of which at the time Berto was the managing editor. Alma, followed her mentor and boss from El Universal, the first job that she had taken in Mexico, to two different magazines, eventually settling with her at a foundation that she created for investigative journalism, where she continues to work today.

<sup>41</sup> At the beginning of 2014, vigilante groups in Mexico's western state of Michoacan took up arms and began fighting the drug cartels themselves. This battle has created a state of war, where the military and local police have joined in on a three-way armed battle between citizens, drug cartels, and government bodies. Reporters have been sent to cover the stories, but the area was declared extremely unsafe and Mexican citizens were advised not to travel through this state under any circumstances.

In some respects it is easy to think that women-only transportation can increase women's mobility by giving them a safe place to travel. In fact, research for this paper shows that women who had access to their own transportation, be it buses, subway cars, or women-driven taxis, were far more likely to increase their mobility than women who did not. However, the data also showed that despite this change in physical mobility, women-only transportation alone had no significant change on the lingering attitudes that women are more vulnerable towards crime and in need of 'special protection.' In fact, conversely, it tended to reinforce these images of women.

However, the data also had an unintended consequence: that under the right circumstance women-only transportation could reduce gender inequalities. In the case of Mexico, government-based organizations in Mexico City created an alternative use for women-only transportation, working with women at the grassroots level to turn women-only buses and taxis into a *safe place* to establish a rights-based movement for gender equality. Rather than teaching women to change their behavior the movement instead attacked the *narrative* that blamed women for the violence, doing things such as pressuring local legislators to define gender-based violence as discrimination and punish offenders with jail time. The result has been a measurable change in the discourse on women's mobility, where both men and women are beginning to express the need to give women an equal right to mobility. In this sense, even though women's physical mobility has not significantly changed, it does give us hope that in the future it will be much harder to use gender-based violence to restrict women's mobility.

This paper concludes by reiterating the importance of looking at the gender norms which underscore gender issues in transportation. Focusing on gendered perceptions of mobility, as opposed to differences in men and women's travel patterns, gives us a much more complete understanding of the entire context in which these processes play out. Consequently, it makes it easier to think in terms of solutions and make predictions about how they will positively affect women's right to mobility in the future.

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# Bus stop matters: Exploring the gendered perspective of functional health

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## ABSTRACT

This study explores the role of the national health initiative for increased physical activity and its association with public transit. The close connection between increased physical activity, weight loss, and better health became the official discourse applied to multiple arenas. This study demonstrates that these factors are potentially, but not necessarily, linked processes. Numeric measurements, such as the number of steps walked and the amount of energy consumed fail to properly account for the lived experience of bus users walking to the bus stop. Based on ethnographic fieldwork from a phenomenological perspective, this study examines the gendered perceptions of navigating the bus stops during the implementation of the *Bus Stops Only* policy at Knoxville Area Transit (KAT) in Knoxville, Tennessee. Survey results indicate that both genders value time but experience the meaning of time differently – *getting there* and *time for myself*. The thematic descriptions suggest the genders' embodied mobility is different. Initial themes show – *holding on* and *wearing down*, and suggest other measurements needed for health, such as functional health. This awareness fills the gap toward a more effective program of active transportation and guides improvements in transport planning in which the bus stop design is valued.

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**KEYWORDS:** Bus stop design; Transport policy; Community health; Phenomenology; Gendered perspective.

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The US Surgeon General's Report *Physical Activity and Health* officially declared that everyone should get a recommended thirty minutes daily of moderate physical activity (U.S. Department of Health and Human Services 1996). Of primary concern is the link between growing sedentary life-style trends and various forms of chronic diseases and obesity (Pate et al., 1995). Subsequent studies introduced transportation into the discourse on physical activity and health (Lachapelle, 2011; Sallis et al., 2004; USDOT, 2004). Within this framework, active transportation initiatives became prevalent. Otherwise, known as any form of travel that is non-motorized as in walking, bicycling, skateboarding, pushcart, or scooter (Sandt et al., 2012). Further studies estimated that public transit users, as compared to those who depend on a car, walk 30% more steps (Edwards, 2008; Besser and Dannenberg, 2005). Therefore, if bus users are more likely to meet national recommendations for increased physical activity, how do bus users experience active transportation?

Some scholars suggest that current measurements of physical health can be enhanced by analyzing how this naturalized reality is bodily sensed (Csordas, 2011; Middleton, 2010; Lock, 1993). A focus on functional health provides a method to collect this bodily sense of navigating the bus stop. Functional health pertains to the structure and function of muscles and joints in conjunction with the ability to perform activities of daily living (Pandy and Andriacchi, 2010). Most research on functional health is in the context of chronic disease prevalence or its relationship to the growth and development of the muscles and joints. But the maintenance of the physical condition of muscles and joints is generally not examined. Furthermore, can a gendered approach contribute to our understanding of walking and functional health? Law (1999) noted that the human body is an ideal point where the different genders feel, as in sensory, their practices and meanings of movement. Therefore, in order to collect a gendered perspective of health and movement this study uses the focus of embodiment within the phenomenological perspective. In which the body is both an object of study as well as the focal point of experiencing the natural world or *being-in-the-world* (Desjarlais and Throop, 2011; Csordas, 1994). The different attitudes the genders display have a way of expressing the different ways individuals are actively engaged with their own social and physical realities (Fernando and Porter, 2002; Hanson, 2010). For example, Seedat et al. (2006) introduced phenomenology into the study of women and transport by looking at female pedestrians in an Asian and African city. The females' experience of walking went beyond the reductive measurements of steps walked. As a result of the descriptive thematic data, the complex social constraints faced by women might be understood by policy makers working in transportation.

This study examines the various ways the different genders navigate the bus stops, the different meanings attached to the different bus features, and the different ways each gender solves the navigational problems. This approach can help to understand contexts of health and movement from a different viewpoint, whereas a combined gendered voice may hide an equally legitimate subjectivity. Implications from these results should help fill the gap toward a more effective active transportation program, such as the importance of a better bus stop design. Otherwise, a program might appear to succeed, but actual better health may not be obtained.

## BUS STOPS

On a local level, the Knoxville Area Transit (KAT) activated the *Bus Stops Only* policy. This directive means that buses will no longer be allowed to pick up or drop off passengers at just any safe location or corner. Buses will only stop at the designated bus stop. Furthermore, fifty percent of the existing bus stops were relocated or completely eliminated. The location of bus stops after the new policy (Figure 1) shows prominently on schedule maps as white dots after the new policy. The objective is for on-time performance meaning buses arrive and depart on schedule. And the goal is to increase both vehicular efficiency and passenger ridership. If bus stop consolidation is becoming more common, then is the design of the bus stop becoming less valued because transit users don't have to wait long and users know exactly where the bus will stop?



**FIGURE 1. 22 Broadway Bus Route – Bus Stops**

Bus stops are vital to using public transit. Bus stops are the point where pedestrians become passengers. Research on transportation and health tend to ignore the bus stop in this navigational process except where it deals with pedestrian safety in relation to sidewalks, crosswalks, vehicular speeds, and location of bus stops (Pecheux, 2008); criminal activity and perceptions of fear (Trumpeter and Wilson, 2013; Loukaitou-Sideris, 2012); or traffic congestion and air toxins as in living next to or while waiting at the bus stop (Hess et al., 2010). But this navigational process encompasses many more experiences. At the bus stop the bus rider experiences the act of carrying packages, standing at the bus stop, adverse weather conditions, and using multiple bus stops. A comparative list from the medical literature would include: elementary school children and heavy backpacks (Mackenzie et al., 2003; Hong et al., 2008), posture stress and firefighters from repetitive movements (Gentzler and Stader, 2010), and reactions to brief cold exposure (Lintu et al., 2006). Therefore, predictive indicators of functional health suggest that actual poorer health may result in the form of shoulder joint dysplasia (packages), weather effects (cold, heat, and rain), and excessive fatigue (standing). Furthermore, these physical changes within the human body often accumulate covertly and in small doses over an extended period of time versus from one acute incident. This scenario is similar to how some medical practices have begun to look at and treat low back pain. The implication is that the bodily insult can impact all ages and may not seem to matter if the bus user begins in a state of good health or bad health. Therefore, a valid marker of future health would measure shoulder strain and specific effects of weather and standing.

News media frequently report the bus users' concern with the lack of adequate shelters and benches. Categorized as amenities, the bus stop design is allotted a lower budget priority by transit agencies. Moreover, the placement of a bus bench or a shelter is primarily justified on ridership counts or length of waiting time between buses. This technocratic approach excludes health criteria. Recently, studies have emphasized the bus stop design (Guttenplan and Reynolds, 2012; Fitzpatrick, 1996). The introduction of urban and transport planning concepts, such as complete streets, multi-modal planning, and the built environment, provides an opportunity for the bus stop design to be more valued. These conceptual designs take into account the effects that structures have on human social and physical health. The primary objective is to create an environmentally-friendly community. More studies looked at these models' effect on personal health as it

relates to physical activity and travel behavior (Handy et al., 2002). Some anthropologists are analyzing the small-scale street design and the processes that “valuing” has on these features’ presence or lack of. For example, ethnographies examined the curb design (Patton, 2007) and the crosswalk (Levinger, 2002). Studies that apply a gendered perspective within a framework of functional health and the bus stop may reveal areas for amenity construction that go beyond a pedestrian perspective, since the different genders may experience spatial movement differently.

## METHODOLOGY

This research is exploratory and descriptive. The analysis is the result of a larger thesis project carried out during the implementation of the *Bus Stops Only* policy at KAT in Knoxville, Tennessee and is designed to reveal the bodily perception of using the bus system within the changing structures and policies. The data collection included participant observations with three groups of bus users in the Knoxville area –22 Broadway Bus Route, Summit Towers, and Downtown Knoxville Transfer Point. In addition, from these three sample areas, a total of 26 bus users completed structured interviews – Likert-type scales and sentence-completion.

### Research Participants

The source of the participant population was current bus users in Knoxville, Tennessee between June 2010 and September 2010. This study used purposive sampling methods. Bernard (2006) states that this type of non-probability sampling can be useful in situations in which in-depth narratives are collected in order to identify a cultural phenomenon, such as ways our cultural values frame how bus users’ bodily experience the use of the bus stops.

### 22 Broadway Bus Route

The six participants (four women and two men) were all adults who use the 22 Broadway bus route either traveling toward downtown or away from downtown between the hours of 6:00 a.m and 9:45 p.m. The primary times of participant observation occurred during the hours of 9:00 a.m to 12:30 p.m and 6:00 p.m to 9:00 p.m. There were two main reasons for choosing those hours and route. Knoxville public transit records indicate these are the peak times for ridership. In addition, the 22 Broadway is one of four core routes (Figure 2) out of a total of 25 routes KAT operates daily during the weekdays, as shown by high monthly ridership reports. Since the study collected experiences from any bus user who used the bus stops, I simply contacted these participants by regularly using the bus route then asking individual passengers’ on the bus permission to interview them at a later date regarding their perceptions of using the bus.

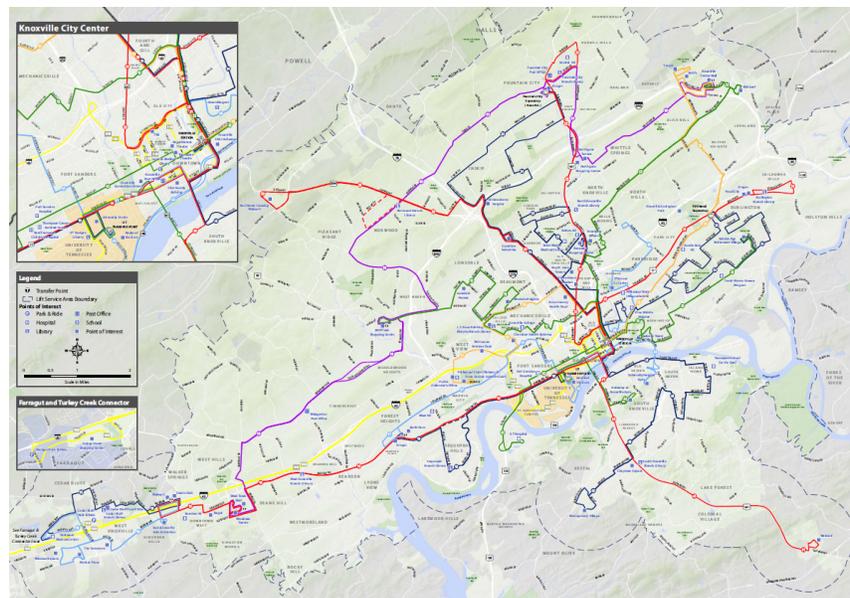


FIGURE 2. Route Systems Map

### **Summit Towers**

These nine participants (three women and six men) were all adult residents from the Summit Towers Apartments who typically use the 22 Broadway bus route. Summit Towers, built in 1979, is a high-rise apartment complex located in the central downtown business district of Knoxville. The primary importance for selecting these residents is twofold. This is the only multi-unit rental building located within the gentrified housing restoration of downtown that is also affordable to low-income individuals. In addition to their position downtown, Summit Tower residents actively participate at the Knoxville Transportation Authority (KTA) monthly public forums as compared to other rental properties, and according to the monthly KTA reports. The Summit Towers Activity Coordinator provided me with a list of residents I could contact, after I led their popular Bingo event held weekly.

### **Downtown Knoxville Transfer Point**

Participants on this route were eleven (five women and six men) adults who were positioned at the downtown Transfer Point on Main Street either waiting to board the bus or who had alighted the bus anytime between the hours of 6:00 a.m and 9:15 a.m. Downtown is the location of the central transfer point – where all bus routes meet and where most passengers make transfers. I gained access to these participants by waiting at the bus stop on Main Street.

### ***Participant Observation***

Participant observation is a primary method of doing ethnographic research. This technique can best be described as acquiring insight into another group by taking part in the group's everyday activities, along with observing and recording those activities as an outsider. For this study, participant observation included talking with and observing people while they rode the bus, waited for the bus, boarded the bus, or after they alighted the bus. By regularly using the bus system, I was able to engage in more informal discussions and identify important areas in the bus user's lived experience that needed further examination. The actual number of individuals I conversed with during the numerous participant observation episodes far exceeded the number of interview sessions, as these unstructured interviews can occur essentially anytime.

The field notes and interviews (described below) were transcribed by the primary investigator and all the interviews were transcribed in their entirety or word for word. The content analyses for the participant observation field notes as well as the interviews began with open-coding by themes that emerged as a result of this inductive research process (Emerson et al., 1995: 150). This allows the significance of a phenomenon to become visible. Next, a text analysis was conducted according to the phenomenology inquiry described by Creswell (1998) and thematic narratives presented by Emerson et al. (1995). The strength of this process involves systematically noting points of concern or events as presented by the bus users while setting aside one's own prior assumptions. Then, demonstrating their situated effects such as how the narrator reports, evaluates, constructs meaning of, and critiques the event. From these initial categories, sub-themes were identified for further analysis. The set of themes offers a qualitative arrangement of the data and fits with the exploratory aims of examining the ways that bus users are actively engaged in the world (Ryan and Bernard, 2003). To better the validity of the results, the thematic structures were then reviewed with many of the participants.

### ***Structured Interviews***

The interview process did not take place while riding the bus. Instead, the questions were asked at a local coffee shop, restaurant, participants' place of residency or while waiting for the bus. All individuals I met in the course of research were told upon introduction that I am a graduate student working on issues regarding perceptions of mobility and transportation downtown, in particular, public transit, as part of my thesis project. All people I met in the course of this study then had the choice as to whether or not to interact with me directly.

### **Likert-type Scales**

Researchers describe Likert-type scales as a systematic way to collect and compare both the weight of particular meanings and underlying meanings to discourse and behaviors. The survey was administered with the same words to each participant. The five words chosen were identified as common features within the bus

system that bus users must navigate in order to complete their bus trip – bus stop, bus fare, bus destination, bus schedule, and bus ride. The five items selected came from transportation and public health literature, and from observations I collected while using the bus system. I used a 7-point judgment scale – very handy, quite handy, slightly handy, equally handy and unhandy or neither, slightly unhandy, quite unhandy, and extremely unhandy. This scaling is useful at finding how individuals' feelings differ on things.

### **Sentence-completion**

These interviews were administered with the same fragmented sentence and each participant was asked to complete the end of the sentence. The part of the sentence administered should be meaningful phrases to bus users. Example of sentence frames included the following: The perfect bus ride would be like, (what)? The worst bus ride would be like, (what)? Do you have a routine to get ready for your bus ride? These phrases were selected by using the bus system myself and listening to the different conversations taking place and by reading the literature on public transportation and public health with an emphasis on the concept of active transportation. This open-ended technique can systematically collect the attitudes bus users have toward the bus system in a non-threatening manner.

## **FINDINGS**

The mixed method research connects the quantitative and qualitative data sets and can produce answers sometimes more revealing than a single approach (Amaratunga et al., 2002). The data analysis shows some commonalities in the results of the survey but more variability in the description of the phenomenon. Survey results indicate that both genders value time but experience the meaning of time differently – *getting there* and *time for myself*. The thematic descriptions suggest the genders' embodied mobility is different. Initial themes show – *holding on* and *wearing down*, and suggest the incomplete conceptualization of transportation measures, such as active transportation.

### ***Illustration of Phenomena***

The Likert-type scales used adjectives of evaluation, handy to unhandy, and allowed systematic comparisons on the value placed on the selected bus concepts. While the sentence completion survey collected participants' thoughts on "the best", and revealed the subjective experience of constraints and possibilities and how an aspect of the bus system is valued or not valued.

### **Likert-type Scales**

The rating importance of the bus concepts is similar for the Combined and the Male only genders (Figure 3). Whereas, the scaling exhibited by the Female only genders is similar except for the concept of Ride is the least handy of the bus concepts. Because the ride is least handy it is most value. In the contextual analysis, the Ride is emphasized as *time for myself* by the female gender, while for the male gender *getting there* figured more prominently. However, when the wider context of the genders' mode from pedestrians to passengers (Ride) is examined, since the bus stops are the point in which pedestrians become passengers, suggests a bodily disconnect of being at the bus stop. From this gendered perspective, a bus shelter or bench provides the experience of given permission to care for oneself.

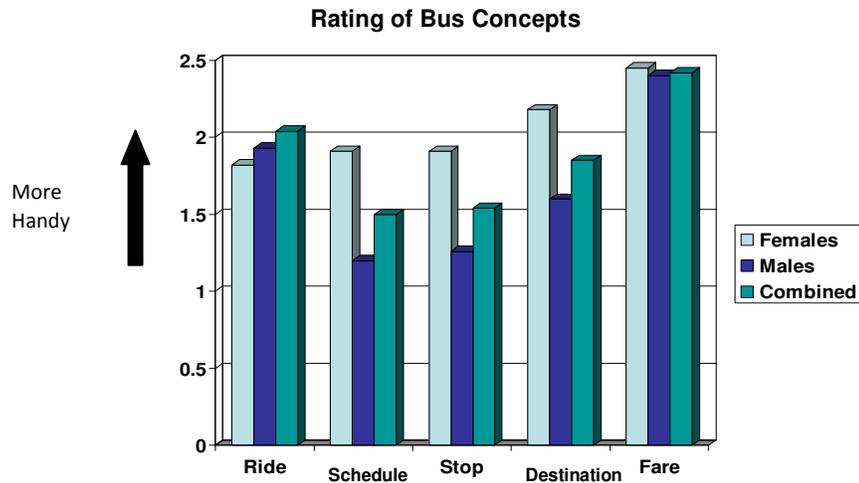


FIGURE 3. Rating of Bus Concepts

**Sentence-completion**

The Sentence-completion survey provided further examination of the Ride concept. The Perfect Ride results are shown below (Figure 4 and Figure 5). Segmented responses identified three themes: (1) Smooth = unnoticeable or feel of the ride, (2) Location = convenience or reference to a car, and (3) Opportunity = opportunity or occasion it provides. Figure 5 displays comments as coded within its context. A smooth ride appears proportionally higher for the female gender than the male gender, suggesting how the meaning of movement (and non-movement) is bodily sensed. This metric adds to current measurements of transport efficiency.

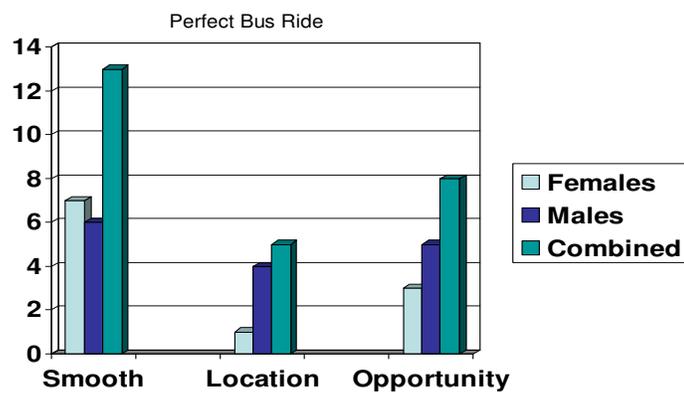


FIGURE 4. Perfect Bus Ride

Female Gender	Male Gender
A smooth ride (1)	Good air, nice driver, quiet (1)
Air conditioned in summer, friendly drivers, on-time service, clean bus (1)	That you don't have to stay (2)
You could go out your <i>door</i> get in then go to your place get right back on & go right home (2)	Friendly drivers, no potholes in road & air condition (the little buses too) (1)
Pick me up at the end of my street, exactly at 730 & drop me off not later 750 & not overcrowded & not only one, so interesting to come with others (1)	Oh, lord, comfortable seats, air... (1)
It's right there (1)	Not too far – walk it (3)
90B like how goes (3)	Air conditioning; without anyone getting mad with the driver (1)
Unnoticeable (1)	It would be like you were on rails – instead of bump, bump, bump & no hard stops (1)
It would be like heaven because I haven't been out in so long (3)	Fast with limited stops (2)
Get to go to the mountains (3)	Either quiet enough to read or interesting enough to talk to somebody (3)
It would have something outside to hold packages (1)	Pleasant courteous driver & pleasant & courteous passengers (1)
Comfortable seats, quiet bus, got one where I needed to go (1)	Express to Wal-Mart (3)
	I would catch a bus at the terminal & it'd take me directly where I am going (2)
	Fine. Chapman Highway (3)
	It would be pretty much like my car ride but I would not be driving (2)
	Had it, it was great (3)

FIGURE 5. Perfect Bus Ride

### Description of Phenomena

A thematic analysis was performed from the descriptive field notes, jottings, and journal entries. Systematic coding occurred. This involved identifying repetitive topics and areas that seem to be significant to the bus users, then sorting these topics into thematic categories for further analysis. The following themes are similar for both genders but the meanings and the expressions are different. The following two examples represent composites of a gendered perspective. The composites are not to claim that all males and females necessarily experience health differently, rather that a gendered perspective revealed more clearly a need for a viewpoint on functional health than a combined gendered perspective would.

#### Holding On: Everyone Knows You Can't Hold a Bus

Bus stop consolidation measures maintain that bus users will not have to wait long at the bus stop because buses will be on time. However, another component to this on-time performance is that buses will not wait for you if you are not at the bus stop; you have to be there. But this being there is more complex. The following scenario is between a potential male bus passenger and a bus at the bus stop:

"The bus was pulling off at the transfer point and this guy was running down and he tried, tried to hold the back of the bus and hold it, he fell down on the street on his face, I know it had to hurt but for the people who was watching it, it was sort of comical because you can't hold a bus with your arms you know; but that bus was going to leave without him and he was going to hold it; but he went down in the street; that had to hurt; but everybody that saw it they had to laugh, you know, even though we felt sorry for the guy".

The embodied mobility is sensed as *holding on*. However, traditional health measurements for cardiovascular and physical fitness do not capture the importance of a bench in being there for the bus. Whereas, a bench provides a resting place to briefly wait for the bus.

#### Wearing Down: Ten Minutes is a Long Time to Wait

Many studies on the experience of waiting present factors affecting perceptions of wait time and safety. Generally lacking is the act of waiting on functional health. The cumulative effect of even brief waits outdoors wears the body down. A female bus user coordinates her navigation to the bus stop.

"I time myself exactly seven minutes before the arrival of the next bus. Then I leave my place. [I] don't want to be out long because hot and humid or rain plus there is no where to sit; so, I leave just those one to two

minutes extra because [I] may be held up by traffic light, waiting to cross [at the crosswalk]”. [Lives approximately 300 meters from the bus stop]

The embodied mobility is sensed as *wearing down*. Such that, predictors of functional health for dependent edema, shoulder joint dysfunction, and weather effects should be examined more closely in transport planning. Furthermore, the viewpoint that buses will be on time (bus stop consolidation programs), sends a message that bus stop amenities do not matter. Whereas, the perception described above – times herself exactly – suggests a shelter certainly does matter.

## RECOMMENDATIONS

This limited analysis showed the impact of bus users as pedestrians before they become passengers. By emphasizing the perception as a pedestrian, the qualitative term, accessibility versus access to services made more sense. The material aspect of mobility was particularly evident at the bus stop. As a result of the bus stop focus, other elements within the participant-observation and survey data that focused on the bus stop were examined. Through the lens of a gendered perspective and predictive health the priority of the bus stop design became visible. In particular, a gender analysis introduced embodied movement into understandings of health and structures.

### ***Change Language to Mobility***

In order to maintain or increase the current health status of bus users the basic language for transit performance measures needs to change. The language needs to express the ability to be and to remain mobile. Not words that depend exclusively on quantitative distance, such as getting from point A to point B or ridership counts.

### ***Add Functional Health to Transport Performance***

Functional health status can be a robust measurement of transportation equity and performance. Markers should register the effects of adverse weather conditions, shoulder joint strain, and circulatory mini-shocks from repetitive walk-stand positioning. The aim is to change the viewpoint and prevent other maladies that are currently invisible.

### ***Require Standard Structures to Bus Stops***

Modify the bus stop policy to include minimal structural requirements. Shelters and benches should be located at every other bus stop regardless of the ridership count. To date, most bus stops are only a narrow sign post.

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# Women only cars in the Cairo metro: A response to what problem?

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## ABSTRACT

In Cairo, in 1989, i.e. two years after the first subway line was commissioned, the management body decided to reserve two cars per train for women (for young children and “vulnerable” people too). The cars are today situated at the centre of the train, and the arrangement operates either all day, or only between 9 a.m and 6 p.m. The research presented here, based mainly on the analysis of a corpus of press articles and international comparison, attempts to show the complexity of the reasons which led to this decision, and at a more secondary level, it was interested in how this arrangement was received by the public. It came to the following conclusions: that the separation of the sexes in terms of inclusion of women in urban life was ambiguous; that the feminist activists were ambivalent about this separation; that issues of sex and class were interlinked in the decision to create reserved cars; that the social relations of sex and class were consubstantial in how interactions played out in the subway environment, and in the reception of the separate car measure. These conclusions invite further research to give a more precise shape to the terms of these ambiguities and entrenchments; this will be the subject of the future MeTraGe programme.

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**KEYWORDS:** Separation of the sex; Subway; Public policy; Egypt.

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## 1. INTRODUCTION

In Egypt, just like in a dozen or so other countries in the world, the introduction of the subway into world metropolises was quickly followed by the institutional decision to separate men from women and to reserve for women the use of one or two cars per train. In Cairo, this decision went back to 1989, i.e. two years after the first subway line was commissioned. The separation of a public space is never neutral, and this decision to call into question the mixing of the sexes has social effects which influence both the effective place of women in the city and the representation of their presence and their legitimacy. The place of women in societies is generally regarded as one of the strong indicators of social change, and public decisions of this type can have considerable impacts on interactions between men and women in the public space, but also in the private arena.

The research presented here aims to question the reasons which led to this institutional decision, to understand what problem it was seeking to address, insofar as sexual harassment, which has been given considerable media coverage since the early 2000s in Egypt, was not yet a public problem in the late 1980s. Our objective is to reconstitute the logics of institutional bodies and their relations or communities of interests with other players such as lobbies, feminist militants or the general public: if several measures were possible answers to the problem of sexual harassment in public transport, why was men-women separation preferred?

With the help of the archive department of the daily newspaper *Al Gomhuria*, we have a large base of press articles: we were therefore able to make use of 124 articles devoted to line 1, 440 articles devoted to lines 2 and 3, and 16 articles concerning sexual harassment in public transport systems. To these articles in paper format, written in Arabic are added English articles available on the Internet, as well as articles quoted by other researchers, in particular the two PhD students Sahar Attia (Attia, 1988) and Yasmine Magdi Kahlifa (Khalifa, 2011).

Interviews with the people involved should have provided first hand data, but the current political conditions in Egypt, in particular the events of summer 2013, prevented us from interviewing as many people as we would have liked. Our presentation therefore concerns some research in progress, which aims to show the interest of certain questions, and at the same time propose some responses. It falls within a wider

programme in progress bearing on the institutionalization of the separation of sexes in other networks of the world<sup>42</sup>.

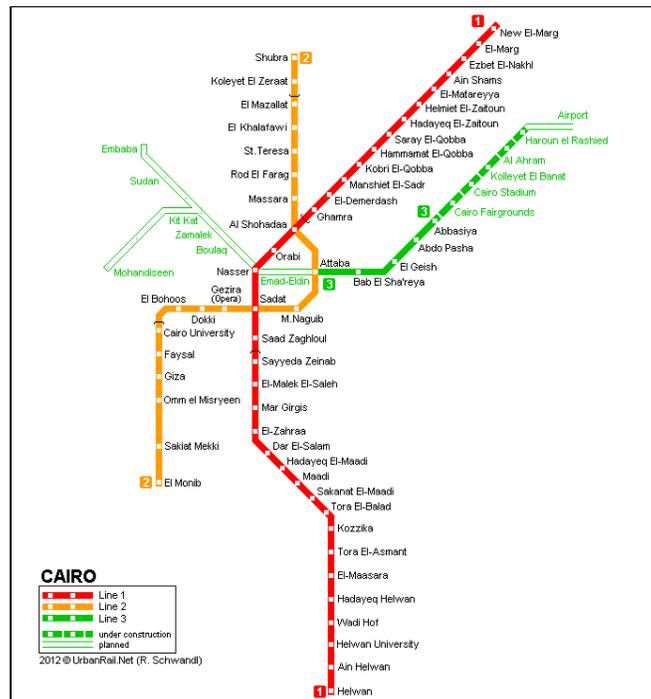
After presenting the principle of women-only cars in the Cairo network, and the spatial distribution of arrangements of this type throughout the world, we will present some contextual elements which seem most directly to explain this decision (increase in the mobility of women and the emergence of the sexual harassment problem), before discussing them in section 3, together with the social and ethical implications of this separation.

## 2. IN CAIRO AND ELSEWHERE, WOMEN-ONLY CARS IN THE METRO NETWORK

### 2.1 The case of Cairo: history of the metro and its separation by sex

The first studies concerning the Cairo metro date from the time Nasser came to power, when the French put forward a project with two lines. This preliminary report presented in 1954 was followed by other studies, French, English and Japanese, during the 1960s; but the war with Israel prevented any major work from being started. It was only in 1973 that the first strategic transport plan was proposed by the French Company for Urban Transport Studies (SOFRETU) in response to an invitation to tender, and approved by the cabinet of ministers.

Work on the first line started in 1981, and this was inaugurated, in its southern section (Helwan-Ramsès), in 1987, in the presence of President Mubarak and Jacques Chirac, who was then the French Prime Minister. This North-South line consists of the connection via an underground link of two regional lines, the Helwan – Bab El Louk line to the south and the Koubri El Leimon – El Marg line to the north. The line as a whole came into operation in 1989. The second line opened in several stages between 1996 and 2005. Just the eastern section of the 3rd line has been in operation since 2012; eventually, this east-west line will connect the districts of Embaba and Mohandissen to Cairo airport.



Map of the present and planned network. "Robert Schwandl (UrbanRail.Net)"

<sup>42</sup> The MeTraGe (Métropole, Transport, Genre) programme, involves a community of researchers in addition to the two authors: Martin Aranguren, Carole Gayet-Viaud, Perrine Lachenal, Rashmi Sadana, Mina Saïdi-Sharouz and Stéphane Tonnelat.

International players (in particular French and Japanese) were very active in the construction phase, but the operation is entirely under the responsibility of two institutions, NAT-ECM. The National Authority for Tunnels, created in 1983, is the client for the work and the operational organization authority. Egyptian Cairo Metro is the transport operator in charge of the daily running of the network.

The subway was principally introduced into the Egyptian capital to solve massive road congestion problems, but when it was brought into service, the comments in the press were mostly about the new types of behaviour which this technological innovation would impose. The authorities were worried about the way in which users would assume their new responsibilities: refraining from smoking, eating or drinking in the trains and on the platforms, and from throwing things on the ground, moving quickly along the corridors and when getting on and off the trains, queuing up to buy a ticket or going through the automatic gates without pushing each other, etc. To supervise user behaviour, dozens of cleaners were recruited to polish the shiny tiled floor all day long, and 600 police officers were deployed in the metro network which at the time, don't forget, only consisted of one line and about twenty stations (*Akher Saa*, September 1987, quoted by [Attia, 1988, p. 126]). After two months of operation, 14,373 fines were imposed: 7,563 for smoking, 4,446 for travelling without a ticket, 1,835 for public cleanliness offenses, 18 for begging, 15 for itinerant trading, 10 for the sale of counterfeit tickets and 9 for travelling with a false subscription.

None of these infringements related to cases of sexual harassment. However, by 1989, barely a few months after the second section of the second line was opened, the decision was made to reserve for women two of the three cars newly added to each train (Al Ahram, 08.10.89, Al Gomhuria 10.10.89, Al Gomhuria, 23.10.89). From October 8th, 1989 therefore, the first and last cars of each train were reserved for women. This separation still exists, even if it now concerns the central cars (4th and 5th cars). One of them is reserved for women all through the day, while the second is mixed between 9 a.m and 6 p.m only. These restrictions are announced above each entrance to the car. The position of the women-only cars is indicated on the platforms by illuminated panels. The rules of procedure specific to the subway provide that these cars are accessible also to boys of under twelve years and to disabled people. In fact, men are also allowed if they are itinerant salesmen (observations by Gillot, 1994-2011, and Tillous, 2012-13). All in all, these cars carry a very large number of passengers, as does the subway in general.

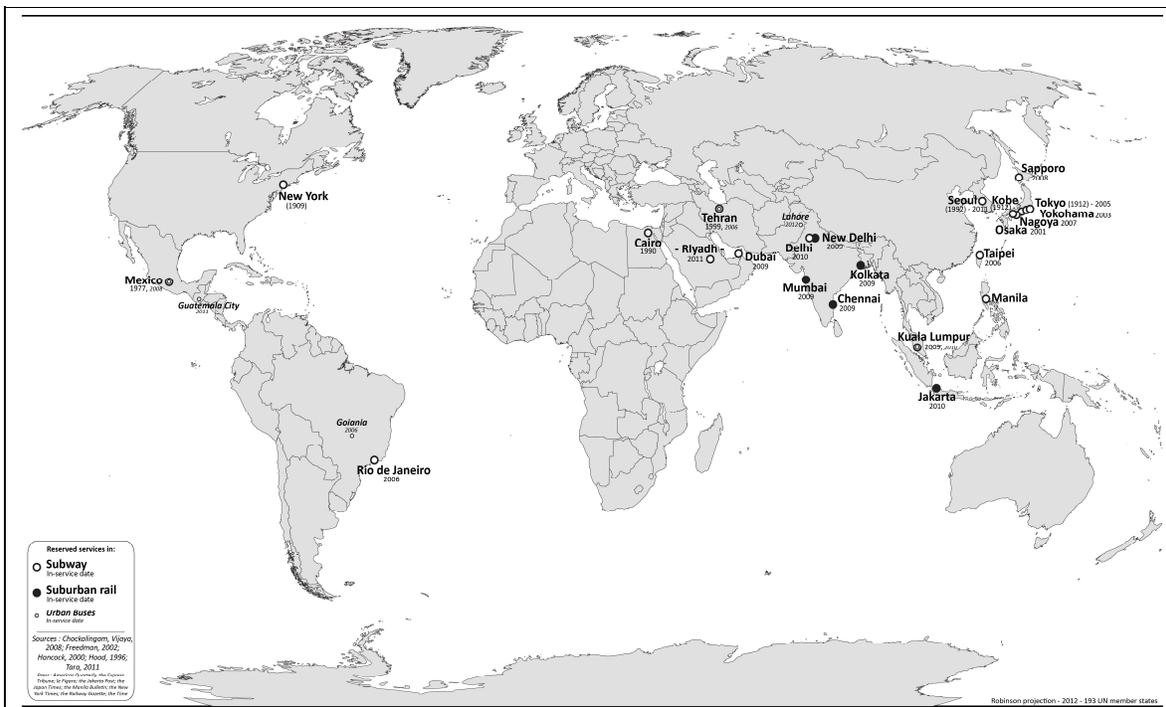
## **2.2 Cairo is not the only case of men-women separation**

The Cairo metro is neither the only nor even the first network to establish men-women separation. In most cases this separation is limited to rush hours. But even when this system only functions at rush hours, the signing on the cars remains in place and separation continues implicitly during the other hours of service. To ensure that this separation is observed, police presence is increased on the platforms, and sometimes, as in Mexico City (Hancock, 2000), separation between men and women is imposed as soon as they arrive on the platform. In other cases just like in Cairo, access to the cars is available not only to women, but also to young children and vulnerable people such as the elderly, those with reduced mobility, or the injured.

A first census, carried out from press and scientific articles (see section 7 "Bibliographical References") itemizes sixteen subway networks in which a car is reserved for women. The oldest case is the New York subway, in which a "Ladies Only" car was created in 1909, but was removed after only a few months. Among the separation arrangements still in use, the oldest is that of Mexico City, created in 1977. The Riyadh network is a special case since the whole of it is reserved for women: it is in fact a small network of 11.5 km and 14 stations serving the campus of the Princess Nora bint Abdul Rahman University for women. The other networks currently concerned are: Rio de Janeiro, Tehran, Dubai, Delhi, Kuala Lumpur, Manila, Taipei, Seoul, Tokyo, and many others Japanese cities.

The subway is not the only travel mode concerned with institutionalizing the separation of sexes: to these sixteen subway networks can be added the suburban train networks of India, Indonesia and Japan, the bus networks of Mexico City, Guatemala City, Goiania (Brazil), Teheran, Lahore and Kuala Lumpur, and the national train networks of various countries such as Belorussia and India, but also in the past Great Britain and France. The French network still has cars reserved for women on its night trains. This does not include the cases in which, independently of a public institution, a private operator decides locally to separate the sexes, this time strictly, as in some buses in Jerusalem.

The map below synthesizes the spatial distribution of the cases listed.



(Tillous, 2012)

Even though this map is not exhaustive, it highlights the fact that the spatial distribution of the networks that have created a men-women separation is not limited to a cultural or religious area. However a concentration can be observed in a crescent connecting Egypt to Japan via the Middle East, India and South-East Asia. Claire Hancock (2012) points out that most of the countries concerned by existing separation in their public transport networks belong to the category of emerging countries or countries that have recently emerged. It can also be observed that separated cars are in cities whose spatial growth and number of inhabitants have accelerated in the past thirty years and with intense modernization of infrastructures dedicated to urban mobility (Troin, 2000).

### 3. CONTEXT OF SEPARATION: RISE IN FEMALE MOBILITY AND SEXUAL HARASSMENT, SOME EXPLANATIONS?

#### 3.1 Increasing mobility: a vector and an outward sign of bringing transport infrastructures up to international standards

Cairo, like many cities in the developing countries, has experienced and is still experiencing an explosion in urban growth, even if it has changed in nature. In the years 2000, approximately 1 million rural emigrants a year were still arriving in Cairo. There were 2.5 million inhabitants in the metropolis in 1953, 6.2 million in 1966 and in 2006, the population which was rising to about 19 million had increased by 44% compared to 1996 (CAPMAS, Central Agency for Public Mobilization and Statistics). If the growth continues at this pace, the metropolis will have 28 million inhabitants in 2016! This urban growth created an enormous, mainly uncontrolled and haphazard spatial spread which went against Egypt's desire to remain the regional urban reference which it still was in the years 2000 (David, 2002). Galila El Kadi wrote in 1990 that there had been great efforts in city planning, and that since the 1980s there had clearly been a notable improvement in the state of infrastructure equipment. This qualitative leap was the result of special attention by the Egyptian State, supported in this effort by international cooperation; the United States and several countries of the European Union for example played an active part in modernizing and upgrading the Egyptian capital to international standards to promote its economic development. In fact, although the effects on the infrastructures are felt at the local level, they are initially calculated in relation to an international standard, the international averages, which are used as the benchmark in all programmes of "infrastructural"... adjustment,

and enable comparisons to be made to measure a possible degree of upmarket economic attraction at international level.

Investments in transport infrastructures, both road and rail, are initially designed to solve a congestion problem and facilitate and strengthen the complex mechanics of metropolisation (Deboulet, 2012). These infrastructure policies are a means of coming within an international movement of the metropolises that count. Fluidity and mobility are regarded as pillars of economic development in the same way as accessibility to districts that are central or symbolic from the point of view of world-wide metropolisation (airports, CBD (central business districts), ports, international hotels and exhibition centres, places for potential international conferences, etc.). Motorway or road infrastructures are always preferred to improve mobility in cities because of high corporate dependence on automobiles (Dupuy, 1999), but congestion and international instructions, since the Rio Earth Summit in 1992, to sign up to development in a “sustainable” manner, have encouraged cities in developing countries to develop specific site underground transport networks. This explains why a very large number of cities under development have obtained subway networks. Cairo, as we have seen, inaugurated its first line in 1987, as a pioneer in the region, the Teheran subway has been in service since 1999, and Istanbul’s metro was opened in 2000. Algiers’ subway project, planned ever since 1928, came to fruition with the opening of the first line in October 2011. In the Muslim-Arab world, few cities actually have a subway and this remains an absolute hallmark of metropolisation, a strong symbol that a city is one of the important cities in the “large centre archipelago network” attracting international investment, which impacts in the sense of standardization of space and gives great importance to the image of the “high tech” city (Veltz quoted by Deboulet et alii, 2007). The subway is an illustration of this. This is testified forcibly by the “Greater Cairo 2050” development project whose objective presented by the GOPP (General Organization for Physical Planning) is *“To make Cairo “an international” “integrated”, “green” city in 2050, and to ensure the city is included in the network of world metropolises: London 2066, Paris 2020, Singapore 2050...”* (Barthel, 2009).

Accessibility and mobility have become crucial in societies “and one of the conditions of success for the multipolar city of tomorrow” (Sueur, 1998). People move about more and more for a variety of reasons such as work, studies, leisure, or consumption. Mobility has become claimed as a right which, when the correct conditions for it to be exercised are lacking, hampers economic inclusion and cannot fulfil its function. So in all countries of the world, the lack of access to transport seriously restricts the chance of finding work, or of benefiting from public services of health or education (Fol, 2009). The economic exclusion of people in a situation where they are forced to remain in one place is now well recognized, and although efforts are being made, with the construction of metro lines, to connect districts that are becoming increasingly distant through urban sprawl and industrialization, the fact remains that travelling is still a major problem and a challenge for a certain number of disadvantaged social categories, and among them, women. In Cairo, relatively speaking, the subway fulfilled a crying need for public transport that was modern, effective and fast. It has become a real mass transport system: 3,700,000 passengers use it each day. Women in particular are faithful users of the subway, or public transport in general because they drive cars less often than men. It is a pity that no statistics have been gathered on the use of the Cairo subway, as this would have informed us on the proportion of its use by women. Nevertheless, their place has been taken into account since public policies with regard to women, the separated cars, have been adopted.

Whereas the rate of women in work in the Middle East and North Africa is one of the lowest recorded in the world (26%), Egypt is on the average with a 24% rate of women in the working population (World Bank, 2011). But these statistics have difficulty in accounting for the reality of female work in Egypt which is largely undeclared, underpaid and discredited. Very many women are employed in the domestic work sector (cleaning ladies...) and never appear in the statistics, whereas they are sometimes the only bread-winners in their family. International incentives for women to access paid work have been persistent for many years, and the idea of the emancipation of women by work is not new (Boserup, 1983).

Many studies have underlined a strong correlation between the emergence of female wage-earners and the globalization process, and the fact that women find themselves en masse in precarious employment in both formal and informal sectors. These new very flexible forms of work lead them to break with their daily lives spent in the home (Marius Gnanou, 2010). And beyond the obligation of travelling to work, women are increasingly claiming a “right to the city”. In Egypt, the campaigns against sexual harassment (Rizzo, 2011) clearly show that it is becoming more and more abnormal for women not to have access to the city in complete safety. Increasingly, by “non-essential” outings (outside shopping, studies or work) they are expressing the desire to try out the city alone, independently, and often know the city better than men. Being away from the sphere of the social network in which they are “supervised”, they are exploiting the infinite spatial

opportunities provided by a city as vast as Cairo, thus creating for themselves spaces of freedom (Gillot, 2005, 2012).

### **3.2 The public problem of sexual harassment, its specific incarnation in public transport, and the links with separation of the sexes.**

The work carried out by the anthropologist Aymon Kreil within the framework of his doctorate on the standards governing the relationships of sex and love in Cairo at the end of the years 2000, precisely analyses and documents the way in which sexual harassment became a public problem in Egypt during this period. Various incidents of rape during the years 1980, 1990 and 2000 received considerable media coverage, in particular, with respect to public transport, the rape at the Ataba bus station which happened during the month of Ramadan 1992; the trial of the attackers concluded with the case being dismissed. In spite of this media coverage, the Egyptian State systematically intervened during this period to prevent a short news item in the “news in brief” column from becoming a public problem.

It was only in the mid-2000s that sexual harassment went beyond the limits imposed by the government, because of three major events. The collective sexual assault on women in 2006 at the time of Ayd Al-Fitr, the festival marking the end of the month of fasting of Ramadan, was very strongly relayed by opposition blogs and gave rise to international media coverage. This led to a collective awakening, amplified by the publication of a report by the Egyptian Center for Women’s Rights “*Clouds in Egypt’s sky. Sexual harassment: from verbal harassment to rape*” which quoted alarming figures: 83% of Egyptian women and 98% of foreign women interviewed declared being victims of harassment, including 46% every day. The report also called into question the prejudices and generally accepted ideas concerning the way the harassed women were dressed (since 40% of the women victims of harassment were veiled) and the fact that the harassment would seem to come from the sexual frustration of young men prevented from marrying because of their poverty (since harassment is also carried out by married men). Lastly, in October 2008 a judgment called “historic” by the ECWR was also given: that of Nuhā Rushdī’s attacker, a minibus driver, who had grabbed her breast openly in the street, and whom justice severely condemned to three years in prison and a fine of 5001 EP (\$895).

Aymon Kreil shows that this breakaway in the collective recognition of sexual harassment as a public problem resulted in a change in the term chosen to designate it. Until the 2000s, groping and sexual comments in public were indicated by the term *mudāyīqa* which refers to the lexical field of annoyances and irritations; but in the years 2000, it was the term *taharrush ginsī* which was preferred, a term hitherto reserved for sexual abuse and in particular for cases of incest. This change demonstrated a criminalisation of sexual harassment, instigated by entreaties from the United Nations and NGOs, whose proximity with Egyptian opposition movements during the 2000s is stressed by Kreil. This criminalisation relied on a lexical association between sexual abuses and forms of harassment hitherto considered as not being very serious. Another example of the break which happened in the mid-2000s concerning the publicising of the public harassment problem: the file on sexual harassment created by researchers of the press publisher *Al Gomhuria*, which began with articles from 2007.

It seems clear in this context that the separation of the sexes in the Cairo subway was mainly intended to answer the problem of sexual harassment. However, this arrangement was twenty years old when sexual harassment emerged as a public problem. Articles published in the press in October and November 1989 speak of it only as one element among others (Al Gomhuria, 10.10.89; Al Ahrām, 02.11.89), and use the term *mudāyīqa* to designate it. These articles mainly connected the measure to the context of great “density” and to the desire to give women more “comfort” (Al Ahrām, 08.10.89; Al Gomhuria, 10.10.89), so that they would give up using their car and no longer contribute to the congestion that was saturating the capital<sup>43</sup> (Al Ahrām, 02.11.89). Insofar as criticism of sexual harassment was very soon suspected of attacking Egypt’s image (Abu Amara, 2011), inviting Western criticisms, and harming its ambition to belong to the group of “international cities” (Berry et alii, 2007), the newspapers, faithful to the power of Mubarak, may have been engaging in self-censorship. But certain articles of the period on the other hand bore witness to a certain freedom of tone, and were critical of the threat imposed on women’s rights by this measure: “Seventy years after Hoda Shaarawi removed the veil... Thirty years after women gained their civil and constitutional rights to education, work and vote. And after women have become ministers and diplomats... At the brink of the twenty-first century we take a step backward to the days when the tram was segregated” (Al Ahrām, 07.11.89). For the author of this

<sup>43</sup> This refers directly to the emergence of the middle class in Egypt.

article, sexual harassment was not, in 1989, a problem which merited going so far as to separate men from women<sup>44</sup>.

However, in 2013, in spite of the emergence of harassment as a public problem, the militants of feminist causes still do not consider separation of the sexes in the subway to be an obvious measure to use in answer to sexual harassment. An interview with Pakinam El Shinnawy (Tillous, 01.02.13), the spokesperson of the *Basma (Imprint)* movement testifies to this uncertainty. This movement was born from the scandal of Aïd El-Fitr in 2006, and takes the shape of patrols which adopt the mission both to campaign against harassment, and to stop harassments if they arise. These patrols preferentially take place during major events (including political), in the universities, or in the subway. There, respect for men-women separation is another element on which the patrols intervene. Because getting into cars reserved for women is liable to a heavy fine, the patrols make use of this legal lever to oblige police officers to stop the harassers, even when the victim does not wish to make a complaint (which is very frequent)<sup>45</sup>.

But, if the men-women separation did not exist, the militants of the *Basma* movement would not want it to be established: “the fact of separating men and women has a calming effect. Quite simply, it alleviates the problem or it pretends that the problem does not exist, but it does not actually solve it. [...] it is not normal to separate men from women, and it is not practical either. It is not normal because in any event, women must meet people in their everyday life, either in school, or at university, or in work, therefore in any event, they must learn how to behave with men. [...] I am against the initiative launched by the Egypt Forte party to have buses reserved for women. Still the same idea but it is not the solution. The solution, the best solution, is in fact for men to respect women, to treat them in a human, worthy, respectable way, and women must report all the deeds of aggression or harassment of which they have been victims. [...] If we want to continue to think or act in this way, it will finally lead to devoting streets reserved for women and streets reserved for men. Therefore, it is no way to live in society.” [1 :08’].

The same reservations can be observed concerning separation with Indian women militants against the practice of “Eve-teasing”, sexual harassment in public places and more particularly in trains. The railway campaign is particularly representative of these measures. It was led by feminists in Delhi in 1998, at a time when suburban trains were already separated, but not yet the subway. It had as its starting point the complaint lodged by a group of women who had been attacked by three drunken soldiers, without the Railway Protection Force intervening, as the latter considered that its role was to protect goods and not people. A campaign of demonstrations, petitions, leaflets and putting up posters followed. Its objectives: to inform women of their rights in order to break the law of silence, to induce a change in men’s behaviour, to make the problem a public question, to put pressure on the public and railway authorities for the police forces to intervene in cases of sexual assaults and for complaint procedures to be made simpler. At no time did these groups militate in favour of the separation of men and women in trains. At most the leaflets distributed reminded women of the legal provisions which enabled them to have this separation observed when it existed (national railways). As in Egypt, therefore, separation seems to be a lever, but not a claim; the solution planned to solve sexual harassment is above all the possibility of making a complaint and of having a legal recourse.

Insofar as civil society has not had to come to a conclusion about the question and the measure preceded the emergence of harassment as a public problem, we are justified in wondering whether the safety and integrity of women are basically the main cause of separation.

## **4. AVENUES FOR ANALYSIS: THE MULTIPLE FACETS OF THE SEPARATION OF THE SEXES IN THE METRO**

### **4.1 *The ambivalence of women only cars; protection or constraint?***

The militant feminists encountered seem to adopt a strategic posture of accepting separation (though without asking for it), in order to obtain equal access in the long term. It so happens that the public policies of separation by sex are themselves very ambiguous. On the one hand, they seek to facilitate access to the city, to public areas for women, implementing international entreaties, giving pledges to financial backers who have

<sup>44</sup> Taken up by Yasmina Khalifa, regretting it, in her thesis devoted to women’s experience of the metro, submitted in 2011.

<sup>45</sup> When it is not the police themselves who are committing the harassment (Darwiche, 2012).

been very sensitive to the question of gender for some years, seeking to reduce one of the aspects of disparity of access to economic opportunities between men and women (second set of priority actions as defined in the report on development by the World Bank in 2012). But at the same time, it is clear that the measures are not carried out continuously. One of the two cars per train reserved for women becomes mixed again after 6 p.m.; in most of the other cities concerned, the arrangement only functions during rush hours.

This can be interpreted in several ways: either it is congestion which is taken into account during rush hours and that in the crowd, the risk of aggression is maximum at these times, or because this is when the number of women is very high (which will be checked during counts in a forthcoming grass-roots study), and that here too, their aspiration for safety has to be answered or they have to be made safe “by force”, allied to the fact that at rush hours the legitimacy of their presence in public transport is recognized. But outside rush hours, although the Cairo subway is very busy all day, women would have no legitimate reason for being there. It is known that the subway, because of the mobility it provides, helps women to disassociate themselves from “the space of residential proximity” which “contributes (...) to calling into question the spatial status of women” and “to reposition the relationships the sexes have with the city” (Coutras, 1993, quoted by Hancock, 2004). Thus, these policies in favour of women who work would not go so far as to acknowledge a right to mobility in safety at any hour of the day and even less so at night, and would lead to reinforcing the idea that outside the periods when the separation measure is implemented, travelling “would be risky” and thus inadvisable for women, who are by essence vulnerable (Lieber, 2011). The right to the city would moreover only apply for those women who contribute economically to the development of the country and with normalized schedules (what about women who work with staggered hours?).

But whatever the hours and the reasons for mobility, Egyptian women must always prove its legitimacy, as shown by the pressures of dress code and by their being accompanied in their journeys by a male member of the family. This would tend to prove that the urban space itself is the major constraint which hinders travelling, when travelling actually only reflects the unequal status of the sexes in the society, as shown by C. Hancock (2012) in his studies of the urban gender policies in Mexico City and Seoul.

#### **4.2 *The metro as symbol and vector of urban civilisation***

When the metro opened in Cairo, many billboards indicated how to behave in the corridors, guides were placed at the counters to help users to buy their tickets, to find their way to the platforms, and to give information about directions. A large police contingent was on patrol and the cleaning was continuous. The station of the now famous Place Tahrir was particularly neat. Alexandre Buccianti, a journalist with RFI interviewed a few years later (interview 1996, Gillot), stressed that the choice of automatic turnstiles, the presence of televisions on the platforms, and of the (relatively) technological environment had had a phenomenal impact when the metro was unveiled to the inhabitants of Cairo. They spoke of their pride that Egypt should be equipped with such high technology equipment, a symbol of the modernity which took them out of underdevelopment. Such equipment, proof of the contemporaneity of the city, showed that it was in line with the global evolution of the shared experiences of urban planning.

It was consequently a question of accustoming the populations to it, and especially the neo-urban populations, in particular those who were poor, reputedly carrying all the evils of the city and singularly lacking in urbanity. The subway rules and regulations, just like the usual regulations in parks, carry in them aspirations to educate the population, a process of mass “civilization” openly asserted in paternalistic urban policies and still on many points of hygiene (Gillot, 2002). The idea that modern equipment will contribute to modernizing the behaviour of the population is very much alive. And just like hygienism, this faith in modernization is structured with a dual and perhaps contradictory aspiration: freedom and morals. Thus, subway by-laws (no spitting, validating one’s ticket, not preventing the doors from closing ...), including separation of cars between men and women, could have to do with modernization itself and the civic education of the population and its distribution by class.

#### **4.3 *Issues of class underlying issues of sex: what men are being separated from what women?***

Historical cases of men-women separation in the subway, in fact those of New York in 1909 and Tokyo in 1912, invite us to question the homogeneity of the opposing categories “man” and “woman”, since they explicitly comprise class issues. In New York (Hood, 1996), the women-only cars were established by the *Hudson and Manhattan Railroad company* at the request of the respectable *Women’s Municipal League*. The intention of its leader, Julia D. Longfellow, the wife of an influential lawyer in the Bronx, was both to protect

women and young girls from the inappropriate attitudes of men and to create spaces of femininity where working class women, whom she suspected of encouragement towards the men and not very civil behaviour in the mob, could reform their conduct. In Tokyo, a few years later, the same class logics were at work in the introduction of cars reserved for women (called “Flower Trains”): the objective was to prevent the faces of wealthy young girls going to school in the centre of Tokyo “from being looked at and appreciated” by the “salarymen”, the men of the new urban middle class, salaried workers in large companies or the civil service, and whose wives did not work (Freedman, 2002).

Even though scientific work relating to women-only cars is today more interested in how the measure was received than in the reasons for its installation, it allows us to think that the same class issues still exist. Mitsutoshi Horii and Adam Burgess (Horii & Burgess, 2012) showed the association made in Japan by the common meaning between sexual assault (“chikan”) and middle-aged working men (“oyaji”), whereas the statistics taken from the complaints lodged contradict this correlation. The authors understand this relation as a reconsideration of the traditional bases of Japanese society through those who represent the “fathers” of the nation. Belonging to a specific class of these oyaji leaves us to think that social relations of class also come into account. Moreover, the women interviewed by these two authors who did use the reserved cars congratulated themselves for three reasons: reasons of personal security, practical reasons (these cars are not so crammed) and for hygiene considerations. They find men smelly and dirty, and they reproach them for their improper behaviour, in particular when they have been drinking.

In Cairo, articles dealing with women-only cars in the subway mention a “civilizing” dimension of the measure (Al Gomhuria, 17.06.2001). It is interesting to note that if the women interviewed by the journalists seemed divided, the men on the other hand, both when the measure was first implemented and in more recent times, are outraged because women are allowed to go into the other cars and because of the humiliation of being regarded as potential harassers. In 2001, a union of male passengers even made a complaint against the operator for sexual discrimination (BBC News, 24.02.01). As advanced by the journalist, it is possible that these men have difficulty in ridding themselves of the privileges of a patriarchal society, but this unanimous and very critical reaction with regard to the civilizing posture of the institution deserves to be examined more closely, which our research material prevents us from doing for the moment. We will simply note that current issues linked to sexual harassment and the logics of division of the public space intended to avoid this harassment have been clearly connected, in Cairo, to logics of class (de Koning, 2009; Lachenal, n.d.). Additional investigations will be necessary to validate or invalidate the hypothesis according to which separation by sex within the subway is founded just as much on logics of class as of gender.

## 5. CONCLUSION

It is difficult, at this stage, to come to any definite conclusions, but preliminary results and comparison with other cases in space and time enable us to advance sound assumptions. Thus, the fact of reserving cars for women in the subway is of course not “a simple” history of security such as it is usually presented, with all the prejudices and generally accepted ideas that this involves on the place and vulnerability of women in public spaces. These decisions of gendered separations of spaces question several points that we still need to deconstruct and analyse: the ambiguity of the separation of the sexes in terms of inclusion of women in urban life; the ambivalence of feminist activists with regard to this separation; enshrining issues of sex and class in the decision to create reserved cars; the consubstantiality of social relations of sex and class in the practice of interactions within the subway and in the reception of the measure of separate cars. These are just some points which will structure our comparative and multi-field research programme, MeTraGe, on subway cars reserved for women.

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# SUSTAINABILITY

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# Engendering the future of electric vehicles: Conversations with men and women

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## ABSTRACT

This research examines early drivers of plug-in electric vehicles (PEVs) from a gendered perspective. Women and men may have differing responses to the new performance attributes of PEVs, for example, the relationship between driving range per battery charge and charging locations. Without knowledge of such potential differences, PEV sales and charging infrastructure deployment may create differential barriers and opportunities for women and men. Thus, understanding any gender differences is vital to policy, marketing, and infrastructure development for electric-mobility to ensure that sustainable mobility is appealing and accessible to all people. Clarifying gender differences in the experience of PEV drivers would also broaden the understanding of the persistence of gender roles in travel behavior. We pose two primary questions. (1) How does the speech of women and men PEV drivers compare? (2) What factors contribute to observed differences and similarities? Data are from two sets of focus groups conducted in 2011 and 2012 as PEVs entered the market in California. A content analysis of the themes in these group conversations reveals that, while women and men talk about their experience in many ways that are similar, there are important differences. Within some themes, women are more likely to talk about their PEV in terms of its practicality as a travel tool and adapting to the present system of vehicle charging. Conversely, within these same themes men are more likely to talk in terms of research and development and how the system should change. The voices of women PEV drivers are underrepresented in conversations regarding future policy, marketing, and technology development both because there are so many fewer women PEV drivers and because the content of women and men's speech differ.

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**KEYWORDS:** PEV; Gender; Sustainability; Policy; Infrastructure.

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## INTRODUCTION

This research seeks to understand whether differences in plug-in electric vehicle (PEV) purchase and use exist between men and women. Before posing our research questions, we first review gender in mobility studies and PEVs as motivation for exploring their possible nexus.

### *Plug-in Electric Vehicles*

The category of PEVs contains both plug-in hybrid electric vehicles (PHEVs) and electric vehicles (EVs). PHEVs have both an electric motor and an internal combustion engine integrated such that it is fueled by either or both electricity from the grid or a liquid fuel such as gasoline or diesel. In contrast, EVs are powered solely by electricity.

Substituting electricity for liquid fuels has several goals, including reducing emissions of pollutants and greenhouse gases (1, 2) while lowering cost, improving reliability, and enhancing the integration of renewable sources of electricity (3, 4). In response to policy, activist, and automobile manufacturer initiatives around the world, markets for PEVs have begun to reemerge. Of interest here, one vehicle manufacturer leased pre-production EVs to households in southern California in 2009-10, and a few started sales and leases of production PEVs in the US in late-2011.

### *PEV Charging Infrastructure*

PEVs are able to charge at multiple rates. The slowest rate, Level 1 charging, is 1.1 kW from 120V electrical outlets. Level 1 charging can restore about 3 to 5 miles driving range per hour of charging. Faster charging requires more specialized electric vehicle supply equipment (EVSE). Most, but far from all, home charging is at a faster Level 2 supplied through an EVSE at up to 6.6kW. Level 2 charging can restore 10 to 20 miles per hour

of charging. Away-from-home PEV charging stations are either Level 2 chargers or high voltage, direct-current (DC) fast charging stations up to 50 kW. A DC fast charger can add between 60 and 80 miles of range to a PEV in approximately 20 to 30 minutes. While the PEV drivers we discuss here leased or purchased their PEVs with an expectation of coming DC fast chargers, none were in service at the time of this research.

One peculiarity shapes the conversations about away-from-home charging by our samples of PEV drivers. In California, electricity can't be bought and resold. At present operators of public charging stations typically bill for connection time, regardless of how much electricity is transferred. These prices vary by the charging provider. Though no DC quick charging existed in the study regions at the time of this research, it was imagined by respondents to be more expensive than Level 2.

### **Conceptualizing Gender**

We use two analytical conceptualizations of gender. First, gender represents the socially agreed upon biological criteria that allow for bodies to be placed into a sex category, male or female. This conceptualization enables us to identify and analyze values and norms associated with men and women. If such gendered ideals are distinguished they can be understood not as an inherent characteristic of biological sex, but as a normative behavior that is socially identified with a particular sex category. This approach permits an analysis of gender and mobility, as we identify where and how men and women adhere to or deviate from the hegemonic conceptions of what is appropriate conduct for each sex category. That is, gender represents the learned behaviors associated with masculinity and femininity. Second and consequently, we also understand gender as a messy, ever-changing social construct that does not map clearly onto a biologically defined sex-binary.

Hanson (5) identifies two strands of thinking about the question of gender and mobility. The first focuses on the ways in which mobility shapes gender ideologies, meanings, and practices. She explains that research in this strand sees mobility (and immobility) as deeply embedded in traditional gender ideologies:

“...equate women and femininity with the home, the private, with domestic spaces and restricted movement (which translates into interactions that are routine, quotidian, familiar), and on the other, equate men and masculinity with the not-home, the public, with urban spaces and expansive movement (which translates into interactions that bring excitement, challenges, new experiences, encounters with the unknown).” (5)

Research in this strand defines gender not as a static entity but as a process of behaving in ways that adhere to the hegemonic conceptions of what is appropriate conduct for each sex category. That is, gender represents the learned behaviors associated with masculinity and femininity. Increased mobility among women is construed as a challenge to these traditional gender ideologies (6). Recent work examines how gender norms and roles impact gender equality in transport policy and public agencies (7, 8) and participation in public forums (9).

The second strand (5) identified asks how gender shapes mobility. Work in this strand provides a breadth of evidence for the differences between male and female drivers (10, 11). Many studies describe gender differences in travel behaviors: commute choices and trip chaining (12, 13); automobile choice (14); and safe driving practices (15-17). These studies show that women are more likely to work at home or close to home and consequently drive shorter distances to work compared to men. Women, in general, report higher percentages of total distance traveled per day devoted to non-work activities when compared with men; transporting passengers and running errands (18). Other evidence concludes women use the car less often, drive fewer miles, and engage in trip-chaining more frequently (8, 18, 19). It seems that, despite changing socio-cultural factors in the home and the paid labor market, gendered differences in daily travel—and daily automobile travel—persist between men and women.

### **Gender and PEVs?**

Pre-market experience and early PEV sales in the US suggest gender is playing a role. Of the people who leased a pre-production electric version of BMW's MINI in California, 14% were women. Descriptions of the early buyers (and lessees) of PEVs in California indicate that so far women have purchased or leased only 29% of Nissan Leafs, 24% of Chevrolet Volts, and 16% of Tesla's Model S. In contrast, women make or are involved in over half of all new and used vehicle purchase decisions in the US. Even if it turns out the relative paucity of women participating in the market for PEVs is short-lived, decisions are being made now about the design of future PEVs, PEV charging devices, and networks of such devices. Given the differences in daily automobile

travel between women and men, and given that the vehicle and infrastructure designs are emerging from technical fields still dominated by men (20), the risk only increases that gendered differences will be “hard-wired” into PEVs and their supporting infrastructures if the initial feedback from users is also disproportionately male. Whether this is true depends not only on the proportion of women and men, but on whether the experiences of women and men with PEVs differ. The literature on gender and PEVs has used gender as a categorical independent variable to describe the research sample when explaining consumer choice, driving behaviors, and perceptions of electric vehicles. Though this research differentiates between male and female participants, gender differences are rarely discussed in detail. An exception is (21), who explores gender differences in concerns about EVs, EV safety, and belief in the sustainability of EVs. Our research lays a foundation for moving beyond the use of gender as an explanatory variable by drawing on both strands of gender and mobility research described by (21) to examine PEV purchase and use as behavior that may be experienced, and thus talked about, similarly or differently by men and women. Listening to PEV drivers talk about their vehicles, we can hear about the contextual conditions and gendered norms shaping (and being shaped by) the PEV experience. This approach supplements broad empirical data collection on gender differences on the drivers of PEV, collection yielding rich information and detailed data. The following research questions guide our discussion of the role to date of women and men in the nascent markets for plug-in electric vehicles (PEVs).

1. How are women’s locations in the PEV market and experience of PEVs’ associated socio-technical systems different from men’s?
2. Will user practices associated with femininity be overlooked in this electric vehicle market – from vehicle design to purchase and use of vehicles?
3. What do these mean for consumption and mobility practices pertaining to PEVs, and thus the private and social goals behind PEVs?

## METHODS

### *Sampling*

Data from two studies of PEV drivers in California are analyzed. In June 2011, two focus groups were conducted in Los Angeles (LA), California. The LA focus groups were convened in one of the regional markets in which a PEV underwent pre-market testing. LA Group 1 had eight participants: three women and five men. LA Group 2 had seven participants: one woman and six men. All these people leased for one year an electric-version of BMW’s MINI. 180 of these “MINI Es” were leased to households in southern California. Because of the high monthly lease payment, the requirements by the vehicle manufacturer that the EV not be the only vehicle in the household and that there be a place at home where the EV could be regularly recharged, these EV drivers tended to be high-income homeowners.

In November 2012, four focus groups were conducted in San Diego (SD), California among buyers and lessees of commercially marketed PEVs. For the four SD focus groups researchers created differences between pairs of groups. SD Groups 1 and 2 were differentiated by gender. SD Group 1 consisted of eight women and SD Group 2, ten men. SD Groups 3 and 4 were differentiated by technological interest and savvy: the less savvy SD Group 3 included two women and four men, while the more savvy SD Group 4 comprised two women and seven men.

Nearly all of the SD participants drove Nissan Leafs (an EV); one drove a Chevrolet Volt (a PHEV) but their results were omitted so that all results pertain to experience with the same type of car. As with the LA population, the population from which households were sampled had to own their home and have a suitable parking and charging location for their PEV on their premises. Thus, distributions of age, education levels, and income skewed upward compared to both the general population and the population of new car buyers.

MINI E drivers charged almost solely at home and rarely at dealerships or elsewhere. Since their experience was “pre-commercial,” they were given no further expectation there would be an increasing number of charging locations during their lease. The PEV buyers and lessees in San Diego also charged their PEV mostly at home, and rarely at a dealership. However, early market PEV drivers in San Diego had both the actuality of a growing number of Level 2 charging locations, i.e., shopping centers, parks, museums, workplaces, etc., and expectations of a network of DC fast chargers.

All of these drivers ranged from 33–77 years old, were a mix of employed and retired, and had annual household incomes ranging from \$80,000 to more than \$150,000 per year. We did not collect occupational data.

### **Data Collection and Analysis**

All focus groups were guided by an outline of topics with possible prompts and follow-up questions. However, given the exploratory approach of both the Los Angeles and San Diego research projects, the groups were moderated in a semi-structured manner. The Los Angeles protocol differed from the San Diego protocol in that it included a discussion linking PEVs to renewable fuels for electricity. Otherwise, all groups tended to cover similar topics such as PEV charging, driving range, and batteries. The moderator for all LA and SD groups was the same man, the third author.

The discussions were recorded and transcribed. Transcriptions were read as statements that might be several sentences, a phrase within a longer sentence, or a single word of agreement or disagreement with a prior more extensive statement. A researcher identified themes in these statements in a comparative and cumulative reading of the transcripts. Recognizing that the discussion outline imposes some limits on content, themes were identified in a three-step coding process: (a) open coding on the first reading to locate themes and assign initial codes, (b) axial coding to review and examine initial codes, and (c) selective coding to look for examples to illustrate themes (22). Theme creation and the selection of quotes to define and exemplify themes were carried out before being coded for the speakers' gender (the initial transcripts distinguish but do not identify individual speakers). Two researchers then reviewed the thematically organized quotes, repeating the three-step coding process to identify sub-themes by gender. These reviews were then compared to identify differences and similarities between male and female participants within themes and across themes.

Similarities and differences between statements by women and men are assessed by their content, not their frequency. As with the populations from which they were drawn, there were more men than women summed across all the groups. Normalizing counts of statements for that imbalance would not account for possible differences in style, e.g., whether speakers of one gender are more likely to make longer statements (thus leaving less time for different statements). Thus as a first level of analysis we note whether women or men said anything about a particular theme. The content of those statements are then compared and contrasted. Content analysis allows the researcher to compare content across texts by systematic recording procedures (22). We do not apply statistical analysis to the textual coding; instead we analyzed if the content existed or not. Practical statements are comments that concern using the vehicle in its current form and tend to have a present time element; typically it is how a driver adapts to the PEV. R&D statements concern ways to improve the vehicle, how a driver hopes it will change over time, or methods to understand the technology better; these tend to have an orientation to the future and focus on innovation. Although practicality and R&D tend to have a time element, it is not mandatory for placement into either category.

## **RESULTS: HOW DO THE EXPERIENCES OF WOMEN AND MEN COMPARE?**

To frame the rest of the discussion, we first state this result: while much of what women and men had to say is similar in content, women were more likely to frame their PEV and their use of it in present-oriented practical terms while men were more likely to frame their PEV and their use of it in terms of a research project, whether a present, personal one or with an eye to future R&D by vehicle and EVSE providers. Women spoke of their PEV as a tool to use in their normal, every day lives. Men elaborated on their explorations of what PEVs are, how they work, and how they would like PEVs to improve in range, decrease in price, and increase body style and size options in the future.

We start by reviewing the themes for which this generalization holds: charging the PEV, driving range, community, environment, and money. We then describe those themes for which the generalization appears not to hold in our data, that is, both women and men talk about these themes in terms of practicality or R&D: family, batteries, electricity. Finally, for two themes neither women nor men spoke in terms of practicality or R&D: safety and politics. Following the order in Table 1, we will detail differences and similarities between women and men. Some material will be distinguished by whether the speaker was from the earlier, pre-market experience of MINI E drivers in Los Angeles or from the early market experience of PEV drivers in San Diego.

**TABLE 1. Definitions of Themes**

Theme	Definition
Stronger practical/R&D distinction between women and men	
Charging	The act of plugging a car into a charger and the contexts in which that occurs, including all away-from-home charging and incipient DC fast chargers.
Driving range	How far a car can go on a charge, including desired range, taking a risk of running out of charge, planning, and remaining range instrumentation.
Community	Do PEV drivers form a community or not? Through what types of exchanges and media are those who see or want community attempting to construct it. This includes “outreach” to non-PEV drivers.
Environment	
Money	The costs associated with a PEV: cost savings compared to gasoline, cost to charge at home or away-from-home, potential cost of DC fast charging, home charger as an investment, buying more range as a dealership option
Both women and men speak in terms of either or both practicality and R&D	
Family	How a family uses the PEV, running out of charge with children in the car, size of the PEV as it relates to the family
Batteries	The PEV battery itself (not the services, e.g., driving range, that it provides), loss of battery performance, cost to replace
Electricity	The sources of electricity to charge PEVs and the effects of PEVs on the grid Solar photovoltaics, utility companies, grid impacts
Neither women nor men speak in terms of practicality or R&D	
Safety	Personal safety a public charger, crash safety
Politics	Road taxes, Reducing dependence of foreign oil, subsidies, getting public chargers installed

### ***Women and practicality: Men and R&D***

#### **Charging**

Women and men shared many similarities in discussions of charging their PEV. Faced with the disappointing pace of the deployment of workplace, public and other away-from-home charging, PEV drivers in San Diego relied mostly, if not solely, on home charging. Public charging was important for some; whether the respondent used the cost of gasoline or electricity for charging at home as the basis for assessing the cost of public charging influenced who would use public charging. Few had access to a workplace charger and some had negative experiences charging at work: confiscated cords and policies disallowing charging due to perceived safety hazards or not wanting to provide a new benefit to select employees. Etiquette to guide behavior at any away-from-home charger was something they wanted: “With the electric cars...nobody really knows yet, so anything you do, it sounds like you’re being rude, if you unplug somebody because they’re done charging...it’d be nice if a group of electric car owners got together and made up a code of ethics and published it somewhere just so you could refer to it” (23).

Respondents in Los Angeles and San Diego spoke of planning their PEV charging as a part of their daily routines. All were able to use their PEV for daily driving but were unable to go on long trips due to the unavailability of DC fast chargers. This caused frustration for many Leaf drivers because at the time they bought or leased their PEV they were told public charging would be increasingly available.

The distinction between the practical implications of charging a PEV and the R&D of charging between women and men arose in how they talked about trips too long to make on a single charge and public charging. Women who drove a Leaf discussed their options within the present slow deployment of Level 2 charging. One woman Leaf driver said, “Stopping at a [a restaurant] for six hours to charge...you’d have to go eat for a long time or shop at a mall while your car charged.” Most women judged this to be impractical and said they would take a gasoline car on long distance trips. In contrast, men discussed long distance trips in their PEV in terms of using (imagined future) DC fast chargers. These men talked less about whether DC fast chargers would extend their PEV driving, rather—almost as if their use of DC fast charging was assumed—focused on the potential price of the service, politics surrounding installation, and desirable locations. Women in the all-women group in

San Diego did not mention DC fast chargers; in mixed gender groups, women participated in conversations about DC fast chargers but did not initiate or add to the discussion.

### **Driving Range**

Women and men, MINI E and Leaf drivers, discussed most of the same topics within the theme of driving range. They confirmed the real-world driving range of 70 to 90 miles of their PEV met most of their daily driving needs: “Really, 99% of my driving is within 20 or 30 miles so it’s perfect for me.” Others would like a slightly longer range so they could include more daily destinations. As with charging, a few participants explained that planning is an important aspect of driving a PEV: “If I’m going to make a trip...look it up on a map, find out how many miles it is, what’s the terrain, figure out if there are going to be any side trips besides where I’m going and include that into what I know my range is on the Leaf...Otherwise, I don’t make the trip.”

Concern about running out of charge short of home or another charger was mentioned as a concern, primarily when they first got their MINI E or Leaf but only occasionally once they became comfortable with the range. Rather than being anxious, some were excited to take risks testing the range: “I purposely did some test drives to see how far it could go to make sure I could get back to the house to figure out what my comfort level is.” Others, in anticipation of not being able to make an entire trip, have chosen to drive a gasoline car instead.

Differences between women and men centered around their response to the remaining range information provided by their car’s instrumentation. Almost all the Leaf drivers—women and men—believed the information was unreliable; the difference was in their response to this perceived unreliable information. Many women refused to drive the PEV before charging it again if it had less than a threshold amount of range left, generally double or triple the amount needed for a trip. They were frustrated with the rapid fluctuation of the indicator. Many women thought the Leaf to be impractical if they couldn’t travel the distance they desired which is assessed partly through the remaining range indicator. Men also distrusted the Leaf range indicator; however, they were more likely to continue to drive the PEV and were more comfortable taking trips without having double the range required. Their lack of confidence in the remaining range information was less likely to deter men from driving and in some instances challenged them to push on. Many men decided to conduct their own research and devised a calculation to produce their own estimated remaining range.

### **Community**

Both women and men discussed the idea of a community of PEV drivers. One Leaf driver shared an experience of charging at a popular charging station: “It just seemed like that was the convention hall. If you plug it in, the next thing you know two more would show up and we’re all sharing ideas.” Many had conversations with other PEV and non-PEV drivers about their vehicle. Some Leaf drivers turned to online forums, blogs, and crowd-sourced databases to learn from other PEV drivers. For most, the amount of time they spent on these sites diminished the longer they had their Leaf: “I learned a lot initially before I got it and maybe the first few months [after I got the car] and I was on the Nissan [Leaf] blogs and all that. But since I found out everything I need to know, that was it.” In contrast some PEV drivers disdained the idea of a community: “I never felt like I was doing this to get into some sort of community.”

While women and men all talked about community, they differed in their eagerness to seek out or form such a community. Men were very excited about talking to people about their PEV. Men were eager to share their ideas and exchange information to build on their own R&D. Women were willing to answer questions in a chance, face-to-face conversation but were less likely to seek communication or information online. Most cited a lack of time as the cause; devoting time to these conversations, interactions, and information searches was impractical.

### **Environment**

For many women and men, the environment was the primary reason for purchasing a PEV, i.e., buying and driving a PEV was putting their environmental beliefs into action: “We are environmentalists, so we always try to support things we believe in. So we thought an electric vehicle would be the logical choice.” These motivations could be about doing something to reduce their environmental impact and about reducing feelings of guilt: “I literally had a sense of guilt driving a gas car so that’s what brought me to buy a Leaf.”

Of those women and men who were motivated by environmental concerns, buying and driving a PEV put those concerns into action in the here and now. For women, this tended to be where the conversation stopped. Environmentally motivated men were more likely to continue on to discuss R&D. Their environmental

assessments were reached after they researched environmental impacts of gasoline and developed ideas about how to make PEVs desirable to a broader base of people. Some of these men looked to other aspects of PEVs, e.g., acceleration and driving performance as being as important—both as additional motivators for themselves now and as the way to continue to bring other people to PEVs. This research expanded their ideas about how PEVs changed the sources of pollution: “Even if there’s pollution in manufacturing electricity, that can be redistributed someplace where it’s not got near the impact [in] this basin we’re in environmentally.”

### **Money**

Women and men shared several ideas regarding money and PEVs. Primarily, they appreciated what they perceive to be cost savings because they paid less for electricity than gasoline: “I like telling people that I can run for 3 cents a mile and they’re running for 22 cents a mile. I just like the look on their face.” Other positive important financial considerations included PEV purchase (or lease) incentives: a California state rebate of \$2500 and a US federal tax credit of \$7500.

When public charging first rolled out in San Diego the electricity was free. Public charging was shifting to a paid service at the time of the San Diego focus groups in Fall 2012. Women and men spoke about this change: “A dollar an hour isn’t that big of a deal, but there’s a big gap between \$1 an hour and free.” With the advent of pricing, some declined to use public charging unless they were going to run out of charge: “It’s become in the event of an emergency.” Some were no longer interested in charging in public because they could charge for less money at home and didn’t need to charge in public to get home.

For women and men who drove a Leaf, much of the conversation about money was devoted to fairness. Women and men prefer to be billed for the amount of electricity required to charge their car, not how long their car is connected to the EVSE. DC fast chargers were not available at the time of the San Diego focus groups but drivers had heard rumors of the pricing and were displeased. This driver compared the cost of one DC fast charge to a month of home Level 2 charging, “My whole [bill for charging my PEV at home] for the month will be maybe \$30. So if you tell me it’s going to take me \$15 to do one [DC fast] charge, that’s ridiculous.” All agreed that pricing for DC fast charging would be higher than they thought fair.

Differences between women and men appear in the additional topics men address. Women focused on monetary motivations for purchasing a PEV; they were tired of paying so much for gasoline and liked that electricity costs less. The perception that their PEV saved them money now won them over. Men were likely to also express concern about gasoline prices going up in the future; they were excited they didn’t need to worry about that. Men also discussed their home PEV charger as an investment: “This improves the value of my home because I’ve got a universal charger already built in.” Men also talked about whether to pay more for more driving range in a future PEV.

### ***Practicality or R&D, But Not Both***

Three themes did not fit into the construct of women’s interest in PEVs as a practical tool and men’s interest in R&D: family, batteries, and electricity. Family was discussed only in terms of practicality, whereas discussions about batteries and electricity focused only on R&D.

### **PEVs and Families**

Women and men with young children spoke about parenting needs and how their PEV fulfilled them in terms of the practicality; there was no discussion of R&D. They used their PEV for daily needs and only occasionally did their PEV not meet their parenting needs, generally for a long trip. For these occasions, the drivers were amenable to using a gasoline car in the household or renting one for the trip.

The prospect of running out of charge with a child in the car produced two different responses to public charging. On one hand, public chargers could be used to ensure the PEV met their daily needs of errands and parenting needs: “I can charge up while I’m running errands, then I can pick up my kids, run my kids around and then get home.” Others avoided using public chargers with their children in the car because they didn’t want to entertain their children while waiting.

Women and men were distinguished in their discussions of the size of the PEV: the MINI-Es were two-seaters and the Leafs are small five-seat hatchbacks. Women did not make any mention of the size of the vehicles in the context of whether or not they were practical cars. Men split on this matter in a way that illustrates how present vs. future tense verbs alone are insufficient to distinguish our categories of practical vs. R&D. Some

men were pleased with the size of their (present tense) PEVs: “The Leaf it has everything – the range, the power, the space. The kids throw their baseball stuff in.” Other men found the size impractical for their families. As one man said, “I want to grow my family. So where is, for lack of a better term, the minivan version of [a PEV]? Where is the wagon version with seven passengers?” These men wanted a PEV for their (future) family; the size of their present PEV would be impractical. Despite these men being concerned about the future, this isn’t an example of speech about R&D; for example, they were not doing research on what larger PEVs might be available.

### **Batteries**

Here we distinguish the battery from the services it provides, e.g., driving range. Women and men spoke about R&D regarding the battery; no one discussed batteries in terms of practicality. Some were worried about a loss in battery performance over time. Some claim they are experiencing it now: “The battery capacity is going down. I’ve lost over 15% in my range in my car. So I’m needing to charge much more often.” Many of the drivers charged their Leaf to 80% instead of 100% because they were told by the dealership and manufacturer this would forestall battery degradation; this was their attempt at conducting research on their own vehicle. The potential cost to replace the battery was an important issue to these drivers. Still, most remained confident—or maybe hopeful—that in the future battery prices will come down and driving ranges will go up. Most of the discussions about batteries came from men as they did their own research on battery technology and development and were eager to share their ideas with others.

### **Electricity**

Electricity was another theme that men and woman talked in terms of R&D but not practicality. Many drivers spoke about researching solar photovoltaic (PV) systems for their home and appreciated the connection of driving a PEV powered by solar electricity, although not all drivers had PV installed at their homes. Drivers had concerns about the electrical grid and the demand that PEVs place on it: “*The public chargers are mostly daytime and that’s why people have been working hard on software systems for dynamic balancing and public charger infrastructure and the grid itself...You have to have some dynamic way of telling those chargers on the fly, ‘whoa, doggie,’ because we’re already overloading the grid.*” Some agreed that time of use electricity pricing might mediate this problem.

### ***When Practicality and R&D Did Not Apply***

For two themes the ideas of practicality and R&D did not arise at all, and therefore can’t distinguish whether the content of women’s and men’s speech are the same or different: safety and politics. Women did not speak of safety in practical matters and they did not discuss politics at all. Men did not talk about R&D regarding safety or politics, though they had a lot to say on both. Still, there are other similarities and differences in the statements of women and men on these topics.

### **Safety**

Safety at public chargers was important to women and men, especially the safety of women at public chargers. Men also discussed safety of the vehicle itself. That a PEV was a good family car in part because of crash safety was explained by one man who was impressed by another focus group participant’s experience: “You’ve got a woman with four children in four different schools doing all that you do and doing it in an electric car. Go back five years and she’d be in a Honda Odyssey. This is a true five-passenger car. You feel absolutely safe in it. It rides incredibly well... I can’t think of a better ad.”

### **Politics, From Personal to Global**

The only incidence of a woman saying anything about politics, either in the all-women group or mixed groups, is when she agreed when a man said that PEV drivers should not be exempt from paying a tax to maintain roads. Men, on the other hand, had a lot to say about politics. For some it was their primary reason for purchasing a PEV, in part because of reducing dependence on foreign oil. Many men were pleased with the support for PEVs from the government, especially the subsidies to consumers. In contrast, many men were frustrated by perceived political barriers to the deployment of charging infrastructure. Finally, some believed that they were paving the way for the rest of the world: “Africa and in China and India and the Middle East they’re just dumping oil and everything else and nobody seems to care. But it’s nice to try and lead the way and I like to be able to brag a little bit.”

## **DISCUSSION: WHAT FACTORS CONTRIBUTE TO DIFFERENCES AND SIMILARITIES IN THE EXPERIENCES OF THESE WOMEN AND MEN?**

In general, these women and men discussed much in common regarding life with their PEVs. There were far more similarities than differences in conversations, regardless of group composition: all female, all male, or mixed gender. They agree their PEV meets their daily driving needs. They want to see a public charging network in their area—if not for themselves then for others so as to increase the number of PEVs on the road. They want to pay for the amount of electricity they take from a public charger instead of paying for the amount of time their PEV is connected to that charger.

Where there were differences between women and men, women PEV drivers in these focus groups talked about managing existing conditions and accomplishing immediate travel needs. They talked far less about active research, information gathering, and speculation about future conditions. Women talked little about longer driving range and public charging, but talked more about how they made the existing capabilities of their PEVs and extant charging opportunities work for them. It is not possible for us to conclude why women did not talk about certain things—no one says why they don't talk about something. We know they did not discuss DC fast chargers; not talking about something that isn't present in their day-to-day lives fits a pattern of focusing on what is present. Women found the rapidly fluctuating range indicator untrustworthy and impractical; they wanted an accurate tool so they could gauge their remaining travel before arriving home or at another charging location. They found charging their PEV at home provided a practical convenience compared to buying gasoline for their car. Some remained open to using public charging as it shifted to a paid service because public charging filled a present need.

While women would participate in live and virtual PEV communities if they needed information, the time required was seen as impractical and a deterrent for most. Women typically were not contributors to on-line media or participants in public outreach events and were more circumspect about casual questions from strangers. Paying less for electricity than gasoline—even when paying for public charging—as well as the vehicle purchase incentives were built into a case for the present cost savings of a PEV. Those with young children found the car to be a practical car.

Where there were differences, the men PEV drivers in these focus groups treated their PEV more as an R&D project. While they talked about problem solving for their PEV, this often extended to passing on solutions to problems they experienced as well as keeping up with, or even producing, information on technological developments. They spoke more about what they want from a future PEV. They were likely to be knowledgeable about technological developments, research, infrastructure technology, deployment, and talked about time spent to do research or gather information. They often looked at away-from-home charging in terms of as yet non-existent DC fast charging: locations, prices, contexts in which they would use them, and potential harm to the battery. They were less interested in public charging once it wasn't free. Rather, they were willing to push past their old comfort levels for driving range. They viewed the fluctuating range indicator as a challenge to overcome; a few developed their own range calculators. They viewed a PEV community as a resource for research and a platform to share their own developments; many devoted a lot of time to speaking with people in person and online. These men did considerable research regarding their PEV and the environment, the political and environmental impacts of gasoline, how and where their electricity was produced, and developed ideas about how to conjoin the environmental benefits of driving a PEV to the larger population of vehicle drivers by promoting PEV driving performance.

Men spoke in detail about the theme of money, specifically about the potential future costs of DC fast charging and battery replacement. Through their research they learned about how battery degradation may impact them, future uses of batteries, and future battery chemistries. They wanted driving range options for future PEVs so they could purchase as much as they wanted. They researched PV energy systems for their homes. Some who had a home PV system prior to purchasing their PEV had designed the PV system for both their existing household demand and their anticipated PEV charging.

## **CONCLUSION: ARE WE HARDWIRING GENDER DIFFERENCES IN PEVS?**

For all their similarities, the differences between women and men illustrate how each engage PEVs and highlight how PEV manufacturers, charging infrastructure companies, and policy makers can support both genders in their use of a PEV. There were differences in how women and men were likely to experience the

PEV; women as a practical tool and men as an R&D opportunity. A similar distinction has been made in other contexts. In the context of management styles, (24) reported men were thought more likely to create innovative solutions, i.e., to change the system, while women were thought more likely to create adaptive solutions, i.e., to create change within the system. (25) found that graduate students perceive “men choose more theoretical subjects for their theses and women more practical ones.”

However, noting the many similarities in the content of the statements of women and men on a variety of themes from conversation about their PEVs, we do not draw the conclusion that the biological female or socially-defined woman is inherently more practical than the biological male or socially-defined man. We do say that if the future course of PEV vehicle design, PEV charging infrastructure, and more generally the course of PEV market development is being determined by voices *such as* those we heard, at present the voices of women are more likely to be silent than the voices of men regarding these future developments. In the present PEV market, more than 70% of consumers are men and the women who are present are less likely to discuss future developments: the early consumer feedback is male dominated. Paired with male dominated technological production, (26, 27) argue that even objects that are ostensibly designed for everybody are designed unconsciously based on the male users’ images. When the user is assumed to be universal it is often a masculine universal, and masculine ideals are prioritized when thinking about vehicles. For example, (28) demonstrates how car design and manufacturing have limited women’s access to public space and independent activity.

Much of women’s and men’s use and experience with their PEVs sounds similar, but the differences indicate a gendered approach to PEVs. Women’s location in the PEV market is secondary to men’s: there are fewer women and those there are speak less to future developments than do the more numerous men. User norms associated with femininity, such as trip chaining or transporting family members, may be overlooked in the PEV market from vehicle design to use of the vehicles. This lack of voice to what women want and need from a PEV may slow the future adoption of PEVs by women, and therefore the total number of PEVs sold and the attainment of the policy goals underlying government support. Women may be left to adapt to a system designed by men for men, or not participate at all.

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# Women's acceptance of and willingness-to-pay for connected vehicles

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## ABSTRACT

When deployed, connected vehicles (CV) will communicate with the roadway and each other. Among the benefits of CV, safety stands out. It has been estimated that a full deployment of CV would mitigate 81 percent of all vehicle crashes involving unimpaired drivers. A decrease in crashes and vehicle conflicts would also improve mobility.

Sources in the popular media estimate that women in the U.S. buy 52 to 65 percent of all new cars and influence 85 to 95 percent of all car buying decisions. Studies have indicated that women are more automobile safety and environment conscious but more vehicle price sensitive than men. Thus, consumer acceptance of and willingness-to-pay (WTP) for vehicle technology may vary by gender. The purposes of this research are to discern women's WTP for CV, accounting for CV costs, socioeconomic characteristics, and perceived safety benefits and suggest policies for CV promotion and diffusion.

The methodology consists of an online survey of drivers and conjoint analysis. Adaptive Choice-Based Conjoint analysis (ACBC) uses stated preferences for CV product bundles and estimates WTP by gender, income, education and age. For both men and women, price is the most important factor for choosing various bundles of CV technologies. The analyses indicate with statistical significance that women are more conscious of safety, fuel consumption, and environmental impacts when buying vehicles, but women had less knowledge of CV than men. Women's budgets for vehicle purchases were lower than men's, yet women are willing to pay as much as men at the individual technology level (e.g., safety) as well as at the aggregated level. Thus, women have higher WTP than men relative to their budgets and lesser knowledge. The associations of gender with income, education and age do not show statistically significant differences, but are suggestive. Women's WTP declines greatly with high income and at age 50 and over. These findings have policy implications for CV promotion to mature women.

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**KEYWORDS:** Connected Vehicles; Willingness to pay; Consumer acceptance; Safety; Conjoint analysis.

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## INTRODUCTION

Motor vehicles are on the verge of communicating with the roadway and each other. One should note that, while there are various sensor-based "smart car" technologies (SCT) on the market today, connected vehicles (CV), those that communicate vehicles' intentions in order to avoid collisions, have not yet been deployed. The primary benefit of SCT and that expected of CV is enhanced traffic safety. According to the National Highway Traffic Safety Administration, a form of SCT, electronic stability control (ESC), saved an estimated 1,045 vehicle occupants' lives in the U.S. in 2011 (1). This estimate represents a substantial increase since 2009. In recent years, the percentage of passenger vehicles equipped with ESC has increased dramatically, because Federal motor vehicle safety standards required ESC to be standard equipment for all new passenger vehicles by September 1, 2011 (1). As the overall passenger vehicle fleet is renewed with ESC equipped vehicles, the lives saved should continue to rise.

The safety benefits of CV may be even more profound than that of existing SCT technologies. Najm et al. estimate that a full deployment of CV would mitigate 81 percent of all vehicle crashes involving unimpaired drivers (2). A decrease in crashes and vehicle conflicts would also improve mobility and reduce congestion and environmental impacts. The ITS Joint Program Office of the U.S. Department of Transportation (USDOT) is convinced of CV safety and environmental benefits and is particularly focused on the social and institutional frameworks that would support transition to deployment (3).

Sociocultural factors, particularly associated with gender, could indeed have deployment effects. It is well established in the research literature that women have different behaviors from men regarding trip purpose

and trip-chaining associated with household and child care duties (4, 5). Studies have shown that women drivers in Europe have more positive attitudes towards traffic regulations and safety and die at much lower rates in traffic than men (6). According to the latest Traffic Safety Facts of USDOT, in 2012 the number of male drivers involved in crashes was three times as high as the number of females (7). The difference has not changed for over the last twenty years. As women have driven more over time, they have not adopted men's driving behaviors.

Sources in the popular media estimate that women in the U.S. buy 52 to 65 percent of all new cars and influence 85 to 95 percent of all car buying decisions (8, 9). Yet, women's acceptance of and willingness-to-pay (WTP) for vehicle technologies may differ from those of men. A survey of plug-in electric hybrid vehicle acceptance in the U.S. indicated that women had different vehicle preferences, but had similar WTP for these advanced vehicles (10). Among Japanese early adopters of electric vehicles, women were more excited about purchasing new technologies and more environmentally conscious than men, and willing to sacrifice some comfort for the sake of the environment (11).

While women may be more environmentally conscious than men, Croson and Gneezy conclude that women are also more risk averse and have different social preferences when making economic decisions (12). From data derived from a Toronto area car ownership study, Mohammadian modeled gender differences in automobile ownership choices (13). He found that women preferred practicality, safety and roominess in vehicles, while men preferred power and performance. Women were also more sensitive to price of automobiles than men. Vrkljan and Anaby found that Canadian women rated safety significantly more important, among all age groups, than men did when buying a motor vehicle (14). Women tended to rate safety similarly across the lifespan, while the importance of safety for male drivers increased with age.

In a survey of SCT acceptance, more male vehicle owners had such technologies than women, but the numbers varied by age group and type of technology (15). More females between ages 18 and 44 owned vehicles with reversing aids (backup warning and cameras) and adaptive cruise control than their male counterparts. Thus, women would likely accept CV as much or more than men, but their WTP for these kinds of technologies is unknown. It is the hypothesis of this research that women have higher WTP than men for CV technologies that advance safety, but WTP will vary by age, perception of safety benefit, financial constraints, and sociocultural factors.

## **PURPOSE**

The purposes of this research are to discern women's and men's WTP for CV technologies, accounting for costs and budgets, perceived safety benefits, sociocultural factors and demographics and to suggest policies for CV promotion and diffusion.

Specific objectives are:

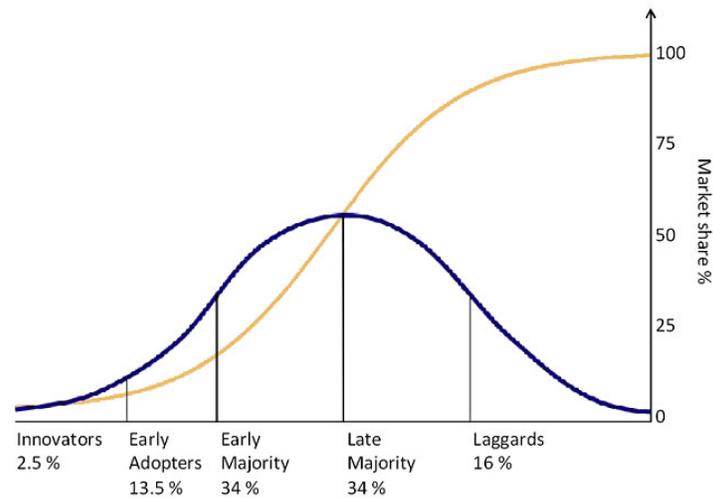
- Understand drivers' preference structures based on an online survey;
- Determine WTP of various bundles of CV technologies related to safety by demographic characteristics and other factors;
- Provide recommendations to government and the automobile industry related to promotion of CV acceptance.

One could argue that consumer acceptance and WTP would not be an issue for market penetration, if government mandates CV deployment. However, studies show that mandates do not necessarily diffuse technology rapidly. Mandated airbags took 16 years to achieve 100 percent penetration (15). The variety of CV technologies, the undefined safety benefits, and the significant costs may result in no mandates for the foreseeable future. Within a heterogeneous vehicle/driver population some may not wish to purchase CV technology. Hill and Garrett estimate a transition period of about twenty years for CV to penetrate the entire vehicle fleet (16).

## **LITERATURE REVIEW**

The diffusion of a new technology usually requires a lengthy time period. The length of diffusion time (or rates of adoption) will be dictated by many social, technical, and political factors. "Diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system"

(17). There is general agreement that most innovations experience an S-shaped rate of diffusion (Figure 1). Depending on characteristics of technology, acceptance by users, and other factors, the slopes (diffusion rates) on the curve would vary.



**FIGURE 1. Diffusion of Innovation**

Source: Rogers, E.M. *Diffusion of Innovations*, 5<sup>th</sup> ed. New York, NY: Free Press

An individual's acceptance of a new product could be influenced by five characteristics of the innovation: relative advantage, compatibility, simplicity, trialability, and observability of the new product (18, 19). Relative advantage is the degree to which an innovation is perceived as being better (economically and socially) than previous products. Compatibility refers to the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters. Simplicity (as opposed to complexity) refers to the degree to which an innovation is perceived as being easy (as opposed to difficult) to use and requires little learning of new skills or information. Trialability deals with how easily a potential user can "test drive" the innovation. Observability focuses on the extent to which an innovation and its benefits are visible to individuals. Other factors have also been identified as being important to the diffusion process, including cost, profitability, and social approval (20). These innovation characteristics provide important insights in designing a stated preference survey.

Acceptance rates of a new technology are also influenced by the socioeconomic characteristics of users. According to the Bass Diffusion Model, the adoption rate of a new product is shaped in part by the interaction between two types of adopters, namely innovators and imitators (21). Innovators are those who decide to adopt an innovation independently of others. They are early adopters who are willing to take risks, are affluent, and base their decisions on external information (18). Imitators on the other hand are more likely to be influenced by the decisions of others. They are also called late adopters. The imitation effect eventually takes over, leading to rapid diffusion rates and has been described by a variety of terms, including "word of mouth," contagion," and "interpersonal communication" (22). The Bass Model has been successfully applied to forecast subscriber rates for DIRECTV and to plan the launch of 3G technology.

The diffusion theory discussed above was also employed in a 2011 USDOT study on the CV deployment plan (16). The study examines different CV deployment scenarios from the perspectives of the public sector interests and market and technology readiness. Depending on the scenarios, the study estimates that it would take 15 to 25 years to reach a deployment rate of over 80 percent (16). It may seem to be a reasonable estimate given evidence from the past. For example, anti-lock brake systems were first introduced in 1971 (on GM Cadillac and Chrysler Imperial models). It took about 19 years until the diffusion rate reached its peak (16). By 1994 it had reached a mature state where about 60 percent of vehicles employed the system. Since its first introduction, the airbag went from zero penetration in 1980 to 100 percent in 1996 (16). It should be noted that the airbag became mandatory for all new vehicles in 1991.

A long transition period similar to the aforementioned vehicle safety features is likely for CV technology. Acceptance of CV safety features could take longer because of the complicated nature of CV technologies.

Unlike seat belts, for example, the benefit of which is independent of other drivers' use, CV benefits can be fully realized only when interacting vehicles or infrastructure are equipped with CV technology. Hill and Garrett expect that the probability of obtaining benefits from a CV system is less than 50 percent over 17 years from the initial introduction (16). However, it is not clear from their report how this estimation was made.

CV technology is not as simple as retrofitting seatbelts in a car. CV systems may consist of numerous features that assist drivers. For example, six potential CV applications were tested during the USDOT sponsored driver clinic studies: Forward Collision Warning, Blind Spot Warning/Lane Change Warning, Left Turn Assist, Intersection Movement Assist, and Do Not Pass Warning (23). According to the team's technology scan, there are at least 30 applications. Some of them may overlap, because some applications with similar functionalities may be named somewhat differently by manufacturers. The point is that unlike seatbelts, multiple combinations of CV applications are being considered, while there has been no clear idea about priority of applications and consumer acceptance. Given the complexity of CV technology features, a closer examination of technology diffusion should be made using user preference estimation.

Two methods are available for estimating consumer preference structures and WTP: revealed preference (RP) methods and stated preference (SP) methods. RP methods are based on the observation of market data or controlled laboratory experiments of consumer behavior, while SP methods infer information from interviews and/or surveys. A SP method has to be used when there is no market or controlled experiments are not possible. With that said a preliminary review of literature, including a recent presentation on the preliminary findings for the USDOT driver clinic (23), found that no studies have utilized a sound methodology to estimate WTP for CV technology. A direct question is often employed, asking participants the maximum dollar amount that they are willing-to-pay. Such a question is not able to identify tradeoffs that consumers make when evaluating bundled equipment attributes and is therefore unable to establish associations between participants' valuation and real purchasing behavior (24).

SP methods can be further separated into two categories: direct SP surveys and indirect SP surveys. The former involves asking marketing experts and/or potential consumers to indicate acceptable maximum/minimum prices. This method has been employed by some WTP studies for new in-vehicle technologies in Europe (25, 26, and 27). However, this method focuses too much on prices and cannot relate stated WTP to real purchase behavior (24). An indirect SP method, the second category, is conjoint analysis. Used in marketing research extensively, conjoint analysis is also known for its effectiveness in measuring preference structures of a new product that has no historical data (28, 29).

Conjoint analysis is "a technique for measuring individuals' preference structures via systematical variations of product attributes in an experimental design" (24). Since its introduction in 1971, conjoint analysis has been the most frequently used market research technique for measuring consumer preferences among alternative goods and services (30). It is a more realistic method to estimate the psychological tradeoffs that consumers make when evaluating bundled products. It identifies not only the relative importance of product attributes, but also the most preferred bundles of attributes. There are various types of conjoint analysis, including traditional conjoint analysis, choice-based conjoint analysis (i.e., discrete choice model) and a hybrid model. In particular a discrete choice model (also called choice-based conjoint analysis) can provide aggregate choice behavior of different product bundles, which can be used to estimate WTP.

In the field of transportation, conjoint analysis was successfully used by Green et al. in designing the launch of an integrated electronic toll system in the New York-New Jersey area (E-ZPass) (28). The study predicted a 38-50 percent adoption rate, which would vary among seven participating agencies. Four years after the study and with two E-ZPass agencies, the adoption rate reached 40 percent, implying that carefully designed conjoint analysis could reasonably predict future market penetration. This result provides important implications for policy formulation by the public sector and for private CV providers' marketing plans.

## **METHODOLOGY**

Conjoint analysis was chosen for this research effort, because it is an appropriate method to identify preference structures and WTP for new products or products not yet on the market (28). Specifically, an Adaptive Choice-Based Conjoint (ACBC) survey was used to determine stated preferences (31). ACBC is a new and the most advanced conjoint analysis technique that studies how people make decisions by simulating real purchasing behaviors.

An online survey was developed to measure drivers’ acceptance of and WTP for CV technology relating to safety and mobility. The survey was developed using Sawtooth Software’s SSI Web software and was divided into three sections. The first section consisted of questions on key socioeconomic characteristics (e.g., gender, age, and the number of adults and children under 18 in the household), last vehicle purchase/lease experience and research on safety features, current driving habits and the level of technology in the driver’s current vehicle. Drivers were also asked the extent to which various attributes, including safety, mobility, vehicle performance, and environmental concerns, would be important to them when purchasing a new vehicle. Drivers were then asked the degree to which they were familiar with the concept of CV technology.

The second section focused on drivers’ stated preferences for CV technology relating to safety and mobility. Drivers were first provided with a description of the different technology features. There were five attributes (collision package, driver assistance package, enhanced safety package, roadway information package, and travel assistance package) that included nine safety features and two mobility features (Table 1). Drivers were first asked to configure their own preferred bundle of attributes at the “build your own” (BYO) section. They were then given screening questions to answer; respondents were shown four products at a time and were asked to consider whether each one was “a possibility” or not “a possibility.”

**TABLE 1. Connected Vehicle Technology Choice Attributes**

Attributes	Levels	CV Technologies
Collision Package	1	None
	2	Front Collision Warning
	3	Side Collision Warning
	4	Front & Side Collision Warning
	5	All-Around Collision Warning
Driver Assistance Package	1	None
	2	Lane Departure System
	3	Intersection & Left Turn Assist
	4	Lane Departure System, Intersection & Left Turn Assist
Enhanced Safety Package	1	None
	2	Do Not Pass Warning
	3	Pedestrian & Cyclist Alert
	4	Do Not Pass Warning, Pedestrian & Cyclist Alert
Roadway Information Package	1	None
	2	Road Condition Notification
	3	Slow/Stop/Wrong-way Vehicle Advisor
	4	Road Condition Notification, Slow/Stop/Wrong-way Vehicle Advisor
Travel Assistance Package	1	None
	2	Real Time Travel Planning & Route Optimization
	3	Parking Spot Locator
	4	Real Time Travel Planning & Route Optimization, Parking Spot Locator

During different stages of the screening rounds, based on noncompensatory screening rules, drivers were asked to identify levels that were “totally unacceptable.” In addition, drivers were asked whether there was a particular level of one attribute that would be a “must have.” There were seven screening tasks, four “unacceptable” questions, and three “must have” questions. This information was then used to develop potentially desirable products for each respondent. These product bundles were shown three at a time, and respondents were asked to identify the most appealing product bundle in each instance (Figure 2). The winning concept from each round moved on to subsequent rounds, until a preferred concept was identified. The third section asked additional demographic questions, including income and education.

⚙ Among these three, which is the **best option**? (We've grayed out any features that are the same, so you can just focus on the differences.)

(1 of 8)

Collision Package	All-Around Collision Warning	N/A	Front & Side Collision Warning
Driver Assistance Package	N/A	Lane Departure System	N/A
Enhanced Safety Package	N/A	Do Not Pass Warning, Pedestrian & Cyclist Alert	N/A
Roadway Information Package	Slow/Stop/Wrong-Way Vehicle Advisor	N/A	Road Condition Notification, Slow/Stop/Wrong-Way Vehicle Advisor
Travel Assistance Package	Real Time Travel Planning & Route Optimization, Parking Spot Locator	N/A	Parking Spot Locator
Price	\$1,604	\$1,908	\$1,674

← →

0%  100%

**FIGURE 2. Example of a Choice Set Question**

## DATA COLLECTION

The authors' survey questionnaire was reviewed by a technical advisory committee, then revised and administered to a small group for testing. The test showed that respondents focused on CV's safety benefits, costs and convenience. There was concern by some respondents over the questionnaire's length; women were more inclined to complete the questionnaire. After further revision, the survey was applied online and promoted to various groups, including personal contacts, mailing lists, and social media, such as Facebook, Craigslist, and Backpage. Recruiting through social media attracted the majority of participants. Even though the participants would not make up a random sample, the authors expected that the unique topic, intense focus of the survey, as with a focus group, and iteration would yield meaningful results.

## ANALYSES AND FINDINGS

### *Participant characteristics*

In total, 865 people participated in the survey. Roughly 52 percent (450 participants) completed all three sections (socioeconomic, CV choice, and additional socioeconomic questions) of the survey. After the data quality assessment, 65 completed surveys were removed from the data set, leaving 385 surveys in the analysis data set.

Men made up a larger proportion of the total number of participants than women, 54 percent and 46 percent, respectively. The largest grouping of both men and women was between 30 and 59 (Figure 3). In general the female sample was relatively younger than the male sample. About 65 percent of both men and women participants had bachelors' or higher degrees, which is much higher than the national average of 29% in 2013 (32). Such a skewed population distribution is probably due to the nature of the sample method – online based survey and use of personal contacts and organization email lists. Also, the large draw from social media could be a contributing factor, because there is a positive association between educational attainment and internet use (33). Women were generally over-represented in the lower income cohorts but well represented in the higher income groupings (Figure 4). About 37 percent of men and 29 percent of women said their annual household income is \$100,000 or higher, which is also higher than the national average of 22 percent in 2012 (34). A higher proportion of participants with post-secondary education seems to be a contributing factor. While survey participants were better educated and higher income than the population as a whole that should not be an issue, because early adopters of technology tend to have higher incomes and education than imitators.

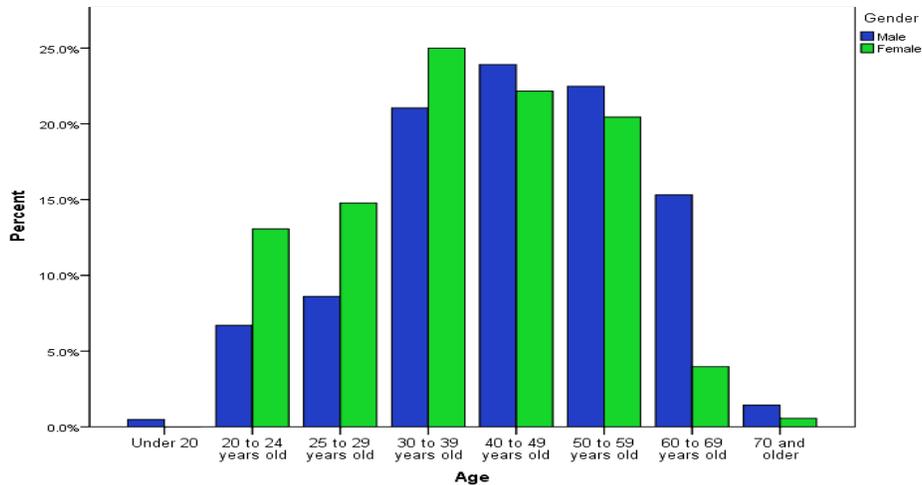


FIGURE 3. Participants Age by Gender (n = 385)

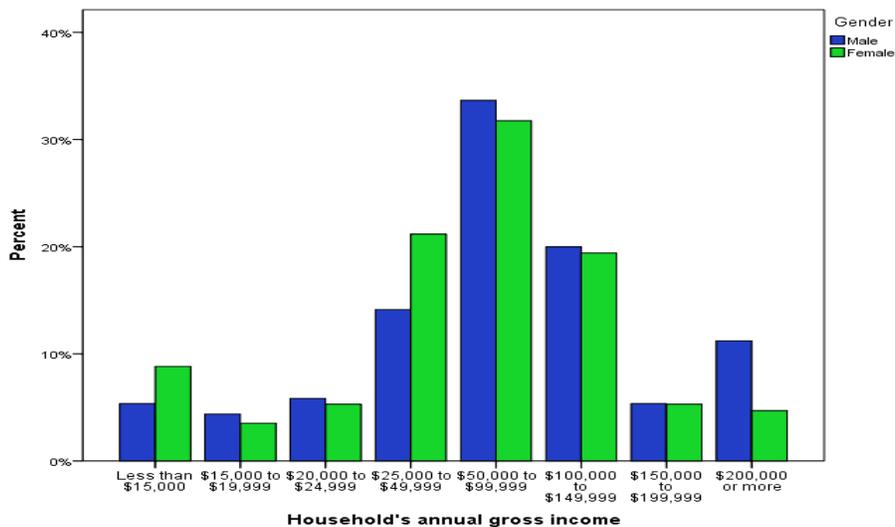


FIGURE 4. Household Annual Income by Gender (n = 375)

To identify participants' purchase/lease experience (especially differences between genders), questions regarding the level of involvement and level of confidence in purchasing vehicles were asked. Men were more involved ( $t(372) = 3.03, p = 0.003$ ) and confident ( $t(372) = 7.24, p < 0.01$ ) than women. In other words men acted more independently in making purchases, while women acted more collaboratively and sought the input of others.

Potential differences in car purchasing budget levels and preferred vehicle features were evaluated. First, women set aside smaller budgets for purchasing a vehicle than men. Roughly 53 percent of women answered that their minimum budget for vehicle purchase is \$10,000, while 32 percent of men said so. When it comes to a maximum budget level, women again want to spend less than men. Approximately 40 percent of women may spend \$20,000 to \$25,000 as a maximum, whereas a similar proportion of men want to spend \$30,000 to \$35,000. For both minimum and maximum budgets, the gender difference was statistically significant (minimum budget:  $t(368.9) = 4.76, p < 0.01$ ; maximum budget:  $t(365.5) = 3.58, p < 0.01$ ). In other words, men want and can afford more expensive cars. This result conforms to past studies (12, 14); that is, women are more price sensitive in economic decision making.

Second, participants were asked to rate (on a 4 point scale) the importance of nine vehicle features when they purchase a vehicle. The features were safety, exterior design, engine power, status, driving comfort, interior space, fuel consumption, reliability, and environmental impacts. As expected, women were more

interested in safety, fuel consumption, and environmental impacts than men. T-test indicates women's preferences are significantly different from men: safety ( $t(313.6) = 5.28, p < 0.01$ ), fuel consumption ( $t(370.8) = 3.54, p < 0.01$ ), and environmental impact ( $t(372) = 3.73, p < 0.01$ ). However, gender differences for the other features were statistically insignificant, which differs from Mohammadian's findings (13).

In general men claimed to be more knowledgeable about CV technologies. Approximately 63 percent of men said that they were knowledgeable or knew something about CV (Figure 5). On the other hand, less than half (44%) of women said they were knowledgeable about CV. This difference was statistically significant ( $t(383) = 3.81, p < 0.01$ ).

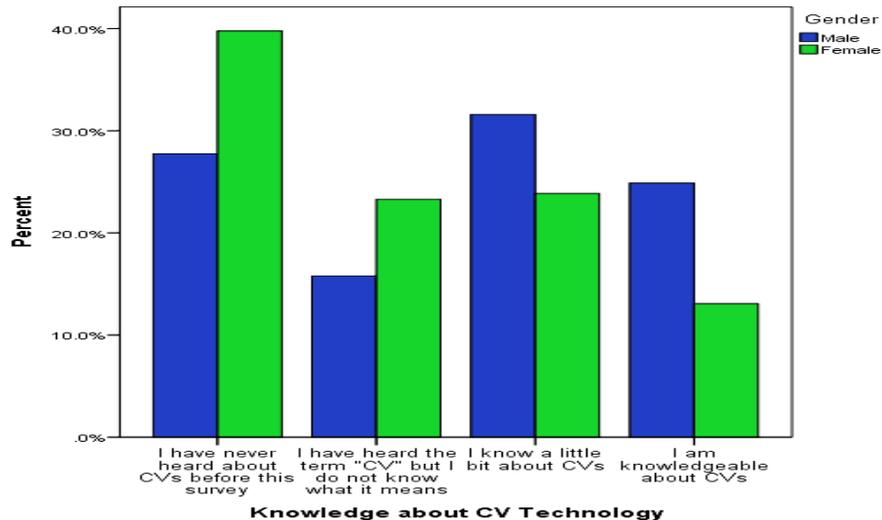


FIGURE 5. Connected Vehicle Knowledge by Gender (n = 385)

### ***Driver's Preferences for CV Technologies***

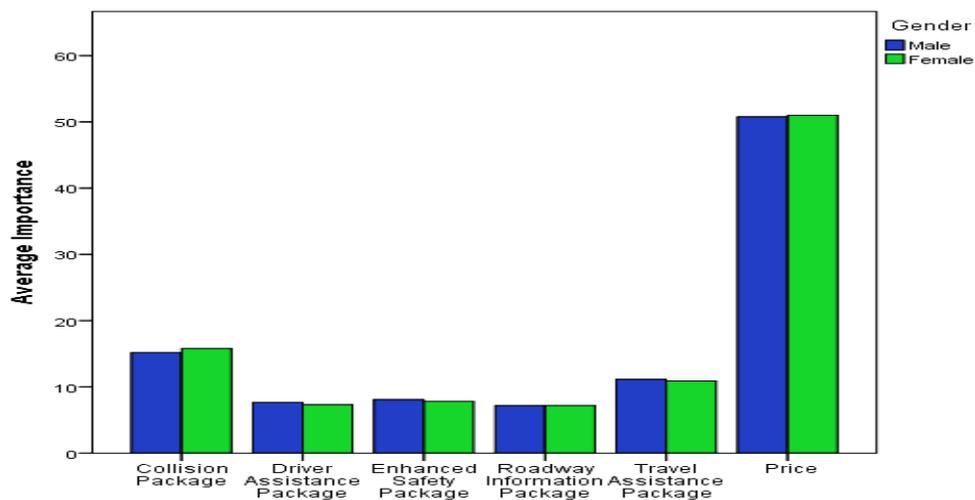
After participants completed the BYO question, a series of screening choice questions were provided to determine the participants' preferences. Using the built-in ACBC analysis tool of the survey software, individual and aggregated preferences (utilities) for CV technology packages were computed. Regardless of gender, participants seemed to prefer to have some amount of CV technology; i.e., for all attributes the response "None" shows negative utility values (Table 2).

Comparing utilities by attributes reveals that the most important factor for technology adoption is price (Summed Price in Table 2). For both men and women, as prices<sup>46</sup> increased, utilities decreased significantly. Overall, regardless of gender, participants favored the most comprehensive bundles of technologies for each attribute, but that decision is largely constrained by price. The relative differences between men and women for different levels of CV technologies were tested using ANOVA. Except for the "Slow/stop/wrong-way vehicle advisor" ( $F(1,383) = 5.04, p = 0.025$ ), there were no gender differences in choosing CV technology. Since there was no gender difference in preferences at the levels of technology, the comparison was made at the attribute level by computing the average importance (Figure 6). The average importance is an average of all ratios of the individual importance scores to the total individual importance scores. The scores are computed using individual utilities on levels and attributes of technology (35). Of all the CV technology attributes, participants considered the collision package the most important. T-test shows no difference between men and women.

<sup>46</sup> Price-estimates were made based on modifying the existing technology prices of leader auto manufacturers such as Audi, BMW, Cadillac, Chevrolet, Lexus, Mercedes-Benz, Porsche, Toyota, and Volvo with V2V (Vehicle-to-Vehicle) and V2I (Vehicle-to-Infrastructure) features, requirements and enhancements with sensors. At BYO section, prices varied depending on the choice level of the participants (\$0 to \$1,100 for Collision package, \$0 to \$1,200 for Driver Assistance package, \$0 to \$1,000 for Enhanced Safety package, \$0 to \$500 for Roadway Information package, \$0 to \$700 for Travel Assistance package, and finally \$0 to \$4,500 for total price). However,  $\pm 30\%$  change in BYO prices applied during the ACBC screening choice questions to represent the actual willingness to pay of participants. Due to the  $+30\%$  increment, the possible maximum total price could be \$5,850 which was considered as the highest price for calculating utilities (see Table 2).

**TABLE 2. Mean Utility Values by Gender**

Attributes	Levels	CV Technologies	Male	Female	Total
Collision Package	1	None	-44.07	-46.01	-44.96
	2	Front collision warning	-2.19	-0.65	-1.48
	3	Side collision warning	-8.28	-8.89	-8.56
	4	Front & side collision warning	13.68	13.09	13.41
	5	All collision package	40.86	42.46	41.59
Driver Assistance Package	1	None	-17.27	-16.17	-16.77
	2	Lane departure system	8.26	8.55	8.39
	3	Intersection & left turn assist]	-4.09	-3.82	-3.97
	4	All driver assistance package	13.11	11.44	12.35
Enhanced Safety Package	1	None	-17.08	-16.61	-16.87
	2	Do not pass warning	-1.58	-1.68	-1.63
	3	Pedestrian & cyclist alert	3.68	3.25	3.49
	4	All enhanced safety package	14.98	15.04	15.01
Roadway Information Package	1	None	-11.70	-9.68	-10.78
	2	Road condition notification	2.92	4.01	3.42
	3	Slow/stop/wrong-way vehicle advisor	-4.97	-7.80	-6.26
	4	All roadway information package	13.75	13.47	13.62
Travel Assistance Package	1	None	-9.28	-7.80	-8.60
	2	Real time travel planning & route optimization	9.22	6.51	7.98
	3	Parking spot locator	-10.43	-9.71	-10.10
	4	All travel assistance package	10.49	11.00	10.72
Summed Price	Price: \$ 0		129.46	132.17	130.70
	Price: \$ 1,572		34.64	37.44	35.92
	Price: \$ 2,433		3.14	7.62	5.19
	Price: \$ 3,381		-38.76	-40.28	-39.45
	Price: \$ 5,850		-128.47	-136.95	-132.35
Mean Utility			82.55	91.72	86.74



**FIGURE 6. Average Importance of Attributes by Gender (n = 385)**

### Willingness to Pay by Gender

Mean WTP was then estimated and compared by gender. Figure 7 shows comparison of the average amount that men and women were willing-to-pay at the BYO selection question and the winning price (actual WTP) at the end of the choice tournament. Both genders had slightly lower WTP in comparison with the BYO selection. The average price level of men for the BYO question was \$2,298. After comparing different bundles, men’s average WTP decreased by 5 percent (to \$2,185). Similarly, the decrease in WTP for women was 5 percent (from \$2,257 to \$2,143). The same figure also shows that men’s BYO and WTP is about 2 percent higher than women’s. Although women had lower absolute BYO and WTP values than men, no statistical difference between the genders was found.

Figures 8, 9, and 10 show WTP by gender compared with various factors. Figure 8 compares WTP by gender and household’s annual income. Interestingly, middle-income women have the highest WTP for all women participants and the same is true for men. While this seems counterintuitive, higher WTP among middle income households may be associated with education and exposure to technology. As observed, WTP of women is lower than that of men for lower- and higher-income brackets, but WTP of middle-income women is the highest of all (\$2,383). From the perspective of gender and education, men and women with bachelor’s degrees had the highest WTP, followed by associate’s degree and lower, master’s, and doctoral or higher (Figure 9). Because one expects that income and education would be highly correlated, this trend confirms the findings in Figure 8, an association among high education attainment, high income, and low WTP. The answer to this conundrum may be the survey participants’ ages.

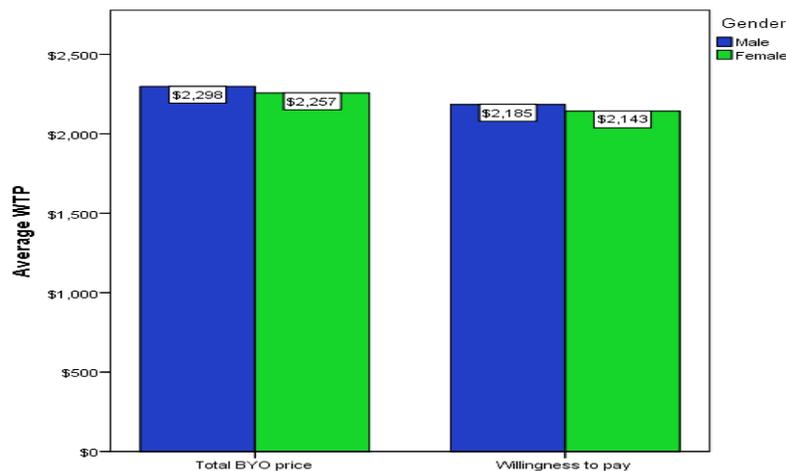


FIGURE 7. Mean Build Your Own (BYO) and Willingness-To-Pay (WTP) by Gender (n = 385)

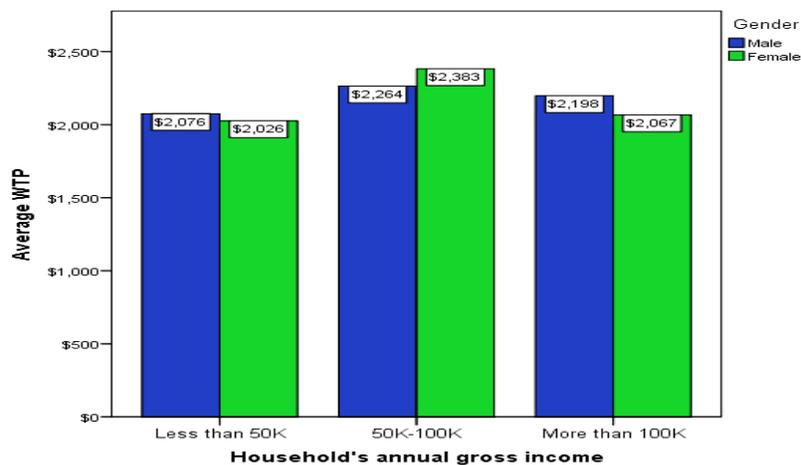


FIGURE 8. Mean WTP by Household's Annual Income and Gender (n = 375)

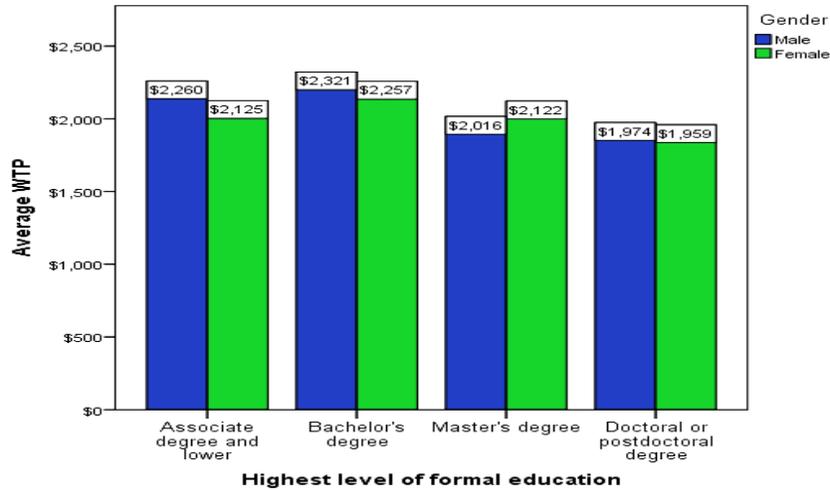


FIGURE 9. Mean WTP by Education and Gender (n = 382)

WTP by gender and age is shown in Figure 10. While WTP values are fairly similar for both men and women at middle ages (30–39 and 40–49 groups), women younger than 30 have higher WTP than men in the same age group. By contrast, women at 50 and older have lower WTP than men in the same age group. Women in their 30's have a WTP of \$2,133, and WTP stays fairly constant until age 50 and older. At 50 and older WTP is only \$1,970. By contrast WTP for men increases as they get older until age 50 and older. The youngest men (younger than 30) are willing to pay only \$1,804, older men are willing to pay more: \$2,169 for ages between 30 and 39, \$2,310 for 40 to 49, and slightly less, \$2,270 for 50 years old and older.

Figures 8, 9 and 10 seem to suggest gender differences in WTP by cohort; yet, even after considering gender and other variables, education, income, and age, no statistically significant differences could be found. Even so, the WTP difference between young men and women and WTP decline for mature women (50 and over) are vividly suggestive.

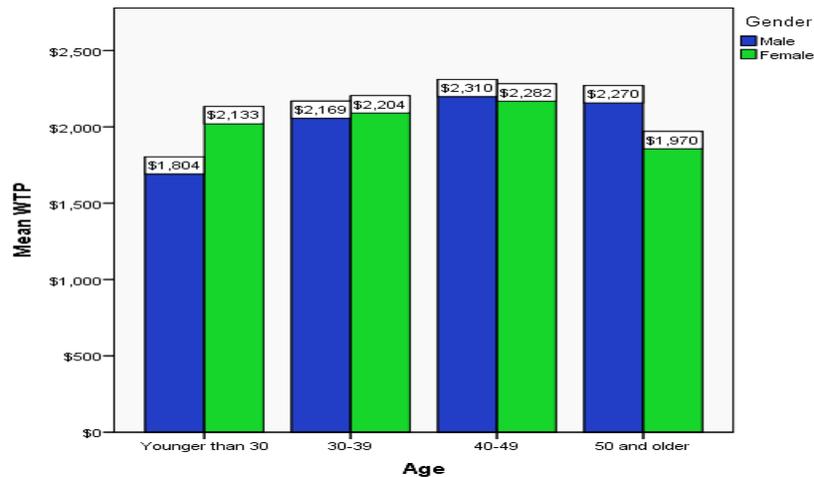


FIGURE 10. Mean WTP by Age and Gender (n = 385)

## CONCLUSIONS

The research literature indicated that women are more risk averse and have different social preferences when making economic decisions, are more sensitive to the price of automobiles, and rate safety significantly more important among all age groups than men. Women tend to rate safety similarly at every age, while the importance of safety for male drivers increases with age. This current research is supportive of these findings. When purchasing vehicles, women are more concerned about automobile safety, fuel consumption, and environmental impacts than other vehicle features (e.g., status and engine power).

Statistical tests rejected the hypothesis that women have higher WTP in absolute terms than men for CV technologies. WTP by gender, and its comparisons with income, education, and age, show no statistical differences either, although mature women and young men appear less enamored of CV technologies. That is, women at every age are more concerned about safety than men, but they are willing to pay only as much as men pay. However, women's budgets for vehicle purchases were lower than men's and the difference was statistically significant at the 95 percent confidence level. Also, women reported significantly less prior knowledge of CV than men. Thus, women have higher WTP than men relative to women's budgets and lesser knowledge.

The findings and conclusions have implications regarding promotion and diffusion of CV technologies to a diverse population. Price is a serious barrier to CV technology diffusion, but one would expect prices to come down with innovation, production, and governmental promotion. Women and men considered the collision package (front, side, all-around collision warning) the most important CV technology. The automobile industry should make low-cost options and common standards a priority for diffusing collision warning technology.

Women have different social preferences than men when purchasing automobile technology, and mature women in general are less technology oriented. Government safety agencies should showcase CV technologies' safety benefits to media that cater to mature women and at family-oriented public events. In addition safety agencies may want to incorporate showcasing of CV within the various safety programs targeted toward young male drivers.

Additional research should focus on placing mature women and young men in situations where they may experience CV safety technologies first-hand. Because of the technologies' unavailability, driving simulators with CV scenarios programmed into them could be the basis for before-and-after surveys of acceptance of and WTP for CV technologies

## ACKNOWLEDGEMENTS

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# Gender differences in on-line social networking and travel behavior of adolescents

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## ABSTRACT

The aim of this paper is to investigate how much and why adolescent females use ICT (Information Communication Technologies) and OSN (Online Social Networks) and how these affect their trip making behavior for social trips. The analysis consists of two stages: First, we investigate all the characteristics (time spent, purpose etc.) of the usage of ICT and OSN through the means of a descriptive analysis for each gender. Next, we develop Latent Class Poisson Regression models, which employ the latent construct to represent the differences in trip making behavior for social purposes among the OSN latent classes. One model is developed for female and one for the male participants in order to compare their OSN usage styles and trip making behavior. The methodology is tested with data from a large-scale survey that refers only to adolescents (12 to 18 years old) and took place in the Republic of Cyprus in 2012. The sample consists of 9,714 teenagers covering the 20% of the total high-school population (5,586 girls and 4,608 boys). The class membership models of both models indicate that there are three latent OSN usage styles, while the results of the class-specific models indicate that the rational OSN usage style (Class 1) and the OSN addiction (Class 2) conduct more social trips than those who are indifferent to OSN usage (Class 3), while gender differences are noticed in the class-specific models, with adolescent females to conduct more trips for social purposes than males. The results of the study provide insights into how OSN usage affects adolescent females' and males' travel behavior, while the class specific model is rich in interpretation, and serves as a harbinger for policy-makers.

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**KEYWORDS:** Travel behavior; ICT; On-line social networking; Social trips; Latent class models; Adolescents.

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## 1. INTRODUCTION

Social media are designed to foster social interaction in a virtual environment and millions of contemporary adolescents use them. Using social media web sites is among the most common activities of today's adolescents. Any web site that allows social interaction is considered a social media site, including on-line social networking (OSN) sites such as Facebook, MySpace, and Twitter; gaming sites and virtual worlds such as Second Life, Club Penguin, and the Sims; video sites such as YouTube; and blogs. Members use these sites for a number of purposes. The root motivation is communication and maintaining relationships. Popular activities include updating others on activities and whereabouts, sharing photos and archiving events, getting updates on friends' activities, displaying a large social network, sending messages privately, posting public testimonials and presenting an idealized persona.

This culture of innovation and rapid technological adaptation is particularly strong among the younger generations, especially the New Boomers or Net Generation (born between 1983 and 2001; PRB, 2009). These so-called "internet natives" grew up in the era of personal computing and the internet or, as Tapscott (2009) puts it, they have been "bathed in bits and bytes" since birth and easily integrate technology into their daily lives. This generation has no memory of a life without Web browsing, cell phones, texting, and high-definition video (Fay, 2013). This discourse has a wide social impact and its echoes can be found in psychology, business literature and government policy. The general claim, made in this generation's discourse, is that this material context has led young people to develop natural aptitude and high levels of skill in relation to the new technologies. In contrast, those older people who grew up in an analogue world are portrayed as always lagging behind, like immigrants to the new world (Tapscott, 2009). It is suggested that these older digital immigrants are never likely to reach the same levels of skill and fluency that were developed naturally by those

who grew up with the new technologies (Kamargianni, 2014; Qualman, 2012). Thus, a generation gap is developing.

The emergence of OSN has upended the way teenagers interact with each other and the world, and there is now little room for doubt about its impact on aspects of social life such as friendships, information sharing and leisure activities. More than ever before, using social media means creating as well as receiving, with user control extending far beyond the selection of ready-made, mass-produced content. Against this background, in recent years a growing body of researchers have tried to investigate the kind of activities teenagers conduct using OSN and the effects on teenagers' personalities and psychology. However, little is known about how much, why, and how individuals, and more specifically adolescent females and males, utilize social media, and how its usage affects their travel behavior.

Having these in mind, the aim of this paper is to investigate how much and why adolescent females and males use ICT (Information Communication Technologies) and OSN, how these affect their trip making behavior for social purposes and potential differences between genders. The analysis consists of two stages: First, we investigate all the characteristics of the usage of ICT and OSN (time spent, purpose etc.) through the means of a descriptive analysis. Next, we develop one Latent Class Poisson Regression model for each gender, which incorporates OSN usage styles as higher-level individual orientations influencing the number of trips made for social purposes. The methodology is tested with data from a large-scale transport survey conducted in Cyprus in 2012 and refers only to adolescents. In cooperation with the Ministry of Education and Culture (MOEC) of Cyprus, the web-based questionnaire was forwarded to all Cypriot high schools and the sample consists of 9,735 participants (21% of the total student population), aged from 12 to 18 years old in 2012 (born 1995-2001; Net Generation). The data set provides information for 15,693 social trips that were recorded over a Saturday of 5,586 females and 4,608 males.

The innovation of this research covers several topics. First of all, to our knowledge it is the first time that such a large-scale survey on travel behavior, focusing only on teenagers, has been conducted. Secondly, the questionnaire used for the data collection was designed specifically to investigate teenagers' perceptions of travel behavior; it was designed not only by transport planners but also by psychologists and economists, with the aim of approaching the multidimensional nature of transportation problems in depth. Third, although the effect of ICT on travel behavior has been widely studied in the last decade, there are only few surveys that investigate the travel behavior of different OSN usage styles of females and males. Fourth, the Net Generation behaves in a different way than their parents, thus a generational gap is created which may affect the transportation sector as well. Furthermore, the findings of this study offer guidelines to transport policy makers as to how the Net Generation and, more specifically females and males, use on-line social networking. Finally, the investigation of teenagers' travel behavior may explain many of the trends and undesired behaviors that adults adopt.

The remainder of the paper is structured as follows. Section 2 reviews the literature. Section 3 describes the modeling framework and associated mathematical formulations. The case study, the sample's descriptive statistics and the OSN usage patterns are presented in section 4, while section 5 describes the model estimation results. Section 6 concludes the paper by providing a summary of the findings, and implications for policy and further research.

## **2. LITERATURE REVIEW**

### **2.1 *ICT and Travel Behavior***

The importance of technology in our daily lives has increased, and the adoption of ICT has changed the way we live, communicate, work and entertain, and consequently how we travel. ICT provides people with alternatives to face-to-face communication and thus has the potential to substitute for physical travel. In response to this rapid expansion, a new literature has emerged to explain the potential effects of these trends on travel behavior. A vast body of researchers has been investigating the impact of ICT on transportation, examining concepts such as telecommuting/teleworking, e-commerce and time planning. Results on telecommuting and travel behavior vary, with some studies concluding that teleworking substitutes for daily travel (Walls & Safiro, 2004; Choo et al., 2011) and others that teleworking modifies the daily commute (Polydoropoulou & Tsirimpa, 2012). Also, the overall effect of e-shopping on travel behavior remains unclear, with different studies reporting contradictory and ambiguous findings, depending on the type of goods purchased (Farg et al., 2007; Dijst et al., 2008; Papola & Polydoropoulou, 2006; Mokhtarian, 2004). These

studies have greatly contributed to our understanding of the possible and potential impacts of ICT on physical travel, which can be grouped into four categories (Mokhtarian, 1990; Mokhtarian, 2004; Pendyala et al., 1991; Salomon, 1986): 1. *Substitution*: usage of technology replaces a physical trip; 2. *Complementarity*: usage of technology creates additional demand for travel; 3. *Modification*: usage of technology does not affect the frequency of physical travel, but may change the characteristics of trips, such as timing and chaining; and 4. *Neutrality*: usage of technology is independent of the traditional trip and has no effect on regular trip making.

Although the relationship between ICT and travel patterns has received a substantial amount of attention, not many studies focus on leisure or social travel, even though it is the fastest-growing segment of travel (van de Berg et al., 2011; Mokhtarian et al., 2006; Axhausen, 2005). It is highly probable that the effect of ICT on social travel differs from its effect on travel for other purposes, such as work or shopping. Travel behavior is influenced by someone's social network characteristics, as they are relevant to his or her propensity to engage in social activities (Carrasco & Miller, 2006).

According to Mokhtarian et al. (2006), complementarity and modification are more likely than substitution in the case of social activities, because ICT-based alternatives to these activities (if available) are rarely satisfying substitutes. This is confirmed by Senbil and Kitamura (2003), who studied the relations between telecommunication and travel for the three types of activities distinguished by Chapin (1974): 1. mandatory (work and work-related) activities, 2. maintenance activities (grocery shopping, eating, household maintenance, etc.), and 3. discretionary activities (leisure, sports, hobbies, etc.). They found substitution effects for work activities; for maintenance activities, the effect appeared to be neutral, and for discretionary activities they found complementary effects. The complementary effect of ICT on social activities was also identified by Tillema et al. (2007), who found a positive correlation between frequency of face-to-face contacts and electronic communication.

However, the majority of these studies refer to adults (the Baby Boomers Generation), while there is little work, particularly produced by psychiatrists and sociologists, on how young people and teenagers (the Net Generation, or Net Geners) use social media and how this affects their activities and travel behavior.

## **2.2 On-line Social Networking and Face-to Face Communication**

Since it is difficult to find similar research in the transportation sector with which to build links between OSN and the number of trips, we use findings from the social sciences regarding virtual and face-to-face communication.

As adolescent OSN usage grows in prevalence, so do psychologists' concerns about the effects of virtual communication on their social development. After we reviewed the research, it became obvious that there was a debate over whether on-line communication is used most by those already socially adept for additional interactions to bolster already thriving social networks, or by those adolescents who lack social skills and employ social networks as a form of social compensation (Sheldon, 2008). This is called the "rich get richer" theory (Wilks, 2012).

More extraverted teens who already have well-established peer groups report using the communication websites for additional peer interaction to reinforce already formed friendships and keep in touch with long-distance friends. On the other hand, less socially adept youth explain their on-line social networking as a place to anonymously self-disclose and make friends when they might otherwise be too uncomfortable to do so (Anderson-Butcher et al., 2010). There is much debate and contradictory research as to which of these motives takes precedence, because past research (Finkelhor et al., 2002) has shown that less socially capable teens are more likely to turn to the worldwide web, while current research is showing the opposite (indicatively: Barak-Brandes & Levin, 2013; O'Keefe et al., 2011; Craig Watkins, 2009; Greenfield & Subrahmanyam, 2008).

Nevertheless, the majority of the most recent surveys verify the "rich get richer" theory. DeGroot et al. (2011) found that on-line social networking has a positive relationship with the frequency of face-to-face communication with Facebook friends, and that communicating on Facebook is positively correlated with personal interactions with Facebook friends. Allen et al. (2010) found out that teens who had displayed negativity in friendships and reported symptoms of depression were less likely to possess a social networking profile, while adolescents who reported more positive intimate friendships were more likely to possess a profile. Regan and Steeves (2010) discussed the way on-line social networking could empower young people. Thus on-line social networks are able to both bridge and bond social capital by connecting large groups of people in loose networks and allowing communication that fosters relationship closeness. In their final

comments on relationships, the authors suggest that on-line social networking positively affects face-to-face communication.

Since the massive popularity of social networking sites did not arise until the early 2000s, research in this field is obviously incredibly young and there is still much to be done. Especially in the transport sector, it is difficult to identify similar surveys. The studies reviewed in this article appear to indicate that, despite initial concern, on-line social networking may have more positive than negative effects on adolescents' face-to-face communication. Internet communication is an outlet for both extraverted and introverted youths. Teens most often use social networking sites to connect with friends and build communities, something they are also doing off-line.

Having all these findings in mind, we try to identify the links between adolescent virtual or on-line social networking and the number of trips they conduct for social purposes. It is obvious that teenagers use social media in order to enhance communication and social connection. Also, it is highlighted that there are groups in the total population that are affected by different ways of using social media. In doing so, we hypothesize that there are different OSN styles for girls and different for boys, which are not directly observable, and that each OSN style affects in a different way the number of trips conducted for social purposes (face-to-face communication) by each gender.

### **2.3 Gender Differences in ICT and OSN usage**

Studies on on-line social networking to date have not uncovered gender differences in usage (Barker, 2009). However, according to the 2007 Pew Internet and American Life Project, gender differences exist. Their research has reported that older (age 15-17) adolescent males (54%) are less likely to have used an online social network compared with 70% of older adolescent females. Older adolescent males (57%) are less likely than older adolescent females (70%) to have created an online profile on an OSN. Adolescent males are less likely (40%) to post photos online when compared with females (54%). Older females are the mega "posters", with 67% of them uploading photos, compared with 48% of older males. Younger females and males are equally as likely to upload photos; however, 39% of younger females aged 12 to 14 upload photos whereas 33% of younger males do so. Online teen males are nearly twice as likely as online teen females to post video files (19% vs. 10%). Twenty-one percent of older males post video, whereas just 10% of older females do.

Pujazon-Zazik and Park (2010) also highlighted gender differences in Internet use of adolescents in California; adolescent males were reported to focus more on the entertainment aspects of the Internet, whereas females seem more interested in the relational aspects of social media and were more likely to talk to friends on the Internet about romantic relationships, secrets, and deep feelings (Rainie, 2003). In addition, Siomos et al. (2008) identified that it is possible more Greek girls are addicted to the Internet than boys.

With regard to social networking sites, teens, particularly girls, reported using the sites to keep in contact with peers from their offline lives, either to make plans with friends that they see often or to keep in touch with friends they rarely see (Lenhart et al., 2007). The girls in this study also reported using social networking sites to reinforce pre-existing friendships, whereas boys reported using them to flirt and make new friends.

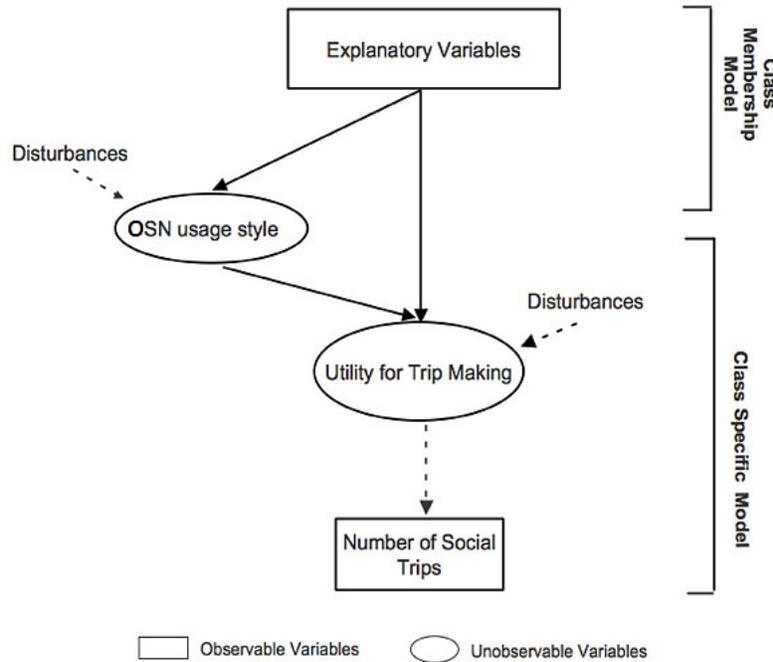
As in adolescent age groups identified differences have been in ICT and OSN usage patterns, it is also worthwhile to investigate the trip making behavior of the various OSN styles between girls and boys.

## **3. MODELING FRAMEWORK**

The dependent variable to be dealt with in this paper is a count of the total number of trips  $T_i$ , measured in a sample of  $N$  individuals. That is, our data form a cross-section. We assume that there are  $X_n$  independent explanatory variables that affect the number of social trips. To assess the impact of the explanatory variables on the trip making of each gender, we specify a Poisson regression model in which the intercept and the coefficients of the covariates vary across the sample according to some distribution. This unobserved mixing distribution is assumed to be discrete, which results in a finite mixture model formulation (Weder et al., 1993). The results of Laird (1978) and Heckman and Singer (1984) show that estimates of such a finite mixture model may provide good numerical approximations even if the underlying mixing distribution is continuous. Heckman and Singer (1984) state, however, that maximum likelihood theory cannot be invoked to justify the large sample properties of the estimators in such cases. Because of the assumption of a discrete mixture distribution for the intercepts and coefficients, the point masses of this distribution can be interpreted as latent classes (see

Lazarsfeld and Henry, 1968; McCutcheon, 1987; Gopinath, 1995; Green & Hensher, 2003) of subjects, which differ in terms of the relationship between the explanatory variables and the rate of occurrence of trips.

LCMs are appropriate for our analysis as the hypothesis is that OSN usage styles exist, that these styles are not directly observable and that each OSN style has a different social-trip making behavior. Furthermore, one LCM is developed for each gender, in order to be able to identify potential gender differences. This section describes in depth the model specification process. The LCM comprises two components: the class membership model and the class-specific model, as shown in Figure 1.



**FIGURE 1. Modeling Framework**

The class-specific model shows the influence of an OSN usage style and socio-economic variables on the number of trips made for social purposes.

Class-Specific Model

It is assumed that each individual belongs to one and only one class. The class-specific model is a Poisson Regression and represents the number of trips conducted by a latent class, varying among the latent classes. The Poisson model assumes that the number of trips any individual makes in a given time period is independent and has a constant rate of occurrence (Ben-Akiva et al., 1996). It is given by:

$$P(T_i | s) = \begin{cases} \frac{e^{-\lambda_{is}} (\lambda_{is})^{(T_i)}}{(T_i)!} & \text{for } \lambda_i > 0 \text{ and } T=0,1,\dots \\ 0, & \text{otherwise} \end{cases} \quad (4.1)$$

where  $T_i$  is the number of trips, and  $\lambda_{is}$  is the mean number of trips made by person  $i$  belonging to class  $s$ .

For each class  $s$ , the mean number of trips for each individual  $i$  is an exponential-linear function of the explanatory variables, as follows:

$$\lambda_{is} = \exp[\alpha_s + X_{ik} \beta_{ks}] \quad (4.2)$$

where  $\alpha$  is the constant of class  $s$ , and  $\beta_s$  depicts the impact of the  $X_{ik}$  explanatory variables on the mean number of trips in class  $s$ .

The formulation of the probability density in equation (4.1) is conditional upon individual  $i$  belonging to class  $s$ . Considering the observed frequencies  $T_i$  as arising from a mixture of  $S$  unobserved Poisson distributions (Heckman & Singer, 1984), we obtain the unconditional probability:

$$P(T_i | \beta_{ks}, \mathbf{s}) = \sum_{s=1}^S P(T_i | \beta_{ks}) \quad (4.3)$$

which is the probability that individual  $i$  conducts  $T$  number of trips, conditional on the characteristics of the individual and conditional on individual  $i$  being a member of class  $S$ .

In this way, we capture heterogeneity across individuals, since: 1. a formulation is used in which the mean event rate has a discrete mixture distribution, i.e. it varies across a finite number of unobserved classes; 2. the mean trip making varies within each class, depending upon the explanatory variables.

#### Class-Membership Model

The class-membership model links the latent OSN usage styles to socio-demographic variables and segments all individuals into  $s_n$  classes (Swait, 1994; Hess et al., 2007; Walker & Ben-Akiva, 2011; Vij et al., 2011). While the latent class to which an individual belongs cannot be deterministically identified from the observable variables, it is presumed that the class membership probabilities can be estimated. The probability that individual  $i$  has OSN usage style  $s$ , conditional on the characteristics of that individual,  $X_n$ , is given by:

$$P(s | X_n) \quad (4.4)$$

LCMs simultaneously estimate class-membership functions and class-specific functions. The model simultaneously breaks down teenagers' OSN behaviors into classes and estimates the class-specific functions in a manner that maximizes model performance. Since the class of each individual is unknown, neither of the above equations can be estimated separately. The two components are estimated simultaneously via an LCM:

$$P(T_i | X_{ik}, X_{in}) = \sum_{s=1}^S P(T_i | X_{ik}, \mathbf{s}) P(s | X_{in}) \quad (4.5)$$

where the probability of an individual  $i$  making  $T$  number of trips is equal to the sum over all the latent classes  $s$  of the class-specific membership model conditional on class  $P(T_i | X_{ik}, \mathbf{s})$ , multiplied by the probability of belonging to that class,  $P(s | X_{in})$ .

#### Likelihood Function

In writing the likelihood function, an individual's probabilities of conducting specific numbers of trips are conditionally independent, conditioned on the individual's SN usage style (the classic latent class assumption) and on the error components. Combining the class-membership model, the class-specific choice model, the error components, and the number of social trips observed for an individual, the joint likelihood function for an individual  $i$  is given by:

$$L = \prod_{i=1}^N P(T_i | X_{ik}, \mathbf{s}) \sum_{s=1}^S P(s | X_{in}) \quad (4.6)$$

#### Defining the number of latent classes

One of the limitations of latent class choice models is that the researcher has to decide on the number of latent classes to use. The model cannot determine this automatically. This limitation is addressed by systematically estimating LCM based on different numbers of classes and then choosing the model that performs best. This approach requires a performance statistic that penalizes decreased model parsimony. To compare the estimated models and their goodness of fit, we use the log-likelihood, the corresponding values for the Rho-bar-squared, the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC). Rho-bar-squared indicates how well the model predicts class memberships. AIC and BIC differ from one another according to how much weight is applied to penalize for each additional model parameter.

The  $\bar{\rho}^{-2}$  is calculated as follows:

$$\bar{\rho}^{-2} = 1 - \frac{L^* - k}{L^0} \quad (4.7)$$

The AIC is given by:

$$AIC = -2 \ln L^* + 2k \quad (4.8)$$

The BIC imposes an additional penalty on the log-likelihood as compared to the AIC, and therefore tends to favor more parsimonious models. The equation for the BIC is:

$$BIC = -2L^* + \ln(N)k \quad (4.9)$$

where

$k$  denotes the number of estimated parameters;

$L^0$  is the initial log-likelihood (the log-prior) for the estimated parameters;

$L^*$  is the log-likelihood calculated at the values of the fitted parameters (log-posterior);

$N$  is the number of respondents.

The lower the values of BIC and AIC criteria, the better the model fits that number of classes. The BIC is often used with LCMs because it imposes a harsher penalty on the number of parameters than the AIC.

## 4. SURVEY

### 4.1 Case study

A web questionnaire that refers only to teenagers was designed specifically for the needs of our research. As mentioned above, traffic engineers and psychologists cooperated in designing the questionnaire with the aim of capturing the fundamentals of travel behavioral processes (for more details about the questionnaire and data collection, see Kamargianni & Polydoropoulou, 2013; Kamargianni et al., 2014). The questionnaire that was used for the data collection contained a section regarding the usage of social media, in which the participants were asked to answer questions regarding: 1. the amount of time they allocate to social media on a school day and on Saturday, 2. on which social media they have a profile and how much time they spend on each, 3. whether they use their mobile phone for connecting to the internet and various characteristics of their mobile phones, and 4. their attitudes and perceptions of social media. These variables are used for the identification of the latent OSN styles of each gender in the class-membership model. All the trips that were conducted for entertainment or leisure, visiting, hanging out and having lunch/dinner/coffee purposes are counted as social trips. We prefer to investigate only the trips made for social purposes, as we postulate that the trips that teenagers make for schooling and tutorial purposes are not affected by OSN.

In 2012, in cooperation with MOEC, the questionnaire was forwarded to all Cypriot high schools. The students filled in the web questionnaire during informatics lessons, under the supervision of their teachers who had received extra guidance to assist with any questions. For this paper, the sample consists of 5,586 adolescent girls and 4,608 adolescent boys (total: 9,714 – 20% of the total high school population of the country).

Table 1 presents the descriptive statistics of the sample. 55% are female and 41% are between 12 and 14 years old. 95% of the teenagers have a mobile phone, and 56% of them use their mobile phones to connect to the internet. Understanding an individual's technological environment is a vital clue to understanding how that person uses the internet, connects with others and accesses information. The average teenager owns 2.9 gadgets out of the four we asked about in our survey: cell phones (conventional or 3G/smartphones), computers (desktops and laptops), game consoles and portable gaming devices. All these gadgets increase teenagers' virtual connectivity as they provide internet access. Laptops have overtaken desktops as the most commonly owned computers. Teens are enthusiastic consumers of gaming devices, both wired and portable. In total, 80% of the teens in our sample have a game console such as a PlayStation, an Xbox or a Wii, while 59% own a portable game device such as a PSP or a Nintendo 3DS. Nowadays, game devices and consoles provide

new ways for teens to go on-line. Also, the survey indicates that the predominant purpose for which teenagers use OSN sites is for communicating with their friends. 9% of the participants indicated that they use OSN mainly for playing interactive games, while 5% use them for keeping up-to-date with various events and friends' activities.

**TABLE 1. Sample's Characteristics**

		Girls	Boys
High School	Gymnasium (12-14 years old)	42%	41%
	Lyceum (15-18 years old)	58%	59%
Grades	Low (< 14/20)	11%	17%
	Medium (14-18/20)	46%	46%
	High (18-20/20)	43%	37%
Own a mobile phone		96%	95%
Connect to internet via mobile		52%	53%
Mobile contract (vs. top-up)		40%	45%
Own a game console (PS, Xbox, Wii etc.)		61%	89%
Own a portable gaming device (PSP, Nintendo 3DS)		55%	62%
Own a desktop		51%	57%
Own a laptop		80%	88%
Own a tablet		60%	68%
Time spent on OSN (hours per Saturday)		(Std. Dev. = 2.30)	1.7 (Std. Dev. = 2.30)
Internet use on Saturday (hours)		2.7 (Std. Dev. = 2.29)	2.7 (Std. Dev. = 2.29)
Purpose using OSN: communicate with friends		85%	74%
Purpose using OSN: flirt		23%	65%
Purpose using OSN: stay update about social events		79%	62%
Household size		4.8 (Std. Dev. = 1.34)	4.5 (Std. Dev. = 1.16)
Siblings		2 (Std. Dev. = 0.98)	1.8 (Std. Dev. = 1.52)
Household car ownership		2.5 (Std. Dev. = 1.12)	2.7 (Std. Dev. = 1.27)
Family's monthly income	Less than 2,000 Euros	14%	16%
	2,000 to 4,000 Euros	26%	28%
	More than 4,000 Euros	36%	35%
	N/A	24%	21%
Number of social trips – Saturday		2.9 (Std. Dev. = 1.19)	2.5 (Std. Dev. = 0.92)

## 5. MODEL ESTIMATION RESULTS

This section presents the process of defining the latent classes and the results of the model estimation. The Latent Class Poisson Regression model described in this paper was estimated using Latent GOLD 4.5 by Statistical Innovations Inc.

### 5.1 Defining the number of classes

A number of different model specifications with different numbers of classes and explanatory variables were tested for each gender. We also estimated the three-, four- and five-classes models with predefined classes. To determine the optimal number of latent classes for the model, the Rho-bar- squared, BIC and AIC values of models with various numbers of latent classes were estimated and the key results are presented in Table 2.

**TABLE 2. Summary Statistics of Models with Different Numbers of Latent Classes**

		Number of Parameters	AIC	BIC	Rho-bar-squared
<b>GIRLS</b>					
G1.	Model without segmentation	18	17476	17548	0.0010
G2.	Model with two latent classes	33	17309	17493	0.1179
G3.	Model with three latent classes	54	17199	17495	<b>0.5360</b>
G4.	Model with four latent classes	75	16997	17404	0.2447
G5.	Model with five latent classes	96	<b>16829</b>	<b>17348</b>	0.4620
<b>BOYS</b>					
B1.	Model without segmentation	18	12771	12841	0.023
B2.	Model with two latent classes	33	12668	12846	0.1456
B3.	Model with three latent classes	54	12582	12867	<b>0.6277</b>
B4.	Model with four latent classes	75	12390	<b>12783</b>	0.4972
B5.	Model with five latent classes	96	<b>12372</b>	12873	0.3595

All the statistics presented in Table 2 indicate that a model with OSN usage segmentation both for girls and boys is preferred over one without. The BIC and AIC of the model estimated for girls suggest that the model with five latent classes is superior, while the Rho-bar-squared suggests the model with three latent classes. Regarding the model that estimated for boys, BIC indicates that the model with four latent classes is superior, the AIC suggests the model with five latent classes, while the Rho-bar-squared the model with three latent classes. Although these statistics provide a lot of information they indicate a different model, while Rho-bar-squared indicates the three class model for both models. Thus, we examine further the estimation results of each model aiming to identify the model that provides the most satisfactory behavioral interpretation regarding the OSN usage latent classes and trip making behavior of girls and boys (logical signs and interpretability of classes). Although Models G5 and B5 have the lowest AIC value, they are rejected because the behavioral differences among the classes are not clear and the classes are difficult to interpret. In terms of comparing Model B4 and Model B3, the first one has the lowest BIC value, while the other one the highest Rho-bar-Squared. We prefer Model B3 to Model B2, as it provides the best and most interpretable results and was chosen to be presented thoroughly below. Similarly, we prefer Model G3 to models G4 and G2 as they also provided the most logical signs and interpretable classes.

## 5.2 Estimation results for the class-membership model

Table 3 provides the parameter estimates of the class-membership models that help us to identify the predictors of the latent SN usage styles. The upper part of Table 3 presents the estimation results of the model that was estimated for girls, while the lower part of the table presents the model of the boys. Class membership model is a multinomial logit model (MNL) of the probability with which each individual belongs to one and only one of the three latent classes. In Table 3 are also given the Wald statistic results. For each set of parameter estimates, the Wald statistic considers the subset associated with each class and tests the restriction that each parameter in that subset equals the corresponding parameter in the subsets associated with each of the other classes. That is, the Wald statistic tests the equality of each set of regression effects across classes. Wald statistic results indicate that the parameters used for the class specific model vary significantly at 95% level of confidence indicating significant heterogeneity across the classes.

**TABLE 3. Estimation Results of the class-membership model**

	Class1		Class2		Class3		Wald statistic
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	
<b>GIRLS</b>							
A	2.11	5.60	-1.97	-4.61	-2.45	-2.57	34.18
Allocate no time on OSN daily	-1.34	-2.43	-6.03	-2.90	1.38	2.76	23.94
Allocate more than 4hours daily	-1.37	-4.45	0.78	7.17	3.67	4.30	27.46
Allocate 1 to 2 hours daily	4.73	7.42	-0.25	-4.62	-0.69	-2.15	5.62
Own 4/4 gadgets (mobile phone, tablet, game consoles, portable game device)	-1.57	-1.34	1.64	5.99	-2.56	-6.58	23.83

**TABLE 3 (continued). Estimation Results of the class-membership model**

	Class1		Class2		Class3		Wald statistic
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	
<b>GIRLS</b>							
Own tablets, 3G phones (2-3/4)	2.18	5.55	-0.13	-1.32	-0.90	-2.53	24.02
Own 1/4 gadgets (conventional mobile phones)	-0.54	-4.45	-1.66	-8.77	0.57	3.84	48.74
Mobile contract (top up/no contract)	1.53	3.43	-0.92	-2.43	2.12	4.21	11.45
Connect to internet via mobile	0.93	2.18	1.61	5.89	-0.76	-2.92	9.15
Have an account on more than 3 OSN	0.89	2.13	1.75	4.61	-2.39	-3.90	16.95
Have an account on 1 OSN	1.74	1.76	-1.51	-2.50	1.30	2.47	20.32
<b>BOYS</b>							
A	3.09	3.99	-1.00	-2.15	-2.09	-3.72	16.70
Allocate no time on OSN daily	-0.98	-2.14	6.03	-2.90	1.38	2.76	28.71
Allocate more than 4hours daily	-0.79	-4.62	1.28	4.86	-0.48	-5.04	15.95
Allocate 1 to 2 hours daily	0.77	6.53	1.26	1.60	-0.49	-2.72	13.14
Own 4/4 gadgets (mobile phone, tablet, game consoles, portable game device)	-1.16	-1.80	1.89	3.99	-2.36	-7.58	43.51
Own tablets, 3G phones (2-3/4)	3.64	6.32	-1.70	-1.07	-1.94	-1.40	30.02
Own 1/4 gadgets (conventional mobile phones)	-1.85	-4.15	-1.96	-3.81	1.05	2.96	10.57
Mobile contract (v. top up/no contract)	0.90	2.03	2.21	4.58	-3.12	-4.05	21.15
Connect to internet via mobile	0.24	2.75	1.34	4.32	-0.76	-2.92	9.32
Have an account on more than 3 OSN	0.44	3.09	0.96	4.79	-1.64	-4.27	21.90
Have an account on 1 OSN	1.78	4.29	1.51	1.97	0.30	1.47	23.50

In the model estimated for girls, Class 1 represents the 42% of the total sample, Class 2 the 39% of the sample, and Class 3 the 19% of the sample. In the model for boys, Class 1 represents the 54% of the total sample, Class 2 the 30% of the sample, and Class 3 the 16% of the sample.

Generally the coefficients of the variables have the same signs in both models. Nevertheless the significance of them differs a lot. For readers' convenience, we are going to analyse the results and name the classes, instead of using the numbers.

Regarding the girls' model, the most statistically significant variables in Class 1 are "Spend 1 to 2 hours on a daily basis on OSN" and "Own 2 to 3 out of 4 gadgets". Connecting to the internet via mobile phone and having a mobile contract affect positively the probability of being in this class. Having an account on more than 3 SN affects the probability of belonging to this class as well. Based on the literature review of other social surveys on teenagers' SN usage behavior, we conclude that this is a rational amount of time, since the average time that the majority of the current teenagers spend in a typical day on SN is 1.5 hour (Teen Facebook Statistics, 2012). In doing so, we name this class "Rational OSN users". As far as the estimation results of the boys' model, the most statistically significant variables in Class 1 are "Spend 1 to 2 hours on a daily basis on OSN" and "Own 2 to 3 out of 4 gadgets". Having an account on one OSN affects positively the probability of boys to belong in this class. As the two most statistically significant variables are the same with the most statistically significant variable in girls, we also name the Class 1 of boys' model "Rational OSN users". Comparing the statistical significance of both models, it is noticed that these two variables are more significant for girls. More descriptive statistics for this class indicate that girls that belong in this class mainly use OSN in order to communicate with their friends, arrange their social activities and discuss the news, while their favorite OSN is Facebook. The descriptive statistics of boys that belong in this class show that these members usually use OSN in order to stay updated about their friends and in order to read the news.

Girls that belong in Class 2 seem to spend a significant amount of their time budget on OSN. The most statistically significant variables are "Spend more than 4 hours on OSN daily" and "Owning 4 out of 4 gadgets". Although we do not include psychological indicators in this paper to assess addiction, the results of this class indicate that girls who belong to this class spend more than 4 hours per day on SN (more than average), they

have all the gadgets that we asked in our questionnaire (3G mobile phone or Smartphone, tablet, game console and portable game devices) and connect on the web via their mobile phones. Thus we name this class “OSN addicted”. In the boys’ class-membership model the most statistically significant variables that positively affect the probability of belonging to this class are “Spending more than 4 hours on OSN daily” and having 3 or more accounts on OSN. These members seem also to be addicted to OSN usage and it is assumed that OSN is a part of their daily life. In doing so, boys that belong in Class 2 are also “OSN addicted”. Furthermore, statistics for this class show that adolescent girls use OSN in order to communicate with their friends, to arrange their meetings with friends and to flirt. Boys that belong to this class usually use OSN to communicate with their friends, to make new friends and to flirt.

As far as the Class 3 of the girls’ model, it is noticed that these members do not allocate a considerable amount of time on OSN on a daily bases, while their gadget ownership is quite low (they own 1 out 4 gadgets). Also, these girls seem not to use their mobile phone in order to connect on the web. Their behavior indicates indifference to OSN, thus we name these members “Indifferent to OSN usage”. In the same way, boys that belong in Class 3 are indifferent to OSN usage, as they do not spend time on OSN on a daily basis and have the lowest gadget ownership. Further statistical analysis of the girls that belong to this class show that these members believe that OSN is a source of gossip and waste of time. Boys that belong to this class seem to spend time on surfing the web generally and play on-line games, but they are not fond of OSN.

While no significant differences are noticed in the latent OSN usage styles between girls and boys regarding their time allocation and usage patterns, the further statistical analysis of each class’ members indicate that there are differences in the purposes of OSN usage.

### 5.3 Estimation results of the class specific model

Taking into account the segmentation of the SN usage patterns, we now continue with the class specific model to check whether the OSN usage styles indicate different social-trip making behavior. The estimation results for the class specific model are shown in Table 4. The explanatory variables include characteristics related to age, internet access at home, number of devices with internet access in household interacted with the number of household size, monthly family income and residential area characteristic. All of the variables used in the class specific model are statistically significant at the 95% and have significantly different effects across classes at the 95% confidence level.

TABLE 4. Estimation Results of the class-specific model

	Class Independent		Class1 <i>Rational SN usage</i>		Class2 <i>SN addictd</i>		Class3 <i>Indifferent to SN usage</i>		Wald statistic
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	
<b>GIRLS</b>									
Household monthly income (continuous)	0.81	1.86	--	--	--	--	--	--	--
Intercept			1.95	3.78	2.31	4.39	1.56	2.58	17.47
Income			0.10	1.99	0.24	1.70	-1.30	-4.87	32.78
15 to 18 years old (vs. 12-14)			0.27	4.04	0.70	2.67	-0.13	-2.87	11.41
Available internet access at home			0.38	3.93	1.93	5.56	-0.68	-1.73	8.53
Number of available gadgets with internet access in household divided by the number of household members			0.26	2.87	0.56	3.61	0.18	1.98	12.47
Urban (vs. suburban)			0.19	3.53	0.36	2.83	-0.88	-2.97	14.09
<b>BOYS</b>									
Household monthly income (continuous)	0.81	2.24	--	--	--	--	--	--	--
Intercept			2.13	3.32	2.73	5.72	1.05	3.03	7.38
Income			0.88	2.27	0.62	2.00	-1.12	-3.37	12.58
15 to 18 years old (vs. 12-14)			0.62	5.43	0.73	1.63	-1.36	-3.02	18.31

**TABLE 4 (continued). Estimation Results of the class-specific model**

	Class Independent		Class1 <i>Rational SN usage</i>		Class2 <i>SN addictd</i>		Class3 <i>Indifferent to SN usage</i>		Wald statistic
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	
<b>BOYS</b>									
Available internet access at home			0.45	3.65	1.35	3.65	-0.14	-1.05	12.73
Number of available gadgets with internet access in household divided by the number of household members			0.72	2.92	0.62	4.23	0.92	2.64	10.82
Urban (vs. suburban)			0.94	2.85	0.25	3.24	-0.26	-2.46	14.89

The mean number of social trips conducted in a typical Saturday is 3.0 for the Class 1 of girls and 2.6 for the Class 1 of boys; 3.2 for Class 2 of girls and 2.8 for the Class 2 of boys; 2.1 for Class 3 of girls' model and 1.9 for the Class 3 of boys' model, while the mean number of trips of the total sample of girls is 2.9 and for boys 2.5. The results of the class-specific model of both genders' models indicate that the rational OSN usage style (Class 1) is likely to conduct more social trips, having at the same time the strongest effect among the intercepts of the other three classes. OSN addicted users also conduct more social trips than average in a Saturday, whilst the indifferent to OSN conduct less social trips.

Demographic dummy variables are also used in order to explain the dependent variable, while the signs of the coefficients are the same between the two models, indicating that there are no differences between genders in social trip making behavior. The only difference is the number of trips, with girls conducting more social trips in a Saturday. Younger teenagers aged between 12 to 13 years old are likely possible to be categorized as indifferent OSN users having a negative sign indicating they conduct fewer social trips. Teenagers from 15 to 18 years old seem to belong in Class 1 and Class 2 and they tend to conduct more social trips. This reflects the fact that as teenagers reach the age of 18 (adulthood), both females and males are involved more in social networking activities and conduct more social trips. As the ratio of available gadgets with internet access in household divided by the number of household size increases, the probability of making social trips increases for all the classes for both genders. Access to gadgets with internet access could be used for searching for various information about activities or chatting with friends, thus creating a need for travel. Adolescent girls and boys who live in urban areas and belong to Class 1 and Class 2 tend to conduct more social trips, while adolescent girls and boys who live in rural areas seem to be indifferent to OSN and tend to conduct less trips for social purposes. Finally, as monthly family income increases, the number of social trips both for females and males is affected positively, while this variable is class independent.

## 6. CONCLUSIONS

Having in mind that current adolescents have grown up in a completely different environment regarding internet, social media and on-line social networking availability than that in which current middle-aged persons have grown up, we strongly believe that it is worthwhile to clarify adolescents' travel behavior as a generational gap is created. Moreover, we further explore adolescents' social-trip making behavior based on gender. Investigation of adolescents' behavior could provide significant insights about the trends of this generation to policy-makers and in doing so to develop future transportation policies and even more to develop policies based on genders' needs.

This paper has explored the influence of various OSN usage styles of adolescent males' and females' travel behavior. The specific aim was to find out if OSN usage substitutes for or stimulates teenagers' trip making behavior and if differences exist between genders. At the same time, we postulated that OSN usage is not unique across the sample and that OSN usage styles exist and affect the trip making behavior in different ways. In doing so, we built a behavioral framework that captures the influence exerted by OSN usage styles on adolescents' social trips. Next, we develop a Latent Class Poisson Regression model for females and one for males consisting of two parts: 1. the class membership model, which links the latent OSN usage styles to socio-demographic variables; and 2. the class-specific choice model, which is a Poisson regression and shows the influence of an OSN usage style and socio-economic variables on the number of trips made for social purposes. The methodology is tested with data from a transportation survey that we launched in Cyprus in co-operation

with the MOEC in 2012. The sample consists of 5,586 female and 4,608 male high-school students (aged from 12 to 18 years old).

Both class membership models of the female and male models suggest that adolescents cannot be treated as one uniform group regarding OSN usage, but instead show considerable heterogeneity. After the estimation of models with various latent classes for both genders and the assessment of their goodness-of-fit, we concluded that three latent OSN usage styles/classes exist. Class 1 of both models includes those teenagers who use OSN in a rational way. The females and males that belong to Class 2 are highly OSN oriented or, in simple words, OSN addicted. Female and male members of Class 3 show indifference to OSN usage.

The results of the class specific model assist us to respond to our research question regarding the trip making behavior of each OSN usage style and if there are differences between genders. The answer is that both females and males who use OSN rationally and those who are addicted to OSN are more likely to conduct more trips for social purposes, thus OSN usage stimulates the number of trips made for social purposes. On the other hand, OSN indifferent females and males conduct fewer trips for social purposes than the other two classes. Moreover, our analyses show that social media and social networking are a part of both adolescent females and males' daily life. They log in to their OSN accounts from wherever they are using their mobile phones. The differences that are noticed between females and males refer to the purposes of OSN usage. Girls use most OSN in order to communicate with their friends and to arrange their social meetings, while boys use OSN for other purposes as well, such as playing games, flirting and reading the news. Also, differences are noticed in the number of social trips that each gender conduct, with female girls conducting more social trips in a Saturday.

The results make clear that, in order to understand the impact of OSN usage on trip making behavior, it is important to distinguish different types of OSN users, while no significant differences exist between OSN usage styles of adolescent females and males. The approach taken here, by requiring less complicated econometrics, should remain within reach of many more practitioners with standard training in maximum likelihood estimation, and still deliver more plausible and substantively different estimates than when segmentation is ignored.

Regarding transport planners and policy makers, they should strongly take into account that the expansion of OSN sites generally boosts the number of social trips that both female and male teenagers conduct. These trends could shake some transportation policies created under the assumption that generally ICT usage substitutes for trip making. Moreover, the results of our survey verify that both female and male teenagers allocate a significant amount of their daily time budget on OSN, a fact that policy makers could benefit from. Policy makers could use OSN sites to promote their green transport campaigns as the Net Generation stays updated via OSN, not brochures and newspapers. By using OSN sites, policy makers could shape the desired behaviors regarding green transport alternatives among teenagers, a behavior that could be maintained in their adulthood as well. Teenagers are the next generation, the agents of change.

In addition, this research provides insights into the rapidly growing literature investigating the relationship between ICT and more specific OSN and travel behavior. The innovative data collection used here and the variables that were tested could be of high importance to researchers dealing with social networking and travel behavior issues. A limitation of the estimated models is the fact that we did not use longitudinal data, thus we cannot capture potential changes in trip making behavior due to OSN usage. It would be desirable to use longitudinal data for the model estimation, as they capture individuals' social networking behavior over time providing better insights.

Concluding, this paper is a first attempt to investigate OSN usage styles, and it will be extended in several directions in the future. Further work includes the incorporation of psychometric (attitudinal and perceptual) indicators regarding the OSN usage and variables that give more information regarding the activities that adolescent females and males conduct on OSN sites. This will lead to the estimation of more advanced LCM providing a richer and more powerful explanatory ability.

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# Effects of gender on presence and virtual driver perception in driving simulators

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## ABSTRACT

Driving simulators are routinely used by researchers to study driver behavior. However, (limited) previous research has shown that the user gender may modify the perception, or even usability of these devices. For example, Mourant and Thattacherry (1) shows that men and women have different sensitivity to simulator sickness. These differences are liable to introduce biases in behavior studies and other virtual reality applications such as driver training.

The validity of driving simulators depends on a number of factors, such as platform dynamics or 3D-database realism. In our research, we focus on simulated traffic behavior. Although there is a huge literature on traffic simulation, its main purpose has been to study capacity, security or recently environmental impact of traffic. Hence, the use of traffic simulation models in virtual reality devices, where the entities interact with users, has not been validated. In this paper, we study how users perceive virtual entities, focusing on the role of gender.

An experiment has been developed to evaluate the users' perception of the driving simulator and of the simulated drivers, using questionnaires and user behavior data. We use the well-known presence concept –developed by Witmer and Singer (2)– to assess the overall validity, and an *ad hoc* questionnaire to assess the virtual entities' behavior credibility. We propose a methodology including a set of tools and data processing units enabling inter-human and virtual agents behavior comparison.

We have found very few significant correlations between driving traces, the perception of the virtual environment and background questionnaires, including gender, driving behavior (see Reason et al. (3)), and immersion tendency, which seems to indicate that the *Archisim* driving simulator does not induce gender bias, and that the virtual drivers replicate in the same way men's and women's behavior. This study calls for further evaluation of the impact of age on the use of driving simulators.

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**KEYWORDS:** Multi; Agent simulation; Credibility evaluation; Objective and subjective approach; Behavior clustering and explicitation.

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## INTRODUCTION

Driving simulator is one of the main tools to study driver behavior in controlled situations. Furthermore, this device has been included as an optional part of the initial training of drivers in several countries such as France. Godley et al. (4) points out the well-known advantages of driving simulators: the cost is reduced, the situations are repeatable, the environment is controlled and the subjects are not put at risk. However, the use of simulators is not neutral with respect to the driving task. In particular, the simulators do not replicate accurate physical sensations and device control, have different immersion qualities, and may induce simulator sickness.

To the best of our knowledge, it is yet unknown whether gender is a factor in such adversary effects. In driving simulator studies, there are two obstacles to such an analysis: firstly, sample populations are not always described (split by gender), and secondly, even when it is mentioned, the limited size of the samples does not enable the researchers to provide a gender-sensitive analysis.

In this article, we study the correlation between driving (behavior questionnaires, driving simulator experiment traces and external annotation), observation of driving (credibility), and background questionnaires. Concerning the driving behavior, a well documented difference between women and men is the risk-taking tendency as shown by Byrnes et al. (5). What has been less studied is the effect of the driving simulator device on participants' behavior. We use objective (driving) and subjective (questionnaires) data in order to (1) study individual and group behavior, (2) analyze their composition (age, gender, immersion tendency, virtual devices habits) and (3) compare it to a behavioral traffic simulation.

In the following section, we introduce the methodology and data clustering process. Then, we analyze experimental data to show that few differences were found between women's and men's traces, depending on the driving situation, and that age is a more likely influence on driving simulator use. Finally, the traffic simulator was found not to be very good in reproducing human behavior, but no strong gender differences were found.

### ***Behavioral validation***

Pavlov and Anrep (6) define behaviors as a set of observable actions of a person in the environment. There are different levels of human behavior: lowest level corresponds to simple reflex actions such as going into first gear in a car; intermediary level is tactical, it is built on an ordered sequence of elementary behaviors; the highest level of behavior is the strategic level, corresponding to the long term. It is based on a choice of tactics and evolves according to the dynamics of the environment and the mental state of the person. In our study, we want to evaluate the last two levels (tactical and strategic) of behavior.

### ***Subjective and objective approach***

The subjective approach comes from the Virtual Reality field and aims at validating the agents' behavior in simulation. It consists in evaluating the general (or detailed) immersion quality via the presence effect using questionnaires such as the presence questionnaire, found in Lessiter et al. (7). In our case, the notion of presence is too broad because it includes various elements (visual quality, sound quality, etc.) of the device, but does not detail the virtual agents behavior credibility component. However subparts of the presence effect evaluation are consistent with our goal:

- Lester et al. (8) defines the behavioral credibility as “users interacting with the agent believe that they observe a human being with his own beliefs, desires and personality”,
- Patrick (9) describes the psychological fidelity as follows: *The simulated task generates for the user an activity and psychological processes which are similar to those generated by the real task.* In a similar way Leplat (10) defines it as when “*the simulator produces a similar behavior to the one required in the real situation*”.

In this article, we focus on the behavioral credibility and especially on its qualitative and quantitative evaluation. A solution is to set up a mixed system where humans control avatars in the virtual environment. The evaluation of presence or of behavioral credibility is subjective. This is why it is sensitive to psychological phenomena such as the inability to explain one's judgments (see Javeau (11)). Moreover this evaluation does not necessarily explain missing behaviors nor the faults of the behaviors judged as not credible.

That is why we propose to complete these subjective studies with an objective analysis of simulation data. The objective approach is generally used in the field of multi-agents systems: it consists in comparing quantitative data produced by humans with data produced by different categories of virtual agents. It aims at verifying that the behavior of the agents is identical to the one observed in reality and therefore at evaluating the realism of the simulation. When the number of agents increases, objective evaluation is generally done at the macroscopic level because real data are both more readily available and easier to compare with simulation outputs as done by Champion et al. (12). This macroscopic validation is necessary but not sufficient to validate the agents' behavior. A valid collective behavior does not imply that the individual behaviors that compose it are valid. Thus, an analysis at the microscopic level is required, although microscopic data analysis and comparison is complex.

Hence, subjective and objective approaches complement each other in two different ways: human expertise and raw data.

## APPROACH

Our goal is the evaluation of the human and virtual drivers' (also called *agents*) behavior in the context of driving simulators. The method we propose is based on the aggregation of individual data (for both agents and human participants) into behavior clusters that will support the actual behavior analysis. In this view, behavior clusters act as abstractions of individual traces. This paper details the computation of such clusters (section *High-level behavior & comparison*) and their use for behavior analysis (section *Experimentation*).

By using the gender information on the participants, we are able to analyze the behavior reproduced by the agents (and the lacking human behaviors) in term of gender. The originality of our model is that we use the two available types of data: objective data with logs, to qualify the realism of the simulation, and subjective data via questionnaires, to qualify both behavior and credibility.

### General approach

The general architecture of the method is described in the Figure 1. It consists of 4 main steps: collection of data in simulation, generation of agents data, automatic clustering of data, and clusters comparison.

The first step of our method is to collect data about human participants. We first consider subjective data, using questionnaires about the studied activity (called *behavioral questionnaires* in the figure), the participant's relation to immersion, and the experiment itself. Secondly, we collect objective data, using immersive (or participatory) simulation in the virtual environment.

The raw data from participants' experiments in the simulator is called *logs* and the answers to questionnaires are called *answers* in the figure.

The second step produces new simulations in which the human participant has been replaced by a virtual driver. This step provides agents *logs*. Our objective is twofold. First, we want to study the correlation between categories of participants and their behaviors observed in the simulation so as to verify that the automated clustering of observation data is related to task-related high-level behavior. Secondly, we need to compare participants' behavior and agents' behavior in order to report on the capability of agents to simulate human behavior depending on the gender. In both cases, this cannot be done on raw data (should it be questionnaires or data logs). Logs, especially in the case of participants, are noisy: two different logs can represent the same type of tactic or strategic behavior. Hence, in order to generalize the analysis of our logs to a higher behavior level, we propose to use behavior categories (called *abstractions* in the figure). These categories serve as abstraction to the logs by gathering together, within the same cluster, different logs representative of the same high level behavior. This is done using automatic unsupervised clustering methods (because supervised algorithms require labeling of a large amount of logs by an expert). In the same way, we use clustering methods on the questionnaires scales.

The comparison of these abstractions is our final step. We evaluate the similarity between agents and humans logs and the reported categories for humans (dashed arrow). This comparison is used to verify that the logs automated clustering corresponds to task-related high-level behaviors. If there is a strong similarity between the composition of behavior clusters and participant reported categories, it then means that behavior clusters are meaningful in terms of participant typology. Furthermore, it allows us to evaluate the level of credibility of our virtual agents in the simulation and to deepen the evaluation with a gender analysis.

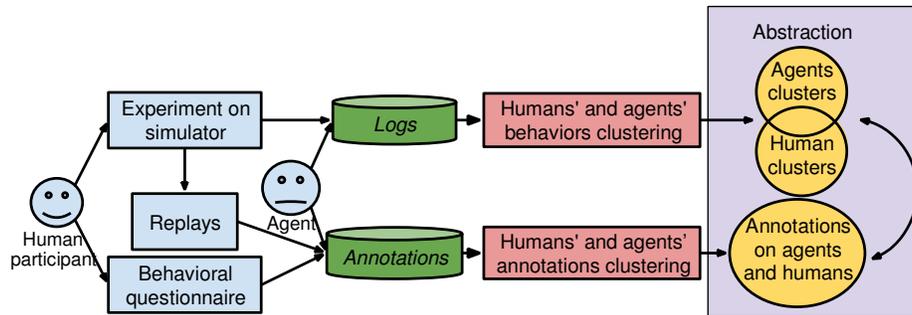


FIGURE 1. An architecture for behavior analysis and evaluation

### Human participants and agents

For the comparison between participants' and agents' behavior clusters, we collect the same logs for simulated agents as for the participants. As will be discussed in section *Objective approach data*, the clustering algorithm does not work directly on raw data: we use higher-level representation based on field expert knowledge.

Different types of agents are generated by exploring the parameter space such as normativity, experience, decision parameters ... The agents are placed in an identical driving situation to that presented to participants, so that the same logs are collected. The clustering is done on both agents' and human participants' logs, gathered together in the general term of *main actors* (see section *Objective approach data*).

For the evaluation step, it is possible to distinguish three cluster types in terms of human agent composition:

1. The clusters containing both human and agent main actors; they correspond to high-level behaviors that are correctly reproduced by the agents. We can divide this cluster type in three, depending on the participants' gender:
  - a cluster with agents and only male participants meaning that this agent behavior corresponds to a male behavior;
  - a cluster with agents and only female participants meaning that this agent behavior corresponds to a female behavior;
  - a cluster with agents, male and female participants. The agent reproduces a behavior shared by both genders.
2. The clusters consisting of simulated agents only correspond to behaviors that were produced only by the agents. In most cases, it reflects simulation errors, but it can also be due to a too small participants sample.
3. The clusters consisting of participants only correspond to behaviors that have not been replicated by the agents, and are thus either missing in the agent's model, or due to a too small agents sample in the parameter space. We can refine the analysis in terms of gender according to the cluster composition: male only, female only, or both genders.

In the end, we combine this agent-human comparison with the *annotation* analysis: the participants' behavior clusters are correlated to their reported categories. Furthermore, the composition of the behavior clusters in terms of simulated agents and participants allows us to give explicit information about those agents and to observe the composition in term of gender.

### Case study

Our method was tested in the context of driving simulators. We want to evaluate the realism and credibility of the behavior of the *IFSTAR's* road traffic simulator's agents (see Figure 2) by using the *Archisim* driving simulator described by Champion (13). To do this, the participants drive a car on a road containing simulated vehicles. The circuit provides three driving situations with about 1 minute of driving each: The first one is on a single carriageway with two lanes in the same direction. The main actor encounters a vehicle at low speed in the right lane. The second one is on a single carriageway with two traffic lanes in opposite directions. A vehicle

at low speed is in the right lane while several vehicles are in the other traffic lane. The third one is on a divided high-way with two traffic lanes for each carriageway, where the main actor encounters congested traffic due to several trucks.

Our method is illustrated in the following sections with this application to the study of driving behavior. However, the presented method may be used in any kind of participatory simulation, by choosing relevant task-related questionnaires.



FIGURE 2. Driving simulator device

## DATA

### *Subjective approach data (questionnaires)*

The behavior of human participants in virtual reality is prone to biases induced by the device. We are thus interested in the participants' behavior in their task, but also in their relation to the device in order to control the experience. For virtual reality systems we propose to use three sets of questionnaires:

1. a set concerning the studied activity, allowing an ulterior comparison with agents' behaviors;
2. a set concerning the type of relation of the participant with the immersion device; and
3. a set concerning the experiment itself to evaluate the device and the behavioral credibility of simulated agents.

### **Typology of behavior**

In the first place it is necessary to submit a behavior questionnaire specific to the field before the experiment to characterize the general behavior of the participant in the studied activity (*i.e.* participants *habits*). In the context of our application to driving simulators, the *Driver Behavior Questionnaire (DBQ)* developed by Reason et al. (3) is well known. It provides a general score, but also scores on 5 subscales: 1) *slips*; 2) *lapses*; 3) *mistakes*; 4) *unintended violations*; and 5) *deliberate violations*. In addition, it supplies 3 subscales related to the accident risk: 1) *no risk*; 2) *possible risk*; and 3) *definite risk*.

An adopted behavior in a precise situation may not correspond to the participant's general behavior. For example, in driving simulators, the general driving behavior captured by the *DBQ* may not correspond to the participant behavior in the precise studied situation. Furthermore, the general behavior questionnaire is completed by the driver about his/her own behaviors. This adds a bias due to introspection.

This is why we created a questionnaire called *annotations*. This questionnaire is completed by a different set of participants. It avoids the introspection bias. Furthermore, having a population which is observing the situation allows us to collect situation specific information. The questions are rated on a *Likert-type* scale (see Likert (14)). In our application to driving simulators, the questionnaire contains a question rated on a 7 points scale (and *no opinion*) from *no* to *yes* for each of the 5 *DBQ* subscales.

The 3 risk-related subscales are merged into a unique question named *accident risk* rated on a 3 points scale (and *no opinion*). We also add a question related to the perceived control on the same 7 points scale with the purpose of evaluating the main actors' control in general. At last, a question asking if the main actor is a human or a simulated agent is added in order to compare how the behavior clustering and the annotators separated the participants from the agents.

### Tendency and habit of immersion

To control whether the users' relation to immersion has an impact on his/her behavior and on his/her perception of the agents credibility, we evaluate how the participant reacts to immersion techniques and hence his/her ability to immerse him/herself in the virtual environment. In order to achieve this, we use a questionnaire of immersion propensity: the Immersive Tendencies Questionnaire (ITQ) of Witmer and Singer (2) which is divided into the following subscales: *Involvement*, *Focus*, *Emotions* and *Game*.

We also take into account the participant's habit of immersion. For this we deepen the *Game* scale of the ITQ, which contains only two items, with a questionnaire about the involvement in video games to evaluate more precisely the gamer engagement typology. We use the Game Engagement Questionnaire (GEQ) of Brockmyer et al. (15) that defines the commitment level of the participant: *Absorption*, *Flow*, *Presence* and *Immersion*.

### Evaluation of the device and behavioral credibility

The first questionnaire evaluates the presence effect of the participant during the experiment in all its facets. For this we use the Presence Questionnaire (PQ) of Witmer and Singer (2) which provides an overall score and scores based on its different subscales: *Realism*, *Ability to Act*, *Interface Quality*, *Ability to Examine*, *Self-Evaluation of the Performance*, *Auditive* and *Haptic*.

In order to deepen the evaluation of behavioral credibility, we have also elaborated two questionnaires:

- the first one aims at evaluating the perceived quality of agents' behaviors in the whole simulation. It contains a statement for each phase based on the following model: "Human beings can have the behavior performed by agents in this situation";
- the second one focuses on precise situations which occurred during the simulation. It is submitted during the replay step and contains one or more questions by phase.

### Objective approach data (main actors logs)

In our traffic simulation, we collect from 8 to 13 variables each 300 ms. The variables shared by all the main actors are the time, the milepost, the road, the gap and the cap to the lane axis, the speed, the acceleration, and the topology. Specific variables to the driven vehicles are added: the wheel angle, the pressure on pedals (acceleration, brake and clutch), and the gear.

### From raw data to high-level data

The road traffic experts chose the following indicators: some high-level variables like the inter-vehicles distance and time, the jerk (the derivative of acceleration with respect to time), the time to collision (under the assumption of constant speeds for both vehicles), and the number of lane changing (which is not a temporal indicator); as well as some low-level variables such as speed, acceleration, lateral distance and cap to the road axis.

## HIGH-LEVEL BEHAVIOR & COMPARISON

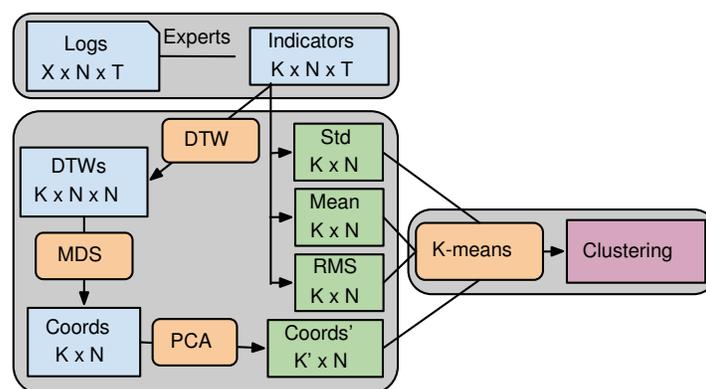


FIGURE 3. Logs preprocessing and clustering

## A cluster based analysis

To generalize the analysis of our logs to the tactical/strategic behavior level, we propose to use behavior categories. These categories serve as abstraction to the indicators by regrouping, within the same cluster, different logs representative of the same high level behavior.

Just as for the categories of the observed behaviors, we need a participant typology from the questionnaires scales and sub-scales. Independently from the application domain, using behavior questionnaires, we obtain qualitative data on *Likert*-type scales. The answers are transformed into quantitative data via a linear numeric scale. Scale scores of questionnaires are then calculated by adding the scale-related questions, and normalized between 0 and 1. Once data are processed, we classify the participants scores using the same clustering algorithm (as the one used for the indicators) to obtain drivers categories. This allows us to obtain clusters corresponding to how participants are annotated.

### Chosen algorithm

We use the *Cascade K-means* algorithm which executes several *K-means* for  $K \in \{1, \dots, N\}$ . The classic *K-means* algorithm uses  $K$  random initial centroids. It then proceeds those two steps alternatively until convergence: 1) The assignment step which assigns each main actor  $ma$  to the cluster  $C_i$  whose mean yields the least within-cluster sum of squares  $m_i$  at time  $t$  (see Equation (1)); 2) The update step which calculates the new means  $m$  to be the centroids of the main actors in the new clusters at time  $t + 1$  (see Equation (2)).

$$\forall j \in \{1, \dots, k\}$$

$$C_i^{(t)} = \left\{ ma_p : \|ma_p - m_i^{(t)}\|^2 \leq \|ma_p - m_j^{(t)}\|^2 \right\} \quad (1)$$

$$m_i^{(t+1)} = \frac{1}{|C_i^{(t)}|} \sum_{ma_j \in C_i^{(t)}} ma_j \quad (2)$$

The initialization of the clusters is done with *K-means++* (see Arthur and Vassilvitskii (16)) which allows a better distribution of clusters' centers in accordance with the data. To do so, the centroid of the first cluster is initialized randomly among the main actors. Until having  $K$  clusters, the algorithm computes the distance of each main actor to the last selected centroid. Then, it selects the centroid of a new cluster among the main actors. The selection is done randomly according to a weighted probability distribution proportional to their squared distance.

Finally, we must select the "best" number of clusters with respect to our clustering goal. This is done using the *Variance Ratio Criterion* created by Calinski and Harabasz (17) which takes into account the inter-distance (*i.e.* the within-cluster error sum of squares) and intra-distance (*i.e.* the between-cluster error sum of squares) of the clusters.

### Preprocessings

Field experts are consulted to identify important indicators. Then we calculate the indicators from the logs for those that could not be collected.

In the context of a dynamic simulation, most of the indicators are temporal. The data to classify are thus ordered sequences of values for each main actor. In order to classify those data, two ways exist: we can use an algorithm taking temporal data as input or use flat data by concatenating temporal indicators related to a participant on a single line. The first solution significantly increases the algorithms' complexity because they must take into account the possible temporal offsets of similar behaviors. The second one ignores temporal offsets but permits the application of classic algorithms.

We choose a hybrid solution of data preprocessing which allows us both to have a single set of attributes for each participant and to take into account temporal offsets. To do this, we generate as many vectors as main actors (participants and virtual agents). Each vector contains the following information extracted from the indicators identified by the field experts: *a*) mean values; *b*) standard deviations; *c*) root mean squares; and *d*) temporal aggregations. Temporal indicators are compared with an algorithm taking into account temporal offsets.

The adopted solution for the preprocessing of temporal offsets is to use a pattern matching algorithm such as *Dynamic Time Warping (DTW)* or *Longest Common Subsequence (LCS)*. We choose the *DTW* algorithm which calculates the matching cost between two ordered sequences (*i.e.* indicators  $ind^a$  and  $ind^b$ ) in order to measure their similarity. Let  $T$  be the number of simulation time steps. The algorithm computes a  $T \times T$  matrix. It initializes the first row and the first column to *infinity*, and the first element to 0. It then computes each element of the matrix  $M_{ij} \forall (i, j) \in \{2, \dots, T+1\}^2$  according to the distance between the two sequences at time  $t$  and to the matrix element neighborhood (see Equation (3)). As *DTW* complexity is  $O(N^2)$ , we use an approximation of this algorithm: the *FastDTW* algorithm of Salvador and Chan (18) which has order of  $O(N)$  time and memory complexity.

$$DTW[i, j] \leftarrow \text{distance}(ind_i^a, ind_j^b) + \min(DTW[i-1, j], DTW[i, j-1], DTW[i-1, j-1]) \quad (3)$$

As *DTW* calculates the similarity between two instances of a temporal variable. The less the instances are similar, the more the cost increases. Let  $inds$  be the set of indicators and  $K = |inds|$  be the number of indicators. For each indicator  $ind \in inds$ , we calculate the  $N \times N$  mutual distances matrix  $D_{DTW}^{ind}$ , where  $N$  is the number of main actors (participants and agents).

In order to include *DTW* similarities as new variables describing the main actors, we use a *Multi-Dimensional Scaling* algorithm (*MDS*) to place each main actor in a dimensional space. The algorithm assigns a point to each instance in a multidimensional space and tries to minimize the number of space dimensions. The goal is to find  $N$  vectors  $(coord_1, \dots, coord_N) \in R^N$  so that  $\forall (i, j) \in N^2, \| coord_i - coord_j \| \approx D_{DTW}^{ind}(i, j)$ .

As *DTW* is a mathematical distance, the *MDS* algorithm applied to each  $D_{DTW}$  is able to minimize the number of space dimensions to 1 (*i.e.* a vector of coordinates). Then we have as many vectors of coordinates as indicators.

Indicators' coordinates may be correlated among each others but the *K-means* algorithm uses a dimensional space of which the axes are orthogonal to each other. In order to apply this algorithm, we need to project the data on an orthogonal hyperplane of which the axes are two by two non-correlated.

The *Principal Component Analysis (PCA)* calculates the non-correlated axes which give a maximal dispersion of the data. It is then possible to reduce the number of dimensions avoiding redundant information by compressing them. Data are represented in a matrix of coordinates  $C$  with  $K$  random variables  $\{ind_1, \dots, ind_K\}$  containing  $N$  independent realizations. This matrix is standardized according to the center of gravity  $(\overline{ind_1}, \dots, \overline{ind_K})$  (with  $\overline{ind}$  the arithmetic mean) and to the standard deviation  $\sigma$  of the random variables. It is

then possible to calculate the correlation matrix:  $\frac{1}{N} \cdot \tilde{C}^T \cdot \tilde{C}$ . The *PCA* looks for the axis  $u$  which maximizes the variance of the data. To do so, it calculates a linear combination of the random variables in order to project the data on this axis:  $\pi_u(C) = C \cdot u$ . We keep the same number of axes  $K$  for the projected indicators as for the indicators ( $K$ ).

$$\tilde{C} = \begin{bmatrix} \frac{ind_{1,1} - \overline{ind_1}}{\sigma(ind_1)} & \dots & \frac{ind_{1,K} - \overline{ind_K}}{\sigma(ind_K)} \\ \vdots & \ddots & \vdots \\ \frac{ind_{N,1} - \overline{ind_1}}{\sigma(ind_1)} & \dots & \frac{ind_{N,K} - \overline{ind_K}}{\sigma(ind_K)} \end{bmatrix} \quad (4)$$

### Behavior clusters

Finally, we apply on the *PCA* projected indicators the clustering algorithm described above. We thus obtain behavior clusters of main actors, as shown in Figure 3.

## Clusterings comparison

Now that we have *annotations* clustering and *behaviors* clustering on main actors, we want to compare the clusters composition between the *annotations* and the *behaviors*.

Hence, we need a similarity measure between two clusterings  $C_1$  and  $C_2$ . We use the *Adjusted Rand Index (ARI)* of Hubert and Arabie (19) which is based on pair counting: a)  $N_{00}$ : the number of pairs that are in the same set in both clusterings (agreement); b)  $N_{11}$ : the number of pairs that are in different sets in both clusterings (agreement); and c)  $N_{01}$  and  $N_{10}$ : the number of pairs that are in the same set in one clustering and in different sets in the other (disagreement) and viceversa. The *Adjusted Rand Index*  $ARI \in [-1,1]$  is calculated using a contingency table  $[n_{ij}]$  where  $n_{ij}$  is the number of agreements between instances  $i$  and  $j$ :  $n_{ij} = |C_1^i \cap C_2^j|$  (see Equation (5)). It is a corrected-for-randomness version of the original *Rand Index*  $RI \in [0,1]$  of Rand (20): where the expected value of  $RI$  for two random clusterings is not constant, the expected value of  $ARI$  is 0.

$$ARI(C_1, C_2) = \frac{RI(C_1, C_2) - E[RI(C_1, C_2)]}{1 - E[RI(C_1, C_2)]} \quad (5)$$

where

$$E[RI(C_1, C_2)] = \left[ \sum_i \binom{\sum_k n_{ik}}{2} \sum_j \binom{\sum_l n_{lj}}{2} \right] / \binom{n}{2}$$

## EXPERIMENTATION

The participants in our driving simulation experiment are regular drivers aged from 24 to 59 (44% female). Our experiment is carried out on a device comprising a steering wheel, a set of pedals, a gearbox and 3 screens allowing sufficient lateral field of view (see Figure 2). These screens are also used to integrate the rear-view mirror and the left-hand mirror. 23 participants used this device.

A first test without simulated traffic is performed for the participant to get accustomed to the functioning of the simulator and to the circuit. Then, the participant performs the scenario, this time in interaction with simulated vehicles. It should be noted that, as the behavior of simulated vehicles is not scripted, situations differ more or less depending on the main actor's behavior. The data are then recorded for the processing phase. A video is also made for the replay. Finally, the participant completes the questionnaires. For the situation specific behavioral credibility questionnaire, the video replay of the experiment is viewed by the participant.

After all the participants did the experiment, another population of 6 participants fills the *annotations* questionnaire, viewing the video replay of the first driving situation in order to evaluate the adopted behaviors of the main actors (*i.e.* 23 participants and 14 agents).

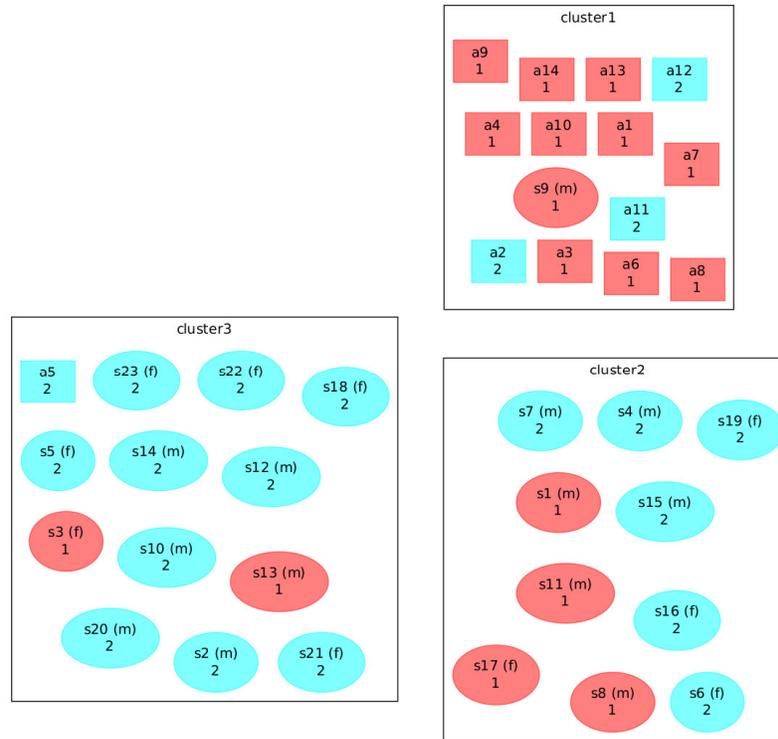
One participant had simulator sickness during the replay but was able to finish the experiment, and one annotator had dizziness and ceased watching.

## RESULTS

### *Annotations and behaviors*

With the behavior clustering on main actors, we are able to analyze how many human (men and/or women) behaviors are reproduced by the agents, how many human behaviors are not adopted by the agents, and how many agent behaviors are not adopted by participants. We are also capable of making those behaviors explicit via the similarity with *annotations* clusters if relevant.

For the first driving situation, the domain experts advised us on the importance of the cap and the lateral distance to the road axis, and of the inter-vehicle distance. The *Variance Ratio*



**FIGURE 4. Comparison of main actors for the first driving situation between *behavior* clustering within rectangles and *annotations* clustering grouped together by color.**

*Criterion* gives the maximal score for  $K = 3$  for the indicators clustering (*i.e.* 3 behaviors) and for  $K = 2$  for the *annotation* clustering (*i.e.* 2 driver categories).

The clustering is shown in Figure 4 with the *behaviors* clusters within rectangles and *annotations* clusters<sup>47</sup> grouped together by color (the cluster number is also written just below the main actors' names). The participants (named from s1 to s23 with gender information: *M* for male participant and *F* for female participant) are represented with ellipses, and the agents (named from a1 to a14), are in rectangles. The rand index is 0.59 and the adjusted rand index is 0.18.

- *cluster1* contains one male participant ( $s9(m)$ ) and nearly all the agents (excepted  $a5$ ). Most of its main actors are annotated in the same way (*i.e.* in cluster (1)). So, the main actors of the *cluster 1* adopted a similar driving behavior, *i.e.*: the lowest scores on risks, slips, lapses, mistakes, unintended violations and deliberate violations questions and the highest scores on the perceived control question. Therefore, they are judged as careful drivers. The participants of this cluster change lane very early when the vehicle at low speed is still far away. They then pull the car back in the right lane after overtaking. We can notice that they respect the first speed limitation and the second one at 70 km/h due to coming turns.
- *cluster2* is only composed of participants (6 male participants and 4 female participants) which are mixed between the two *annotations* clusters. Those participants do not overtake the vehicle at low speed or only at the very end.
- *cluster3* is mainly composed of participants (6 male participants, 6 female participants, and the agent  $a5$ ). Those participants are largely annotated in the same cluster (2), which has the lowest score on the perceived control question and the highest scores on other questions, meaning that they are judged as

<sup>47</sup> All subscales were included except for the *human or simulated agent* question which is not directly related to the adopted behavior.

unsafe drivers. We can note that the agent  $a_5$  is separated from other agents and judged as an unsafe driver because it changes lane at the last moment, overtakes but stays in the left lane. It also does not respect speed limitation with an average speed of 10 km/h above limitation.

### **Behaviors clustering composition**

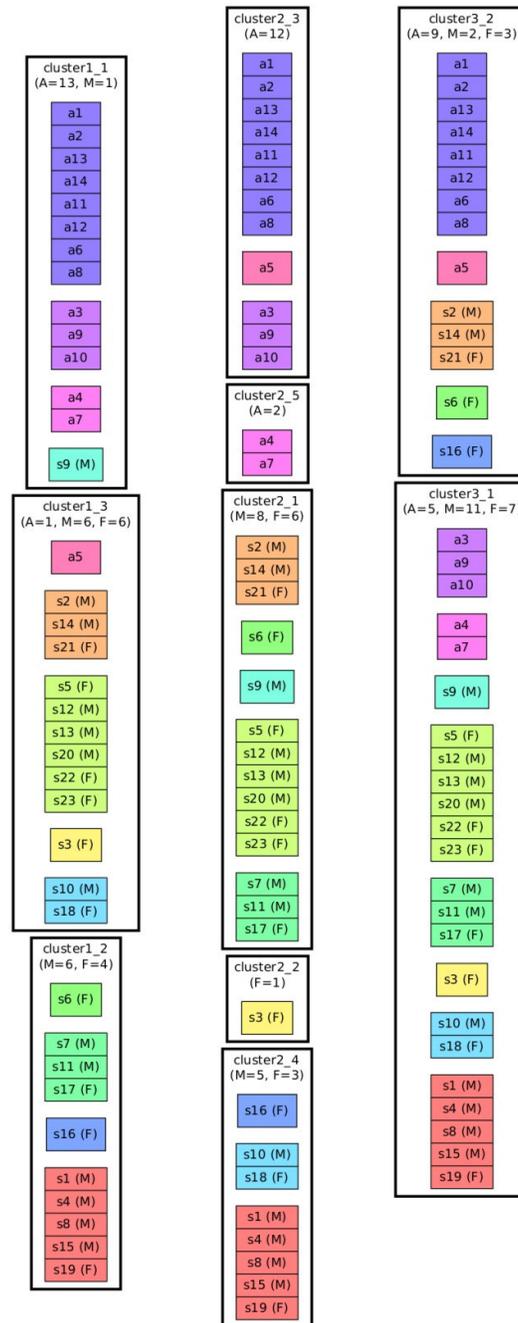
The Figure 5 shows the clustering composition for each driving situation (left to right). Clusters of each clustering  $c$  are represented within rectangles, and named  $cluster_c\#$  with the composition details in terms of agent  $A$ , male  $M$ , and female  $F$  just below them. As for the previous figure, agents are names  $a\#$ , male participants  $s\#(M)$  and female participants  $s\#(F)$ . We have regrouped the main actors who are together for all driving situation. As the first driving situation has been described in section *Annotations and behaviors*, we will now analyze the two other driving situations.

For the second driving situation, the domain experts indicate us to focus on the number of lane-changing, the lane number, and the time to collision. The rand index between the first driving situation clustering and this one is 0.74 and the adjusted rand index is 0.39.

- *cluster2.1 contains 8 male participants and 6 female participants. They all overtake the vehicle at low-speed after the second or the third oncoming vehicle.*
- *cluster2.2 is only composed of one female participant who tries to overtake after the third oncoming vehicle, changes lane, but reconsiders the situation seeing another oncoming vehicle and cancels her move.*
- *cluster2.3 is an agent only cluster: Those agents do not try to overtake the vehicle at low-speed and follow it at constant speed and constant inter-vehicle distance.*
- *cluster2.4 is composed of 5 male participants and 3 female participants who do not try to overtake either or only after the fourth oncoming vehicle.*
- *cluster2.5 contains 2 agents whose behavior is roughly similar to the one of the other agents.*

For the third driving situation, the relevant indicators are the number of lane-changing, lane number, and the average speed. The rand index between the first driving situation clustering (respectively the second one) and this one is 0.50 (respectively 0.54) and the adjusted rand index is 0.02 (respectively 0.09).

- *cluster3.1 contains 5 agents, 11 male participants, and 7 female participants. It contains two main behaviors: not overtaking, and overtaking and then pull back in.*
- *cluster3.2 is composed of 9 agents, 2 male participants and 3 female participants. Main actors have strong accelerations and decelerations. They stay on the left lane and overtake. The participant  $s_6$  do not overtake but her vehicle have important lateral oscillations maybe misinterpreted as overtakings by the clustering algorithm.*



**FIGURE 5. Behavior clusterings for each driving situation (left to right). Each cluster of a clustering is represented as a rectangle with the agent, male and female composition. The main actors who are together in all clusterings are grouped together within a cluster.**

## DISCUSSION

We have a significant similarity between *annotations* and *behavior* clusterings, meaning that we are able to classify our logs data into high-level behavior clusters which are meaningful in term of driving *annotations*. Nevertheless the two clusterings are not identical with regard to the clusters composition nor with regard to the clusters number. This could be due to the number of annotators. Furthermore, the behavior clustering is

done on noisy indicators for human participants and on smooth indicators for agents. A solution might be to add a noise on the agents data or to smooth the participants data. This problem may come from the clustering algorithm which is a classic but basic one. We have to test with advanced algorithms like *EM* or a temporal algorithm.

In the comparison between *annotations* and *behaviors* for the first driving situation, one agent was in a mainly human composed cluster (with the same number of male and female participants, meaning that this behavior is common to both genders). An explanation is that it is able to simulate the majority driver's behavior of this cluster which is *unsafe*. If it is, we can then consider that this *unsafe* behavior is an agents ability. To verify this assumption, we would need a specific test in which the parameter set that was used for the agent *a5* is confronted to different situations, and compared with logs and *annotations* of cautious human drivers.

Conversely, one male participant was in the mainly agent composed cluster judged as cautious for a majority of them. This requires further study to understand what was specific in this subject's driving behavior that was similar to the agents' behaviors. A possible explanation is that the agents behaviors are closer to male drivers, or that a typically male behavior is produced by an overlarge number of agents. This will require a larger driver population to conclude. *cluster2* does not contain any agent, meaning that the agent's model is not able to reproduce this human driving behavior (*i.e.* this behavior is lacking in the agent's model).

In the second driving situation the agents do not overtake the vehicle at low-speed but follow it at constant speed and inter-vehicle distance. The fact that no participant is in the agent clusters (*i.e.* no participant adopted those behaviors) shows that those behaviors are inaccurate (*i.e.* are errors) and should be investigated further. Two clusters contain both male and female participants meaning that those two behaviors are common to both genders. One female participant is a singleton. With a larger population, if she is still alone, that would mean that she is an outlier. On the contrary if she is grouped with other female participants, that would mean that this behavior is female-specific and not reproducible by the agents.

In the third driving situation, the two clusters contain agents, male, and female participants. This indicates that the agents are able to reproduce the adopted highway behaviors. This might be due to the specific highway driving style which is more easily reproducible.

### Questionnaires correlations

We have calculated the Two-Tailed Pearson correlation ( $df = 21$ ) between *Driver Behavior Questionnaire* subscales, *Immersive Tendencies Questionnaires* subscales, *Game Engagement Questionnaire* and *Presence Questionnaire* subscales. Significant results (with  $p < 0.05$  as in the works of Fisher et al. (21)) are shown in Table 1, for both age and gender.

We have found very few significant correlations between gender and questionnaire results. Men have lower scores on the *DBQ unintentional violations* scale, higher scores on the *PQ performance auto-evaluation* subscale, and lower scores on the *ITQ emotion* subscale.

As the scores are auto-evaluations, there is probably a bias due to gender since these three subscales are typically loaded with social representations. Men tend to report less emotions, and to overrate their performance in tasks (see *e.g.* O'Laughlin and Brubaker (22)).

**TABLE 1. Significant correlations (Pearson,  $df = 21$ , two-tailed)**

	DBQ violations	Mistakes	Slips	PQ perf	HMI	ITQ Emotion	Implication
Gender	-0.45 ( $p < 0.05$ )	-	-	0.52 ( $p < 0.02$ )	-	-0.47 ( $p < 0.05$ )	
Age	-0.42 ( $p < 0.05$ )	-0.47 ( $p < 0.05$ )	-0.56 ( $p < 0.01$ )	-	0.45 ( $p < 0.05$ )	-	-0.44 ( $p < 0.05$ )

Interestingly, we have found more correlations between age and questionnaire results, which show that younger generations have less problems with the human-machine interface and overall implication in the simulation. It is also seen in several *DBQ* subscales: mistakes, slips and violations.

Several hypotheses went unsupported. We have not found correlations between gender and game habits or game engagement. Concerning the virtual agents behavior, there is also no correlation between gender and virtual drivers credibility scores, although there is a correlation between age and virtual drivers credibility scores.

## CONCLUSIONS

Although gendered differences in driving behavior are well-documented, our study through automatic clustering did not differentiate strongly men and women traces.

The presence questionnaire performance auto evaluation is correlated to gender, but also to the *DBQ* unintentional violations and mistakes; which may indicate that mistakes done in real life driving are also done in simulators. Confidence also plays a role in self evaluation, since the annotators did not separate their observation results strongly.

Although women tend to trust automated systems less than men Cottrill and Thakuria (23), we did not find significant differences in their experience with the simulator, neither for presence scales, nor for virtual agents behavior credibility. From our results, age is a much stronger factor to differentiate immersion tendency, credibility annotations, and overall behavior.

One of our working hypotheses was that participants video game experience would impact the result of our study. Once again, no independent significant correlations were found from our data. However, age is indeed a factor. An explanation is that technology penetration is higher in younger generations, and since the gender gap is diminishing, video game experience is no more discriminating, especially between genders. This is counter intuitive since previous studies show that gaming is not yet past the gender divide Kafai et al. (24) (habits, types of games, platforms are still heavily gendered), although playing some types of games reduces some gender differences such as spatial cognition Feng et al. (25).

Our methodology proposes a set of tools and data processing units enabling inter-human and virtual agents behavior comparison. By using objective and subjective data, an in-depth analysis of observed behavior is enabled, while automatic clustering provides an objective viewpoint on the simulation results.

Concerning driving simulators' validity, we found that in the case of the *Archisim* simulator, there is not significant gender bias either for the driving part or for the virtual drivers behavior. However, this kind of study should be conducted each time a simulator is validated for a use, in order to ensure that it is the case. Furthermore, we found several significant correlations with age, which calls for further studies on this dimension in the design and validation of driving simulators.

We also found two contradictory results: the virtual drivers tend not to reproduce human behavior, as automatic clustering does differentiate their behavior in several situations. Hence, the realism of their behavior is not high. However, the perception of this behavior by external annotators has been judged differently, since they scored the virtual drivers as being more human than the human replays. Hence, the credibility axis and the realism axis have opposite scores. One explanation is that humans tend to be less normative than virtual drivers which follow strict rules, while the social expectation is that humans should have a normative driving behavior, and deviance from the norm is considered as an error of the virtual driver.

Finally, we found out that the agents behavioral credibility was not correlated to the presence questionnaire results. This is due to the axis on which presence is scored in Witmer's and Singer's presence questionnaire, which is more a score on the device components' quality than the immersion feeling or psychological fidelity. Hence, we recommend using other presence questionnaires to study virtual agents credibility, such as Schubert (26).

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# SUSTAINABILITY

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# The contribution of comfort, convenience, and liking of bicycling to the bicycling gender gap: Evidence from Davis, California

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## ABSTRACT

Bicycling as a mode of transportation has many benefits for women, yet throughout most of the world, women cycle less than men. Researchers have put forth many reasons for the gender gap in cycling, including that bicycling is less convenient for women, that they are less comfortable bicycling, and that they like bicycling less than men. Thus, a deeper understanding of women's attitudes toward bicycling is an important step towards the development of policies and programs to increase bicycling among women. To that end, this paper explores results from a series of studies in Davis, California that have aimed to identify key factors influencing bicycling as a mode of transportation. The studies, conducted between 2006 and 2012, include both quantitative and qualitative approaches, with some focusing on adults and some on children. The results from these studies point to comfort and liking of bicycling as more important factors than convenience, and they suggest that differences between men and women begin early in life. These findings have implications for the development of policies and programs to reduce the gender gap in bicycling.

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**KEYWORDS:** Travel behavior; Bicycling; Cycling; Gender.

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## INTRODUCTION

Bicycling as a mode of transportation has many benefits for women, including improved health, low monetary costs, and a smaller environmental footprint. Yet throughout most of the world, women cycle less than men. The notable exceptions are the Netherlands and Denmark, where over half of bicyclists are women; in Germany, Sweden, and Finland, nearly half of bicyclists are women (Garrard, Dill, and Handy, 2012). But in countries that are less friendly to cycling, the shares are much lower: less than one-third of bicyclists are women in Canada, the U.K., Australia, and the U.S. Within any given country, men and women face the same cycling environment – the same distances to destinations, the same bicycle infrastructure, the same vehicle traffic. The fact that women are less likely to cycle than men in most countries suggests that they are less able to overcome or less willing to overlook limitations of the cycling environment in these places.

Researchers have put forth many reasons for the gender gap in cycling (Garrard, Dill, and Handy, 2012). One potential explanation is the burden of household responsibilities that women often bear, including childcare duties and household chores. These responsibilities often mean less flexibility in daily schedules and more need for transporting others that could make bicycling inconvenient. Another potential explanation is that women feel less confident and comfortable bicycling and, conversely, that they are more concerned about safety and security when bicycling than men. A third possibility is that women simply don't like bicycling as much as men. Although the high shares of female bicyclists in the Netherlands and Denmark suggest that a good bicycling environment can erase these differences or at least their effect on the decision to bicycle, it is clear that, in other parts of the world, how women think and feel about bicycling plays a critical role in explaining their lower bicycling shares.

Thus, a deeper understanding of women's attitudes toward bicycling is an important step towards the development of policies and programs to increase bicycling among women. To that end, in this paper I explore results from a series of studies in Davis, California that have aimed to identify key factors influencing bicycling as a mode of transportation. The studies, conducted between 2006 and 2012, include both quantitative and qualitative approaches, with some focusing on adults and some on children. My exploration of the results from these studies points to comfort and liking of bicycling as more important factors than convenience, and they suggest that differences between men and women begin early in life. I conclude with a discussion of the implications of these findings for policies and programs.

## BACKGROUND

Davis, a prosperous university town with a population of around 65,000 located in the Central Valley of California, is well-known for its bicycling culture. According to data from the 2005–2009 American Community Survey, 15.5% of Davis workers usually bicycle to work, far above the national rate of less than 1%. Nearly half of employees at the University of California, Davis (UC Davis) who live within the city commute to campus by bicycle. Its flat topography, compact development patterns, and generally good weather make it a good place for bicycling, and since the 1960s the city has supported bicycling through infrastructure investments and other bicycle-friendly policies (Buehler and Handy, 2008).

Several things make Davis an interesting setting for a study of bicycling behavior. First, there is enough bicycling that it is possible to acquire a sufficiently large sample of bicyclists. Second, the supportive physical environment makes it possible to study the effect of individual and social factors on bicycling; in other communities, a poor cycling environment can outweigh favorable individual and social factors. In addition, although the physical environment is generally supportive of bicycling throughout the city, there are notable variations (e.g. central Davis has few off-street bike paths), and distances to destinations (e.g. downtown or the high school) differ substantially depending on residential location.

With a team of enthusiastic students, I have undertaken seven studies since 2006 in Davis that aimed to identify key factors influencing bicycling as a mode of transportation. Four studies focused on adults, three on children. Four studies involved large sample surveys, while three employed semi-structured interviews. I provide an overview of the studies and their methods below; more detailed descriptions can be found in the papers cited.

- *Six-city Survey*. The purpose of this study was to explore the relative importance of physical environment, social environment, and individual factors in explaining bicycling behavior. In 2006, we surveyed adult residents of Davis and five other small cities in the western U.S., chosen for their similarities to Davis with respect to size, climate, and topography, but differences with respect to bicycling culture and infrastructure. For each city, we purchased a random sample of residents from a commercial provider and recruited participants by mail to complete an on-line survey. We achieved an overall response rate of 12.6%, with a rate of 18.8% in Davis. Analyses of the survey data are published in Emond et al., 2009; Xing et al., 2010; Handy et al., 2010; and Handy and Xing, 2011. Results presented in this paper are for the 335 Davis respondents in the sample.
- *Campus Travel Survey*. The annual Campus Travel Survey is a joint effort by Transportation and Parking Services and the Institute of Transportation Studies at UC Davis. The main purpose of the survey is to assess how the UC Davis population travels to campus, awareness of campus transportation services, and perceptions of mobility options. The 2010 survey was administered online in November to a stratified random sample of 15,704 students, faculty, and staff (of an estimated total population of 40,618). Invitations with a link to the online survey were sent to university e-mail addresses, and 26% of those invited completed the survey. Results presented in this paper are for the 2980 faculty and staff respondents who live in the City of Davis (other communities are at least 10 miles from the campus and thus generally beyond a reasonable bicycling distance). Analysis of the survey data is presented in Miller and Handy, 2012.
- *Formation of Attitudes Toward Cycling*. The purpose of this study was to explore the formation of attitudes towards cycling among adults using a “mobility biography” approach. We recruited participants through advertisements posted in the local newspaper and other means. All participants were required to be English-speaking residents of Davis between the ages of 25 and 65. We conducted semi-structured interviews between July and October 2010 of about one hour in length with each of 54 participants. Participants were asked about their experience with bicycling throughout their lifecourse. Interviews were professionally transcribed and then analyzed for key themes. Analyses of the interviews can be found in Lee et al., 2013; and Underwood et al., 2013. In this paper, we present selected examples from these interviews.
- *E-bike Early Adopters*. In this study, we qualitatively explored the experiences of early adopters of electric bicycles (e-bikes) in Davis and the surrounding Sacramento region. We used a variety of techniques, including the snowball method, to recruit 27 e-bike owners, all adults, to participate in semi-structured interviews about their experiences in the fall of 2011. We conducted 3 interviews by phone and 24 in person, with the semi-structured interviews lasting between 20 and 45 minutes. Interviews were

professionally transcribed and then analyzed for key themes. Interview results are available in Handy et al., 2013. In this paper, we present selected examples from these interviews.

- *Bike-to-Soccer Study.* In October and November 2006, we surveyed parents of players in the local youth soccer league as to their mode of travel to the game and to practices. The two-page survey was administered in-person at Saturday morning soccer games. Survey takers covered 76 games over three weekends. The final dataset includes surveys for 1,084 players, nearly half of all players in the league. The players in the league range in age from 5 to 18. Survey results are published in Tal and Handy (2008).
- *High School Survey.* In April 2009, we conducted a survey at Davis High School to measure mode share for school trips as well as attitudes toward bicycling. The two-page survey was administered during home period on a selected day, yielding a 75% response rate and 1,357 valid surveys. Davis High School has grades 10 through 12, with most students in the age range of 14 to 18. Survey results are published in Emond and Handy (2011).
- *Kid’s Attitudes Study.* In 2009, we launched Phase I of a longitudinal study of the formation of attitudes towards bicycling and driving beginning in childhood. We conducted semi-structured interviews with 20 fourth graders (ages 9 and 10) in Davis and their parents. In 2011, we re-interviewed 14 of the original child-parent pairs and added 11 new pairs for a total sample of 25; the children were now sixth graders (ages 11 and 12). The interviews lasted about 40 minutes on average, including questions for both the child and the parent. Interviews were professionally transcribed and then analyzed for key themes. We plan to repeat the interviews at two- to three-year intervals. Phase I results are summarized in Maiss and Handy, 2010, and Phase II results in Driller and Handy, 2013.

## RESULTS

Although gender differences were not the primary focus of any of the seven Davis bicycling studies, they produced an abundance of quantitative and qualitative data that shed light on differences between women and men with respect to both the amount of cycling and attitudes towards cycling. First I present a variety of findings for adults from bivariate analyses, multi-variable logistic regression models, and qualitative analyses, then for youth.

### Adults

In Davis, as in the rest of the U.S., men bicycle more than women, though the differences are not as great. Among Davis residents, half of women reported having bicycled in the last week on an average of 2.78 days, compared to 56.4% of men on an average of 3.31 days (Table 1). The differences in percent bicycling last week or not are statistically significant, however. Among UC Davis employees (faculty and staff), the gender differences for bicycling to campus are starker: women are less likely to report any travel by bicycle to campus, that the majority or the entirety of their travel to campus is by bicycle, or that they bicycled as their primary mode at least once in the previous week.

**TABLE 1. Gender Differences in Bicycling - Adults**

Davis Residents	Women	Men	p-value
Biked last week	50.0%	56.4%	0.240
Days biking last week	2.78	3.31	0.051
UC Davis Employees			
Any travel to campus by bike	51.8%	57.6%	0.003
Majority of travel to campus by bike	41.7%	50.9%	0.000
All travel to campus by bike	29.1%	40.0%	0.000
Bike as primary mode at least once	50.3%	55.9%	0.003

Convenience does seem to play a role. For UC Davis employees, women are more likely to say that they need to use a car during the day and to have responsibility for picking up children than men; the differences are statistically significant but not large (Table 2). Among women, those who bike are far less likely to need to use a car or to have pick-up kid duty than those who don’t bike. In other words, household responsibilities do

seem to help explain which women are and aren't bicycling, but they do not seem to explain much of the gender difference in bicycling, at least in the UC Davis sample. Note that other aspects of convenience not measured in the survey might have a stronger contribution to gender differences in bicycling.

**TABLE 2. Gender Differences in Bicycling Convenience – Adults**

UC Davis Employees	Women	Men	p-value	Women who bike	Women who don't bike	p-value
Need to use car during day	34.6%	31.9%	0.000	23.9%	45.1%	0.000
Pick-up kid duty	17.4%	15.4%	0.003	8.3%	20.8%	0.000

The differences in bicycling comfort for men and women are dramatic both among Davis residents and UC Davis employees (Table 3). Men express greater comfort bicycling on all types of facilities, with the differences increasing with the exposure of the bicyclist to traffic. For example, about 60% of women said they are comfortable riding on a four-lane street with a bike lane, in comparison to nearly 72% of men. Among women, those who bicycle are far more comfortable than those who don't on most facilities, but they are equally unlikely to feel comfortable bicycling on a four-lane street without a bike lane. The patterns are similar for UC Davis employees. The majority of UC Davis employees report agreement or strong agreement with the statement "I am very confident riding a bike," but again the share is higher for men than women and higher for women who bicycle than those who don't.

**TABLE 3. Gender Differences in Bicycling Comfort – Adults**

	Women	Men	p-value	Women who bike	Women who don't bike	p-value
Davis Residents						
<i>Comfortable riding on...</i>						
Off-street bicycle path	92.8%	94.9%	0.718	98.7%	86.8%	0.017
Quiet residential street	96.1%	98.9%	0.191	100.0%	92.2%	0.044
Two-lane local street with bike lane	87.0%	92.5%	0.026	96.1%	77.9%	0.004
Four-lane street with bike lane	60.5%	71.8%	0.011	73.3%	48.1%	0.004
Four-lane street without bike lane	5.2%	14.8%	0.000	5.2%	5.2%	0.034
UC Davis Employees						
<i>Comfortable riding on...</i>						
Off-street bicycle path	80.9%	90.3%	0.000	87.2%	74.4%	0.000
Quiet residential street	92.0%	96.8%	0.000	96.7%	87.2%	0.000
Two-lane local street with bike lane	77.5%	89.4%	0.000	88.7%	65.9%	0.000
Four-lane street with bike lane	61.4%	80.1%	0.000	71.7%	50.7%	0.000
Four-lane street without bike lane	11.7%	27.8%	0.000	12.4%	11.1%	0.000
I am very confident riding a bike	63.5%	84.3%	0.000	72.6%	54.3%	0.000

Concerns about potential safety hazards are related to bicycling comfort. Among Davis residents, women are more likely than men to be very concerned about being hit by a car, bitten by a dog, mugged or attacked, or crashing because of road hazards (Table 4). Women who bicycle are less likely to report such concerns than women who don't bicycle. Interestingly, concerns about being hit by another bicyclist are not statistically significantly different for women and men, or for women who bicycle versus those who don't. By far the greatest concern for all groups is being hit by a car.

**TABLE 4. Gender Differences in Bicycling Concerns – Adults**

Among Davis Residents	Women	Men	p-value	Women who bike	Women who don't bike	p-value
<i>Very concerned about...</i>						
Being hit by a car	25.3%	19.3%	0.025	15.6%	35.1%	0.014
Being hit by another bicyclist	11.2%	7.4%	0.419	6.5%	16.0%	0.177
Being bitten by a dog	5.8%	3.4%	0.078	1.3%	10.4%	0.055
Being mugged or attacked	4.6%	3.4%	0.000	1.3%	7.9%	0.003
Crashing because of road hazards	12.3%	6.9%	0.123	5.2%	19.5%	0.011

In addition to convenience and comfort, some observers have hypothesized that women simply like bicycling less than men. Our data show that this is indeed the case. Among Davis residents, women are less likely to agree and to strongly agree that “I like riding a bike” than men (Table 5). Among UC Davis employees, women are more likely to say that they agree that they like riding a bike, but far less likely to strongly agree that they like riding a bike than men. For both populations, women who don’t bike are almost as likely as women who bike to agree that they like riding a bike, but they are far less likely to strongly agree. This is particularly true for women in the Davis population, less than 4% of whom strongly agree that they like riding a bike. In other words, simply liking bicycling is not enough; really liking bicycling is what seems to get women (as well as men) on their bikes.

**TABLE 5. Gender Differences in Attitudes – Adults**

Davis Residents	Women	Men	p-value	Women who bike	Women who don't bike	p-value
I like riding a bike (agree)	43.1%	45.3%	0.05	42.9%	43.4%	0.000
I like riding a bike (strongly agree)	27.5%	35.2%		50.6%	3.9%	
UC Davis Employees						
I like riding a bike (agree)	42.5%	39.8%	0.000	44.7%	40.2%	0.000
I like riding a bike (strongly agree)	33.2%	44.8%		46.5%	19.5%	

Multi-variable binary logistic regression models show significant differences in the importance of just some of these factors for women relative to men in predicting whether an individual is a bicyclist (defined as having bicycled at least once in the last week) or not while controlling for other factors. For Davis residents, having child pick-up duties was important for both men and women to an equal degree, but in an unexpected way: those with such duties were almost twice as likely to bicycle as those who didn’t (see Table 3 in Emond et al., 2009). Bicycling comfort was a significant factor in predicting bicycling for women though not for men, but safety concerns were not a significant factor for either men or women, while liking biking was a significant predictor for both men and women. Among UC Davis employees, liking biking was also significant for both men and women, but strongly liking biking had over 7 times the effect of just liking biking (see Table 5 in Miller and Handy, 2012). Comfort and convenience were equally important for men and women, and had much smaller effects than liking biking. These results suggest that while women and men differ on average with respect to bicycling convenience, comfort, and liking, the effect of these factors on their bicycling is largely similar. In other words, gender differences in bicycling occur because women, on average, are less comfortable bicycling and like it less than men, not because comfort and liking are more important to their decision.

Our interviews with Davis residents also highlighted the importance of convenience, comfort, and liking of bicycling for women. In one analysis, we focused on bicycle crashes and their impact on the participant’s comfort with and continued desire for bicycling (Lee et al., 2013). Interestingly, while crashes reduced comfort and desire for some women, for women with a strong liking of bicycling they seemed to have little effect. In addition, women who didn’t bicycle were affected by hearing about bicycle crashes. The following comments illustrate these points:

“Once I was not paying attention or something and I ended up twisting the front handlebars and then skidding and scraping my shoulder blade. And that was a little scary, but it was nothing, I was just not being attentive, and both of those things just forced me to be more cautious and attentive. It didn’t detract me from riding. No way, I got right back on.”

“I fell off my bike once in Madison [Wisconsin], on a fairly busy street and if a car had been coming it would have run over my head. That was kind of traumatic. I wasn’t injured or anything, it was just a big scare...but I don’t think it stopped me from biking any more or anything like that.”

“I’ve had two major falls. One of them was when I was living in Austin... I fell off my bike and I got so scared that I didn’t really want to get on my bike again in Austin after that. I was on a busy, four-lane road and there was no bike lane... I wasn’t injured, just scared myself.”

“I had a little accident on my bike riding on the gravel in the parking lot. A car came in unexpectedly and scared me, so I slipped on the gravel and fell down and got all scratched up. So that turned me away from bicycling for awhile.”

“I was afraid after hearing about all those bike accidents. I think my perception would probably be different if I biked as well... If I were an experienced biker, what I read in the paper wouldn't so much influence me... But when you don't have that experience, you tend to believe and base your reaction on what you read. I mean, that's what you have to go by.”

In these interviews, women also described the ways in which they like bicycling, whether the feel of bicycling itself or the social aspects of bicycling:

“I feel like I'm flying.”

“You can join with your friends to bike together to just to a new place and explore new places... I like [bicycling] because [of] this.”

“I think my experience as an undergrad in Davis really shaped my like for biking. Biking was a really fun thing I did... it wasn't just a mode of transportation to campus... I have some really good memories attached to doing social activities on my bike.”

## Youth

Gender differences in bicycling start at an early age, even in Davis (Table 6). Boys are more likely to usually bicycle to their soccer games, to middle school, and to high school. By middle school, the gap is already over 12 percentage points (as reported in retrospect by high school students); by high school it has increased to 13 percentage points.

**TABLE 6. Gender Differences in Bicycling – Youth**

	Girls	Boys	p-value
Share biking to soccer games	14.3%	21.4%	0.000
Share biking to middle school	44.3%	56.9%	0.000
Share biking to high school	30.1%	43.4%	0.000

As for adults, differences in convenience, comfort, and liking of bicycling seem to contribute to these differences, though parents and peers are also a factor. In high school, girls and boys differ significantly on factors related to convenience: girls are more likely to say they are rushed in the morning, have lots of stuff to carry, and wear clothes that make bicycling difficult (Table 7). Boys are more likely to say that they are confident in the bicycling ability, feel comfortable riding on busy streets, and feel comfortable getting places on their own, though the majority of girls also agree on these points. Girls are less likely to say they like bicycling and also less likely to say that they like being physically active. On the other hand, they are more likely to agree that protecting the environment is important to them, and they are less likely to agree that driving is the coolest way to get to school, attitudes that might encourage more bicycling. Boys are more likely to say that their friends bicycle to school, but few boys or girls admit that they worry what their peers will think of them if they bicycle. With respect to parental influences, the differences between girls and boys are not statistically significant.

Girls who bicycle are more likely to report agreement with statements related to confidence and comfort than girls who don't bicycle. The share of girls agreeing that they like biking is nearly 30 percentage points higher than for girls who don't bicycle. Girls who bicycle also like physical activity more, and they care more about the environment. They are more likely to have friends who bicycle to school, and less likely to say that driving is the coolest way to get to school. The largest difference between girls who bicycle and those who don't is for parental encouragement: 79% of girls who bicycle agree that their parents or guardians encourage them, compared to less than one third of girls who don't bicycle. Girls who bicycle are more likely to say that their parents or guardians bicycle and less likely to agree that they can rely on them to drive them places. However, convenience seems to matter less: the two groups do not differ with respect to being rushed in the morning or having stuff to carry, though girls who bicycle are less likely to say they wear clothes that make bicycling difficult.

**TABLE 7. Gender Differences in Attitudes\* - Youth**

High School Students	Girls	Boys	p-value	Girls who Bike	Girls Who Don't Bike	p-value
<i>Convenience</i>						
I am always rushed to get ready in the morning.	56.7%	48.2%	0.002	52.7%	58.4%	0.165
I have lots of stuff to carry to school.	59.1%	41.5%	0.000	63.2%	57.2%	0.146
The clothes I wear make it hard to ride a bicycle.	17.4%	5.7%	0.000	12.3%	19.6%	0.021
<i>Confidence and comfort</i>						
I am confident in my bicycling ability.	79.6%	88.6%	0.000	92.7%	73.9%	0.000
I feel comfortable bicycling on a busy street with a bicycle lane.	53.0%	69.0%	0.000	69.8%	45.6%	0.000
I feel comfortable getting places on my own.	81.6%	88.5%	0.001	87.8%	78.9%	0.006
<i>Preferences</i>						
I like bicycling.	49.1%	56.1%	0.012	69.8%	40.1%	0.000
I like being physically active.	75.3%	83.1%	0.001	82.4%	72.2%	0.005
Protecting the environment is important to me.	74.9%	60.5%	0.000	81.0%	72.2%	0.160
<i>Social influences</i>						
My friends bicycle to school.	46.9%	53.2%	0.023	61.5%	40.6%	0.000
Driving is the coolest way to get to school.	26.4%	39.9%	0.000	20.0%	29.2%	0.013
I worry what my peers will think of me if I bike to school.	5.6%	7.8%	0.806	4.9%	6.0%	0.000
<i>Parental influences</i>						
One or both of my parents/guardians bicycle frequently.	27.9%	25.8%	0.391	41.2%	22.1%	0.000
My parents/guardians allow me to go places by myself.	84.9%	87.5%	0.183	89.3%	83.1%	0.038
My parents/guardians encourage me to bicycle.	46.5%	44.3%	0.412	79.0%	32.4%	0.000
I can rely on my parents/guardians to drive me places.	43.9%	39.8%	0.142	35.5%	47.5%	0.004

\*Percent agreeing or strongly agreeing with the statement.

A binary logistic regression model of bicycling to high school (or not) were estimated for girls and boys for this paper by Yan Xing using a market segmentation approach. She developed separate models for boys and girls, then used these results as a basis for a pooled model with interaction terms for gender. The final model shows several differences in the factors that matter to girls versus boys (Table 8). Confidence in bicycling ability is associated with a greater likelihood of bicycling for girls but not boys. Girls who are able to rely on parents to drive them places and often go off campus for lunch are less likely to bicycle; these factors do not matter for boys. On the other hand, needing a car and actual bicycling distance are deterrents to boys but not to girls, though both boys and girls are deterred by the perception that they live too far from school to bicycle. Surprisingly, having a parent with a high level of education (a proxy for family socio-economic status) is a strong predictor of bicycling for boys but not girls. For both boys and girls, having parents who encourage them to bicycle is one of the most important factors, as is having a driver's license and access to a car. Liking biking is also an important factor for both boys and girls. It is notable that, with the exception of the parent's educational level, the factors they have in common have larger effects than those that differ, suggesting that, as was true for adults, the differences in their level of comfort or liking are the primary explanation for their differences in bicycling.

**TABLE 8. Binary Logistic Regression Model of Bicycling or Not for High School Students**

Variable	Coefficient	Sig	Odds Ratio
<i>Constant</i>	-2.273	***	0.103
<i>Socio-demographics</i>			
Driver's license and car access	-1.493	***	0.225
Parent has least Bachelor degree*Male	1.183	***	3.265
<i>Attitudes</i>			
Like to bicycle	0.364	***	1.440
Bicycling ability confidence*Female	0.197	**	1.218
Often go off-campus for lunch*Female	-0.307	***	0.736
Need a car*Male	-0.304	***	0.738
<i>Social environment</i>			
Parents encourage bicycling	0.797	***	2.220
Can rely on parents chauffeuring them*Female	-0.311	***	0.733
<i>Physical environment</i>			
Live too far from school to bicycle	-0.524	***	0.592
Actual bicycling distance*Male	-0.235	*	0.791
Valid N	1064		
Pseudo- R <sup>2</sup>	0.375		
Log-likelihood (full model)	428.158		
Log-likelihood(constant only model)	701.299		

\*\*\*p < 0.01; \*\*p < 0.05; \*p < 0.1

Some of the attitudes held by high school girls as revealed in the survey were evident in our interviews with 6th grade girls living in Davis (Driller and Handy, 2013). Although most girls said that they enjoyed bicycling, many of them expressed discomfort with or dislike of certain aspects bicycling. It is notable that girls' concern over appearance was apparent even at this age. These patterns are illustrated by the following comments:

"I love biking. It's really fun."

"I don't really like – well, biking is not my thing."

"If it's in the morning and it's super cold, I don't like [biking]."

"Sometimes when I'm too tired, it's kind of uncomfortable and I'm just really pooped."

"I don't like traffic. It's bad – I'm bad enough as it is that like just on the bike lane. And then in the street, I don't know. No, I don't think I could do that well."

"Because then – I usually like wear a ponytail and if I had to put a helmet on, then it'd just mess it up."

In reflecting on their experience with bicycling during high school, the adult residents of Davis that we interviewed highlighted the social stigma associated with bicycling (Underwood et al., 2013). Although both men and women expressed these views, the effect seemed to be stronger and more lasting for women and more often associated with a sense of fashion that influenced their liking of biking. The following comments are illustrative of these views:

"Once I was in junior high school it was not the cool thing to do, to ride bikes."

"You know, I always liked riding my bicycle as a kid, but when I got to high school it was considered dorky, so then I never rode it in high school."

"In high school biking is not that cool; it didn't seem trendy enough to do."

"People that biked generally speaking were nerdier... big backpacks versus the cars with the purse and the book bag."

"My younger brother rode a bike a lot in high school, but I didn't. It wasn't a fashionable thing to do."

## DISCUSSION

Several clear patterns emerge from this exploration of gender differences. First, women bicycle less than men, even in Davis, and the difference starts as early as middle school. Second, women are less comfortable and confident bicycling, and they like bicycling less than men; the same is true for girls. Third, factors related to convenience are more of a mixed bag, perhaps because of the many different dimensions of convenience. Convenience seems to be more important at the high school level, particularly for girls. Fourth, parents seem to be more important for high school students than peers for both boys and girls. Finally, across all of these factors, comfort with and liking of bicycling are consistently important for women as well as for men.

These results have important implications for efforts to increase bicycling among women and decrease the gender gap between women and men. First, communities must build facilities that are more comfortable for women given their lower level of bicycling confidence. As recent studies have shown, women prefer facilities separated from traffic, such as bicycle paths and cycle tracks, or routes on low-traffic streets, sometimes called bicycle boulevards (Monsere et al., 2012). Second, communities must implement programs designed to increase bicycling comfort and confidence for women as well as girls. Several advocacy organizations across the U.S. now offer courses tailored to women, for example. Third, communities must adopt strategies to increase the convenience of bicycling in a variety of ways. This could range from land use policies that ensure that destinations are within bicycling distance to programs that provide subsidized bicycle trailers to families. Finally, communities must implement promotional programs that move women from simply agreeing that they like bicycling to the “strongly agree” category. Cyclovias and other community events may help on this score. The League of American Bicyclists has outlined a wide range of strategies for getting more women on bicycles (Szczepanski, 2013). Whatever strategies a community chooses to implement, it is important they rigorously evaluate the strategies to determine their effectiveness and guide further efforts (Pucher et al., 2010).

Such strategies are largely consistent with at least three of the traditional “4 E’s” approach to bicycling planning in the U.S.: engineering, education, and encouragement. To the degree that enforcement, the fourth “E” helps to increase bicycling comfort, it too has a role to play. Another “E” that could make a significant difference, though it has generally received less attention, is equipment (Lovejoy and Handy, 2012). Having the right bicycle with the right gear can help to increase comfort and convenience as well as liking of bicycling. Our qualitative studies especially highlighted the importance of equipment – helmets, bicycles, baskets, trailers, etc. – in several different respects. For example, our interviews with adults in Davis suggest a connection between equipment and fashion, as illustrated by these quotes:

“...most of the time I wear my hair in a ponytail, and then [wearing a helmet] goofs up your hair. I know it’s a silly thing...” [note the striking similarity of this quote to the quote from a 6th grader in the previous section]

“...after going to Copenhagen, and also Amsterdam and seeing women look so lovely on bicycles. And they were not slouched over with their butts up in the air, which is just so unfeminine... that was the first transition I made was a more female oriented bike.”

Beyond fashion, which may influence the liking of bicycling, equipment has important implications not just for comfort and convenience but for the very feasibility of bicycling for women, as illustrated by these comments:

From an e-bike user: “I’m 65, so I don’t think people should think age is a barrier. Who would have thought somebody my age would be commuting 20 miles a day on a bike to work?”

“... a little bit of pride that goes into it, like one time we went to Target. So, I have a two-year old son and so he was on the bike trailer. We went to Target and ended up buying all these storage baskets and bins... My son was carrying like 3 boxes in his lap, and then I had the back of the trailer stuffed full, and then I had like all these things that were precariously in my bike basket. I just felt kind of like proud of myself that I could do all that and get home without dropping anything.”

In addition to highlighting the importance of equipment, these last quotes also illustrate the old adage, “where there’s a will there’s a way.” These women had a strong will to bicycle, and they found a way to do it. Living in Davis made that easier, in that good infrastructure and abundant bicycling have created relatively safe and comfortable conditions there. In communities with less supportive bicycling environments, women may be unable to find a way, no matter how strong their will. By investing in bicycle infrastructure and adopting policies and programs to promote bicycling, communities can ensure that women with the will to bicycle have

a way to do it. But our Davis research also points to the importance of increasing the will of women to bicycle by addressing the comfort, convenience, and liking of bicycling, and doing so from an early age. By providing the way and promoting the will, communities can increase the proportion of women bicycling and the proportion of bicyclists who are women, to the benefit of all.

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# Gender and the growth of cycling in a megacity region: Emerging evidence from London

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## ABSTRACT

Cycling's multi-decade secular decline in London levelled off in the 1990s, and in the 2000s there has been sustained growth. A range of policy interventions and physical/operational changes to the network have encouraged cycling, and the current policy ambition is for cycling to continue growing from 2 per cent of journeys to 5 per cent by 2026.

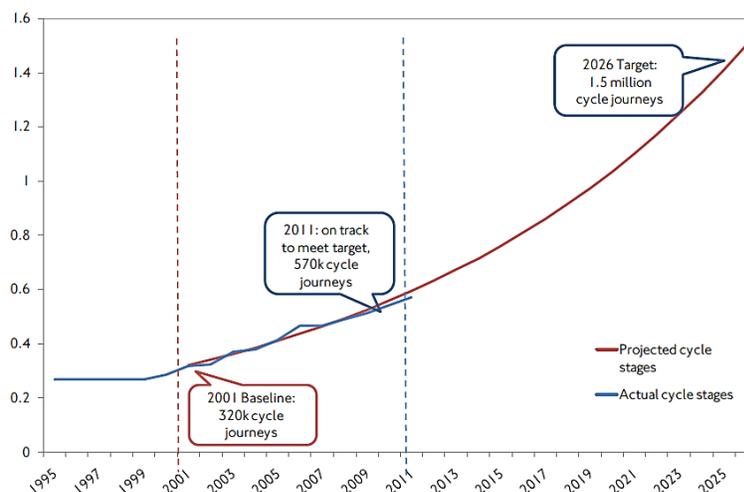
Little is known, however, about gendered aspects of London's cycling 'boom', and it is this research gap that we address. Drawing on British National Travel Survey data centred on 1998 (1996 through 2000) and 2008 (2006 through 2010), we characterise women's distinctive patterns of cycling in London, and show that, although men still outnumber women as cyclists, women have been disproportionately responsible for London's increasing cycling activity.

**KEYWORDS:** Gender; Bicycling; London.

## 1. INTRODUCTION

Across a wide range of geographic and social contexts, cycling is seen by transport policy makers as a desirable form of personal transport and worthy of encouragement. London is no exception, with two successive mayors in the 2000s having publicly committed to delivering a 400% increase in cycling's mode share (from 1% to 5% of all journeys) from 2001 levels by the year 2026 (1).

Specific policy initiatives have included junction re-design, new cycle lanes, travel planning, tax incentives, and a large-scale bikesharing system. As can be seen in Figure 1, the growth in cycling since 2001 has been broadly in line with the policy goal for 2026.



**FIGURE 1. Comparison of recent growth in cycling and growth trajectory required to meet the 2026 target of 5% modal share (reproduced from [1])**

This paper characterises the gendered aspects of the recent growth in cycling in London. Section 2 discusses relevant background, and Section 3 presents the main results. Section 4 concludes the paper with a discussion of the implications of this study's findings.

## 2. BACKGROUND

Cities around the world are pushing the agenda for more urban cycling as an active mode of transportation. Many supporting strategies are implemented, frequently in combination: infrastructure investment, bike sharing, public awareness campaigns, etc. For society, cycling is usually considered to be a green mode that can help deal with emissions leading to climate change, and at the same time improve energy efficiency and public health. For individual cyclists, this mode is seen as one of the quickest (in terms of journey time), most reliable (relatively unaffected by congestion), least expensive, and a way to keep fit.

Despite the societal and individual benefits of urban cycling, this mode is subject to major constraints:

- Cycling still represents a very small modal participation – less than 3% of journeys to and from work in most U.S. cities (2, 3).
- Cycling is perceived as an unsafe mode, which is confirmed by accident statistics.
- In addition to safety, other important challenges faced by urban cycling include infrastructure, air quality, weather and cultural aspects (4).

A key dimension that has attracted attention in recent years is *gender differences* in the practice of cycling. In many places, cycling is less prevalent among women than among men (although exceptions exist such as the Netherlands and Belgium (4)). In North America, even in cities with a relatively high population of cyclists, women do not routinely exceed a third of the total (this means that, in such cities, at least 2/3 of cyclists are men). The situation is somewhat similar in Australia, in which the participation of women in cycling for transport and recreation is also approximately half that of men. Unlike in Germany and a number of Scandinavian countries, this general pattern is also found in Greater London (5).

This gender difference has attracted some attention, but very little in countries like England where cycling is expected to continue growing as a form mode of transportation. A 2013 Parliamentary Inquiry noted that, despite Britain having lower rates of cycling than continental-European peers, *'there is nothing in the nature of the British temperament, or the way in which local economies function, which makes it impossible to see substantial double figures of [cycling] mode share'* (6). It noted that in Cambridge there is near-gender-balance amongst cyclists, but the only suggestion for increasing women's cycling levels was dedicated funding for promotion targeted at women.

Among the main factors, collision risk appears to be one of the most significant deterrents for women cycling. It has been argued that women are generally more risk-averse than men (7). Women are more sensitive to vehicular traffic exposure, surface conditions, winter, and in general to the risk of injury (8, 9). Several recent studies have also demonstrated that women prefer biking in certain environments and certain types of facilities: consistent with gender differences in risk aversion, women commuter cyclists preferred to use paths with maximum separation from motorized traffic (10, 11). However, very little research has also focused on investigating the link between women's cycling and the individual, socio-demographic, cultural and economic determinants of participation.

From a gendered studies perspective, ideally this would require taking into account a wider set of social, demographic, cultural and economic variables than is commonly available to transport researchers. But it would also require examining the sources of *assumptions* about the nature of how women's and men's household roles relate to bicycle travel demand, and of the resultant *decisions* taken by transport authorities to provide (or not provide) support for bicycling.

At the heart of such an analysis would be an appreciation that standard transportation system indicators such as trip rates and travel times, analysed by gender, are insufficient. Indeed it could be argued that the predominant preoccupation of transport professionals with peak-hour congestion is mostly irrelevant to women who would meet some of their household responsibilities, and/or access to employment, by bicycle. This is because some types of employment, notably part-time (or multiple part-time) employment in the health, education and personal service subsectors remain predominately the work of women. The temporal and spatial characteristics of such employment, coupled with typically disproportionate responsibility for

escorting children and grocery shopping, are likely to restrict the viability of bicycle use (12). Furthermore, the consequences of transport system changes to relieve congestion may favour peripheral shopping centres to an extent that induces the closure of neighbourhood shops and leisure facilities, to the detriment of bicycle access, and even to personal safety and security.

In a more general sense, the link between women's household roles and transport is often problematic to detect because in most countries women, more than men, perform many activities of economic importance but for which their labour is unpaid. These activities are therefore "off the radar" of official labour market statistics.

The research context is thus one of highly variable data availability and quality. At the current stage of transport and gender studies, a combination of fairly large sample national or regional travel survey data and a limited number of specialised surveys of cyclists is typically the best approach to overcome the relative rarity of cyclists in the population. The choice of variables that come closest to the understanding of roles, such as household structure (especially the number of young children, and the number of heads of household), detailed journey purposes, and the temporal and spatial distributions of cycling, is crucial.

Regardless of the difficulties, more research is needed to determine what policies and strategies are likely to be most effective in promoting cycling in cities like London. This research can help identify the factors and the characteristics of groups that can be targeted in order to increase the participation of women. In the longer term, we are interested in translating what is learnt about roles and bicycle travel into designs for built environments and facilities that can improve both the perception and the reality of cycling.

### 3. RESULTS

For this study we employ data from the British National Travel Survey (B-NTS), a large-scale and nationally-representative survey that has been undertaken periodically since the 1960s and continuously since the late 1980s (13). The instrument package includes both a detailed interview and a seven-day travel diary completed by all household members (including children). We focus on the London sub-sample of the B-NTS, and compare results from two 5-year bands ('earlier' being 1996–2000 and 'later' being 2006–2010), with sample sizes of  $n = 3,359$  and  $n = 9,016$  adults (18+) respectively. Although children's travel is included in the B-NTS, this study focuses exclusively on adults' travel. It is worth noting that the geography of Greater London is quite varied in comparison to the municipal boundaries of North American central cities, ranging from the City of London (where the financial district is located) through inner neighbourhoods of Victorian-era terraced homes to 20<sup>th</sup> Century suburbs and including some semi-rural outlying areas with agricultural land uses.

The advantages of using large-scale household survey data like the B-NTS are that the sample is representative of the population at large (in this case Londoners), the data collection protocol is subject to rigorous quality control, and the data include very rich descriptors of respondents' socio-demographics and a week's worth of their travel. Less resource-intensive (when measured in units of cost per observation) ways of observing cycling, such as traffic counts, are conversely limited by the lack of any detailed information about the cyclists or why they are cycling. A general weakness of large-scale travel survey data for this type of application, however, is that relatively few observations are made of lightly-used methods of transport (such as cycling in London), which places constraints on the ability to identify statistically significant patterns. Further, a specific limitation of the B-NTS is that privacy restrictions prevent publication of the microdata with fine-grained spatial information, and therefore the dataset provides limited opportunity to relate characteristics of the urban environment with cycling levels.

In the rest of this section we present this study's empirical results, based on a series of descriptive statistical analyses and a binary logistic regression model for participation in cycling.

#### 3.1 Top-level statistics

The B-NTS shows the number of cycling journeys per Londoner to have increased by 49% from 1996/2000 to 2006/10, to an average of 18.6 journeys per person per year. Women's rate of cycling is below men's, though cycling journeys per women have more than doubled (110% growth between 1996/2000 and 2006/10) whereas men's cycling journeys per capita have increased at a rate of 31%. In 2006/10 women were responsible for 31% of all cycling journeys by Londoners, as compared to 24% in 1996/2000. (All time-trends discussed in the preceding paragraph are significant at  $p < 0.05$ ).

### 3.2 Depth and breadth of cycling

As we observe a week's worth of B-NTS respondents' travel behaviour, we define 'cyclists' as anyone that cycled at least once during their diary week. By this method we find that 3.9% of adult Londoners were cyclists in 1996/2000, a figure that increased to 5.1% in 2006/10. This increase is very statistically significant, but the growth in the number of cycling journeys per cyclist per week was not significant (6.2 in 1996/2000 v. 7.0 in 2006/10:  $p = 0.13$ ). Thus we can conclude that the growing *breadth* of cycling is predominantly responsible for the overall growth, rather than the growing *depth* of cycling.

Table 1 shows this analysis for men and women separately. The share of female cyclists increased significantly over time, but the growth was not quite statistically significant for men. Average journeys per women cyclist increased more than men's, but neither of these time trends is statistically significant.

Finally, when we compare men and women (both in 2006/10), we see that the 'gender gap' in the share of adults that are cyclists (2.9% of women v. 7.5% of men) is statistically significant ( $p < 0.01$ ), but the gender gap in cycling journeys per cyclist is not ( $p = 0.40$ ). We can conclude that differences in the *breadth* of cycling between men and women are more responsible than differences in the *depth* of cycling (journeys per cyclist) for men's overall higher rate of cycling journeys per capita. Once we know that a person is a cyclist, no gender differences in frequency of use were found.

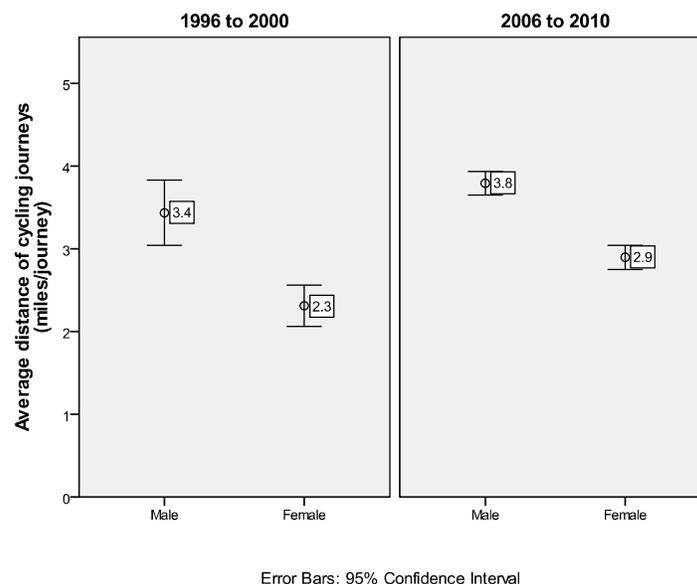
**TABLE 1. Share of adults that were cyclists and cycling journeys per cyclist, by men and women**

Measure	Gender	1996/2000	2006/10	Significance
Share of adults that were 'cyclists'	Women	1.7%	2.9%	$p < 0.01$
	Men	6.3%	7.5%	$p = 0.11$
Cycling journeys per cyclist per week	Women	5.9	7.3	$p = 0.23$
	Men	6.2	6.8	$p = 0.30$

Overall unweighted sample sizes: men in 1996/2000: 1,606, women in 1996/2000: 1,845, men in 2006/10: 4,356, men in 2006/10: 4,983. Unweighted sample sizes of cyclists: men in 1996/2000: 102, women in 1996/2000: 34, men in 2006/10: 315, women in 2006/10: 133

### 3.3 Cycling journey lengths

Figure 2 shows average cycling journey lengths for men and women in the late 1990s and late 2000s. Average cycling journey lengths are in the range between 2 and 4 miles, and whilst men's journey lengths have consistently been longer than women's on average, this difference is shrinking over time. The average cycling journey by men was 48% longer-distance in 1996/2000 than the average women's cycling journey, which decreased to a 31% difference in 2006/10.



**FIGURE 2. Average cycling journey distances, for men and women**

Figure 3 demonstrates gender differences in average journey length when journeys are classed into commuting and other journey types. It can be seen that women's cycling commutes have become much longer-distance over time, lengthening from an average of 2.9 miles/journey in 1996/2000 to 4.3 miles/journey in 2006/10 – now equalling the average distance of men's cycle commutes. In 2006/10, there was no difference between the genders in the average distance of cycling journeys for commuting, but men's journeys for all other purposes combined were 57% longer on average. Therefore, the previous differences in distances can be explained not by differences in commuting, but by other types of trips.

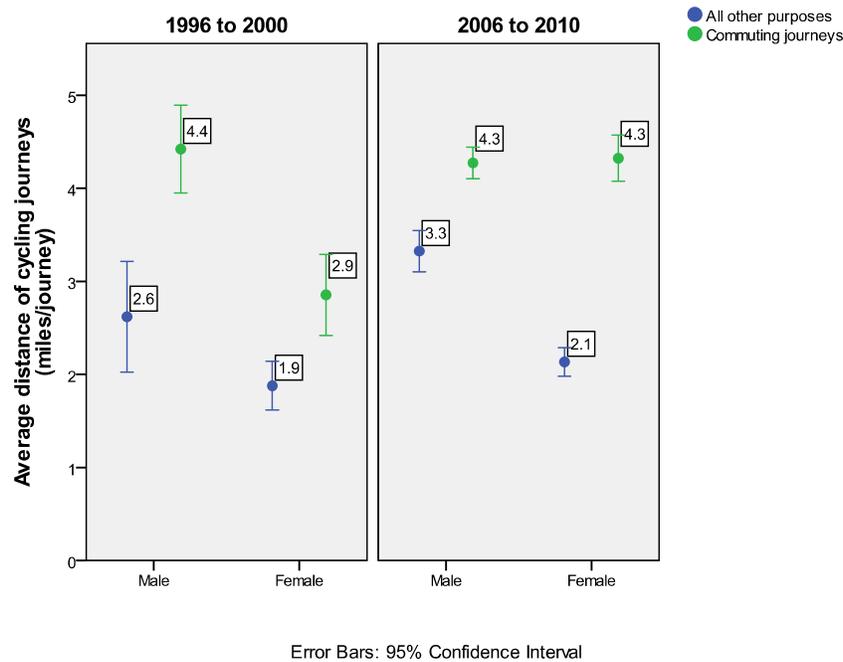


FIGURE 3. Average cycling journey distances for men and women, by commuting and other purposes

### 3.4 Journey purposes

Figure 4 looks more closely at gender differences in the cycling journey purposes. Commuting is the journey purpose that accounts for the largest share of both genders' cycling journeys, though it forms a smaller share of women's (34% v. 49% for men, in 2006/10). Journeys that are made in the course of work are, however, a larger share of women's cycling (9% for women v. 4% for men). The journey purposes that form a statistically-significantly larger share of women Londoners' cycling journeys than men's are:

- Business (9% v. 4%);
- Shopping (15% for women v. 10% for men);
- Personal business (11% v. 6%);
- Entertainment/public activities (10% v. 4%).

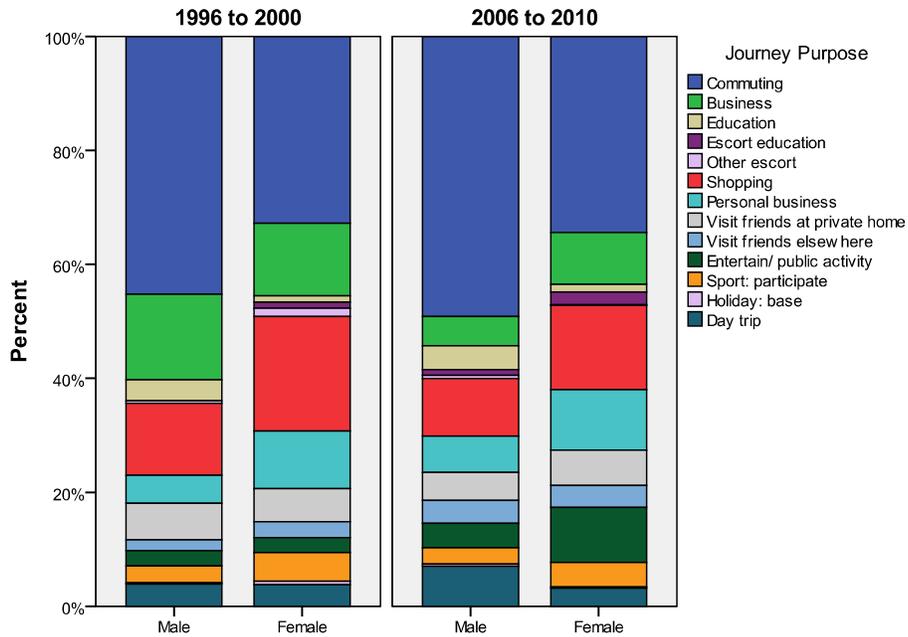


FIGURE 4. Distribution of cycling journeys by journey purpose, for men and women

### 3.5 Seasonality

Counts of cyclists in London show pronounced seasonal variation, with cycling activity much more prevalent in the warmer months (1). Figure 5 shows the rate of bicycling journeys per man and per woman when travel diaries that were recorded during the May to September period are considered separately from those recorded between October and April. The B-NTS shows higher rates of men’s cycling during the warmer months than the cooler months in both 1996/2000 and 2006/10, but the differences are not statistically significant. For women, cycling in the warmer months was not statistically significantly different from the cooler months in 1996/2000, but in 2006/2010 this had changed and women’s cycling during the warmer months was significantly higher. From the late 1990s to the late 2000s women’s cycling during the warmer months grew three times more quickly than in the cooler months (+ 153% v. 50%), and in the case of the cooler months the increase is not statistically significant.

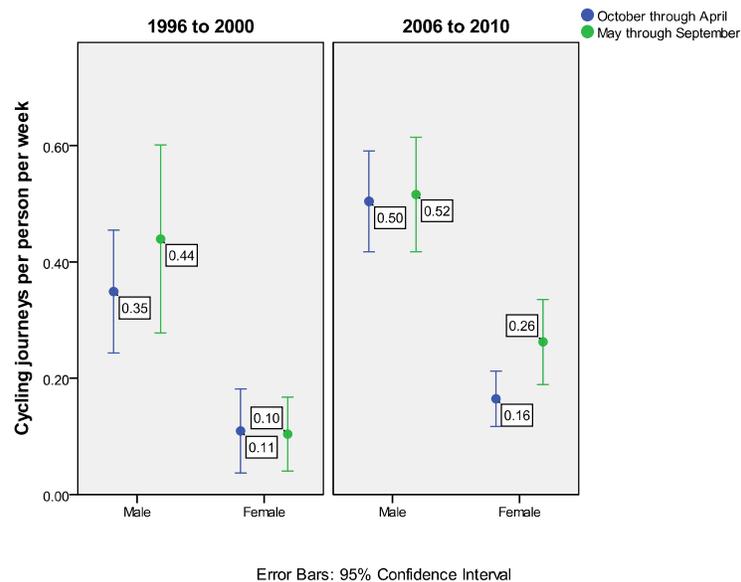


FIGURE 5. Average number of cycling journeys per person per week, for men and women

### 3.6 Party size

The B-NTS records travelling party size for all trips, and Figure 6 shows how this differs for men's and women's cycling journeys. In both time periods, women's cycling journeys were more likely than men's to be accompanied by others, but these gender differences are not statistically significant. For both genders, the time trend has been an increase in the share of cycling that is accompanied, but this trend is not significant for women.

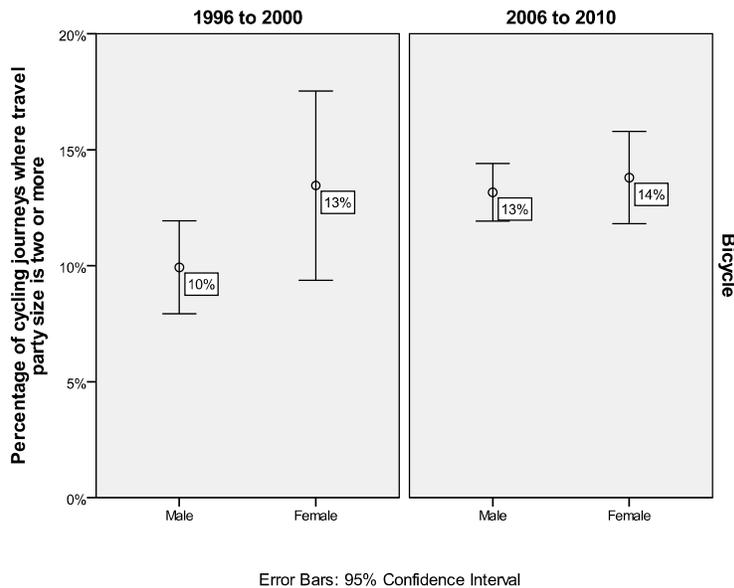


FIGURE 6. Percentage of cycling journeys that are accompanied by at least one other cyclist, for men and women

### 3.7 Profiles of male and female cyclists

In this section we examine the profile of men and women that cycled during their B-NTS travel diary week, bringing in a range of socio-demographic characteristics.

As can be seen in Table 2, the average age of both men and women cyclists are in their late 30s, with neither the time trend nor the difference between the genders statistically significant. In both time periods, women cyclists lived in higher-density neighbourhoods than men, and for both genders the residential density of cyclists may have increased over time – but neither the gender difference nor the time trends are statistically significant. When men and women are combined, however, the time trend of increasing residential density amongst cyclists is significant ( $p < 0.01$ ). This is consistent with results from London showing that the number of cyclists in Central London has grown very quickly since the late 1990s (roughly tripling) whereas cycling levels in Outer London has been basically flat (14).

The personal incomes of male cyclists may have increased somewhat over time (the difference is not significant,  $p = 0.12$ ), but women cyclists incomes appear to have fallen ( $p = 0.06$ ). Though the latter finding is nearly statistically significant, caution is called for as the 1996/00 data contain just 34 observations of women cyclists.

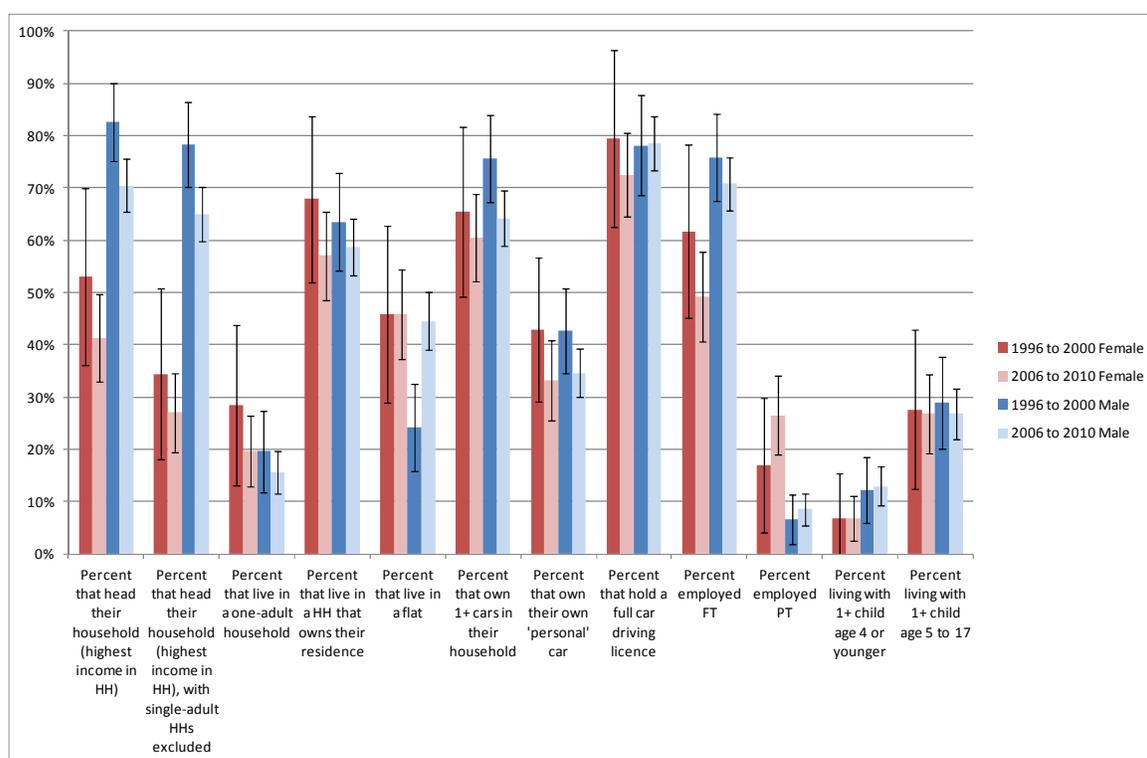
If one considers the aggregate income earned by other household members (i.e. cyclists' household income minus their personal income), this has increased by about £8,000 for both genders. Amongst men this change was statistically-significant ( $p < 0.01$ ), whereas it was not for female cyclists ( $p = 0.15$ ).

In 2006/10, male cyclists had statistically-significantly higher personal incomes than female cyclists (£32,161 v. £20,736,  $p < 0.01$ ), but female cyclists lived in households with higher levels of 'residual' income earned by the non-cyclist members (£23,905 v. £35,532,  $p < 0.01$ ), many of whom will be male partners. So, it may be concluded that gender differences in income levels among the population at large are also present in the much smaller set of adults that are cyclists.

**TABLE 2. Average age and income characteristics of cyclists, for men and women.**  
Standard errors are in brackets

	Women, 1996/2000	Women, 2006/10	Men, 1996/2000	Men 2006/10
Average age	38.0 (3)	39.4 (1)	39.6 (1)	38.8 (1)
Average residential density of postcode district of residence (persons/hectare)	53.1 (4)	62.0 (2)	50.4 (2)	60.6 (1)
Average personal income (earned by cyclist)	£28,408 (£4,251)	£20,736 (£1,810)	£28,138 (£2,323)	£32,161 (£1,468)
Total average income earned by other members living in households of cyclists (not the cyclist)	£27,374 (£4,933)	£35,532 (£2,690)	£15,846 (£1,838)	£23,905 (£1,444)

Figure 7 shows further socio-demographics of men and women cyclists.



**FIGURE 7. Selected socio-demographic characteristics of cyclists, for men and women**

We see that a smaller percentage of female than male cyclists are the highest-income-earner in their household, and that the difference becomes more pronounced when cyclists living in single-adult households (where the sole adult by definition earns the highest income) are excluded. Male cyclists have over time become less likely to earn the highest-income in their household, but it is of note that this is not reflected in an increase in the share of women cyclists that are the highest-income-earner in their household.

We found that in both 1996/2000 and 2006/10 a higher share of female than male cyclists live in single-adult households, and that for both genders the time trend is indicatively downwards. Neither the gender difference nor the time trends are statistically significant, however, and the downward time trend in the proportion of cyclists living in single-adult households is insignificant ( $p = 0.17$ ) even when both genders are combined.

No significant differences between the genders were found in the share of cyclists living in an owned residence (as opposed to rental housing). There was a significant increase in the share of male cyclists living in flats (apartments), but there was no change in the share of women cyclists that live in a flat (46% in both time periods).

In both the late 1990s and late 2000s the share of male cyclists living in a car-owning household (76% v. 64%) was higher than the figures for female cyclists (66% v. 60%), but the gender difference was not significant in either period. There has also, among both genders, been a corresponding drop in ownership of a personal car (defined as a car that the cyclist drives more than anyone else drives it). The drop in personal car ownership is not statistically significant when the genders are evaluated separately, but it is nearly so ( $p = 0.06$ ) when they are combined.

When we look at the percentage of cyclists that hold a driving licence, we see no clear time trends (a statically-insignificant decrease for women, and a statistically-insignificant increase for men). One hypothesis for the growth in cycling in London is that it is linked with the decreasing rate of driving-licence holding amongst both male and female Londoners under age 30 (15). However, the results of this analysis do not support that hypothesis as no significant growth in the share of cyclists that do not hold a licence was found, and the average age of both male and female cyclists was stable at roughly 39 years.

Male cyclists are more likely to be employed full-time than female cyclists (Figure 7) and are less likely to be employed part-time (both findings are statistically different only in 2006/10), a pattern that is also reflected in the population at large (beyond cyclists), as captured in the NTS sample. For both genders, the B-NTS data show decreases in the percentage of cyclists who are working full-time, and increases in the percentage of those working part-time, though the time trends are not statistically significant. When the genders are combined, the decrease in full-time employment amongst cyclists is nearly significant ( $p = 0.08$ ). The overall rate of full-time employment amongst adult Londoners in the NTS sample remained steady at 48% between these two time periods, hence we can conclude (subject to the significance level of 0.08) that cycling is increasing fastest amongst people that are not in full-time employment.

We see that women cyclists in both time periods are less likely to have young children (defined here as age 4 or younger) in their household. The gender difference in 1996/2000 is not close to significant ( $p = 0.37$ ), but is in 2006/10 ( $p = 0.07$ ). A larger share of [adult] cyclists live in households with older children (between ages 5 and 17). No major differences between men and women cyclists were observed.

### **3.8 Model of cyclist status**

The descriptive statistical analysis was followed up with a multivariate analysis, where the dependent variable was the binary indicator of whether or not a person was observed to cycle at all during their NTS travel week. Four binary logistic regression models were estimated, one each for men and women in 1996/2000 and 2006/10. Gender is typically specified in this type of analysis as an explanatory variable that accounts for *ceteris paribus* gender differences, and sometimes interacts with a subset of other explanatory variables. However, in order to investigate heterogeneity between the genders, in this study we estimated separate regression models for men and women independently.

Goodness of fit ( $r^2$ ) was modest, ranging between 0.05 and 0.12, suggesting that factors other than those captured in these models account for much of the variation in whether people cycle or not (Goodness-of-fit was better for the models of women's cycling than men's cycling). Likelihood ratio testing for all four models rejects the null intercept-only specification ( $p < 0.01$  for all four models). Therefore, whilst these regression models account for a relatively small proportion of the variance in whether or not people cycle, on the basis of the likelihood ratio test results we may reasonably use them to characterise the correlates of cycling in London.

**TABLE 3. Parameter estimates from binary logistic regression models of whether or not a person cycled at least once during their B-NTS diary week**

	Women 1996/2000		Women, 2006/00		Men, 1996/2000		Men, 2006/10	
Pseudo $r^2$ (McFadden's)	0.12		0.08		0.06		0.05	
Unweighted sample size	1,845		1,606		4,356		4,983	
	Parameter	p-value	Parameter	p-value	Parameter	p-value	Parameter	p-value
Intercept	-6.370	<0.001	-4.489	<0.001	-3.095	<0.001	-4.398	<0.001
Personal income (GBP/year)	6.54E-06	0.005	2.37E-05	0.005	-4.97E-06	0.303	8.32E-06	0.001
Income earned by other HH members (GBP/year)	3.90E-06	0.591	-4.44E-06	0.053	-1.02E-05	0.127	1.58E-06	0.541
Residential density	4.47E-03	0.564	4.81E-03	0.051	-1.68E-03	0.704	2.61E-03	0.336
Holds a full car driving licence	1.181	0.082	0.682	<0.001	0.244	0.410	0.573	<0.001
# cars in HH	0.023	0.955	-0.500	<0.001	-0.701	0.001	-0.475	<0.001
Employed PT	0.775	0.273	0.610	<0.001	0.677	0.155	0.376	0.109
Employed FT	0.797	0.225	0.172	0.247	0.733	0.032	-0.045	0.805
Presence of kids 4 or under in HH	-0.763	0.284	-0.342	0.022	-0.332	0.311	-0.185	0.280
Presence of kids 5 to 17 in HH	-0.063	0.905	0.037	0.757	0.307	0.236	0.090	0.533
Travel diary took place between May and September	0.395	0.285	0.162	0.082	0.277	0.175	0.081	0.471
Has any travel difficulties	-0.802	0.443	-1.214	<0.001	-2.549	0.015	-1.086	0.004
Age 18-34	0.210	0.786	0.651	0.001	0.357	0.395	0.877	<0.001
Age 35-59	-0.028	0.971	0.831	<0.001	0.390	0.345	1.081	<0.001
Age 60+	Reference variable							
Single adult HH	0.388	0.565	0.579	0.001	0.104	0.795	0.592	0.006
2-adult HH	-0.036	0.944	0.463	<0.001	0.124	0.650	0.562	<0.001
3+ adult HH	Reference variable							

The effect of one's personal income is positively linked with cycling for women in both time periods, but the effect grew weaker by the late 2000s. This is consistent with the result, shown in Figure 7, that there is a growing proportion of women cyclists that are not in full-time work. For men, the effect of personal income was not significant in the late 1990s, but was, like for women, positive and significant in the 2006/10 period. For women the effect of income earned by others in the household was negative (but not significant) in the late 1990s, and flipped signs (and became statistically significant) to become positive in the late 2000s.

Perhaps counter-intuitively, holding a driving licence is *positively* associated with cycling for both men and women; these effects are significant in the 2006/10 period but not the earlier one (the effect for women is close to significant,  $p = 0.08$ ).

The gender differences in the effects of working either part-time or full-time (versus not being in market employment) are not significant. For women, part-time work is positively and significantly associated with cycling only in 2006/10.

We see that for men in both time periods the likelihood of being a cyclist falls as household car ownership increases, and the same was found for women but only in the late 2000s.

The presence of young children (age 4 or younger) did not have a significant effect on men's cycling, but was negatively linked with women's cycling in the late 2000s. We found no significant effects associated with the presence of older children (age 5 to 17) in one's household.

We also found that the effect of a travel diary taking place in the warmer months (May through September) is positive in all four models. The effect is however not statistically significant, with the exception that for women in 2006/10 it is nearly so ( $p = 0.08$ ).

Respondents to the B-NTS are asked to indicate whether they have any travel difficulties. This was included as a binary variable, and it was found, unsurprisingly, that having travel difficulties is statistically negatively linked with a lower propensity to be a cyclist. The exception to this was for women in the late 1990s where it was insignificant.

Age was specified as a categorical variable, with three classes (up to age 34, 35–59, 60+). No significant effect of age was found for women in the late 1990s, but for women in the 2006/10 period and men in both time periods the two lower age groups were associated with significantly higher propensity to cycle than the 60+ age group. For the latter three models the *ceteris paribus* positive effect was largest for adults in the 35–59 age group, but the differences with the 18–34 age group were not significant.

The final variable included in the model is the number of adults in a person's household (in categories of 1, 2, or 3+). No significant effects were found in 1996/2000, but in the more recent time period statistically-significant positive effects of being in a one- or two-adult household were found (relative to living in a 3+ adult household), and this held for both men and women.

## 4. DISCUSSION AND CONCLUSIONS

This paper reports on the gendered patterns of cycling in Greater London, providing a comparative analysis of the late 2000s and a decade earlier. It examined within- and between- gender differences over time. Over the decade under study cycling levels increased sharply, particularly amongst women, but nevertheless men continue to represent the majority of cyclists in London. It contributes to the growing body of literature addressing gender issues in cycling, which have important policy implications as both London and many other cities actively seek a step-change in cycling levels. These findings are particularly pertinent in both Britain and North America (though not some continental European cities) where women cycle at much lower rates than men.

The following inferences about adult cyclists for the late 1990s and the late 2000s are of particular significance for further analysis, and for comparisons with other city regions:

- Despite men still outnumbering women as cyclists, women were disproportionately responsible for London's increasing cycling activity. This is principally because the number of cyclists increased by a much faster rate for women than it did for men, rather than growth in the number of cycling journeys per female cyclist. There were 3.7 adult male cyclists for every adult female cyclists in the late 1990s, but of the growth over the subsequent decade half of the 'new' adult cyclists were female. Of further note is that both men and women that cycled at all were seen to make an average of about 5 to 7 cycling journeys per week; the gender gap is largely in the number of cyclists rather than their intensity of cycling.
- The characteristics of women's cycling journeys suggest that those for commuting are becoming more similar to those of men over time. For all other journey types, men's journeys remained substantially longer, on the average, than those of women. A speculation that can in principle be addressed with travel diary data is that the average length of women's non-commuting journeys is much influenced by the a relatively high number of short, local trips, and the higher percentage of shopping and personal business trips made by women perhaps reflecting the traditional division of labour in the household. These are interesting echoes of results reported elsewhere (e.g. [16]) that require further investigation.
- The proportion of journeys for either commuting or work-related purposes has remained quite similar over time for women, but slowly diminished over time for men and so has brought their proportion closer to that of women. There is again a parallel to explore with car use: a number of travel surveys

indicate that the proportion of car travel that is not work-related has risen in recent years (15), and this may reflect changes in household logistics and role allocation associated with the progressive entry of women into the labour force.

- Cycling activity by women grew much more in the warmer months than in the cooler months, an effect not seen among male cyclists. This invites further analysis: it does not seem that cycling performed together with children is an explanation, because the proportion of active cyclists in households with children under 4 is very low (and appears to be lower amongst women than men). One hypothesis requiring investigation is that men's propensity to cycle may be less affected by inclement weather.
- We did not find significant gender differences associated with others accompanying cyclists on their cycling journeys. While this may not be surprising, different definitions of accompaniment, especially for those with children in their care, should be applied to travel data sets that have sufficient detail and contextual coverage.
- The multivariate analysis shows that women's personal income is positively linked with cycling, but that this effect has become smaller over time. The same may be true with being employed, particularly full-time (women cyclists are more likely to be in full-time employment than non-cyclists, but the proportion of women cyclists that work full-time seems to have fallen over time). It seems that growth in women's cycling is being led by women on lower incomes and those less likely to be in market employment. How much of the explanation is to be found in adaptations by women who transition to part-time employment or non-employment is not clear, and further research is required to confirm and explain this finding.

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# Bicycle lessons, activity participation and empowerment<sup>48</sup>

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## ABSTRACT

This paper addresses the impact of bicycle lessons for immigrant and refugee women on bicycle use and activity participation. Especially non-Western immigrant and refugee women have been identified as one of the population groups most likely to experience accessibility problems and, subsequently, transport-related social exclusion. The bicycle offers considerable potential to increase the mobility of these women. Hence, in the Netherlands and elsewhere, governments and non-governmental organizations have set up bicycle lessons for immigrant and refugee women. The paper discusses the impacts of these lessons on their bicycle use and activity participation. It draws on a quantitative survey and a series of in-depth interviews among non-Western immigrant women in Amsterdam. The results show that the impacts of the bicycle lessons vary. Some participants use the bicycle for everyday purposes, while others still face constraints preventing bicycle use for regular errands. The impacts on activity participation are limited. At the same time, the lessons have substantially improved women's feelings of self-esteem and self-confidence.

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**KEYWORDS:** Bicycle lessons; Gender; Activity participation; Empowerment; Amsterdam.

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# French gender equality policy and its reception in a men's field: An example in transport and logistics

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## ABSTRACT

In the field of distribution<sup>49</sup> over the past few decades, modernisation of production tools, new standards of gender division of labour, and the development of support functions has led to the feminisation of these professions, providing the opportunity to consider research that goes beyond companies' reports which are limited to a comparison on a year-to-year basis. These reports do not allow for monitoring differences in gender division of labour or career development opportunities, and potentially hide inequalities between men and women, as well as gender diversity issues (Cousin, 2007).

This feminisation occurs in a labour changing world (economically, organizationally, technically, and socially). Today in France, new socio-cultural issues driven by new kinds of social movements, such as those addressing gender inequalities and environmental protection, seem to nourish socio-economic issues of wealth distribution and production tool ownership or control. Professional equality is now an issue of CSR (Corporate Social Responsibility), including economic, environmental, and social dimensions. If professional equality aims to contribute to the well-being of employees, it is also part of the performance measurement of an organization. In this process, French legislation tends to be a regulator.

However, gender equality policies are more difficult to understand and to apply in male-dominated environments where legal obligations face organizational constraints and/or cultural ones. Therefore it is necessary to determine to what extent employees of male-dominated companies recognize and abide by the law. Indeed, the introduction of a gender equality policy requires a re-examination of new forms of solidarity, organization processes, ways of working, and the nature of work itself.

It is our hypothesis that transport companies do address gender equity under the impulse of an opportunity effect while facing the paradox of a male working culture where theoretical gender equality implies highlighting women. In the company studied, the difficulty of workers' jobs (particularly due to heavy carrying, flexible schedules, and subzero temperatures), added to the tense economic context faced by the sector, create the conditions of a collective resistance based on a male-dominated culture. From this perspective, managers do not see an interest in applying law, which cannot be supported by human resources managers either.

This proposal is based on a case study of the European leader of goods transport and logistics under controlled temperatures<sup>50</sup>. In a workforce where only 18% of nearly 12,000 staff members are female, the "gendering of work" increases with efforts to work on gender in a masculine organization, where theoretical gender equality resides alongside informal and invisible structural inequality. We will consider issues of equality between men and women according to their concrete and tangible manifestations, such as gender equality agreements, women advancements policies, etc., ambitions which often challenge realities and local constraints.

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**KEYWORDS:** Gender division of labour; Masculinities; Distribution; Logistics; Freight transportation; Gender equality policies, Gender discriminations.

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<sup>49</sup> See "vocabulary".

<sup>50</sup> The entire supply chain is chilled, refrigerated or insulated to organize the delivery of perishable goods. Work in platforms and warehouses is being performed in temperatures between -27° (for the coldest frozen warehouses), +2° (for "fresh" platforms) and 15° (for the "sensitive temperature" products).

**PHD subject:** Gender relations and masculinities: an ethnography of virility among the leader of distribution under controlled temperature

**PHD Director:** Régine Bercot

**Methodology:** This proposal is based on a PhD research in sociology in the European leader of goods transport and logistics under controlled temperature from within the roles of gender equality leader and also as a temporary employee in warehouses over the time period of a few days up to several weeks. In addition, observations during negotiations of a gender equality agreement, semi-structured interviews with employees and managers, as well as the collection of internal and external data are key to the study.

**Key Figures:** The transport and logistics sector is the fifth largest economic activity in France, after industry, construction, trade, hotels, and catering industry. With the expansion of exchanges, the sector continues to grow. It has more than 1.5 million employees, which represents 5.5% of employees in France. Transport has around 700,000 employees, most of them are workers. Jobs in logistics are overwhelmingly occupied by men: only 18% of women among employees. This percentage is about 11% in road freight transport<sup>51</sup>.

**Vocabulary:** “**DISTRIBUTION:** Regarding goods distribution, the process of storage, handling, loading, and delivery (mainly by road) of goods/products to retail outlets or the final consumer. In practice, many other individual functions may be involved (order processing, order picking, inventory control, etc.)” (Source: *The dictionary of transport and logistics*, David Lowe, Kogan Page Publishers, 2002)

**PARCEL SERVICES** = Messagerie

**WAREHOUSE** = Entrepôt logistique

**PLATFORM** = Plateforme de transport

**QUAY** = Quai

**SUPPLY CHAIN** = Chaîne d’approvisionnement

**GENDER RELATIONS** = Rapports sociaux de sexe

## 1. INTRODUCTION

In recent decades in France, gender studies has developed as a new academic discipline. We count few studies regarding issues of gender equality policies, their establishment and their impact. (Laufer, 2009; Poilpot-Rocaboy, Kergoat, 2010). Most studies focus on the feminisation of professions and women's access to hierarchical responsibilities (Landrieux-Kartochian, 2007; Laufer, 2004). Due to socio-cultural developments and legal requirements, gender equality has recently become a concern for organizations. The Corporate Social Responsibility policy (CSR) is a new criterion which specifies that “enterprises should have in place a process to integrate social, environmental, ethnical human rights and consumers’ concerns into their business operations and core strategy in close collaboration with their stakeholders”<sup>52</sup>. Gender equality is part of CSR, and could be defined as: “equality of rights and opportunities between women and men regarding access to employment, working conditions, training, qualification, mobility, articulation of lifetime, promotion and compensation (equal pay)”<sup>53</sup>. Gender equality is concretely introduced into companies through diversity policy actions and has two main objectives: to fight against discrimination and to create the conditions for a male and female mixed environment where both sexes have a place. In this process, the French government can be seen as a regulator through the enactment of gender equity laws. The government now requires, under threat of financial penalty, that companies with over 50 employees institute: gender equality in hiring, wages, and career opportunities. These obligations have to be covered by a collective agreement and measured in a report on gendered working conditions.

However companies’ openness to gender equity varies from one company or sector to another (Britton, 2000; Belle, 1990). In male-dominated organizations like distribution, the introduction of professional gender equity can be challenging for companies as “gender is deeply embedded in organizational structures” (Acker,

<sup>51</sup> Mariotte H., *L’emploi dans la fonction logistique en France*, SESP, En bref, n° 16, mars 2007.

See also: Bilan social annuel du transport routier de marchandises, Observatoire social des transports, Commissariat général au développement durable.

Fiche sectorielle de l’INSEE : [http://insee.fr/fr/ffc/docs\\_ffc/ENTFRA13o\\_FTL010transports.pdf](http://insee.fr/fr/ffc/docs_ffc/ENTFRA13o_FTL010transports.pdf)

<sup>52</sup> “A renewed EU strategy 2011-14 for Corporate Social Responsibility”, European commission report, 2011.

<sup>53</sup> French Ministry of Labour, Employment, Training and Social Dialogue.

1994). Moreover, theoretical gender equity promoted by laws faces a numerical and structural gender hierarchy. In this context, can a male-dominated structure comply with the gender equity law? We will focus on this issue through a case study in distribution where theoretical and legal obligations are facing sectorial and cultural constraints. With males making up over 80% of more than 12,000 employees, the introduction of gender equality policies in this company requires (beyond a pedagogical approach) some substantial improvements.

We favour an approach in terms of gender and not in terms of sex, to underscore that gender is a social construct. We generally oppose "sex" as revealing the biological makeup of an individual reproductive anatomy of men and women and prefer "gender" as it reveals a social and cultural identity. "Human society with remarkable monotony overdetermine biological differentiation by assigning different functions to both sexes (divided, separated and generally hierarchized) in the social body as a whole." (Hirata, 2004). Gender reveals the global logic of a social organization that is not limited to mixed environment. Gender not only reveals standards of a social group, but also "uncovers the androcentrism"<sup>54</sup> basic concepts in sociology such as work" (Clair, 2012). In this context, ethnographic studies describing gender relations are the materialistic translation to a cultural conception of gender. These studies questioned a social order and social practices. It is with this perspective that this article will explore issues of gender equality policies in transport.

It is our hypothesis that transport companies do address gender equity under the impulse of an opportunity effect while facing the paradox of a male working culture where theoretical gender equality implies highlighting women. In the company studied, the difficulty of workers' jobs (particularly due to heavy carrying, flexible schedules, and working under subzero temperatures), and difficulties running through the Transport sector create the conditions of a collective resistance based on a male-dominated culture. In this perspective, managers do not have an interest in applying law which cannot be supported by human resources managers either.

We will first describe the legal obligations companies need to consider and the context in which these obligations are embedded. Then, we will study how transport companies have responded to these obligations. Finally, we will focus on our field of study to demonstrate that instability in the transport market strengthens a masculine-dominated culture that inhibits implementation of these laws.

## 2. FRENCH GENDER EQUALITY POLICY IN ROAD TRANSPORT: THE OPPORTUNITY EFFECT

While our perspective remains the working environment, we will begin by establishing how gender equality has developed more generally in France and in the transport sector.

Following the enactment of equal employment and affirmative action policies in the United States in the 1960s, "diversity" imposed itself in France and in Europe in the late 90s. (Martin, 2010) Under pressure from international and European laws, French legislation has demonstrated a continually renewed inspiration to ensure equality between men and women. Gender equality is firstly a constitutional principle that specifies equal rights between men and women. It has developed into a legal requirement –employers cannot discriminate on the basis of gender– and corporate policy –taking into account concrete discrimination for men or women. Most studies tends to demonstrate the benefits of diversity in business (Welbourne, 1999), including the contribution of women in the performance of companies (Landrieux-Kartochian, 2007; Bender & Pigeyre, 2003; Belghiti & Rodhain, 2001). More than a fight against discrimination (as in the US), it is a fight for equality of chances and diversity. We count no fewer than nine successive laws taken in this direction. The first, in the preamble of the French constitution, the latest on 27th January 2011, raised a wave of panic by requiring companies to impose quotas for women in their boards (at least 20% of women by 2014; this percentage increases to 40% by 2017). Since 2010, a financial penalty has accompanied these laws. In addition we include various initiatives taken by the current French government, such as the creation of a ministry of women's rights and a gender equality label to reward good business practices. The legal pressure is lower than in the U.S and does not constitute a sufficient incentive, but guarantees a logic of equality (Landrieux-Kartochian, 2007).

<sup>54</sup> Androcentrism is a way of thinking, conscious or not, which consist of considering the world to the point of view of male human beings. For more details on this topic: Mosconi N., "*Femmes et savoir : la société, l'école et la division sexuelle des savoirs*", L'androcentrisme de la théorie sociologique, L'Harmattan, 1994 ; Léveillé D., "*L'androcentrisme en anthropologie*", Groupe de recherche multidisciplinaire féministe, Université Laval, 1989.

In distribution, we note a lack of gender analysis in France, especially in the area of warehouses and platforms. It remains difficult to compare business practices in this sector. However, some studies have focused on women in male environments (Pruvost, 2007; Quemin, 1998; Buscatto, 2005; Scotto, 2008), while very few look at the transport sector (Rodrigues, 2010; Ponchut, 2010), as the working area is shown as “genderly” neutral (Kelan, 2009). The concept of “masculin neutre”, especially developed by Jacqueline Laufer in France, highlights the lack of gender perspectives and the androcentrism of research, particularly in studies focusing on organizations (Laufer, 2010). It is as if labour escaped a gendered structure type, perhaps because of its disembodied bureaucratic nature, and is therefore asexual in the collective imagination (Acker, 1990). In other words, labour organizations appear falsely as alien to issues of gender relations.

Still, this concept is even more valid in male environments like distribution, where the absence of gender perspectives is embodied by a lack of references made to gender policies in collective agreements. In France, each company is related to a collective agreement which defines the status of employees in a professional branch following negotiations between employers and unions. The main collective agreement governing the sector of road transport and logistics was created in 1950, and was amended in 1994 to address conditions of equality at work between men and women. It suggests in one paragraph the terms of this equality. When we interviewed a representative of the major employer’s organization of transport<sup>55</sup>, she confirmed the poverty of measures on the subject

“There are still so many things to do. Our collective agreement<sup>56</sup> is at the grassroots, especially on the subject of maternity leave. There’s 36 days of compensation, plus a maternity leave of 16 weeks<sup>57</sup>.

- Are you working with unions to rewrite the collective agreement, especially about the gender equality part?

- Oh yes, it’s five years’ work now, to rewrite the whole collective agreement, it is very outdated. When looking at the classification of jobs, it’s amazing! There’re trades that do not exist in the collective agreement. A lawyer does not exist, a human resources manager does not exist, a computer specialist, does not exist either! The problem is that we negotiate with truck drivers, they want to start working on their jobs.” (extract of field notebook)

Distribution is mainly represented through truck drivers which constitute most union representatives<sup>58</sup>. Their main objective is to negotiate about working conditions in an increasingly tense economic context in which gender equity does not appear to be a priority. From this perspective, it seems difficult for a transport company to appreciate a topic that federations and representatives of business do not make their own.

However, we can note some initiatives taken by companies (Keolis with a Gender Equality Label obtained in 2004<sup>59</sup> and LG Transport with a campaign of recruitment of women), road transport associations (program OPCA Transport –T Profession’elles, association “women and the road”), or research seminars (Wlit, International Forum of Transportation– “Transport and gender”). In France, this slow and deep movement was born in 2002 through the first regional agreement for the feminization of the business of transport and logistics between the Upper Normandy Region and professional federations of transport<sup>60</sup>. Its objective was to increase the percentage of women truck drivers from 0.8% to 2%. Communication campaigns were conducted and days of meetings were organized by the Regional Delegation for Women’s Rights, training organizations and the

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<sup>55</sup> We count several professional employers unions in transport: TLF (Fédération des entreprises de Transport et de Logistique), FNTR (Fédération Nationale des Transports Routiers), UNOSTRA (Union nationale des organisations syndicales des transporteurs routiers automobiles) and OTRE (Organisation des Transports Routiers Européens). Professional employers unions defend the interests of their professional sector. These organizations among other activities negotiate with major workers unions about working conditions.

<sup>56</sup> The collective agreement of road transport and related activities.

<sup>57</sup> Statutory maternity leave is determined by the Labour Code and is at least 16 weeks. In most collective agreements, leave is extended and employees benefit of it. In other words, the collective agreement of transportation meets the minimum required and provides no other benefits to women.

<sup>58</sup> The feminization of trucks drivers is around 2% (Rodrigues, 2010).

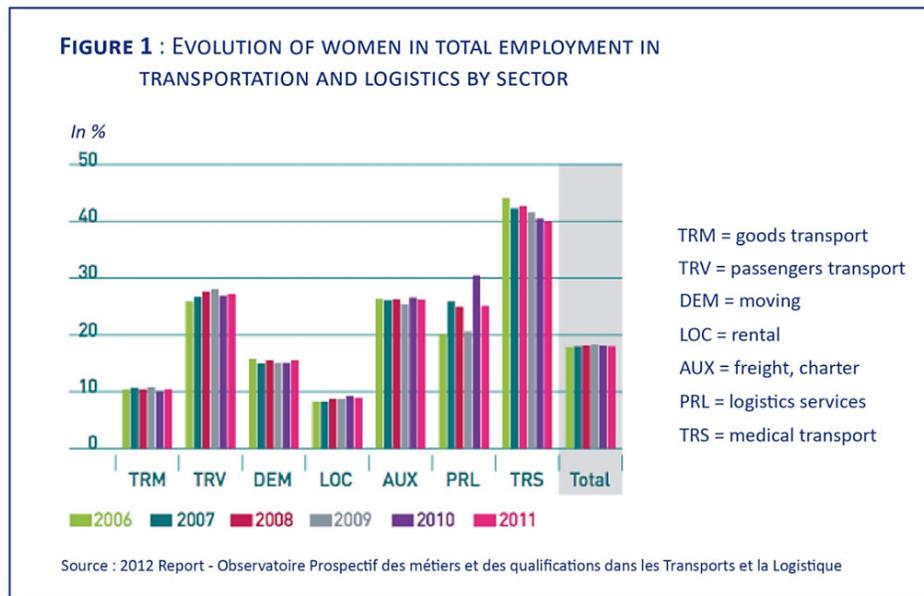
<sup>59</sup> French Government created in 2004 “the equality label” to reward companies or institutions which recognizes exemplary practices in gender policies.

<sup>60</sup> TLF, Unostra, FNTR and FNTV.

French employment center<sup>61</sup>. This agreement was renewed for the 2006-2013 period. The objective of 2% of women among truck drivers was nearly reached (1.9% in 2006); the goal for 2013 was 4%. This initiative was taken at a time when the transport sector was going through a crisis of recruitment (Rodrigues, 2010). Indeed, in the past decades, the military service provided men with a truck driving license. Since 1997, this military service is no longer compulsory and obtaining a this license requires costly training. This is one of the reasons leading to a crisis of recruitment for this job. To overcome this issue, initiatives have been launched to recruit available, flexible, and cheaper employees: women. This is the first opportunity effect we identified. The second opportunity effect that promotes professional gender equality between men and women is promulgated by way of an avoidance strategy. As one leader of a representative employers union explained, the topic of gender equality appears to be well-suited to elude other issues:

"For now, we're not really up to work on hardship. When Mr F. from CFDT<sup>62</sup> has offered to negotiate on gender equality, I have not waited the permission of my boss, I have said « I'm in! ». Disability can be connected with hardship, so I want to be careful on the subject. When I explained this to my President that I didn't waited for his permission, that I had already said "ok" for negotiations on gender equity because while we talk about it, we do not speak of sensitive topics, he said "yes, seen like that, it suits me very well!". (extract of field notebook)

Besides these "utility" effects or initiatives taken by some companies, in the last few years the feminization of these professions has slowly grown and remains stable in transport. Feminization doesn't exceed 10% and in logistics services, this feminization seems unstable.



Marine Ponchut and Isabelle Barth have theorized some reasons to help explain the absence of women in a company of passenger transportation<sup>63</sup>. Three factors have been identified: "congruency between male characteristics and expectations of behaviours in management positions, separation of personal and professional spheres, and a culture of long working hours". In this article, we aim to utilize a case study in distribution to go further and identify new methods of explanation to take into account not only top management and hierarchy, but also dynamics across occupations and hierarchical levels.

<sup>61</sup> Pôle Emploi.

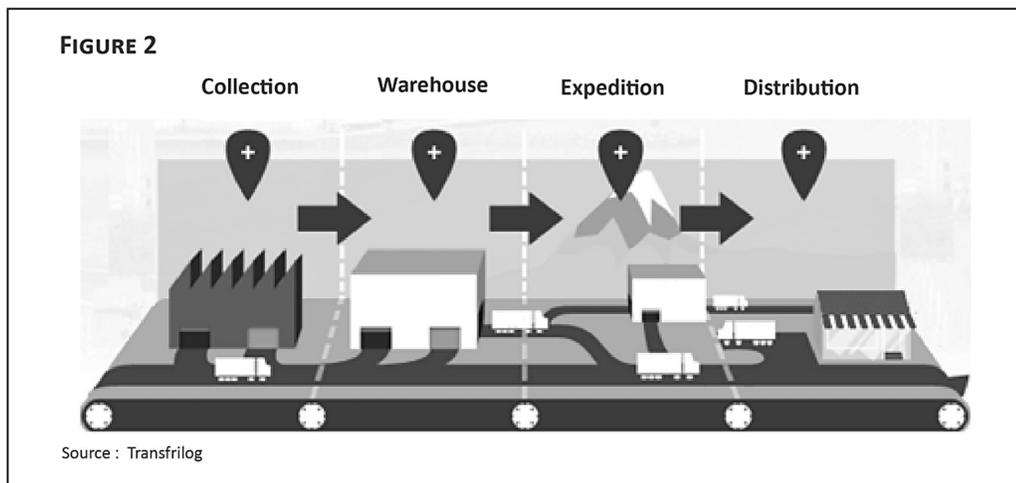
<sup>62</sup> One of the main workers union.

<sup>63</sup> Ponchut, M. et Barth, I. « *La place minorée des femmes dans les organisations. Exploration d'un facteur explicatif : la culture organisationnelle. Cas d'une entreprise de transport public* ». @ GRH, 2012, No. 3, pp. 11-31.

### 3. AN ETHNOGRAPHIC APPROACH OF GENDER EQUALITY IN ROAD TRANSPORT & LOGISTICS

This article is based on an ethnographic study of the European leader of the refrigerated business of transport and logistics from headquarters (those that drive the gender equality policy) to warehouses and platforms (those affected by their decisions). We conducted this study from the perspective of the roles of gender equality leader, and also as a temporary employee in warehouses over the time period of a few days up to several weeks. In addition, observations during negotiations of a gender equality agreement, semi-structured interviews with employees and managers, as well as the collection of internal and external data, are key to the study. The study will be conducted over three years, between 2012 and 2015.

The company has around 12,000 employees (85% male) in France spread over 160 platforms. 70% of the activity is related to Transport, 30% to Logistics. We anonymize the company, calling it “Transfrilog”. Distribution has as a main task the delivery of the finished product to the stores. It consists of order processing, warehousing, and transportation under controlled temperature. Distribution can be seen as management of internal and external flows such as a succession of small transportations of goods (from the fabric to the warehouse, then to the distributor and in the end, to the consumer).



The specificity of Transfrilog’s jobs is their difficulty mainly due to “just-in-time” pressure and some heavy carrying in a refrigerated environment. This reinforces the natural assignment of men and women to specific tasks and “justifies” a gender division of labour. For this article we chose to separate transport and logistics, as we see differences in the nature of work, the proportion of men and women, and the integration of gender policy actions.

An initial approach to gender equality was made in 2008 through an internal collective agreement at Transfrilog. Its two main objectives were: combatting discrimination and developing jobs for women. A primary task of the agreement was to develop feminisation in Transfrilog. Between 2002 and 2012, the proportion of women increased from 15.6% to 20.60%; Transport only saw an increase from 14% to 15.7%. This feminization of the company occurred especially under the pressure of the growth of support functions and the co-optation, characteristic of a company that boasts a paternalist capitalism. Women mainly integrated Transfrilog through trained jobs of employees or managers while men were mostly self-taught.

In 2013, Transfrilog accepted my application to conduct a study on gender mix as an opportunity to demonstrate goodwill in this process and to develop an innovative diversity policy. Their policies toward handicapped workers are dynamic and have been repeatedly rewarded. The project was formed to implement the same policy upfront. In 2013 a second collective agreement was signed, including Logistics. Transfrilog specified in this agreement that it is an important issue for both management and unions and decided to develop a proactive policy. In accordance with legal obligations, the head of human resources developed various tools for each platform and warehouse to work on the subject. It is as of yet too early to examine the impact of the second collective agreement, but we can analyse what has transpired since the signature of the

first collective agreement. Through this monograph we are going to describe the difficult enlightening of gender issues in a male-dominated sector where the professional culture has been built on manly strategies. As we said earlier, we will focus on transport, as the first agreement was signed for this activity of the company.

#### **4. ISSUES OF IMPLANTATION OF A PROFESSIONAL EQUALITY POLICY**

At the end of 2008, Transfrilog counted 1,194 women and 6,998 men in the transport section (14.6%). At the end of 2012, the proportion increased to 15.6% of women as the number of male employees fell to the benefit of the staff in Logistics. Staff of the company inflated through Logistics and support functions as the transport section, the historical profession of the Group, stagnated for the first time since the birth of Transfrilog. In the meantime, the feminisation promised is close to zero and we have no trace in the company records of gender actions initiated between 2008 and 2012.

We note a discrepancy between what seems to be a priority (gender equality) for the French government, for companies, and in some ways, for Transfrilog, but concretely this is an airtight area. We are going to explore some possible explanations, based on the field we studied.

We have not overlooked the extent to which androcentrism in the company has had an influence on the slow implementation of such policies. We choose not to dwell on this argument, already well-studied in the literature (Acker, 1990; Guilbert, 1966; Laufer, 1982). Moreover, we realize that hardship jobs may have an influence on the feminization of Transport, but as jobs in Logistics are more physical and have a higher proportion of women (22%), this does not seem to be a valuable argument either. In the light of these considerations, we develop two main explanations of the issue of implementing a gender equality policy: the subaltern position of human resources managers and an unstable market of Transport that led to a reification of gender relations through masculinities issues.

##### **4.1 Gender equality policies facing the tied position of human resources**

Transfrilog is a family-owned company, established on the basis of a paternalistic capitalism. The founder (and current president) of the Group maintains the image of a good father who soon will pass the reins of the company over to his son. The company prides itself on being 16% owned by employees who invest all or part of their year-end bonuses in the company. 2012 was the twentieth birthday of the company saving plans, but also a year to celebrate a change of governance. Coupled with financial uncertainties, organizational changes, and the retirement of the elders who had founded the Group, this helped to bring a change in managerial methods.

The establishment of a gender equal opportunity policy was decided on a few months before a turning point for the company, the transfer of power between the former leader (the founder of the Transfrilog) and the new leader, who implemented a different kind of management. In the past few decades, while under a strategy of internal economic growth, the group doubled the number of employees. The new corporate governance, which tends to accelerate an external development, now favours marketing and business entities to the detriment of other departments, which are forced to save. The feminization of the company due to this mechanical growth (attributable to the enlargement of support functions), is now discontinued due to a recent decision to implement a hiring freeze in the department. Worse still, current trends suggest that this function is threatened, and human resources managers fear a scheduled "defeminisation" due to human resources' loss of power. To clarify this shift, at the beginning of 2012, one of the first decisions taken in this the new direction was the restructuring of headquarters offices. Trade and marketing entities conquered space, gaining additional offices while human resources piled in a corner. The "diversity pole" (in charge of disabled employees, elders, and gender equality) was the only service to be moved from the building. Cut off from corporate headquarters, even from human resources and its information, this evidenced the way in which human resources and its diversity policies were relegated. In platforms of transport, this tension seems to have been reproduced.

We observed in the agencies we studied a clear dichotomy between offices and quays. The company is structured in a pyramidal configuration: corporate headquarters at the top, regional branches in the middle, and at the bottom, platforms (offices + quays). Orders are given from the top to the base where they are applied. This contrasts with a relative autonomy once enjoyed by platforms. Now, decisions are centralized at the head office and are made by top management. Autonomy in decisions replaces execution of them.

"One day I was told: you make "management" of human resources. If you want to implement a project, you have to show them how to save money. They run a 14 000 employees business in a difficult economic context, it is normal but sometimes I feel I'm dealing with « inhuman » resources" (human resources manager, extract of filedbook)

Thus, we observe two forms of response: "silent authoritarianism" or "solidarity against corporate headquarters" (Benquet, 2011). HR managers already marginalized in platforms, due to perform what some consider to be "unproductive" work, are in a position of tension between the corporate headquarters and the field, between managers and employees. Managers themselves are in a similar position of tension between headquarters and employees. Managers have to juggle the "just in time" characteristic of the sector of perishable goods. This position requires responsiveness and the constant adjustment of work. The productivity pressure and the flexibility are building a business identity. In this context, middle managers favour obligations, like payroll or psychosocial risks. This short-term strategy contrasts with diversity actions as long-term projects, including gender equality policies. In addition, a succession of new laws and the burden of their application have increased demand on middle managers' attention. Companies now need to negotiate on disability, pensions, hardship work, etc., all reasons to forget what does not seem a priority. In this process, the increase of bureaucratization hides the process of implementation and multiplies the number of actors. Information came slowly and sometimes partially (Crozier, 1963). Also, piecemeal commitment of human resources managers on gender equality stresses the implementation of concrete actions. The lack of training on the subject and disinterest in adopting a gender perspective mask any discrimination. Therefore, at each hierarchical level, you can hear the same chorus: "what's the point of this?"

"- Is it a topic that interests you?

- It stresses me out. It takes at least 2 days and we really do not have time ...

- Yes, it's terrible, but we must prioritize and push from all sides. We don't have time for gender equality" (human resources managers, extract of filedbook)

Human resources are faced with daily management of uncertainties of the work that requires a risk control. These difficulties of positioning for executives in companies do not allow them to develop the flexibility of implementing long-term projects (Cousin, 2008; Flottes, 2004). In this perspective, HR managers cannot be a relay on this subject. Not supported by executives, caught between managers and employees, focused on short-term projects, the flexibility of HR managers is relative (Gilbert, 2006).

This flexibility seems to reduce as the labour market tightens, but the re-individualization of human resources managers contrasts with the resistance of a collective transport identity. When the work is becoming precarious, is collective resistance possible? It is our assumption that the casualization of transport jobs reinforces a collective dynamic based on a culture of masculinity which rules out the introduction of a policy of equal opportunities.

## **4.2 Mutations in the transport sector and its impact on gender equality policies**

The transport profession, as it has traditionally functioned, is experiencing a crisis (Rodrigues, 2010). The fragmentation of labour, over computerization, ongoing discourse about the crisis and pressure from social movements create an uncertain future. In 2012 in France, transport activity contracted. Quantities transported (by vehicles over 3.5 tons) decreased by 6.7% and fell to a lower level than in 2009. In this context, employees in road transport fell by 1% between 2011 and 2012. The largest decrease was observed in parcel services where employment continues an uninterrupted decline for 10 years. The number of jobs collectively in the supply chain fell from 16.3% compared to 2011. Recent trends in 2013 show that, while the French economy slightly rebounded (+0.5%), the volume of goods transported and employment continues to decline<sup>64</sup>. These market developments influence the mapping employment in Transfrilog. Between 2002 and 2012, the Group doubled the number of employees under the pressure of Logistics and Support Functions. Meanwhile, between 2007 and 2012, the number of employees in the transport section decreased. While some transport platforms closed, new logistics warehouses are created. Yet Transport is the historical activity of Transfrilog and many of its employees have built their carrier on the know-how of these trades. The degradation of working conditions and the uncertainty of work reinforces what was once valued in a trade: a professional business identity and

<sup>64</sup> Bilan social annuel du transport routier de marchandises (2012) – Observatoire social des transports, Commissariat général au développement durable, décembre 2013.

the consistency of working conditions depending on registration of its employees in collectives (Castel, 2009; Beau, 2004). The family structure of the company is no longer valid. The emergence of new forms of employment is a clear break in the constitution of a socially protected wage (Castel, 2009; Paugam, 2007). If the most valued components of a business do not exist, can it remain attractive? Precariousness and solidarity are not incompatible concepts (Bérout & Bouffatigue, 2009). We even think that the uncertainties in the workplace tend to recreate solidarity in a profession. In the case of Transfrilog, the sense of belonging to this company added to the feeling of belonging to "the family of transport," strengthening a professional identity. This identity has been built by men and is still carried by them, through truck drivers and transport operators (95% of whom are men) as the basis of a masculine organizational culture.

"An organizational culture comprises discourses, practices, norms, languages, and values which reflect the socially-constructed images of maleness and femaleness and define specific power relations among the members of an organization according to their sexual membership" (Gherardi, 2001). Studying a culture means examining the "symbols, beliefs, and patterns of behavior learned, produced and created by the people who devote their energy and labor to the life of an organization" (Strati, 1992: 1-2). In distribution, maleness occupies a hegemonic position through a series of well-established rules, both explicit and implicit, which define gender contents relative to the male and the female behaviors appropriate in the organizational context in which maleness is dominant (Gherardi, 2001). The environment of working in Transfrilog is based on a non-gender mix culture<sup>65</sup> which legitimates some cultural behaviours and gender divisions of labour (Kergoat, 1982). The few women who have achieved a position in top management of the company are brandished as evidence of equal access and opportunity. This leads us to a recurrent argument we heard in Transfrilog: "Look at the head office, there's only women, look at human resources department, there's only that!". Some women legitimate this discourses by integrating these inequalities, which renders invisible further potential discrimination and produces "gender blindness" (Messing, 2009).

"On the platform everyone respects each other. Regardless of whether you're a man or a woman. I do not feel particularly discriminated against. I have no problem working part time. The director is really understanding. In this sector, you need to be firm for sure, but it is never mean and once you make them forget that you're a woman, there is no problem." (extract of fieldbook)

Marginalized women gather at well-defined areas of the platform, creating zones of lawlessness where –informally– they do not have access. In some areas, gender equality polices are no longer relevant due to a simple lack of women. This is precisely the case on quays where strenuous jobs hardly allow for hiring women. Indeed, work collectives gather around masculine values, which can be seen as a method of circumventing arduous work. (Dejours, 1993; Foli, 2010). While physical force is no longer necessary to operate the equipment, thanks to technological progress, it remains central in the constitution of the masculine identity and the identity of business. (Rodrigues, 2010) In this perspective, introducing a gender mix to warehouses is seen as a way to disturb this manhood balance.

"I can tell you, I'm not ashamed, I don't want a woman on my quays. It's really disturbing for my guys. They can't work with a women, they're all disturbed. Besides, a woman can't do our job, it's too difficult and you have to be quick. My guys will have to help her all the time, it's a waste of time" (extract of fieldbook)

For Transfrilog, preventing on-the-job accidents seems easier than restructuring an organization of work so that gender may be registered. The resistance to gender equality policies is constitutive of a –productive– job identity that top management has no interest in disturbing. That reinforces an absence of relay at each level of the company, even from top management which is not interested in hiring women who will challenge manly strategies, destabilize the labor collectives, and require a rethinking of the organization of work. It is our hypothesis that the fear of hiring women feeds into this masculine culture that has built its reputation and expertise on virility.

Moreover, gender equality policies are even less understood than intersectional issues make them obsolete. Ethnic issues are now intertwined with the question of equality in the workplace, leading to new forms of issues as matter of race and class as well as gender. Class and race dynamics need to be understood and combined with gender to apprehend that a gender equality policy cannot be appreciated or applied without a global diversity policy. In some platforms, particularly in the South of France (where racism is more of

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<sup>65</sup> Generally define by a proportion of men or women not more than 30%.

an issue) or in the suburbs of Paris, gender must be understood in the light of the cultural diversity of relationships between men and women. As we were told by a female director of a warehouse in a Paris suburb:

« You put two ethnicities in the same warehouse, they can kill each other. Once, we had big problems on a platform. The leader of the tribe was the only one to read and write. So he was making all the admin stuff for everyone. He just had to snap his fingers for everyone to align. It was such quite difficult for management. At first, he didn't say hello to me because I was a women. Now, I deal with it. » (Human resources manager, extract of filed book)

In this perspective, “they may be less in the gender conflict than in an affirmation of masculinity” (Neveu, 2012, p. 133). Conflicts between men do not leave room for such conflicts with women, and relegates them to menial jobs, schedules, and circumscribed spaces. In this perspective, gender equality policies tend to even more to stigmatize women. The working conditions is no stranger to gender but “justifies” a gendered labour division that becomes constitutive of a social environment in a male-dominated organization. From this analysis, we can observe a reification of gender relationships through a conflict of masculinities more than an evolution for women in transport. This valuation of masculinity is valid from top management to the base. Gender equality policies face domination and prejudice even more so because potential complaints about gender are received and conveyed by men whose job identity is based on the image of a “hegemonic masculinity” (Connel, Messerschmidt, 2005).

## 5. CONCLUSION: IS THIS PROBLEMATIC SPECIFIC TO THE ROAD TRANSPORT FIELD?

Some studies already develop the question of men's resistance to gender equality in organizations (Cockburn, 1991; Burton, 1991). In distribution, the subject is recent and requires further study. As we do not have any studies, we cannot make a real comparison. However, the importance of Transfrilog in the French transport field gives us good reason to suspect that similar patterns are operating in other companies. Although we cannot yet be certain, the long hours culture, the professional solidarity, the difficulty of jobs, and the popular ideology that permeates the transport sector may create such an environment. However, some studies in male-dominated sectors which show similar manhood strategies as hegemonic masculinity leads us to believe that this is not something specific to France and/or to transport but more generally to male-dominated sectors.

The problem of the implementation of a gender equality policy in companies of distribution is of too recent vintage to determine their effects, but is no stranger to the actual crisis of the market. The long-term effectiveness of such policies is conditional on an overall improvement in working conditions. Moreover, professional equality policies are likely to be ineffective without prior and appropriate pedagogy, but can also be a way to address a topic that would probably never have been discussed otherwise. Because we don't have concrete results on the benefits of such policy, it is above all an opportunity to question an organizational model, provided that women themselves feel concerned. Structural changes will be measured in the long-term. In the meantime, an avenue of research worth consideration remains the study of “arrangements” adopted by women in male-dominated environments, as well as surveys to determine to what extent transport and logistics define themselves as professions.

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# Gender employment inequality in the transport and logistics industry: The specifics in the Republic of Serbia and the Republic of Macedonia

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## ABSTRACT

In 2011, the average women's share of the workforce for the transport and logistics industry (TLI) was approximately 22% in the European Union. In the Republic of Serbia, the share was similar (22%), while in the Republic of Macedonia this share was only 13%. These data inspired us to explore the reasons for gender employment inequality (GEI) in the TLI and the possibilities to decrease it, while respecting their specific and complex environments. The Republic of Serbia and the Republic of Macedonia have many similarities, so it could be expected that the GEI rates in transport and logistics sectors are similar.

Both quantitative and qualitative research methods are used in the presented research. We compared the countries' main characteristics, by using a statistical database on gender employment in the TLI in both countries, "Gender Organization System" (GOS) perspective and gave an example to explore the gap between the women's share in the TLI labor force in the two countries, and possible reasons for it.

We went beyond the GOS perspective and explored both horizontal and vertical impacts on sex segregation in the TLI, as well as the impact of a macroeconomic context. The paper underpins the necessity for understanding gender-related industry specifics within an overall economy environment, and a need for a suitable database development. They are necessary preconditions for the continuous monitoring of gender mainstreaming and a starting point to set up the priority measures to improve gender equality and equity in the TLI in the future.

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**KEYWORDS:** Gender inequality employment; Transport and logistics industry; Horizontal and vertical sex segregation; Gender organization system perspective; Republic of Serbia; Republic of Macedonia.

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## 1. INTRODUCTION

The Transport and Logistics Industry (TLI) is traditionally considered a "man's world". According to some reports, the average women's share in the workforce was approximately 21.83% in the European Union (EU27 + Croatia) in 2011 (Davydenko, 2009, Eurostat). In the Republic of Serbia, this number was approximately the same (over 22%, according to the Statistical Office of the Republic of Serbia, 2011b, p. 19), while in the Republic of Macedonia the share was only 13% (Eurostat). These data inspired us to explore the nature of Gender Employment Inequality (GEI) in the logistics industry and the possibilities to decrease it, respecting the specific and complex environments in both countries. They are neighbors and former Yugoslav, Balkan landlocked countries, which hope to join the EU. Also, both of them have vulnerable economies that have been targeted with transition, a hard political situation and with an overall economic crisis. Therefore, it could be expected that the GEI rates in transport and logistics sectors are quite similar.

By exploring similarities and differences between economies, TLI, labor force characteristics, as well as the ones from gender perspective, the research aimed to identify and explain the possible reasons for such a gap in GEI, and prepare the directions (obtain the ground) for the set of related measures.

We used both quantitative and qualitative research to explore the nature and level of the GEI in transport and logistics. First we compared the statistical database on gender employment characteristics in both countries. Second, we used the theoretical lens of "Gender Organization System" perspective (GOS) to explain significant differences in gender employment and management position inequality. Besides the three main groups of

factors covered by GOS – individual, social and organizational, the impact of logistics industry specific characteristics on sex segregation within a macroeconomic context was also included into the analysis. A lack of data about vertical gender distribution was partly bridged with an example.

## 2. GEI IN TRANSPORT AND LOGISTICS SECTOR IN EUROPEAN ECONOMY

The transport sector is characterized by a great diversity and different transport modes that come with different technologies, regulations, challenges, know how, and skills requirements (Davydenko *et al.*, 2009). TLI is one of the most important sectors for the European economy and it takes up a substantial proportion of employment (Mallard and Glaister, 2008). Beside its size, its importance also stems from the fact that it plays a crucial role in interconnecting different economic actors. It traditionally belongs to the sectors with clearly expressed GEI, with dominant male workforces. This male dominated industry employs limited numbers of women with even fewer numbers of women in management, particularly in senior positions around the globe (French and Strachan, 2009). Such interference of profession-specific horizontal sex segregation, and traditional vertical sex segregation, related with women's under-representation in management structures, result in strong gender inequality and inequity<sup>66</sup> in TLI, and its range was from 6.28% in Turkey, to 32.93% in Iceland in 2011 (Eurostat).

The road freight transport sector is particularly dominated by men. Possible reasons for the low presence of female employees in this sector could be that the work has a higher physical workload. But social reasons like safety issues on European roads, especially concerning long distance freight transport and safe parking areas (rest areas), or that it is more unfavorable for family life, as well as the difficulties for women to enter male-dominated occupations, should also be considered (Davydenko *et al.*, 2009).

## 3. THEORETICAL FRAMEWORK

While the majority of logistics and transport research is focused on the social, economic and spatial needs of communities, a neglected area of research is relating to the strategies and employment policies of firms in the industry itself (French and Strachan, 2009).

The GOS perspective is used for the prescriptive part of our research, to explore the complex interaction between three groups of factors which constrain women from progressing toward higher management positions: individual, social and organizational ones (Fagenson, 1990). The GOS approach practically assumes that gender, organizational context and overall social framework, legal environment and culture may influence vertical sex segregation, i.e. the women's share in management positions. All three groups of factors will be briefly explained. Additionally, we included the macroeconomic and industry-specific factors into the analysis to comprise both vertical and industry specific, horizontal segregation into the research.

### *Individual factors*

Individual factors may be natural, e.g. physical and psychical strength, or related to early socialization and accumulated learning, whereby women traditionally take an inferior position. They include character, temperament, attitudes, language, gestures and interpersonal orientation (French and Sheridan, 2009).

The individual factors may be crucial for accepting or breaking traditional frames, in the occupation, or education choice, personal ambitions, or overall management skills. While the former two are rather related with horizontal sex (de)segregation, the latter two refer more to vertical sex (de)segregation, although it is hard to make a simple classification. For example, ambition and self-motivation skills impact both the level of education and the carrier's attitude.

### *Social and legislative factors*

The social factors refer to social norms, expectations and gender stereotypes (French and Sheridan, 2009). Males are expected to be strong, independent and prepared to take risks, which, consequently, has an impact

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<sup>66</sup> For further reading see also (French and Sheridan, 2009).

on the viewpoint that they have naturally better predispositions for managers, or for harder and more risky occupations.

Legislation, regulations and gender policies may set the framework that could gradually change some traditional occupational and/or hierarchical divisions. However, the success and the needed time for the changes is affected also by other environmental factors, i.e. macroeconomic and industry more specific characteristics. They will be discussed separately.

### **Organizational factors**

The traditional viewpoint related with gender equality is that organizations should be gender neutral. However, it has been exposed to criticism, because deeper analysis reveals that it is developed on male values, just allowing the women to compete with men following men's rules (Smithson and Stokoe, 2005). Women have traditionally more responsibility for the family and the home, which rather directs them to a reduced work time than toward overtime hours. Therefore, women have often not been perceived to 'fit in' with the social characteristics of managers, particularly in senior positions (French and Sheridan, 2009). Negative attitudes towards maternity leave were also noted (*ibid.*).

### **Transport and logistics industry-specific characteristics which impact on individual and organizational factors**

The study done for the European Parliament on women and transport highlights "the male-domination of employment within all areas of the transport labor force and the few examples of good practice that are trying to overcome women's under-representation in this industry" (IP/B/TRAN/ST/2005\_008, p. i). The study points out that the EU missed addressing gender differences in employment between men and women in the transport labor market.

The male domination can be explained with the numerous risks that the staff faces throughout the industry. The most significant risks facing employees in the transport sector are noise, vibrations, lighting, temperature fluctuations/heat, emissions, dust, strenuous postures/lifting, challenging working hours for long-distance drivers, repetitive work, safety etc. (Davydenko et al., 2009). That explains why the majority of transport drivers, pilots, seafarers and handling operatives are male, as well as those employed in vehicle trades (e.g. as car mechanics).

Today, transport and logistics techniques and technology development, including supporting information technology development, give more opportunities to employ women. It has improved working conditions, e.g. in regard to ergonomics, assistance for handling heavy objects, reduction of noise and pollution, as well as safety and protection (Davydenko et al., 2009). New technologies have made it possible for physical workers to be replaced by controllers, planners, analysts and managers. These trends increase the number of jobs that require less physical strength and more skills and education level (Bragdon and Berkowitz, 1997). It seems that these opportunities have not been utilized enough to improve the GEI sector picture until now.

Women are also under-represented in professional and managerial positions within the sector; hence, their influence over the decision-making processes (IP/B/TRAN/ST/2005\_008). Male superiority and centrism, combined with hard, risked and stressed jobs, support sexual harassment as a manifestation of society's gender-bias.

### **Macroeconomic factors**

It is well known that economic growth is closely and positively correlated with human capital (e.g. see Piatkowski, 2002) and transport activities (Mersman, and Van der Voorde, 2008). The current economic crisis has intensified gender inequalities throughout the world. The crisis seems likely to affect women in such areas as employment and social safety nets, unpaid care work, education, migration and gender based violence (Baroni et al., 2009). Women in the developing world are even more exposed to the financial crisis, due to their vulnerable employment, lower earnings and lower levels of social and gender protection, while maintaining primary household care responsibilities (*ibid.*).

Additionally, the workforce faces many and hard challenges in economies which have past economic transition (e.g. see Fekete, 2009, Baroni et al., 2009). The economies suffer the consequences of transitions even after decades of transformation from a command economy to a market economy (Piatkowski, 2002). In cases of economies with an unsuitable business environment, with significant grey sector and/or rich labor

market, struggling enterprises and entrepreneurs cannot be reasonably expected to take into account labor rights and gender employment equality, even within the context of a fair legal framework.

All explored factors have separated and compounded, joined and synergized the impact on GEI.

## **4. THE MAIN CHARACTERISTICS OF THE ECONOMIC AND SOCIAL ENVIRONMENTS IN THE REPUBLIC OF SERBIA AND THE REPUBLIC OF MACEDONIA**

### **4.1 *Common economic, individual and TLI characteristics in both countries***

The general characteristics of economies and TLI are similar in the Republic of Serbia and the Republic of Macedonia. Both countries suffer the coupled effects of the global economic crisis and the effects of a past economic transition, which make their economies very vulnerable. The post-socialist transformation processes, which involve changes towards a market economy, ownership transformation, and sector restructuring, have led to substantial changes in the characteristics of the labor market. They create an increase in unemployment and an informal economy (Gender Equality Council, 2008a). Women's income has had a more significant role in the family budget, but as a vulnerable workforce group, they often face more challenges to protect their rights in finding jobs, keeping them and making progress in their professions.

Within the processes of European integration, in both countries, the sets of strategic documents and regulations regarding the labor gender employment equality policy have recently been adopted.

TLI has additionally faced numerous challenges in the Western Balkan region that refer to aged transport and logistics technology, bad infrastructure and typically insufficient investments. The favorable geographical position in the Western Balkans brings out opportunities for the TLI in both countries. As a whole, the Republic of Serbia has more developed inland waterway transportation, several international ports and airports, which also contribute to industry development and employment. However, Serbia also has three times more inhabitants than the Republic of Macedonia, and as a result of that, the labor force is also that much larger.

Regarding the individual perspective, both countries are still pretty conservative regarding the woman's role in the family, which puts big pressure on them to have a job, but keep a traditional key role in the family. Of course, there are also urban/rural, and education-related differences like in most developed countries.

In the rest of the section, the particular characteristics that describe TLI and the related main gender employment characteristics will be briefly shown.

### **4.2 *The Republic Of Serbia***

#### **Economic characteristics**

The economy and the people in the Republic of Serbia still suffer the consequences of the economic transition and political events in the recent period. Once a mid-developed republic in former Yugoslavia, in the early 90s Serbia became an economy with an income per capita below US\$1,000, suffering of further stagnation and structural destruction caused by: loss of the former market, UN ban on foreign trade and direct investment, hyperinflation and, finally, the NATO bombing campaign, together with inconsistent and wrong policies (Cerović, 2006).

#### **Labor market characteristics in Serbia**

In Serbia, workers' rights are openly violated under the excuse of maintaining economic stability, while big companies and tycoons are free to refrain from paying taxes, salaries and other benefits (Baroni et al., 2009). In order to deal with the economic crisis within particular business environments, small, medium and micro enterprises may find the solution in informal and short-term employment and a grey economy.

The process of privatization has led to a significant transfer of the workforce to the private sector. However, it is interesting to note that the enterprises with state ownership employ a more female workforce (49.6%), than the male one (40.7%), while in private sector (registered) work 54.9% of male and 47.9% of female population (Statistical Office of the Republic of Serbia 2012a, p. 28). In the public sphere, the job positions may have a lower status and be paid less, but in praxis the labor rights are more protected than in the private sector. This phenomenon is similar with the experiences from other East European countries (Gender Equality Council, 2008b.), and is one of the underlying reasons for the fact that the total number of employed women

had a significantly lower decrease (0.6%) than men (4.6%) in 2011, compared with 2010 (Statistical Office of the Republic of Serbia, 2012b, p. 47). The overall number of employees who have formal – legal employment contracts decreased in 2011 by 2.8% (*ibid.*, p. 53).

In 2012, 76% of the population aged 15 years and over represented the share of the active population. The total employed population was 2,228,343 in the Republic of Serbia, of which 42% are women, while in the unemployed population (701,138 persons) the female rate is 44.2% (Statistical Office of the Republic of Serbia 2012a, p. 43). Women slightly prevailed among the inactive population group “willing and able to work” - 54.5% in 2012 (*ibid.*, p. 44). Further, in the inactive population, significantly more women than men report that they are not able to work due to diseases, inabilities, personal or family reasons.

Although the legal system related to the labor market and gender equality has been continuously improving in the last decade, and some strategic documents have been adopted, it is still fragmented and inefficient, and there is a gap between the normative framework and practice (see also Gender Equality Council, 2008b).

Serbian annual TLI statistical reports do not offer the female share and age distribution of the employed in the TLI. However, the overall female age distribution reveals that only 11.8% of employed females are aged up to 25 years, or 17.1% are younger than 30 in 2012. On the other side, 55.85% of employed females were older than 50 years of age in 2012 (Statistical Office of the Republic of Serbia 2012a, p. 47). This is an alarming situation, which can be a consequence of the overall long-term circumstances, including insufficient maternity support during the job, emigration of young, educated and skilled people, etc.

### **Transport and logistics labor market characteristics in Serbia**

Although the process of privatization started in the early 90s, and emerged after the political change in 2000, some vital and big enterprises in the TLI, which do not belong to the road sector, have not been privatized until 2013 (e.g. the national post, the railways, the airport Nikola Tesla and state air company, the port of Novi Sad, main part of the public urban mass transport etc.). The recent economic crisis, combined with the abortive economic transition, has had a serious impact on the transport industry. A high level of grey economy is recorded, particularly in the road transport industry (Srbijatransport, 2013).

Regarding the salaries, in the TLI sector, men's salaries are 101% of the average industry salary, while women earn 97% of the average industry salary (Statistical Office of the Republic of Serbia 2011c, p. 65). It might be predominantly, but not exclusively, related to their occupations and lower management positions.

The first problem in exploring the women's share in the TLI labor force we faced is a lack, or non-consistency, of official data in different sources. For example, the Statistical Office of the Republic of Serbia offers two official sources with different number of employees in the TLI. According to one source, which uses survey methodology (2011b), the total number of employees in Transport and storage was 122,788, with the women's share being 23.82% in 2011. Another source, where the annual statistical data are obtained regularly from all sector enterprises, the data shows only 60,937 employees in the transport sector in the same year, without showing the women's share (2012b, p. 308). Furthermore, it is impossible to separate the labor data for passenger and freight transport. Therefore, in the rest of the section, we'll analyze the overall sector characteristics, with the limitation that it can be supposed that the gender distribution characteristics are similar across the sector.

The women's share of the total sector of the workforce has continuously recorded a growth until it was doubled at the beginning of the new century, when it was stabilized around 20% (Statistical Office of the Republic of Serbia, 2008 and 2012a). Compared with 2011 (23.82%), the share of women in the labor force shows a slight decline in 2012 (20.36%), but it still cannot be considered as a trend.

Transport and storage belong to the sections and activities with the largest drop in employment rates. However, it is hard to estimate how much this number is related to the shifting of business toward the grey economy. According to data from the Statistical Office of the Republic of Serbia, from 2007-2011, the number of employees in the TLI (including the postal section) has decreased 12% (Statistical Office of the Republic of Serbia 2012b, p. 318). The sector covers only 2.9% of total employed females in 2012 (Statistical Office of the Republic of Serbia 2012a, p. 21).

Although there are only 34 big enterprises among 4,586 in TLI, they employ the majority of the workforce – 64%, while approximately equal rates of employees share micro, small and middle enterprises (app. 12%)

(Statistical Office of the Republic of Serbia, 2011a, p. 22). Most employees in the transport and storage sector have full time jobs (92%) (Statistical Office of the Republic of Serbia 2012a, p. 60).

Due to a lack of data related to vertical sex distribution within the enterprises, for that purpose, we used an example. As the postal section keeps a good level of industry employment, it was explored more in-depth.

### The example of "Pošte Srbije"

The postal operational network of Serbia stands as the largest infrastructure and logistics network in the country, although its activities are specific within the industry. The total number of employees in the public enterprise "Pošte Srbije" in 2011 amounted to 14,939. The gender structures of the occupations and the management positions are given in Table 1.

**TABLE 1. The Gender Structure In Occupations And Management Positions In "Pošte Srbije" in 2012**

Position groups	Males (%)	Females (%)	Total (%)	Total (no.)
1. Top management (Board of Directors, CEO, Deputy of CEO)	100.00%	0.00%	100.00%	10
2. Middle management	43.75%	56.25%	100.00%	16
3. Low management	64.94%	35.06%	100.00%	77
4. Experts, professionals (engineers, economists, lawyers)	59.07%	40.93%	100.00%	2018
5. Technicians, associate professionals, controllers (also mostly with high education – engineers, economists, lawyers, etc.)	37.49%	62.51%	100.00%	2059
6. Administrative staff	34.44%	65.56%	100.00%	360
7. Drivers and delivery workers	98.61%	1.39%	100.00%	1511
8. Technical and technological staff (handling workers, warehouse staff, walking deliverers)	57.38%	42.62%	100.00%	8923
9. Half-qualified and non-qualified workforce	61.76%	38.24%	100.00%	102
Total	58.56%	41.44%	100.00%	15076

The company employs 41% women, which is almost double than the industry average. The females slightly dominate among middle managers, technicians and controllers and administrative staff (groups 2, 5 and 6 in Table 1, respectively).

Although the women are surprisingly fairly presented in management, the gender inequality might be recognized in a couple of details – for example, the "zero presence" in top management and just 35% of the management positions in total. Also, comparing the position groups 4 and 5, both include high education (former entirely, latter mostly), but the less average salaries are in group 5. This means that women dominate in the position group where employees have less than average salaries for the same education level.

It can be concluded that the company "Pošte Srbije" mostly recognizes and uses equal employment opportunities, although there is room for improvement. However, according to the overall sector statistical data, it seems that the company can be rather used as a good example for cross-TLI sector benchmark study, than a sector representative one.

## 4.3 The Republic of Macedonia

### Economy characteristics

The Macedonian economy has faced many challenges since claiming its independence from Yugoslavia. With the implementation of the "management/employee buyouts (MEBOs)" the formation of privatization has had negative consequences on future growth and labor market developments (Zalduendo, 2003). Also, the absence of good infrastructure, and many political events, like UN sanctions on Yugoslavia as Macedonia's largest market, the Greek economic embargo in 1995, NATO attacks on Serbia and the 2001 armed conflict in Macedonia, all created bad conditions for the development of the national economy.

In the last few years, the Macedonian government managed to develop a constant macroeconomic policy. Structural reforms and fiscal policy as well as a high level of public investments in the recent past, led to a stable macroeconomic condition and improved the business situation in the country.

The world economic crises had reduced economic growth of the country from 2009 to 2012, but on the other hand, numbers show that the crises did not have a negative impact on the unemployment rate. According to the data of the State statistical office (SSO), one of the key sectors that mitigated the effects of the world economic crises on the Macedonian economy in 2010 was the logistics sector (transport and communication) with a 5.1% growth. The government projections for the following years are expected to show further macroeconomic stability of the country that will reduce the unemployment rate and increase salaries.

#### **Labor market characteristics in Macedonia**

According to SSO, 56.5% (943,055 persons) of the population over the age of 15 were active and participating in the labor market, while 43.5% (726,910 persons) in 2012 were inactive. The unemployment rate for 2012 was 31% (292,502 persons), which places the country at the bottom of the European list of countries (SSO, 2013a).

The main characteristic of the labor market is that men participate much more than women (61% active men, 39% active women). Bearing this in mind, and considering the share of employed and unemployed men and women in the active population, a conclusion can be made that men and women in Macedonia have equal opportunities to find a job. Calculations show that the unemployment rate for women in Macedonia in 2012 was 30.3% and it is even lower than the unemployment rate for men – 31.5%.

What significantly contributes to the gender gap employment in the country is the high share of women in the inactive population. If we analyze the structure of the inactive population, data reveal that the share of women in the inactive population is 64%, showing significantly higher female participation, whereby over 46% of inactive women are considered to be housewives. This is specific to more traditional societies and strongly urges us to consider individual and social factors when analyzing gender employment inequality in the transport and logistics industry.

According to the education statistics, the data shows that 53.6% of the employed individuals have a secondary education, of which 33.9% are men and 19.7% are women. The smallest percentages of employed individuals are individuals who have completed a higher vocational education (3.1%), and individuals without an education (3.2%). Rendering to the statistical reports, 21.1% of the employed persons had completed university level education, of which 10.8% men and 10.2% women (SSO, 2013a). It indicates that educated women have as equal opportunities for employment as men do. It also shows that women participate in jobs that are close to the decision making processes in the work place.

#### **Transport and logistics labor market characteristics in Macedonia**

There were 6,445 active companies in 2012 in the transport and logistics sector in Macedonia, which is 8.7% of the total active companies in the country (SSO, 2013d). Most of them (90%) are small private companies with less than 10 people employed. Only 7 companies in this sector have more than 250 individuals employed and some of them, like railway companies (transport and infrastructure) and Macedonian post, are state owned companies. Our calculations, based on the data of the Statistical review 2.4.13.07/748, shows that over 43% of the total individuals employed in the sector work in the category of companies with 10 or less people employed. This indicates that these small companies create most of the employment potential in the transport and logistics labor market. Data shows that 72% of the employed persons in the sector work in private companies. More than 15% of the employed in privately owned companies are women, compared to the companies with state ownership, where more than 23% are women. Therefore it can be concluded that state companies employ more women than private companies do.

Table 2 shows that over 76% of the total employees in the transport and storage sector are working in land transportation. We can also notice that some logistics subsectors, like air transportation or postal and courier services which are using higher levels of technology, as well as more sophisticated equipment and working methods, have a low level of GEI. Still these subsectors are only 9% of the total labor force in the transport and storage sector and do not have much influence on reducing the gender employment gap in the logistics sector in the Republic of Macedonia. It should be noticed that according to this source, the women's share in TLI workforce is significantly higher, compared with Eurostat.

**TABLE 2. Employees In Transport And Storage Sector By Types Of Ownership, 2012 (Data Are Weighted)**

Sector/subsectors	Total		Ownership			
			Private		Other	
	Total	Women	Total	Women	Total	Women
Transport and storage	28441	4993 (18%)	20436	3146 (15%)	8005	1847 (23%)
Land transportation and transportation via pipelines	21750	3177 (15%)	17805	2402 (13%)	3945	774 (20%)
Air transportation	73	32 (44%)	73	32 (44%)	-	-
Warehousing and support activities for transportation	4167	869 (21%)	2347	603 (26%)	1820	265 (15%)
Postal and courier activities	2451	915 (37%)	212	108 (51%)	2239	807 (36%)

Source: SSO, Statistical review 2.4.13.07/748, p. 16

Land transportation has the highest disproportion of gender employment, as less than 15% of the total employees in this subsector are women. That is why we must point to gender employment improvements in land transportation. Reducing the gap in land transportation will cause a reduction in the overall gender employment inequality in the transport and logistics industry in the country.

One of the good signs of gender employment equality in the sector is that the number of persons employed in 2012 increased compared to 2011, as a result of employing more women in the land transportation subsector (SSO, 2013b, p. 11).

Most of the employed (95%) in this sector are full time workers. By economic status, the structure of the employed shows that 75% are employee, 8% employer and 15% are self-employed. According to the analysis of the structure of the employed by occupation in the business enterprises, most of the workers in this sector are plant and machine operators and assemblers (56% in 2012), which is expected bearing in mind the characteristics of the sector (Table 2). The number of employed in these positions has increased nearly 6.5% from 2011 to 2012. On the other hand, the share of managers and professionals in this sector, which includes individuals with higher levels of education, is low (7.4% in 2012) and has decreased in 2012 compared to 2011 (SSO, 2012a, 2013a). So, as we have noticed initially, one of the specifics of the Macedonian labor market is a lower participation of women without higher education. Thus we can conclude that at this point, the specifics of the transport and logistics labor market favors men over women.

We can support these findings by analyzing the employed individuals in the transport and logistics sector by gender. Barely 17.5% of the total workers in the sector are women and they only contributed with less than 2% of total women workers in Macedonia in 2012 (SSO, 2013b). Most of them are aged 25-64. An encouraging situation is that the number of young women employed in this sector has doubled in 2012 compared to 2011 (Table 3). It leads to an increase of the share of employed young women in the total young people employed in the sector from 10% in 2011 to 25% in 2012. Even though their share in total employment in this sector is insignificant, it still shows that young women are getting more chances than before for employment in the logistics sector. It might be an indicator of certain improvements in the sector on the gender employment issue. However, this picture is pretty different from the Eurostat statistics data about the Republic of Macedonia (13.3% of women share), although there is still much room for further improvement.

**TABLE 3. Employed by Activity of Business Entities, Age and Gender**

	Men			Women		
	15-24	25-64	65 and over	15-24	25-64	65 and over
2011*	1068	25260	40	129	3837	53
2012**	753	25608	-	264	3750	36

Source: \* statistical review 2.4.12.11/727, p. 45, \*\* Statistical review 2.4.13.06/745, p. 56

Still, at this level of development of the country and the labor market, we cannot say that there is high potential for opening new job positions at the moment in the transport and logistics sector.

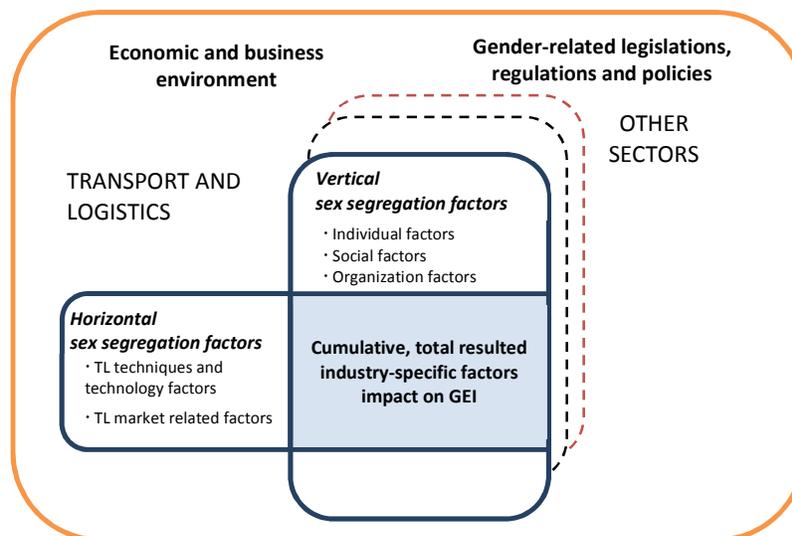
Now we can conclude that the employment in Macedonia is characterized by a very unfavorable gender structure. This situation also applies to the employment rate in the logistics sector. We have identified some reasons why this condition has not changed over a longer period of time: unstable economic and social conditions in the country; imbalance between the available and required profiles on the labor market; the traditional role of the female in a family, especially in rural areas; small number of women employed in land transportation as a result of low level of technical and technological development of this logistic subsector compared to other subsectors, etc.

## 5. DISCUSSION

Our research tackled an important question of GEI in the TLI in two Balkan countries. We used the official statistical database and GOS perspective in our research. The results confirm that there are many more similarities than differences between the two countries in many ways. The overall impression is that the women's personal capabilities and characteristics, social norms and gender stereotypes are not the source for the significant differences between Serbian and Macedonian female shares of the TLI labor workforce.

The impact of organizational factors on GEI is strongly related with industry-specific characteristics and circumstances. The number of middle-sized and big enterprises has strongly decreased in the recent period, and it is difficult to speak about career and vertical progress of management positions in micro and small firms. The available data from Serbia shows that, in big enterprises, organizational factors have similar characteristics as in other, more developed countries. However, in both countries, the dominance of small firms in the TLI sector limits the variability of impacts of organizational factors.

It was obvious that GOS was not enough to explain by itself the gap in women's share of the TLI workforce. Therefore, we expand the analysis on industry specific factors and, particularly, the impact of the macroeconomic environment on it. This extended research framework on GEI, which comprises horizontal, vertical and environmental impact factors, is given in Figure 1. The sector gender employment inequality is a result of complex (direct or indirect) impacts of all these factors. While GOS may find the same reasons for GEI in different sectors, the sector and environmental factors explain percentage variations between the sectors and economies and they are principal for sector improvement measures.



**FIGURE 1. The sources of impact factors on sex segregation in transport and logistics sector**

Old infrastructure, transport, storage and transshipment capacities strongly impact on competitiveness and the overall employment in the TLI in both countries. They also contribute negatively on the share of employed women in the TLI. Changing educational levels and improving technology are necessary preconditions to reconstruct the patterns of gender segregation. While the women's educational level has improved in recent decades, there are often transport capacities and equipment older than 10 years, where still traditional physical work is necessary. Therefore, improving technology should be considered in order for many limitations regarding GEI to decrease in the industry.

The gender-related legislative framework progressing toward women's protection is similar in both countries. In the socialist period, women had legally protected rights, and it made way for their better share in the workforce in state-owned enterprises. According to the EU standards, both countries have started to introduce a set of laws and regulations that highlights a need for gender equality and equity, and constituted the governmental bodies and offices which continuously support their implementation and monitoring, but the developments of the institutions are yet to be finished.

They also improved the statistical database on gender employment and unemployment, but there is still a lack of some data and an inconsistency between the sources within and between the countries.

According to the obtained data, it seems that GEI is rather expressed in the structure of the inactive population, particularly in the "willing and able to work" group, than in the share of the unemployed workforce. Women desire full time jobs because they are key for increasing the family income.

The most recent trend is that the Republic of Macedonia records a slight increase in the women's share in the workforce in the TLI, while the Republic of Serbia records a slight stagnation in 2012. However, it is too early to make any conclusions, and further research on these trends in the forthcoming period is necessary.

The most important difference between the two countries is in the total number of employed in the TLI, and the employment rate in big and middle sized companies in Serbia, which are still mostly state-owned. Although these enterprises often record an excess of employees, they still treat them more carefully and with more sense for social factors than the private sector and, particularly, small firms in the industry. According to the results, we can express the concern that decreasing the number of state ownerships in Serbia could have a serious impact on further decreasing the women's share in the TLI workforce. This hypothesis has to be more thoroughly explored in further research.

According to the findings in this research, we can identify the main factors related to the improvement in gender employment equality in the TLI in both countries:

- Maintenance of macroeconomic stability of the countries, and improvement in the overall business climate and country competitiveness. It will contribute to the sector both through the increased transport activities and create a better business environment, particularly when it comes to the grey market.
- Increasing the level of technological development of the TLI and attracting the investments.
- Generating opportunities for part time employment and flexible arrangements with the intention of legal support to balancing women's private and public lives.
- Adjusting the educational system according to the labor market needs and introducing training programs to increase the skills and competencies of women.
- Availability and consistency of statistical data, necessary for making governmental policies on gender equality and equity in the TLI in both countries.
- Supporting sector programs for self-employment with improved access and facilities for women to start and run their own businesses.
- Further compliance of national gender-related regulations with European standards and their implementation in practice.
- As the big enterprises are still mostly under state control, it could be taken as an opportunity to implement and control selected gender equality policies, where possible.
- Caring not only about quantity, but also about quality in gender mainstreaming (Wittbom, 2011).

We are completely aware of the challenges involved in implementing the related measures, but we think that future research and praxis has to be directed at supporting them. Also, the aim shouldn't be only directed at closing the gap, but to mutually use the experiences, particularly of good examples in both countries, to make the improvements.

## 6. CONCLUSION

Women in the TLI suffer both horizontal and vertical sex segregation more so than in most of the other sectors. Therefore, the attention directed toward gender mainstreaming and efforts to reach it should be more

appropriate. Surprisingly, the literature research reveals that there are indeed small concrete directions related to higher women employment rates in the TLI.

In the post-socialist period, the economy transition, and recently, the economic crisis, both reflect on an overall unemployment rate and endangered labor rights in both countries. The TLI in such economies faces various challenges. They are related primarily, but not exclusively, with privatization, an increased level of unemployment, grey economy, old technology and insufficient funds for investment into further development. In such conditions, the enterprises try to survive in a more challenged market than in developed countries, and the workforce suffers the consequences in different ways. Although such consequences target the workforce as a whole, women, as a more vulnerable group, may often feel a synergy of negative impacts and, therefore, require additional efforts to be protected.

We identified a list of the most important factors that contribute to GEI. It is difficult to weigh their priority without more in-depth research, but intuitively, we think that overall economic development is the primary goal. For example, investing in education and training, without overall economic development and welfare, could have very serious and complex consequences. It may partly improve the level of women employed in the TLI, but it can also contribute to a higher level of unemployed highly-educated young women, or their migration from the countries.

The paper underpins the necessity to go beyond traditional GOS analysis and to understand industry specifics within the overall economic environment. There is a need for developing a more comprehensive database for continuous monitoring of gender mainstreaming in the TLI. It is one of the preconditions for applying all related current and future gender related policies, regulations and recommendations.

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**A list of Acronyms:**

GEI: Gender employment inequality

TLI: Transport and logistics industry

GOS: Gender Organization System" perspective

CEE/CIS: Central and Eastern Europe/Commonwealth of Independent States

WWII: World War II

PTT: Postal transport and telecommunications, an acronym used in the name of the company "PošteSrbije"

SSO: State statistical office

# Gender, income, and transportation mobility in Bangalore's IT sector

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## ABSTRACT

This paper takes Bangalore's Information Technology sector as the starting point for a discussion on gender and transportation mobility in the city. The original motivation behind this research was to better understand how women's concern for personal security in Bangalore affects their transportation mode choices. It was predicted that women with the financial means to use private transportation, such as a car or two-wheeler, would choose such modes over public transportation in order to avoid the common occurrence of gender-based harassment in public transportation. The decision to focus on women (and men) employed in the IT sector stemmed from the logic that a) Bangalore's IT population is highly mobile both in regards to interregional migration (people moving between Indian states to IT hubs) and intercontinental migration, and b) the incomes of men and women employed in the IT sector are higher than the city's median income, affording this population of workers more modal choice than other socio-economic sectors. The general findings reveal that, although security is the most significant factor in determining this population of women's transportation mode, it does not inherently lead them to choose private over public transportation modes.

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**KEYWORDS:** Gender; Company Bus; IT; India.

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## INTRODUCTION

The issue of women's personal security in India has received widespread attention since the 2012 Delhi rape case, an incident in which a young medical student was fatally gang raped while onboard a bus in Delhi. The Delhi rape case united women (and men) across tangible and intangible boundaries in recognition that gender-based harassment, physical or verbal, is a part of women's daily life. Although there continues to be an emphasis on gender-based harassment as a collectively shared experience among women, the nuances of how women of different social, economic, caste, and class positions mitigate this experience remains unaddressed within policy, particularly transportation policy research.

Public transportation is a contested and often uncomfortable space [place] for women of all ages, castes, and classes where a practice known as 'Eve teasing'<sup>67</sup> persists. For over a decade, India has initiated public sector efforts to mitigate gender-based harassment on public transportation. The most salient example is the establishment of women only cars in metros and trains and women only sections in buses, a practice that is not unique to India but found in metropolitan areas of Mexico, Japan, Guatemala, and Indonesia. However, some (Banbinard and Scott, 2009; Root, 2000; Saravanan, 2009) would argue that this is a mere Band-Aid to a much deeper wound. Gender segregated infrastructure, in the long term, only further produces and reinforces a gender-segregated city (see also Hayden, 1981).

It is from this perspective that I lay the groundwork for the questions that motivate the research of this paper. If public spaces such as city buses and metros remain limited or inaccessible to women, what kind of solutions, specifically transportation mobility solutions, are women turning to? How does one's 'position', be it socio-economic status, class status, caste, ethnic, religious or income status, open up or further limit not only transportation mobility but also socio-economic opportunities such as employment?

Immediately after the Delhi gang rape, many women were encouraged to share their personal experiences through blogs, twitter, social networks, and traditional media sources. *Atlantic Cities* quoted Arkaja Singh, a female lawyer in Delhi: "I have never really felt unsafe [in] Delhi... But I have a car. I would really like to see the

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<sup>67</sup> Mitra-Sarkar and Partheeban summarize Eve teasing as "a form of sexual aggression toward women or girls in South Asian countries" (2009: 75).

city think through how to make it much easier, safe and more comfortable for people to get around without cars” (Bergen, 2013).

Personal modes of transportation are often (but not always) more expensive than public, particularly in India where the cost of owning a car remains prohibitively expensive to the majority of women and men. Historically, we find many examples of positive correlations between rising household incomes, Gross Domestic Incomes, and automobile use/motorization rates. These quantitative measures however, do little to explain or address causality. As Reichman stated more than 30 years ago, “many factors support the idea that the car implies a whole lifestyle and mobility strategy,” (Reichman, 1983: 100).

Bangalore, the capital of the South Indian state Karnataka, was chosen as the geographic site to explore multiple research questions regarding the relationship between gender, income, and transportation mode choice. In a span of less than 30 years, Bangalore has transformed from a sleepy hamlet into a global, high tech city, a transformation attributed almost exclusively to the rise of the Information Technology sector. What was once ‘the garden city’ is now referred to as the Silicon Valley of the East. Bangalore has one of the fastest growing populations in India<sup>68</sup> and is increasingly considered a city of migrants. However, those migrating to the city to work in the Information Technology-Business Process Outsourcing (IT-BPO) sector tend to be highly educated, part of what national and international media outlets refer to as the ‘new middle class.’ The IT sector, and those working in it, should be considered a significant factor behind the amount of money the city currently receives from the central government, which is more than many other first tier cities of comparable size and population<sup>69</sup>. Despite large private and public sector investments, public infrastructure—public transportation included—has not kept pace with the growing population. This has led to a significant increase in private vehicle ownership (from an average of .3 vehicles per household in 1987 to 1.7 vehicles per household in 2005<sup>70</sup>), which has created severe traffic, congestion, and pollution problems.

As stated, the IT-BPO sector is considered the main attraction for the city’s influx of labor migrants. Although the IT sector is associated with the new middle class, it requires workers of all skill levels, from office cleaners, food servers, security personnel and company drivers, to software engineers, designers, and business leaders. Most full time employees who are employed directly<sup>71</sup> by the IT companies receive incomes that are higher than the median incomes of city residents and significantly higher than the median income of India as a whole<sup>72</sup>. Given these incomes, as well as other motivating factors (to be discussed later), full time male and female IT employees tend to have more transportation mode choices available to them than those working in other employment sectors. To briefly summarize, women and men employed in Bangalore’s IT sector were chosen as the population of study for three main reasons:

- Bangalore’s IT sector has many gender inclusive policies that are meant to attract and retain women employees;
- Employees of Bangalore’s IT sector earn incomes that are significantly higher than the national median;<sup>73</sup>
- Many of the individual IT firms have their own transportation systems; this usually includes a company bus and (night) taxi service for women.

The influence that gender has on an individual’s transportation mode choices cannot be easily untangled from other factors, such as one’s ‘background’, a word often used by survey respondents to summarize class, caste, and socio-economic position. Furthermore, the profound influence the IT sector has on local politics, the

<sup>68</sup> UN population projections. 2011 census data find that the city has grown by 48 percent in the past decade, even though the fertility rate has decreased (DNA 2011).

<sup>69</sup> India uses a Tiering system, which classifies and ranks cities according to population density. This ranking is then used by various departments within the Government of India to determine funding for housing, tax exemption, infrastructure funding etc. To give an example, although Chennai ranks higher in the tiering system, Bangalore receives more capital investment funding (see McKinsey, 2010).

<sup>70</sup> Les Ateliers, 2012.

<sup>71</sup> Office cleaners, security, and food service workers are all examples of contract-based workers.

<sup>72</sup> To be discussed in greater detail. 2011 census data find that the national median income level is just under 50,000 INR annually, or approximately \$830 US dollars.

<sup>73</sup> Author was unable to find the median income of Bangalore city.

strategic urbanization of Bangalore, the type of urban infrastructure projects that are being financed, as well as the city's culture cannot be overlooked in the context of the transportation mode choices of men and woman.

## **Overview**

**Section One** begins with an overview of the importance of Bangalore's IT-BPO sector in terms of women's formal employment, and the significance this sector has on the spatial, social, political, and environmental development of Bangalore. **Section Two** introduces the research that was undertaken in summer of 2013. The research methodology is presented, followed by a summary of important descriptive statistics from the sample population. **Section Three** focuses on the top four modes taken by men and women in this sector, the motivating factors for choosing these modes, and how these factors differ between women and men. I will touch on the issue of personal security and a few paragraphs will be dedicated to a discussion regarding the popularity of the company bus and the ways in which this quasi-public space impacts the concern for gender-based security in interesting and unusual ways. I then turn my attention to perceived 'ideal' modes of transportation, and the transportation modes used outside of work. In **Section Four** I present some initial conclusions, and speculate on why transportation researchers and policy should continue to interrogate and address the relationship between gender, transportation mobility, and environmental sustainability in Bangalore.

## **SECTION ONE**

### ***Women and mobility***

While mobility usually refers to the ability to move across (geographic) spaces, accessibility can be seen as the ease with which one is able to do so. Looking at mobility and accessibility in the context of gender allows us to better understand the distinction between the two. A good deal of research has established that women have more transportation mobility, but less transportation accessibility, than men (Calvo, 1994; Kunieda, 2007; Peters, 1998). Cost, personal security, and time poverty are three factors that impact a woman's transportation accessibility. Women earn proportionally less than men making the cost of using transportation higher, women are more likely to experience gender-based harassment while in public, and time poverty refers to the double work day, a term that describes the societal expectation that women will participate in work inside and outside the home. This is also referred to as market and non-market based labor, or a difference between care giving and paid employment. Although every year more and more women across the globe enter the formal labor force or participate in some form of paid employment, they remain the primary care givers within families and communities. Women (or girls) are expected to get water from the communal pump, run household errands, plan and provide meals, take care of the sick, and, also, work outside the home be it an office, field, or market stall. In this way, we can say that, although the duties women are expected to perform vary greatly across cultures, women around the world share the burden of the double workday.

### ***Car and personal security***

The connection between women, personal transportation, and personal security remains understudied and undervalued in transportation research and policy, particularly in cities and countries where gender-based harassment in public is pronounced. While researchers, particularly women researchers, have made it clear that public transportation has, by and large, failed to address the mobility and accessibility needs of women (see Spain, Rosenbloom etc) how and why public transportation is failing on the issue of personal security must be probed further. If every time a woman uses a public form of transportation she is subjected to gender-based harassment—groping, uncomfortable staring, verbal abuses or worse—how does her perception of not only public transportation but public space and the public sector change? Does having access to a car change her literal and conceptual perception of not only transportation mobility, but also, social and economic mobility?

### ***Women in the IT economy***

Around the world women are entering, even dominating the wage labor force. The majority of these women, particularly in the Global South, tend to be concentrated in informal, low-wage, often vulnerable

sectors (ILO, 2009). The IT-BPO<sup>74</sup> sector in Bangalore offers a unique contrast. It is perceived as being not just gender neutral but gender inclusive. Company policies such as strict anti-harassment rules, comprehensive maternity leave, having child care and doctor at work are some of the many examples of companies initiatives to attract and retain women in this particular workforce. Between 2006 and 2008 the number of women in India's IT-BPO sector increased by 60 percent. When asked what women like best about these jobs, the response is often 'work environment' (Singh and Pandey, 2005; D'Mello and Sundeeep, 2007). Work environment in this case refers to everything from the modern interiors of the office building to company 'perks' such as subsidized company cafeterias, game rooms, the landscape architecture of the campus environment, and company policies such as paid maternity leave and crèches for children. The IT-BPO sector is an urban sector, and the tremendous increase in women working in India's formal urban sector is attributed to the IT-BPO sector alone (NASSCOM, 2009, 3). Approximately 40 percent of this workforce is female<sup>75</sup> (ibid) and, although one finds fewer women in executive roles, women remain more prevalent and more integrated throughout this sector than more traditional sectors such as manufacturing and the public sector.

A 2008 comprehensive report of women in the IT-BPO sector done by NASCCOM found that it was the transportation policies of companies within this sector that were particularly instrumental in the attraction and retaining of female employees. One such policy is the guaranteed ride home policy. Any full-time, directly employed female employee working past 8 p.m is eligible for free door-to-door transportation. This transportation is usually a taxi that is shared by other women who live in the same vicinity or a small mini bus. Even with this policy, companies initially encountered reports of harassment and even rape of female employees. Now, many companies have mandatory security personnel along for each trip. Other monitoring techniques include strict time keeping, kilometer counting of the taxi, and text services.

### ***Rise of the IT Sector***

Bangalore's IT boom began in the mid 1980s, prior to the country's economic liberalization<sup>76</sup>. In his memoir, *Imagining India*, the former CEO and founder of Infosys<sup>77</sup> writes about the company's decision to move to Bangalore and why information technology allowed for certain freedoms that more traditional sectors did not.

Shortages in infrastructure did not affect us, as our markets were international, and all we needed to do business was a wire and some computers... Since the government did not recognize us as a 'conventional' business for a long time, their regulations did not hamper us, and we worked outside the controls that stifled companies in manufacturing and agriculture. We did not need the raw material—iron or coal, but for instance—that required Indian firms to interface with the state-run companies that controlled these resources,"(Nilekani 2008; 5).

Although unburdened by the need for urban infrastructure, the company chose a 462-acre area of land approximately 18 kilometers from the City Railway station<sup>78</sup> as the space in which to build the first comprehensive IT park. There were several justifications for the firm's decision to locate on what was at the time outside the city's municipal boundary, namely, land was cheap and there was more of it. Being outside city jurisdiction and having undeveloped land, these early IT companies were able to literally fashion a new city, fittingly called Electronics City, a city that has led to what architect John Stallmeyer calls Bangalore's 'Silicon

<sup>74</sup> Although IT and BPO tend to be lumped together into one sector (service/client-based...), the two are very different. Information technology can be anything from business solutions, data analytics, hardware and software development and other services that would require an employee to have, at the minimum, a BA, usually in engineering. Business Process Outsourcing on the other hand is what is also known as 'call center' work such as telesales, company support, marketing etc. BPO work for US and UK industries has been 'off-shore' for decades, originating first in the Caribbean and eventually moving to Southeast Asia. BPO work requires a proficiency in the English language but not necessarily an advanced degree. In India, women constitute between 30-40 percent of the IT sector and over half of all BPO workers.

<sup>75</sup> In a separate paper I discuss the gender constitution of IT and BPO separately as BPO (call work) has become a predominately female sector where as IT, though there are more women in IT in India than many other parts of the world (e.g. USA), they remain less than 40 percent of the workforce.

<sup>76</sup> India was forced to open its economy in 1991 after a balance of payment crisis. Many see this as the end of India's 'pink' era, the color pink indicating India's strong ties with Russia and socialism.

<sup>77</sup> One of the first, and most successful IT companies in India.

<sup>78</sup> [www.electronic-city.in](http://www.electronic-city.in)

Valley Imaginary', best understood through the description a senior executive provided to Stallmeyer during his research.

Whenever clients come here, they walk in, they walk through this chaos; [and] they are confused because they see... cattle on the road. You see people crossing the road; you see the buses going helter-skelter, you see the road is crowded, you see the dirt on the road, and you are confused... and they come here, and suddenly they see order, they see beauty and they see aesthetics, they see a lot of well-dressed people moving about (qtd. in Stallmeyer, p. 60, 2011).

While these IT companies were able to create a place that, upon entering, felt (and continues to feel) worlds away from the rest of Bangalore, at the time Electronics City really was worlds away from the city; there was one arterial road and no public bus service. Land was the prime motivation in the sector's decision to locate on the urban periphery; transportation connectivity was an afterthought. At the time, the majority of the workforce lived within the urban boundary, usually in the central, north or eastern areas of Bangalore. What arose was a spatial mismatch between place of residence and place of work. The result was, and, to a certain extent remains "a city of 60,000 unfilled potholes... where software workers morning commute to work can take up to two hours," (World Bank, p. 1, 2005)<sup>79</sup>.

### ***Bangalore Overview***

In Bangalore, a plurality of transportation modes exists, though the majority of income categories use some form of motorized transport. Although Bangalore has one of the highest motorization rates in India, the city has some of the poorest transportation infrastructure. Part of this can be attributed to the fact that Bangalore was never planned as a great metropolis. Historically, roads were narrow with few footpaths. For the past decade, roads have been constructed in a piecemeal, ad hoc manner. Comprehensive planning to connect different designations of land uses to existing transportation networks seldom occurs, meaning bus routes fall short of getting people where they need to go. Unlike most first tier cities, Bangalore has no rail network, and a metro system of more than 20 years in the making has yet to be realized. Although improving, Bangalore Metropolitan Transit Company's (BMTC), the city's public bus system, remains overburdened. These are just some of the factors that seem to explain the increase in personal vehicle use among Bangalore residents. It does not, however, account for the more general connection between rising incomes/standards of living and rise in personal vehicle use.

### ***The company bus***

While there is no formal definition of the company bus, for the purpose of this discussion the company bus will be defined as bus transport that is provided to employees on behalf of their employer. What is provided—in terms of routes, timings, locational coverage, and cost to users varies greatly<sup>80</sup>. While company provided transportation is not unique to India or the IT sector, IT company buses have the largest private service network (many companies have a fleet of 80 or more buses), the most extensive routes, highest frequency, and most luxurious buses of any other economic sector. So although many IT-BPO employees own some form of motorized transportation (two or four wheeler), the company bus is one of the most utilized transportation modes among IT employees.

As suggested, the company bus emerged out of the need to address the spatial mismatch between residential and work locations. The main problem IT companies faced in nascent years was getting their workforce to Electronics City in a safe, efficient, and timely matter. On the one hand, it was because of a lack of pre-existing transportation infrastructure that required companies to provide their own; on the other hand, it

<sup>79</sup> Note this is not the opinion of the authors of the report, but a paraphrased description taken from the financial press. However, it is curious that, in this report, the emphasis is on software workers. Presumably, other workers, particularly the service workers of Electronics City would also have commutes equally as long. The decision to mention software workers perhaps suggests their importance to and in the city.

<sup>80</sup> Companies clustered in one specific geographic location, like an industrial office park, might all provide employees with company initiated transportation, but again routes, timings, and costs will vary from one company to the next. Similarly, one company with offices scattered throughout different regions and countries will vary its company transport policies according to that particular region. We might then envision company transport, specifically the company bus, as an institutional arrangement dependent on both private and public factors, particularly the built environment in which it is located.

is important to note that prior to the development of Electronics City, there was little or no demand for BMTC to service this area as it was mostly paddy fields and agricultural lands. In other words, the company bus fulfilled a spatial mismatch that the IT sector itself created. This is one, but not the only example of the profound influence the IT sector has on the spatial development and urbanization of Bangalore. While I will not take the time to discuss these in detail, other examples include: extending the urban boundary to include Electronics City, the building of a new airport in south Bangalore, the increased number of toll roads in the south, and the rise of gated real estate development around Electronics City—often at the expense of pre-existing residents. Between 1941 and 2001, a time span of 60 years, Bangalore's population has gone from roughly 411,000 to 5,686,800 people and the city, in this time span of 60 years, has increased from 66 square kilometers to 531 square kilometers (Nair, 2005).

Not only was the company bus a way to get people to work, it was seen as a necessary component to the industry's global delivery model<sup>81</sup>. In its initial stages, companies such as Infosys and Wipro (the two largest IT companies in Bangalore) contracted with private companies to provide point-to-point transportation for their company's employees. However, as IT expanded, these companies discovered that the supply of private bus contractors did not meet the sector's demand. Furthermore, when private bus contractors went on strike, companies faced major set backs and significant financial losses. In the early 2000s, a decision was made to adopt a private-public transportation model and a contract with Bangalore Metropolitan Transit Corporation (BMTC), the city's public bus company) as well<sup>82</sup>.

The IT company buses of Wipro and Infosys currently service a 30-40 km radius and offer an extensive point-to-point service network. Company buses arrive at designated (public) bus stops throughout the city at set times, pick up their employees and travel directly to the IT campus. There are approximately two pick up times in the morning and two departure times at night<sup>83</sup>. All buses, regardless of belonging to the BMTC or a private company, are air-conditioned and multi-axle, with enough seating for every passenger. In its initial stages, the company bus was free to employees. However, as Bangalore's urban boundary expands in size and residential locations spread out, the cost of the company bus has become burdensome to many companies. For many years now, employees must pay a monthly fee to use the company bus. Although subsidized by the company, a monthly bus pass is anywhere from 1500 INS to 2300 INS. This fee is considerably higher than the Bangalore Metropolitan Transit Corporation's (BMTC) range of monthly pass options, which are anywhere from 800 to 1200 INS (depending on type of bus)<sup>84</sup>. The fee to use the company bus is especially high if one takes into account that this mode can only be used to go to and from work.

## SECTION TWO: METHODOLOGY

Electronics City is currently home to approximately 300 predominately multinational companies<sup>85</sup>. It is the largest technology hub in Bangalore and one of the largest in India. One of Electronics City's oldest, largest, and most prominent IT firms was selected as the subject of this research. A case study approach was decided, with factors such as time constraints<sup>86</sup>, gaining access to employees, and ease of execution being significant determiners of this methodological approach. An email was sent to the addresses of the firm's full time IT workforce. The body of the email explained the purpose of the research, an overview of the research objectives, and explanation of respondent confidentiality. At the bottom of this paragraph was an electronic link to an online, comprehensive survey<sup>87</sup>. Although I did not have control over the distribution of this email,

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<sup>81</sup> This model refers to many aspects of these IT companies, but in essence it recognizes that a Bangalore-based company's primary client is located in a geography other than India. In other words, these are global companies.

<sup>82</sup> It has been argued by those in the IT sector, that this partnership forced BMTC to become more efficient, that BMTC has learned from the IT sector's model and structured their system off the private sector and today is one of the only public bus companies in India that maintains a profit margin.

<sup>83</sup> In the past there were more drop off times in the evening but, as per the guaranteed ride home mandate from the national government, eliminated an after 8 p.m drop off time as it meant women leaving the office after 8pm went unmonitored.

<sup>84</sup> For example: AC or Non-AC bus.

<sup>85</sup> Infosys, Wipro, Biocon, HP are some examples.

<sup>86</sup> Research was conducted from July to August of 2013.

<sup>87</sup> People employed in call center work, which is typically a night shift and done by men and women who are younger and often with less formal education, were not a part of this survey.

senior management estimates that the email reached approximately 20,000 employee inboxes, of which 2,070 responded, providing a 10 percent response rate. The survey was divided into three categories: characteristics of work commute (e.g. mode choice, kilometers from work); perception of security (e.g. gender-based concerns regarding personal security); and demographics (e.g. age, income, children). In addition to the survey, elite interviews were conducted with the heads of the sustainability, transportation, night taxi, and gender inclusivity units. A total of 30 one-on-one interviews lasting approximately 45 minutes were conducted with men and women of various ages and ranks within the company. Lastly, three focus groups were conducted. The first was a woman-only group, also of various ages, ranks, and life stages. The second was with bicycle commuters, and lastly, a group of women who work in the BPO unit. While the decision to focus on one company presents limitations on the ability to make statements on the relationship between gender, income, and transportation mobility within Bangalore's IT sector, the depth and detail of responses allows for a better understanding of this relationship, as well as the unique position the company bus holds regarding transportation perceptions and preferences of men and women.

### ***Descriptive statistics***

The demographic distribution of respondents reflects the demographic distribution of the firm itself and of the IT sector in Bangalore, and, to a larger extent, India. The gender ratio of survey respondents was 61 percent male and 39 percent female, while the gender composition of the firm is closer to 67 and 33 respectively. When presented with this information, a senior executive of the firm commented that the higher reportage rate of women reflects the greater interest women tend to have in transportation policies, perhaps because they are more greatly affected by it.

Age was reported as a categorical variable, with 55 percent of respondents being between 20 and 29 years old and 95 percent of respondents being 39 years or younger. Again, this distribution mimics the overall sector in India. Although this a young workforce, lifestyle choices such as marriage and having children are occurring at ages that are much older than the country's average<sup>88,89</sup>. India's 2011 census data reports that 47 percent of women in India are married by the age of 18 and have their first child by the time they are 20<sup>90</sup>. There is a stark difference between this distribution and that of the firm's. Although survey respondents were not asked about their marriage status, when asked about children, only 12 percent of respondents between the ages of 20 and 29 had children, but 80 percent of respondents age 30 and older had children. This suggests that the survey population follows a demographic trend that more closely resembles the populations it works with, (e.g. US, UK, and Australia) as opposed to the population of geographic proximity. Education is often a significant factor in explaining delays in marriage and children; 99 percent of survey respondents had a B.A. or higher, suggesting again that this is a population that stands out in India.

Another relevant demographic point is the number of employees coming from outside Karnataka state. 58 percent of survey respondents came from other states and regions of India. Again, this high percentage of non-natives reflects the overall city demographic, where Kannada, the official language of Karnataka, is not spoken by the majority of the population. The fact that native Bangalorians and their language have become a minority within the city has significant social consequences, some of which are relevant to transportation. Someone coming from a less urbanized, poorer state (e.g. Bihar) will have different impressions of Bangalore and its transportation network than someone who is coming from a cosmopolitan metropolis such as Delhi or Mumbai. However, in both cases, neither individual will speak Kannada, and so both will experience similar challenges while navigating the city, be it by foot, bus, or car, but particularly the bus.

Not being able to speak or read in the local language makes travelling more challenging, and sometimes there is a gender dimension to this. Asking for directions, reading bus route signs affixed to most (but not all) public buses is difficult, all of which may impact a person's decision as to what mode to use. A young female employee originally from Chennai explained: "It's a floating community here so no one can help you with directions, it's really hard to figure out." Her mode choice was the company bus and it seemed that language

<sup>88</sup> <http://timesofindia.indiatimes.com/india/47-of-young-Indian-women-marry-before-18/articleshow/8211979.cms>

<sup>89</sup> The ages of marriage and first child vary widely throughout the country. In South Indian states such as Karnataka and Kerala, these percentages are much lower, for example, less than 15 percent of women in Kerala will be married by 18, illustrating the ways in which regional culture, education, and other factors play into this.

<sup>90</sup> <http://timesofindia.indiatimes.com/india/Fewer-women-having-kids-in-30s-Study/articleshow/10898196.cms?referral=PM>

had a significant impact on this choice. When asked to talk about her experience on Bangalore’s public buses she explained: “You get the stares and stuff like that. The men here talk and make comments but since I don’t understand Kannada, I don’t know what they are saying to me,” (8.23.2013). However, when the same topic was addressed by another female user of the company bus, this time a native Bangalorian, her response was quite different. “See, Bangalore used to be so relaxed. Only now it is different, unsafe because there has been such an influx of people, now you have different kinds of people. There has been a ‘cultural influx’. See, Bangalorians aren’t aggressive. But you had this first influx and then a second influx of people,” (8.8.13).

Although 61 percent of respondents live less than 20 kilometers from work, 69 percent of respondents have one-way commutes that are greater than 45 minutes. 23 percent of respondents said proximity to work was the primary reason they chose to live where they do.

### SECTION THREE

#### *Top four mode choices*

Respondents were asked to identify the transportation mode they most commonly use to get to work. 10 possible choices were given as well as an option to write their mode if the appropriate choice was not given. The company bus, followed by BMTC buses were the most used transportation modes of both women and men. Women used cars and two-wheelers in equal proportion but for men, the third most utilized mode was the two wheeler followed by the car.

**Top Four Mode Choices of Employees**

Women	Percent of sample population	Men	Percent of sample population
Company Bus	64%	Company Bus	49%
Public Bus	15%	Public Bus	14%
Car	4%	Car	12%
Two-wheeler	4%	Two-wheeler	13%

Although the top four mode choices are approximately the same for women and men we see a greater distribution of modes among men than women. Cross-country data collected by government and non governmental organizations (Kunieda, 2007; Peters, 1998) indicates that, globally, women use public transportation more than men, with lack of access to other modes frequently cited as the cause for this difference. The above findings would support this claim. However, it is interesting to note that female respondents have more access to cars than men. 45 percent of female respondents either own or have access to a car compared with 37 percent of men<sup>91</sup>. The fact that women are driving less to work than men, even though they have access to a car suggests there are other factors influencing women’s transportation mode choices.

#### *Reasons for mode choice*

Survey participants were asked to choose up to three reasons for using this mode or again write their reason if the response choices were inadequate. Personal security was the primary reason women gave for choosing the company bus, followed by comfort, and then the ability to avoid traffic. For men, the motivating factor in using the company bus was cost, followed by comfort, and lastly, the ability to avoid traffic.

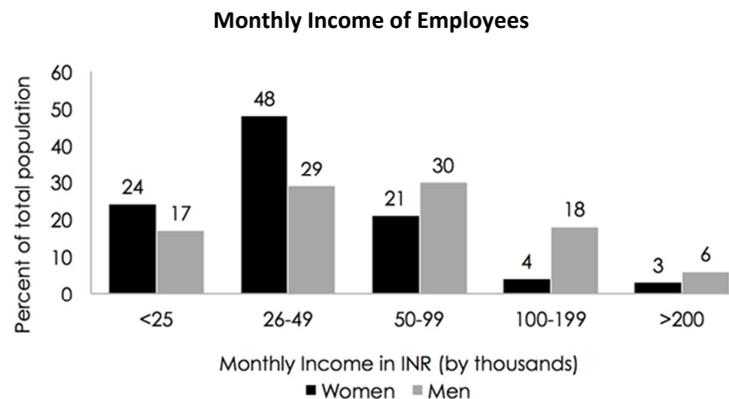
On the company bus employees can stream TV shows from their smart phones, work on their laptops or take a nap without fear of the personal possessions being stolen. During interviews, both male and female company bus users frequently referred to this mode as a comfortable, safe space, where one did not need to

<sup>91</sup> The survey question was ‘do you or your spouse (if applicable) own a car?’ Aside from the obvious issue of wording problems, there are many possible explanations for the greater number of women responding yes to this question. One plausible explanation is that although there are fewer female employees, a higher percent of women are married when compared to men. Individuals who are part of a household are more likely to own a car than those who are not. Of course, being part of a household that owns a car does not inherently grant someone access to that vehicle.

be 'on guard' with their possessions. Several men said they switched to the company bus after being pickpocketed while on the public bus. For women, however, it wasn't just concern for one's possessions but concern for one's personal space, namely the body. As one female executive explained to me: "It's a community that you know. Here on the company buses we are bound by a code of conduct. It is an extension of our office space." She then followed up by saying, "But on the weekend, you'd never see me on the bus,"(8.8.2013). That personal security was overwhelmingly cited as the main reason women choose the company bus suggests that violations against one's personal space or being harassed is indeed a significant aspect of women's experience in public, and seriously affects a woman's transportation decisions.

This is particularly true if we consider the cost factor. As stated in Section Ig, the company bus is significantly more expensive than the BMTC bus, and for those in the lower ranks of the income distribution, a significant part of their personal or household budget. For many women, however, this cost was justified. To quote one young woman "Many times I've considered not taking the company bus and taking public transport and even a good route is available [to me] and then I think no, even if you are paying more at least you are getting something comfortable, a seat to sit in and there is more security,"(8.21.13).

Yet cost, and presumably, the cheapness of it, was the number one reason men gave for choosing to use the company bus. We might ask then, would the men who gave this answer choose a different mode if they could afford it? Perhaps another possible explanation is that men aren't as concentrated in the lower ranks of the income distribution as women, so the cost of using the company bus is not considered burdensome. As the above table illustrates, women tend to concentrate in the lower ranks of the income distribution while men tend to occupy the middle ranks. That men are, proportionally, higher earners could affect their view toward the cost of the company bus relative to other modes<sup>92</sup>.



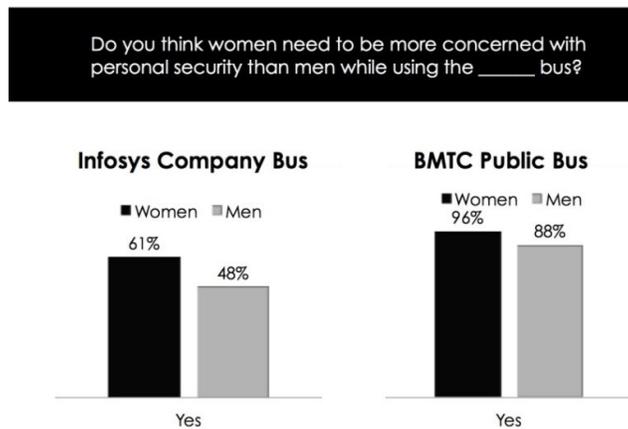
For women, flexibility was the number reason for using the BMTC bus system whereas cost, again, was the primary reason men used the BMTC buses. Findings from the interviews suggest that many women who used the BMTC bus would prefer to use the company bus but find the lack of frequency, especially departure times in the morning, to have a significant impact on the feasibility of using this mode. Getting children ready in the morning or taking care of other family members were frequent examples given by female employees as to why their morning schedule was more complicated and subject to fluctuation than those of men's. Two women interviewed said that being far away from a bus route serviced by the company bus was the primary reason for taking the BMTC bus over the company bus. Cost was the second significant factor for women in choosing the BMTC buses. As one female interviewee explained: "If I was to take the company bus it would be costlier than this bus pass [BMTC] so in fact this is the reason I prefer public transport, because I can use the pass to go anywhere and if I take the company bus I would use it only for going from home to work and you know I travel on the weekends," (8.13.13). For many of these recent hires, travel on the weekends usually means travelling outside Bangalore, even outside Karnataka to see their families. This seems to be particularly true among

<sup>92</sup> During interviews, there were two instances in which male employees said that taking a two-wheeler worked out to be cheaper than taking the company bus. When asked, senior personnel within the transportation unit confirmed that this was in many instances, true. How to interpret the results regarding men's reason for choosing the company bus or how reliable this response is, should be questioned further.

young women who would be the first generation to move away from their family prior to being married (for literature on this topic see Mirchandani, Patel, Radhikrishnan).

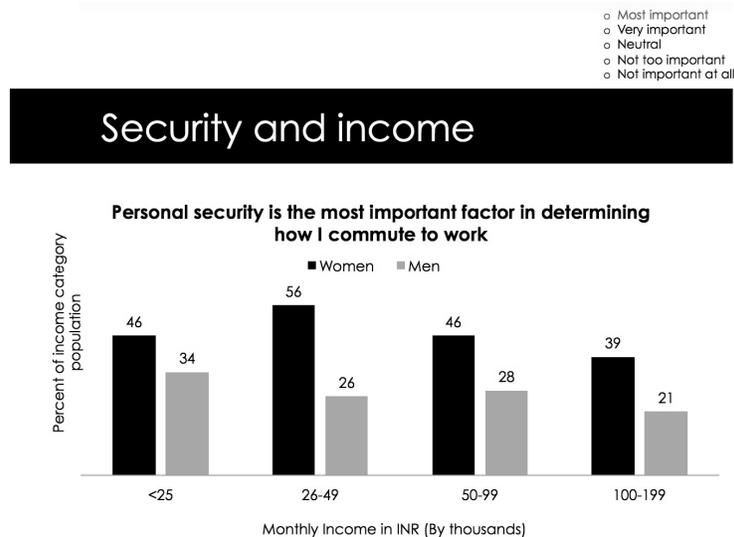
66 percent of respondents who use some form of bus transport live within 10 minutes of their bus stop and 29 percent live within 20 minutes from the bus stop. The majority of respondents walk to the bus stop but some take rickshaws or two-wheelers, suggesting issues of ‘last mile’ connectivity. When asked about how safe one feels while traveling to the bus stop, only 24 percent of women said they feel ‘very safe’. While the survey question did not indicate as to whether safety referred to safety from crime and harassment or safety from road crashes and traffic, during one-on-one interviews it became apparent that respondents interpreted it as both. Many of the young female hires who are not native to the city frequently mentioned activity around the bus stop and its proximity to their place of residence, as significant factors that contributed to the determination of where to live. Women mentioned street design (such as lack of sidewalks and poor lighting) and local activity (either absence of economic and social activity or economic and social activity of ‘the wrong kind’) as factors that influenced their feeling of safety.

In a separate question all survey respondents, regardless of mode choice, were asked whether or not women needed to be more concerned with their personal security than men while on board the company bus and onboard the public buses. In the chart below we see that men and women perceive these spaces differently. While less than half of men felt women needed to be more concerned with their personal security onboard the company bus, more than half of women felt they did. This is somewhat of a surprise given how many women praise the company bus as being a secure place for them. Both men and women believe women need to be more concerned with their personal security than men while onboard the BMTC buses, again though we see a higher percent of women responding yes.



The relationship between security and income, and whether women with higher incomes are less concerned with their personal security, presumably because of having more transportation modes available, was explored. In the proceeding table we see that security was most important for women in the 26-49 INR category. These women would presumably have more mode choices than those in the category of less than 25 INR, for whom cost might be one of the most important factors. As we get into the higher income ranks, security as the most important factor decreases. Again it is important to remember that a very low percent of women are actually in these upper income ranks. We might ask if concern for personal security decreases because these women would have even more, presumably more secure, transportation modes available to them. The results presented below are inconclusive and more research must be done<sup>93</sup>.

<sup>93</sup> Those in the 100-199 INR income category would be entitled to a company-paid for driver who would pick them up and take them home from work.



Reckless driving is one of the primary reasons women do not use two-wheelers or cars to get to work. Some women felt targeted on the road by other drivers; honking, tailing, and having gender-based stereotypes shouted at them were some of the reasons women cited for choosing not to drive at work. Many of these women do drive cars or two-wheelers on the weekends, (a point I will come back too) suggesting that morning and evening rush hour in Bangalore is a particularly stressful time to be on the road. However, for the four percent of women who do commute to work by two-wheeler, the reasons cited for this mode choice are exactly the same as men. Both men and women chose to use two-wheelers primarily because of the flexibility it allows (e.g. “saves time”), as well as the ability to avoid traffic<sup>94</sup>, and, lastly, cost. No interviews were conducted with women who used a two-wheeler to get to work. But, while women frequently spoke of reckless driving as a deterrent to using some form of personal transport to get to work, one male employee seemed to enjoy this aspect of the morning commute. “I am keen to the two-wheeler, I just love driving my bike. I haven’t gotten a four-wheeler [car] see cause the main thing is traffic. If you have a four-wheeler you have a lot of traffic and it will take a lot of time. If you have a two-wheeler you can get anywhere within a half an hour.” When a follow up question regarding concern for personal safety was asked the response was “see safety could be a concern but I am a passionate driver,” (8.21.13). This is in contrast to an interview with a woman who owns a two-wheeler but does not use it to get to work.

It’s not that it is crowded, it’s because people do not have good road sense. They are so reckless and don’t even bother about the people, there is no ethics, especially these two-wheeler people they really get to your nerves in the morning, riding on the platforms [sidewalks] and actually, the thumb rule is that the pedestrian gets the priority but you can’t even step out of the house you know (8.21.13).

The same male employee who is a ‘passionate’ two-wheeler driver was asked if he noticed many women using two-wheelers. He explained: “When I came here it was 2007. The number of women driving was different, it was none, it was maybe nil and now in 2013 I’d say it’s maybe 30 percent. Still, when I see women driving, I see them driving more four wheelers than two wheelers.” This comment was reiterated in a second interview, this time with a female employee who had a car in her household. When asked the same question her reply was “I feel as though more women are going for a four-wheeler over a two-wheeler. I don’t come across women who say, ‘I want a two-wheeler.’ It is pretty less. I think it is because it is less safe,”(8.20.13). This brings me to ideal mode choices and mode choices outside of work.

<sup>94</sup> This perhaps sounds contradictory to the previous discussion. Because roads are narrow, most of the traffic congestion is a result of a gridlock between buses and cars. For those on a two-wheeler, it is quite easy to weave around this traffic and it is not uncommon to see (male) two-wheeler drivers weave through the pedestrian path in order to get around traffic in the street.

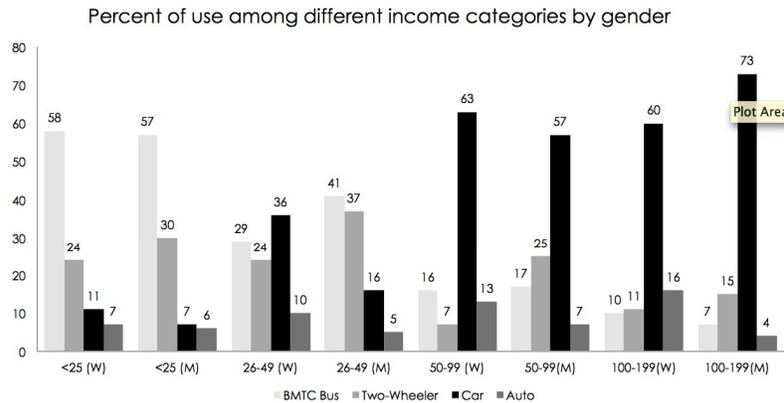
**Ideal mode choice and non-work mode choice**

**Ideal Mode Choice for work commute**

Women	Percent of sample population	Men	Percent of sample population
Company Bus	40%	Company Bus	33%
Car	11%	Car	13%
Metro	10%	Metro	13%
Public bus	9%	Public bus	9%

For many women and men, the company bus remained the ideal mode for work trips. However, unlike their actual mode choice, this was not the ideal mode for the majority of female respondents, for whom we find a greater distribution among preferences than we do actual modes used. Car becomes the second most popular response for both women and men, followed by the Bangalore metro, which, at this time is not actually in service (but again we are talking about ideal modes), and then the public bus. What is unclear among those who said that the car was their ideal mode choice is whether this was the ideal mode choice in the context of current traffic conditions or if this ideal mode also required ideal road conditions. Again further research is required to better understand this finding.

Looking at the transportation modes used by women and men for non-work trips we see that women in nearly every income category, except the highest, use cars more than men. Men of all income categories use two-wheelers at a higher rate than women, confirming the observation of several employees regarding women’s preference for the car.



**Mode choice outside of work**

**SECTION FOUR**

**Concluding thoughts**

Public spaces, including public transportation, remain a contested and often unpleasant place for women in India. It seems that for many of the women who participated in this research, if there was an alternative mode to public transportation, then that alternative would be chosen, even if it was more costly to do so. The significance of the company bus, the influence it has on the transportation mode choices of Bangalore’s Information Technology employees, particularly women employees, was an unanticipated finding of this research. Pre-existing research done on women in India’s IT sector has illustrated the significance gender inclusive initiatives such as company-provided transport have on attracting and retaining female employees. What remains unknown is what modes women would turn to if company-provided transportation was unavailable, or, indeed, if we would find as many women working in this sector.

The question of how one's 'position', be it socio-economic status, class status, caste, ethnic, religious or income status, open up or further limit transportation mobility must be probed further. What was not explored in this research was the transportation mode choices of contract-based women workers. Contract workers are those who work full time within a particular IT company but are not directly employed by the company. These are the food vendors, the office cleaners, gardeners, and security personal and their monthly salaries are significantly less than 20,000 INR. For these workers, the company bus is not an option. How then do these women (and men) get from their place of residence to place of employment? Do we see a more pronounced connection between access to transportation and access to socio-economic opportunity in this population group?

Lastly, what can IT companies and city officials do to make the experience of using transportation better for women? Could women-targeted policies be good for all genders and people of all ages? Should we consider initiatives such as women only cars a solution, or an accomplice of what seems to be a long term, deep-seated problem? Do gender-targeted policies encourage women to use public transportation or cause women to aspire to cars? How does sector-sponsored transportation cause deeper stratifications within society? While this paper does not offer clear-cut policy recommendations regarding the issue of women's concern for personal security while using transportation, it has illustrated that we find significant differences between the transportation mode choices and preferences of women and men in Bangalore's IT sector. It is the author's hope that these findings will be put toward follow up studies, specifically those that examine the mode choices among different populations of women within the IT sector more closely.

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# Truck cab design: Perceptions of women truck drivers

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## ABSTRACT

The trucking industry is a major force behind the United States (US) economy, with approximately 750,000 interstate motor carriers. Trucks deliver 70% of all freight tonnage, while 80% of U.S. communities receive goods exclusively by truck. The motor carrier industry provides jobs, generating significant income and tax revenue, representing approximately 5% of U.S. Gross Domestic Product (GDP). Despite one of every 13 people employed in a trucking-related job, there is a significant driver shortage. The American Trucking Associations (ATA) currently projects a shortage of 20,000 to 25,000 drivers in the for-hire truckload market (ATA, 2012).

Women are well positioned to address this shortage. In 2011 women represented 7% of total employment in the U.S. trucking industry (Bureau of Labor Statistics, 2011). The purpose of this study was to identify truck design needs for women truck drivers. This research is significant due to limited data sources about truck design needs for women drivers. This study also contributes to the body of knowledge about women in the trucking industry. In response, a 33 question survey was developed using Qualtrics™ survey software. In April 2012, an electronic survey was distributed to 663 Women in Trucking Association members over a two week period with a response rate of 18%.

Results were separated into quantitative and qualitative data and analyzed accordingly. Adjustability was a central issue facing women truck drivers. Recommendations for seat design, side mirrors, steps, handrails, hydraulic hood lifters, and steering consoles will be presented. Limitations of the study and recommendations for future research will be discussed.

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**KEYWORDS:** Truck cab design; Women truck drivers; Trucking industry; Needs assessment.

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## INTRODUCTION

The trucking industry is a major force behind the United States (US) economy with approximately 750,000 interstate motor carriers. Trucks deliver 70% of all freight tonnage, while 80% of U.S. communities receive goods exclusively by truck. The motor carrier industry provides jobs, generating significant income and tax revenue, collecting more than \$650 billion in revenue. This represents approximately 5% of U.S. Gross Domestic Product (GDP). Despite one of every 13 people employed in a trucking-related job, there continues to be a significant driver shortage.

A 2012 report by American Trucking Associations (ATA) currently projects a shortage of 20,000 to 25,000 of drivers in the for-hire truckload market in the U.S.A (ATA, 2012). Deregulation of the motor carrier industry dating from the 1980s has been credited for increased growth of the industry and a demand for drivers (Beilock, 2005). According to the published literature, at least one fifth of all long-haul drivers are age 55 and older and it is expected that a larger percentage of long haul heavy duty truck drivers in the transportation industry will be older with within the next decade, resulting in an increase in retirements (Bunn, Yu, Slavova, & Bathke, 2009).

The beneficial aspects of being a truck driver involve several aspects: independence, ability to make decisions, operation of new and better trucks, high income potential, and ability to explore and travel to different parts of the country (Johnson, Bristol, McClure, & Schneider, 2011). In terms of income potential for women truck drivers, the average starting median income can be upwards of \$30,000 annually USD (E. Voie, personal communication, February, 25, 2014). However, a review of the literature reveals wide variability regarding annual median incomes reported in the United States for women drivers as well as their male

counterparts. A study by Stephenson and Fox (1996) reported the average median income of drivers was approximately \$40,000 per year USD, while a study by Valway, Jenison, Keller, Vega-Hernandez, and McCree published regarding truck drivers (N = 652) in New Mexico that the annual median income for women drivers was approximately \$50,000 per year USD versus \$61,000 per year USD for male drivers. The Bureau of Labor Statistics in 2012 reported the annual median income of women drivers was approximately \$27,924 per year USD with the annual median income of male drivers reported at approximately \$38,272 per year USD (BLS, 2012). Factors that may influence the reporting of annual median income data in the literature may be related to the hours or service regulation rules, anti-discrimination laws in the United States, and low reporting (V. Walker, personal communication, February 25, 2014).

Although these are attractions to the industry, truck drivers spend long hours behind the wheel, working an average of 41.5 hours per week (BLS, 2009a). Long hours, driver shortages, and challenging working conditions are related to the high turnover rates in the trucking industry compared with the overall labor force considered in its entirety (Stephenson & Fox, 1996; Beilock, 2005). Truck drivers are subject to hours of service regulations (HOS) by the Department of Transportation (DOT). These rules limit drivers to 60 hours of work time in 7 days and require an 8 hour break after 10 hours of driving and 15 hours of total work time (Belman & Monaco, 2001, p. 504). Such limitations impact the median income of drivers and may be a contributing factor regarding the wide range of variability in reported annual median income data among the truck driver, population in the United States.

Although the research recommends the industry focus on scheduling greater home time, increasing pay, improved benefit packages, technology assistance for government paperwork requirements, driver skill, safety, and decreasing driver stress, there has been limited focus on the truck cab design needs for the trucking industry specifically focused on women (Johnson, Bristow, McClure, & Schneider, 2001). A well-designed truck cab not only makes a significant difference in the working conditions for a truck driver but also affects the safety of truck drivers and other road users. If the design of the truck cab is poorly fitted to the size and dimensions of the driver, the road may be less visible, driving controls may be more difficult to reach, and seat belts may be less comfortable and less likely to be used—all of which increase the risk of injury to the driver and other road users.

In 2011 women represented 7% of total employment in the U.S. trucking industry (Bureau of Labor Statistics, 2011). This new demographic reality necessitates an updating of the data used for the design of truck cabs because of the link to various demographic characteristics (Bradtmiller, Ratnaparkhi, & Tebbetts, 1985; Gordon, Bradtmiller, & Ratnaparkhi, 1986; International Organization for Standardization [ISO], 2006). Given the previous discussion regarding the continued driver shortage, there is a pressing need to enhance ergonomic cab designs for safe and efficient over-the-road operation, especially for women drivers. A 2012 study by Jinhua; Hongwei; Bradtmiller; Tsui-Ying; Reed; Jahns; Loczi; Hardee; and Piamonte, found that although male truck drivers were shorter in stature, female truck drivers were not different from the U.S. general population. Demographic evidence suggests that the population is changing, with a greater representation of racial and ethnic minorities, especially the Hispanic ethnic group. In 1983, the combined category of truck drivers (heavy and light) and driver-sales workers included 11.7% African Americans, 5.6% Hispanics, and 3.5% females (BLS, 1983). In 2009, the category of driver-sales workers and truck drivers included 13.4% African Americans, 18.7% Hispanics, and 5.2% females (BLS, 2009c). Improvements in the quality of the driver working environment, comfort, and driver experience are recommended to attract, retain, and enhance profitability for the industry (Stephenson & Fox, 1996). This study focuses on eliciting the perceptions of women truck drivers regarding the design and equipment needs and recommendations for Class 8 trucks. This study seeks to inform and add to this body of literature.

## METHODS

The study sample consisted of 663 female truck drivers who were members of the Women in Trucking (WIT) Organization, located in Plover, Wisconsin, U.S.A. Survey questions were designed based on available information from the literature, interviews with Ellen Voie, President for Women in Trucking, and an experiential assessment exercise evaluating a new 2012 Class 8 Model Truck and a used Class 8 Model Truck at a local dealership in March 2012. The survey was a component of an applied learning project for a graduate level course and was developed as an online survey using Qualtrics™ survey software. Data were collected from states across the continental United States. The survey used convenience sampling methods and was

distributed to WIT members for a two week period in April 2012. Only those with a valid Class A Commercial Vehicle Driver's License (CDL) were measured.

## RESULTS

A survey was developed using a 4 point Likert scale rating with an open ended question text boxes following each question option. Survey question design resulted from an experiential learning exercise with students in March 2012 using 1 new class 8 truck and 1 used class 8 truck as exhibits. Survey questions were formulated, edited, and reviewed by the President of Women in Trucking (WIT), course professor, and the students. The population sample was a convenience sample of the membership from the Women in Trucking (WIT) organization in a 2 week time frame in April 2012. The electronic survey was developed in Qualtrics and e-mailed to 633 WIT members with a resulting response rate of 122 or 18%. Questions 1 through 6 of this survey provide the demographics of the sample representing the quantitative portion of this study. The remaining questions and results of the survey are qualitative in nature and reported in terms of frequency, with central themes and subthemes derived from the qualitative analysis with recommendations for truck cab improvement (Miles & Huberman, 1994). Limitations for future survey design and distribution will be discussed in the recommendations section.

## QUANTITATIVE RESULTS

**TABLE 1. What type of truck do you usually drive?**

#	Answer	Response	Frequency %	Statistic	Value
1	Heavy Duty (Class 8)	101	89%	Min Value	1
2	Medium Duty	10	9%	Max Value	3
3	Light Duty	2	2%	Mean	1.12
				Variance	0.15
				Standard Deviation	0.38
	Total	113	100%	Total Responses	113

**TABLE 2. How long have you been driving this truck?**

#	Answer	Response	Frequency %	Statistic	Value
1	Less than 6 months	8	7%	Min Value	1
2	6 months to less than 1 year	7	6%	Max Value	5
3	1 year to less than 3 years	18	16%	Mean	4.04
4	3 years to less than 5 years	20	18%	Variance	1.59
5	5 years or more	60	53%	Standard Deviation	1.26
	Total	113	100%	Total Responses	113

**TABLE 3. How many hours/day do you spend driving this truck?**

#	Answer	Response	Frequency %	Statistic	Value
1	1-5 hours	6	5%	Min Value	1
2	6-10 hours	33	29%	Max Value	3
3	> 11 hours	74	65%	Mean	2.60
				Variance	0.035
				Standard Deviation	0.059
	Total	113	100%	Total Responses	113

**TABLE 4. The cab of this truck is comfortable for your body type.**

#	Answer	Response	Frequency %	Statistic	Value
1	Yes	85	76%	Min Value	1
2	No	27	24%	Max Value	2
				Mean	1.24
				Variance	0.18
				Standard Deviation	0.43
	Total	112	100%	Total Responses	112

**TABLE 5. Do you feel safe when driving the truck?**

#	Answer	Response	Frequency %	Statistic	Value
1	Yes	105	92%	Min Value	1
2	No	9	8%	Max Value	2
		114		Mean	1.08
				Variance	0.07
				Standard Deviation	0.27
	Total		100%	Total Responses	114

**TABLE 6. Are you satisfied with how your truck handles while driving?**

#	Answer	Response	Frequency %	Statistic	Value
1	Yes	100	90%	Min Value	1
2	No	11	10%	Max Value	2
				Mean	1.1
				Variance	0.09
				Standard Deviation	0.3
	Total	111	100%	Total Responses	111

**Quantitative item analysis**

Tables 1-6 represented the quantitative results for this study. Of this sample, 88% of survey participants represented driving Class 8 (Heavy Duty) trucks with 10% driving Medium Duty trucks. Participants indicated they had been driving for 5 years or more. Twenty nine percent of participants reported driving 6 to 10 hours per day while 65% indicated driving more than 11 hours per day, representing a sum total of 94%. Seventy-five percent of respondents reported they were satisfied with their current truck and 92% of participants replied feeling safe while driving their truck on the highways, interstates, and byways.

**Qualitative results**

The remaining survey questions focused on the qualitative items of the survey by eliciting feedback about the issues that women face in terms of truck cab design of Class 8 Trucks. The questions were designed as open ended, with a response section for recommendations for improvement in these areas. Central themes and subthemes were analyzed using qualitative coding methods to explicate frequency of these themes and subthemes (Miles & Huberman, 1994).

**TABLE 7. What could be improved in terms of safety of the truck?**

Central Theme	Frequency (%)	Subtheme	Recommendation
Seat belt adjustability	80%	Seat restraint systems built for women	Make seat belt adjustable
		Uncomfortable seats	Change the seat design
		Less flexibility in seat position	
Airbags	20%	Airbags not available	Addition of airbags

**Qualitative item analysis, Table 7.** The qualitative analysis for Table 7 identified the central theme of safety. Eight percent of respondents reported that safety was a concern when driving the truck. The subthemes identified were lack of truck seats designed for women, both from an anthropometric and ergonomic design standpoint, resulting in uncomfortable and lack of adjustability of the seat mechanism to meet the needs of women truck drivers. In addition, survey respondents also indicated the lack of airbags in the Class 8 trucks they drove (20%). The subtheme of airbags was aligned with the central theme of safety.

**TABLE 8. Are you satisfied with how your truck handles while driving?**

Central Theme	Frequency (%)	Subtheme	Recommendation
Not satisfied	9%	Suspension	Air ride
Not satisfied	9%	Handling	More wind resistance

**Qualitative item analysis, Table 8.** Table 8 inquired about satisfaction of truck handling of the Class 8 trucks driven by survey respondents. The analysis revealed that survey respondents were equally divided in terms of dissatisfaction. Feedback of respondents identified issues in the areas of suspension and truck handling as opportunities for improvement related to overall truck design.

**TABLE 9. Which of the following components of your truck seat are you not satisfied with in terms of design?**

Central Theme	Frequency (%)	Subtheme	Recommendation
Adjustable Lumbar Support	81%	Adjustability	Better position for women
Seat Comfort	61%	Cushioning	Softer seat Better absorption Softer ride
Seat Belt	45%	Adjustability Positioning	Upright position of seatbelt Reduce neck irritation due to placement

**Qualitative item analysis, Table 9.** Table 9, attempted to explore satisfaction in more detail as to results in Table 7. In regard to the central theme of suspension, adjustable lumbar support (81%) was perceived by respondents as a primary need for improvement. This was followed by seat comfort (61%) and adjustability of seat belts (45%) respectively. Study participants who responded to this question recommended greater adjustability and comfort in the design of these features for Class 8 trucks.

**TABLE 10. Which of the following components of your truck steering wheel are you satisfied with in terms of design?**

Central Theme	Frequency (%)	Subtheme	Recommendation
Positioning	58%	Obstructed view of dashboard Uncomfortable	Tilt steering Height adjustability
Dimensions	52%	Too Small	Steering wheel sized to the driver
Rotation	47%	Difficult to turn	Power steering standard for all trucks

**Qualitative item analysis, Table 10.** Analysis of the results in Table 10 focused on the design and position of the steering wheel of the Class 8 truck. Analysis of this question identified 3 central themes in the areas of: position, dimensions, and rotation concerning the steering wheel mechanism. In regard to steering wheel position, 58% of survey respondents identified the steering wheel design as uncomfortable and/or obstruction for viewing the truck dashboard. Fifty-two percent of respondents reported that the steering wheel design was too small with a recommendation of design sized with the driver. Rotation of the steering wheel was the third most common theme (47%). Respondents reported that the steering wheel mechanism was difficult to turn while driving.

**TABLE 11. Which of the following components of your truck pedals are you not satisfied with in terms of design?**

Central Theme	Frequency (%)	Subtheme	Recommendation
Adjustable Pedals	77%	Material	Non slip material (design)
		Design	Wider pedals
		Adjustability	Adjustment for short and long legged people
		Positioning	Placement of clutch Wider pedal area

**Qualitative item analysis, Table 11.** Table 11 focused on the adjustability of the foot pedals for Class 8 truck. Adjustability of foot pedals was a central theme and concern of study participants (77%). Subthemes identified were: adjustability, materials used for foot pedal design, position, and overall design of the pedal were problematic for women drivers. Study participants recommended opportunities for improvement in areas of: non slip materials, wider design, pedal adjustability, and overall design regarding clutch placement.

**TABLE 12. Which of the following components of your truck's cabin facilities are you not satisfied with in terms of design?**

Central Theme	Frequency (%)	Subtheme	Recommendation
Mattress and cabin Space	60%	Better mattresses	Higher quality mattresses, Bigger and comfortable
Bunk	42%	Quality	Bunk versatility
			Increased cabin storage
			Space
			Better carpet Softer cushions A larger bunk
Storage Facilities	36%	Lack of space for equipment	Microwave placement More storage space Drawers that pull out

**Qualitative item analysis, Table 12.** Table 12 focused on the perceptions of women drivers in terms of the cabin facilities of Class 8 trucks. Survey respondents identified the following central themes related to satisfaction levels: mattress and cabin space (60%), bunk design (42%), and storage facilities (36%). Survey respondents recommended opportunities for improvement in the areas of: mattress quality, increased and adjustable storage space, versatility, comfort, and other amenities.

**TABLE 13. Which of the following components of your truck's transmission are you satisfied with in terms of design?**

Central theme	Frequency (%)	Subtheme	Recommendation
Ease of Use	86%	Exactness of shifting	Easier and smoother gear transition
Location	42%	Location of gear shifter	Automatic Transmission
			Adjustability
Clutch	35%	Reachability	Better location of clutch
			Adjustability

**Qualitative item analysis, Table 13.** Table 13 focused on the perception of women truck drivers in terms of Class 8 transmission design. Central themes identified were: ease of use (86%), location (42%), and clutch (35%). Analysis of qualitative responses yielded the following subthemes: exactness of shifting capability, location of gear shifter, and the reachability of the clutch. Opportunities for design improvements that were associated with these themes and subthemes were: easier and smoother shifting and gear transition, options for ordering automatic transmissions and/or having manufacturers make automatic transmissions standard

design features, and adjustability of the gear shifter. Survey participants recommended better locations for clutch placement and adjustability to better meet the design needs of women truck drivers.

**TABLE 14. Which of the following components of your truck's instrument console are you satisfied with in terms of design?**

Central theme	Frequency (%)	Subtheme	Recommendation
Dashboard	69%	Reachability	Slanted and contoured dash design
Lighting	59%	Lighting	More Lights on and in dash Back Lighting Better light on top of cabinets
Cabinets	39%	Reachability	Cabinets doors instead of Stretched mesh material

**Qualitative item analysis, Table 14.** Table 14 focused on the perception of women truck drivers related to truck instrument console design. Central themes identified were related to: dashboard (69%), lighting (59%), and cabinets (39%). Reachability was the primary subtheme for respondents for dashboard and cabinetry. Survey respondents recommended opportunities for improvement for instrument console design in the areas of dash design, improved lighting options, and the availability and reachability of cabinet doors that open and close, rather than the industry standard of stretchable mesh materials.

**TABLE 15. Which of the following components of your truck's engine accessibility are you satisfied with in terms of design?**

Central theme	Frequency (%)	Subtheme	Recommendation
Fuel tank accessibility	74%	Pump handle jumping Fuel spills	Ergonomic dash design
Ease of lifting hood	50%	Weight of hood (heavy) Hood latches (difficult)	Top of the dash too slanted
Ease of closing hood	43%	Visibility Weight of hood (heavy) Hood latches (difficult)	More lights in dash Back lighting Better light top cabinets

**Qualitative item analysis, Table 15.** Table 15 focused on women truck drivers in regard to perceptions about accessibility to the Class 8 engine compartment. Central themes identified were related to: access to the fuel tank (74%), ability of lifting the truck hood (50%), and ease in closing the truck hood (43%). Subthemes identified were: the jumping of the pump handle when fueling which precipitated the potential for fuel spills, heavy weight of the truck hoods, difficulty in closing truck hood latches, and reduced visibility. Analysis of recommendations for improvement related to truck design were: develop a more ergonomic dash design, additional lighting to improve visibility, and materials to address the weight and difficulty in the opening and closing of the truck hood.

**TABLE 16. Which of the following components of your truck's side mirror are you not satisfied with in terms of design?**

Central theme	Frequency (%)	Subtheme	Recommendation
Side mirror size	31%	Difficulty to get the complete view Too narrow to see the tail of the trailer	Design-longer and wider (e.g. West Coast mirror design)
Side mirror adjustability	28%	Limited adjustability	Electrical adjustment

**Qualitative item analysis, Table 16.** Table 16 depicted the feedback from survey respondents regarding side mirrors. Side mirror size and adjustability were the central themes identified. Survey respondents reported that side mirrors were too small, narrow, and/or lacked adjustability. Opportunities for improvement included designing longer and wider mirrors including the ability of electrical adjustment, similar to standard passenger vehicles.

**TABLE 17. Which of the following components of your truck's accessibility are you not satisfied with in terms of design?**

Central theme	Frequency (%)	Subtheme	Recommendation
Step spacing	37%	Difficult to reach the cab floor due to spacing	Have one more step Steps made close together
Step width	48%	Steps too narrow	Wider steps-especially top step
Handrail location	44%	Slippery handrail material Safety concerns due to loss of grip while climbing	Return to Century design for more accessibility Handrail inside the truck
Handrail availability	50%	Difficulty getting into the truck due to lack of handrail(s)	Increase the number of handrails

**Qualitative item analysis, Table 17.** Table 17 explicated the perceptions of survey respondents regarding accessibility to the truck cab. Step spacing (37%) and step width (48%) revealed challenges women truck drivers face on a consistent basis. Subthemes identified spacing between steps, in general and for entrance into the truck cab, were too wide of a distance for women drivers. The second subtheme indicated that steps were too narrow for proper foot placement. In addition, the topic of handrail availability and location were prominent central themes for participants in this study. Respondents recommended the additions of steps and handrails. Wider steps and availability of the number of handrails and inclusion of handrails within the truck cab were also recommended as opportunities for improvement.

## DISCUSSION AND FINDINGS

This study focused on eliciting the perceptions of women truck drivers regarding the design and equipment needs and recommendations for Class 8 trucks. This study sought to add to this body of literature. The analysis tells us that most of the design issues could be remedied if various aspects of Class 8 trucks were made to be more adjustable. In this study, no differences were found in survey answers between women drivers taller than 5' 6" and drivers shorter. Therefore, height of participants was not a limiting factor. In addition, no differences were found between genders in terms of truck cab perceptions. Survey participants in this study were satisfied with their trucks.

As a result of this pilot study, following are recommendations regarding specific design aspects of Class 8 trucks. These are based on items that were repeatedly identified by the study participants, who were truck drivers and members of the Women in Trucking (WIT) organization.

1. *Seat adjustability.* Participants in this study recommended increasing the adjustability of the seat style and mechanism for the Class 8 truck. General recommendations by survey participants were in the categories of: adjustability, increased lumbar support, shock absorption of the truck seat to accommodate bumps and road conditions. Specific recommendations in terms of adjustability included designing seatbelts that are adjustable to fit all body types, changing the seat design for positioning to fit women drivers, and increasing leg capacity and space under the steering column. Lastly, study participants recommended manufacturers include airbags as a standard design feature.

2. *Adjustable steering wheels.* Study participants recommended that adjustable steering wheels be included in the overall design or as an option for purchase when selecting a Class 8 truck. In addition, increasing the current adjustability features of the steering wheel was also a primary recommendation. Study participants consistently reported positive comments about the tilt steering wheels in the current trucks driven by participants in this survey. Study participants in this survey suggested the involvement of women truck drivers in the design phase of steering wheels at the time of manufacture. In addition, participants recommended truck manufacturers and distributors allowing greater decision making and choices in terms of size and placement of the steering wheel during the purchasing process.

3. *Adjustable foot pedals.* Participants in this study recommended a review of the adjustability of the pedal mechanisms. Study participants also recommended manufacturers review the raw materials used during the

manufacturing process and select materials to make the pedals less slippery in times of inclement weather. Suggestions were also made to widen the space between pedals, specifically the clutch mechanism.

4. *Increased truck cab lighting and comfort.* Study participants recommended improvements in the areas of lighting, storage facilities, and comfort. Recommendations included, but were not limited to, the following: 1) increasing the number and types of lights in the truck cab and sleeper compartments; 2) increasing the storage and accessibility of storage; and 3) improving the quality, comfort and size of the mattresses in the sleeper compartments.

5. *Easy access engine compartments.* Accessibility of the engine compartment was a design priority for women truck drivers in this study. The weight of the truck hood and difficulty closing hood latches were specific concerns identified in this study. Study participants recommended accommodations in the ergonomic design of the hood and engine compartments. The recommendations included: 1) attempts to decrease the overall weight of the hood in the manufacturing process, considering lighter materials without compromising quality and durability; 2) use of hydraulic lifters for easier opening and closing which would accommodate all body types; and 3) increased lighting within the engine compartment area. Study participants also recommended manufacturers consider automatic transmissions as a standard design option for Class 8 trucks.

6. *Adjustable side mirrors.* Survey participants recommended increased adjustability of the side mirrors for the Class 8 truck design. Increased adjustability of side mirrors is recommended for good sight lines toward the rear of the truck. This would improve the safety for the driver in handling the truck during normal operations. In addition, longer and wider mirrors to view the end of the tractor trailer would improve safety and handling of the truck and also increase efficiency and maneuverability by truck drivers.

7. *Step spacing and width.* Study participants provided recommendations in terms of the design and width of the steps exiting the truck compartment. Specific recommendations for manufacturers based on this study included: 1) widening the top step for exiting the truck cab compartment to provide a wider platform base and improve safety for drivers exiting the compartment. 2) Decreasing the width between steps to accommodate operators of shorter stature and stride capacity. This would reduce safety risks and fall potential.

8. *Handrails.* Study participants also suggested the availability of handrails externally. Participants stated that handrails were not standard equipment for some Class 8 trucks. Including handrails inside the truck cab were also recommended to avoid slipperiness in times of inclement weather. Survey participants also suggested increasing handrails in areas where climbing may be a necessity.

## CONCLUSIONS

This study found that there were no differences in the responses from women drivers above 5'6" tall and those that were below 5'6" in height. Adjustability was the primary theme and recommendation from the WIT respondents. While study participants were primarily female in terms of gender, the common themes of this study apply to all gender types. Study participants indicated issues with the placement, adjustability, and size of at least one or two items in their trucks. A positive qualitative finding of the survey participants was the overwhelming response to tilt steering. This furthers the study's assertion that flexibility and adjustability are necessities for women truck drivers regarding the design of Class 8 trucks. Including truck drivers in cab compartment design at the manufacturer level would be beneficial for the potential driver, brand loyalty, manufacturers, and the trucking industry in general. Allowing choices regarding adjustability and providing options for accessories for prospective truck drivers at the time of lease or purchase is also recommended.

## LIMITATIONS OF THE STUDY

This study experienced limitations in terms of study design and duration. This study was limited in terms of time and experience level of students as researchers. This study was part of an applied learning project as a component of a graduate course at a University in the Midwest (United States). Therefore, challenges were experienced due to the nature of this learning environment. There was a noted design error in question design and formatting which was discovered after initial survey distribution. This resulted in a delay in survey deployment, limited responses, and delayed data collection. Although the student researchers corrected the survey design error, this impacted the overall duration of survey availability to study participants, which limited the number of responses and resulted in an 18% response rate. In addition, the survey was deployed in April

2012 at the time of a readily observed holiday. Data analysis was impacted due to end of semester deadlines for course work in the university setting.

## **RECOMMENDATIONS FOR FURTHER STUDY**

Despite the limitations of this pilot study, significant and relevant information was obtained that provide the foundation for further study and future research. The following suggestions are recommended for future consideration.

1. Redesign the survey to include more detailed survey logic and deploy the survey over a longer duration of time.

2. Include a larger sample for analysis. This study had 122 responses with some questions reporting 113 responses out of a total of 663 surveys distributed. Distributing the survey over a longer duration and/or multiple replications of this survey would yield more reliable data for analysis.

3. Include survey constructs and questions that collect a wider demographic data set, such as: age, gender, medium income, etc. to allow for increased analysis against industry trends and BLS data.

4. Partner with National Institute of Safety and Health (NIOSH), truck manufacturers, and representatives in the trucking industry to create a validated survey construct. It is recommended that focus groups and additional survey measures be considered to validate survey questions to improve the reliability and validity of this survey instrument.

5. As a result of recommendation item 4, revision and redistribution of the survey to a pilot group or other transportation organizations is recommended prior to wider distribution of the survey.

6. Include questions specifically focused on the topic of recruitment of women into the truck driving industry as well as questions designed to elicit feedback on retention of women in the trucking industry would be beneficial for further study.

7. Continued partnership with the Women in Trucking (WIT) organization regarding the presentation and distribution of the results of this study to inform truck manufacturers and carriers about the cab design challenges women drivers experience.

8. Continued partnership with Women in Trucking (WIT) and the University of Wisconsin-Stout to develop a user guide for equipment purchasing specifically focused on women truck drivers.

9. The Women in Trucking (WIT) organization will offer member companies and sponsors of the Women in Trucking organization the results of this study in an effort to assist in redesigning the specifications of new trucks and retrofitting of existing trucks with a focus to align with the results, findings, and recommendations of this study.

Women are an untapped resource to consider in addressing the current driver shortage in the industry. Improvements in the quality of the truck driver environment are recommended to be a high priority for every trucking company for the recruitment and retention of women truck drivers. There is a pressing need to enhance ergonomic cab designs for safe and efficient over-the-road operation for women truck drivers. In addition, there has been limited focus on the truck cab design needs for the trucking industry specifically focused on women. This study seeks to inform the body of literature regarding the truck cab design needs based on the feedback and perceptions of women truck driver members of the WIT organization.

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# Examining employees' preference toward telecommuting with an emphasis on women employees

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## ABSTRACT

The increasing role of women in social and economical activities expands their contributions to urban traffic. Telecommuting as an approach in Transportation Demand Management (TDM) can play an important role in lessening or redistributing peak hour trips. In this study, telecommuting by focusing on women employees' characteristics is examined. The sample used in this research has been obtained from the survey at seven organizations in Tehran, Iran. Three discrete choice models are generated based on collected data. Using binary logit and ordered probit models, women employees' preferences towards telecommuting and their preferences of working from home or local offices as well as the frequency of doing telecommuting are modelled. Moreover, marginal effects are discussed for each model. Results indicate the significance of the effects of telecommuting for women. More attention should be given to women's profession characteristics, their commuting specifications, and their personal and social characteristics.

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**KEYWORDS:** Transportation Demand Management; Women; Telecommuting; Binary Logit; Ordered Probit.

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## 1. INTRODUCTION

Gender is an important factor and should be explicitly integrated into transport research, practice and policy. A better understanding and definition of gender equity in transportation are needed to determine what gender equity means and how equity can be accomplished. Although men and women travel patterns have been converging at an aggregate level, there are still significant differences between their travel behaviours. This divergence has been increased on the basis of societal patterns such as *Employment Disparities*, which can be seen as results of differences in income, occupation, part-time and flexible labour force employment, *Household Roles* as a cause of changes in lifestyle which urge women to have trip chain, and also *Changing Household Structures* of which, in single-parent households, women are substantially more likely to be the head than men [1].

Since late 1970, transport study towards gender issues has been started [2]. The initial research was in women's mobility needs in two different areas: constraints on women's mobility [3] and also women's shorter commute distances and duration [4]. Interests in women's transportation issues and gender differences have increased, and women's travel behaviour has been investigated from different points of view [5]. It is also indicated that women are more likely than men to change their travel behaviour and adopt work schedule changes [6]. Travel distance, age, holding a driving license, household structure, having children, number of private cars, number of family members and income were influences in women's travel behaviour and trip choices [7]. They make more trips and linked trips than men yet their trip length and time are less. Picking up or dropping off some one, personal and family affairs and shopping were the most frequent reasons for women to have a trip chain [8-10]. Women are more willing than men to use their own car less and engage in ridesharing. Walking is favourable as well [11-13].

Approaches in Transportation Demand Management (TDM), as a new strategy in management and modification of commuting pattern, can be classified in four different groups: Incentive-Based Methods, Land use Management, Improvement of Transportation Options, and Policies and Programs. Telecommuting is a valuable policy based on telecommunication advancements in the recent decades and could be an approach in

lessening work-purpose trips and redistributing them to off peak hours [14]. Telecommuting has been a consistently important factor in shaping travel patterns, not only workers' one-way commute trip but also their total work trips and non-work trips [15]. Adopting telecommuting is a multidimensional decision, and different aspects such as work, life, leisure, travel and ideology should be considered [16]. Considering the increasing role of women in societies as a work force, and also their unique responsibilities in households, highlight the necessity of addressing women's drives, constraints and preferences towards telecommuting.

## 2. LITERATURE REVIEW

Telecommuting as a policy and strategy in TDM has been studied from different aspects. Mokhtarian has played an important role in introducing telecommuting. Through her vast studies, she defined telecommuting as the use of telecommunications technology to partially or completely replace the commute to and from work to alleviate the massive twice-daily peak commuting loads imposed upon most major cities. According to her findings, telecommuting is sometimes equated with teleworking, which is simply the use of telecommunications-related technology to conduct work, but not all teleworking (e.g., teleconferencing) replaces a commute trip. In fact, teleworking may or may not replace travel at all. Telecommuting can also be considered as one type of remote work, which has been defined: work done by an individual while at a different location than the person(s) directly supervising and/or paying for it. Telecommuting, of course, is both. Telework and remote work and can be categorized into two types: home-based and non-home-based [17].

The internal decision making process is initiated by some threshold level of dissatisfaction with one or more aspects of life. Such a search for a solution is motivated by drives, and in case of dissatisfaction, it is the drives which activate a search for adjustment to reduce it. On the other hand, constraints are factors that inhibit the formation of preference. Understanding the effect of constraints, in addition to the role of drives, is important for forecasting purposes. Constraints are those which, when they are active, essentially preclude telecommuting from being chosen. Drives are categorized into work, family, leisure, independence, ideology, travel and the constraints can be external (based in the work environment) awareness, also organization and job or internal (arising from psychological considerations) psycho-social variables [16]. In addition, a preference may express a long-term priority that may not always be exercised. The main reason for mismatch between preference and action is assumed to be the presence of constraints. The preference model estimates the trade-offs between advantages and disadvantages of telecommuting that an individual must consider in forming his or her preference [18].

In terms of propensity to telecommuting, Mokhtarian and Salmon examined men and women employees' preferences through explanatory variables and binary logit models. Results indicated that by highlighting disability, stress, personal benefits as well as commute stress and time, preferences toward telecommuting would increase. On the other hand, workplace interaction, household interaction and commuting benefit would decrease employee preferences for telecommuting [18].

Through several studies the influence of gender on adopting telecommuting has been discussed. Popuri and Bhat in their research presented a joint discrete model of home-based telecommuting adoption and home-based frequency using revealed preference. The results underscored the importance of socioeconomic and occupational characteristics of employees in explaining telecommuting behaviour. It was also mentioned that women with children are more likely to telecommute [19]. Mannering and Mokhtarian also mentioned in their study that being a mother of small children had a positive influence on adopting telecommuting [20]. In a case study in Minnesota, the results pointed out that telecommuters are more likely to be women, married and with children [21].

Bailey and Kurland surveyed the literature on teleworking and telecommuting. In terms of differences linked to gender, they indicated that full-time employees who telework are more likely to be male, slightly younger and making higher income, while part-time telecommuters are doing that more informally, being predominantly female, older and earning less [22]. Mokhtarian and her colleague in another study and through binary logit models on choosing telecommuting, mentioned that women have more preferences than men and also telecommute more [23]. In a case study in India, the effect of telecommuting on travel behaviour examined and indicated that telecommuting should be considered more for women [24].

In terms of benefits of telecommuting for women in quality of work life (QWL), Olorunfemi found that promoting telecommuting policies could reduce pressure from women and bring productivity and increase the

QWL [25]. Mokhtarian et al., in their research examined the impact of gender, occupation and presence of children on adopting telecommuting. Through statistical analysis, nearly the entire specific hypothesis formulated from literature and judgments were corroborated: women are more likely than men to cite family, personal reasons and stress reduction as advantages of telecommuting and more likely to see the lack of visibility of management as a disadvantage. Moreover, they highlighted that women are more likely to see keeping the same job after relocation as a benefit of telecommuting and men are more likely to see the lack of professional interaction as a cost [26].

Therriault et al examined telecommuting from home using the data from the sample of more than 30,000 workers in the Quebec metropolitan area (Canada). In a binomial logistic model of propensity to telecommuting they found that women are far less likely to telecommute than men, and among women those who were under 24 were less enthusiastic to adopt telecommuting. In a cross-effect of gender and professional status they indicated that self-employed women and women of those powerless categories are far more prone to adopt telecommuting [27].

Khattak et al showed that education, age, presence of children in the household, gender, and certain measures of location and accessibility are important in explaining the tendency to work from home. In terms of gender they found that men have more tendencies to work from home than females [28]. Walls et al. analyzed the survey of Southern California residents and found that there is no difference between male and female workers in the propensity to telecommuting and also statistically a significant effect of gender is not found in the telecommuting frequency model [29].

Jin and Wu, based on the data from 1995 Nationwide Personal Transportation Survey (NPTS) and 2001 and 2009 National Household Travel Survey (NHTS) in United States, explored a wide range of individual, household and land use characteristics relevant to individuals' telecommuting behaviour. It was indicated that male workers are more likely to work from home than are female workers. They also mentioned that 14 percent of male workers had the option of working from home, whereas only 10 percent of female workers had that option [30].

In most of the reviewed studies, telecommuting adoption by women was mainly discussed. Whether women or men are more likely to choose telecommuting widely depends on the context and the population from which the sample is taken. By the way, based on women's unique role in societies and households, in addition to examining women's characteristics on adopting telecommuting, their preferences towards location and frequency of doing telecommuting need to be addressed.

### 3. METHODOLOGY

In this study, women employees' preferences towards telecommuting from different aspects are modelled. Women's preferences to adopt telecommuting, their preference to do telecommuting from local offices or home and, finally, the frequency of doing telecommuting are examined. In terms of decision making, choice and random utility models are applicable [31]. In random utility model it is assumed that  $U_{in}$  the utility of alternative  $i$  for individual  $n$ , is given by:  $U_{in} = V_{in} + \varepsilon_{in}$ . Where  $V_{in}$  is the systematic component corresponding to some functional form of attributes that effect utility, and  $\varepsilon_{in}$  is the random error corresponding to unobserved attributes and taste variations, measurement error, imperfect information, and instrumental variables. It is assumed that each individual attempts to maximize his/her utility. Thus the probability that individual  $n$  will choose alternative  $i$  is given by:

$$\text{Prob}_n(i) = \text{Prob}(V_{in} + \varepsilon_{in} \geq V_{jn} + \varepsilon_{jn}) \quad \text{for all } j \neq i$$

Depending on the assumptions made about the functional form of  $V$ , and the distribution of the disturbance  $\varepsilon$ , various discrete choice models such as Logit and Probit models may be formulated. In first two models, Binary Logit models will be developed to identify women's preferences on adopting telecommuting as well as the location where they prefer to do it. In the third one, women's preference in terms of frequency and number of days doing telecommuting is examined. Preferences are defined in three categories in forms of weak (0 or 1 days a week), medium (2 or 3 days a week) and high (4 or 5 days a week). As this approach deals with ordered independent variables, by considering latent variables and thresholds and also specifications of error term, ordered probit model is developed [32].

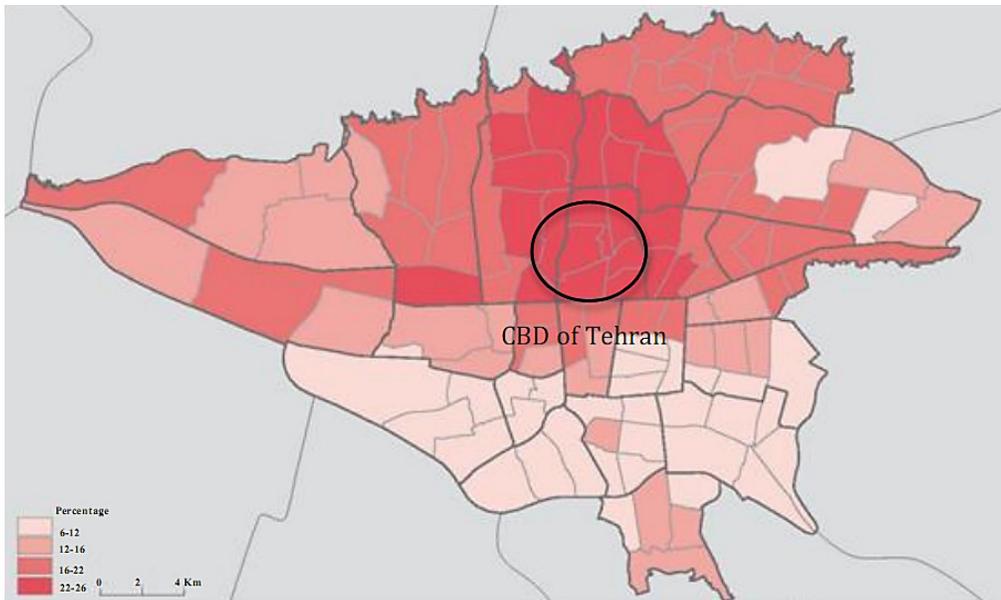
To discriminate women’s information, two approaches are selected: first model is developed by using only women’s data (70 individuals). In the two others, considering the low amounts of women respondents and in order to highlight their important characteristics in relation with independent variables, by using gender dummy variable (*Sex* = 1 for women and 0 for men) explanatory variable *x* is inputted as follows:

$$\beta (1+ a.Sex) x = \begin{cases} \text{For men: } \beta x \\ \text{For Women: } \beta x + a \beta x \quad \Rightarrow \quad \beta x + \gamma x \end{cases}$$

where  $\gamma$  is behavioural difference between men and women. If  $\gamma$  is statistically significant then the behaviour of women and men will vary in terms of explanatory variable *x*. Otherwise the behavioural differences will be neglect.

#### 4. DATA DISCRETION

The data has been obtained from a two-page questionnaire distributed at seven governmental and semi-governmental organizations in a Central Business District of Tehran, the capital city of Iran. As telecommuting is almost a new approach in terms of working in Iran, initially employees and their managers were given some information. The data consist of 245 individuals (70 women and 175 men) and, through a comprehensive interview, socioeconomic and demographic factors, travel and commuting issues, ideology, preferences and suitability of adopting telecommuting have been asked from employees and their supervisors. In terms of job categories and wide range of job titles, the concept of abstract job has been applied [33].



**FIGURE 1. Employment rate in Tehran**

Ref: Tehran Municipality official statistic website: [www.atlas.tehran.ir](http://www.atlas.tehran.ir)

Employment rate in Tehran during the period of data collection was about 6-26 percent (Fig 1). As is clear from the figure, in the CBD of this metropolitan area, employment rate is in maximum range and by considering the increasing role of women in the society and job market, 70 women (about 28 percent) have been interviewed to represent the population.

#### 5. MODELS AND RESULTS

In this section, mentioned models and related results are calibrated and discussed respectively.

## 5.1 Women employees' preferences towards telecommuting

In the first step women's preferences toward telecommuting is modelled using binary Logit and it is calibrated based on *only* women's information. Results and marginal effects are illustrated in tables 1 and 2.

**TABLE 1. Binary Logit model for women's preferences toward telecommuting**

Variables	Coefficient	t-Value	P Value
Constant	9.373	2.02	0.043
Importance of reports, correspondent etc.	-3.739	-1.88	0.06
Number of children	-0.831	-2.03	0.042
Ideology about the impact of telecommuting on work efficiency	4.017	2.12	0.033
Travel time from home to work	0.084	1.88	0.059
Using organization's car	-6.341	-2.66	0.007
Age group (20-29)	-3.806	-1.83	0.066
N	70		
Log-Likelihood at 0	-45.52		
Log-Likelihood at constant	-30.443		
Log-Likelihood at convergence	-12.491		
Pseudo-R square	0.7425		
Adjusted pseudo-R square	0.589		

It can be concluded from the above table that women's dependence on reports and correspondences is an important factor that decreases their preferences towards telecommuting. Increasing the number of children causes lower tendency on adopting telecommuting, which can be related to their loads of duties as mothers at home. In addition, those women employees who use their organisations' car for commuting and also younger women employees, who are experiencing a new work environment, prefer to work from the primary offices. An expected result appears in variable of travel time from home to work, that by increasing travel time, telecommuting is more preferable. Those women employees who consider telecommuting as motivation for more productivity, have more tendencies to do telecommuting.

Marginal effects of the above model are in Table 2. Marginal effect of an independent variable demonstrates the changes in probability of choosing an alternative when it increases 1 unit [32]. Women employees' preference towards telecommuting will decrease about 1.6 percent when the importance of reports and correspondents increases about 1 unit respect to the average. Tendency of adopting telecommuting when a child is added to a family, using the organization's car and being younger than 30 will decrease about 0.3, 19.1 and 3.8 percent respectively. It is worth mentioning that marginal effect for dummy variable explains the situation corresponding to 1 against 0.

**TABLE 2. Marginal effects of Binary Logit model for women's preferences toward telecommuting**

Variables	Marginal Effect
Importance of reports, correspondent etc.	-0.016
Number of children	-0.003
Ideology about the impact of telecommuting on work efficiency	0.017
Travel time from home to work	0.0003
Using organization's car	-0.191
Age group (20-29)	-0.038

## 5.2 Women employees' preferences towards the location of doing telecommuting

In the second model, the women employees' preference towards location of doing telecommuting is studied. Preferred location of doing telecommuting has been inferred through the stated differences between

number of days of working between the local office and home; thus the information of those who had equal preferences is omitted. Because of the low numbers of women employees' respondents, the model is calibrated by the whole sample and the women's information is extracted through gender dummy variable approach discussed in the previous section. With regards to the available data, a binary Logit model is developed. Tables 3 and 4 illustrate the results and the marginal effects.

Based on this model, total work experience by negative coefficient appears which means when employees' work experience increases, they prefer to work from the local office and they do not consider home as a suitable working place. This can be interpreted that telecommuting is almost a new approach and this could be accounted as a paradigm shift by employees against the traditional state of working from home and eventually it is not acceptable. The mentioned reason could be approved by the effect of education variables as well: those employees who hold undergraduate degrees do not prefer to telecommute from home. In addition, employees consider telecommuting as an approach that could have impacts on work efficiency when it is done from the local office rather than home. Walking to work in the morning has a utility for employees and it brings more tendencies to telecommute from the local office rather than home. However, in the return trip, which usually is in the afternoon peak hours, those who use the bus prefer to telecommute from home and not waste their time in public transportation.

Average daily time spent on the phone or fax machine appeared in the model in two ways: by spending more time on it, male employees tend to adopt telecommuting more from home, yet women employees behave in opposite the direction. When they have to talk more with phones or use fax machine as part of their job, they prefer to do telecommuting from the local office. It can be implied that when the phone or fax machine plays an important role in men's jobs, home is the preferable place to telecommute. Women who are involved in advertisement, marketing, sales or customer service sectors, prefer to work more from local offices, which highlight the nature of their work that should be in touch more with clients and customers. Finally, when the importance of reports, correspondents increases, women are more likely to telecommute from home. However based on previous model, their tendency of doing telecommuting would decrease.

Table 4 shows the marginal effects of second model. Mode choice in commuting and changes in education and employees' ideology towards productivity lead to significant differences in preferences of employees towards location of doing telecommuting.

### **5.3 Amount of women employees' preference towards telecommuting**

In the last model, the frequency and number of days of doing telecommuting by employees and women is examined. The preferences have been defined through three alternatives: Weak (0 or 1 day a week), Medium (2 or 3 days a week) and High (4 or 5 days a week) and there is no difference between the tendency of working from local office or home. Based on characteristics of error term in the utility function, an ordered probit model is developed and employees and women's specifications are highlighted. Results and marginal effects are shown in Tables 5 and 6.

The results indicate that the importance of reports, correspondents etc. and dependence on special places such as Lab, studio etc., would cause lower preference towards telecommuting. Those employees who hold a driving license also tend to commute and use their car. Work experience in a current job and also belief in the impact of telecommuting on lessening traffic congestion and work efficiency would encourage employees to do telecommuting more. Using car as a mode of travel to get to work is a factor that increases employees' preferences to do more days of telecommuting.

Women's specifications in terms of frequency of adopting telecommuting are examined in this model as well. Women managers or supervisors, as well as those women who work in research and consultation area, prefer to telecommute less as they need to appear in their primary work place more. The ideology of women on family wellbeing is another important issue and related variable appeared by positive coefficient in the model, which means women as mothers or wives consider telecommuting as an approach through which they could spend more time with their family. However, by increasing the number of children, women employees prefer to do few days of telecommuting; that might relate to high amount of responsibilities which can prohibit them from doing their jobs' duties. Women employees who walk to work in the morning prefer to do telecommuting less; it can be interpreted that they probably live near their primary work offices and telecommuting can be meaningless in this case.

Threshold is 2.6 and it shows that whenever the value of independent variable is less than zero, the preference is weak, between 0 and 2.6 is medium and more than 2.6 the preference will be high. Table 6 shows the marginal effects and clarify the changes in probability of weak, medium and high preferences when the value of independent variables increase 1 unit

**TABLE 3. Binary Logit model for employees and women's preferences toward telecommuting from local office/home**

Variables	Coefficient	t-Value	P Value
Constant	3.08	2.34	0.019
Total work Experience	-0.30	-4.08	0.000
Average time spent daily on Phone/Fax machine	0.88	2.85	0.004
Education: Diploma or less	-1.59	-2.05	0.041
Ideology about the impact of telecommuting on work efficiency	-0.87	-1.95	0.052
Home to work trip mode choice: Walking	-1.50	-1.82	0.069
Work to home trip mode choice: Bus	3.19	1.69	0.092
(Women) Importance of reports, correspondent etc.	4.29	3.70	0.001
(Women) Job categories: Advertisement/Marketing/Sales/Customer Service	-4.33	-1.99	0.046
(Women) Average time spent daily on Phone/Fax machine	-1.73	-3.52	0.001
N	90		
Log-Likelihood at 0	-62.383		
Log-Likelihood at constant	-62.027		
Log-Likelihood at convergence	-37.409		
Pseudo-R square	0.4		
Adjusted pseudo-R square	0.397		

**TABLE 4. Marginal effects of Binary Logit model for employees and women's preferences toward telecommuting from local office/home**

Variables	Marginal Effect
Total work Experience	-0.072
Average time spent daily on Phone/Fax machine	0.213
Education: Diploma or less	-0.376
Ideology about the impact of telecommuting on work efficiency	-0.211
Home to work trip mode choice: Walking	-0.357
Work to home trip mode choice: Bus	0.408
(Women) Importance of reports, correspondent etc.	0.078
(Women) Job categories: Advertisement/Marketing/Sales/Customer Service	-0.070
(Women) Average time spent daily on Phone/Fax machine	-0.041

**TABLE 5. Ordered probit model for employees and women's preferences towards frequency of doing telecommuting**

Variables	Coefficient	t-Value	P Value
Constant	0.129	0.29	0.82
Importance of reports, correspondent etc.	-0.217	-1.73	0.08
Holding driving license	-0.597	-2.37	0.02
Ideology about the impact of telecommuting on reducing traffic congestion	0.462	3.38	0.01
Ideology about the impact of telecommuting on work efficiency	0.305	2.81	0.00
Home to work trip mode choice: Car	0.538	2.45	0.01
Work experience in current job	0.033	1.64	0.10
Importance of special places (Lab/Studio...)	-0.165	-1.42	0.15
(Women) Job categories: Management/Supervision	-1.076	-1.63	0.10
(Women) Number of children	-0.316	-3.22	0.00
(Women) Ideology about the impact of telecommuting on family wellbeing	0.033	-2.05	0.04
(Women) Home to work trip mode choice: Walking	-0.820	-1.20	0.23
(Women) Job categories: Research/Consultation/Expertise	-0.377	-1.15	0.25
Threshold	2.600	15.17	0.00
N	245		
Log-Likelihood at 0	-269.160		
Log-Likelihood at constant	-190.596		
Log-Likelihood at convergence	-160.167		
Pseudo-R square	0.405		
Adjusted pseudo-R square	0.296		

**TABLE 6. Marginal effects of ordered probit model for amount of employees and women's preferences towards telecommuting**

Variables	Marginal Effect Alternative 0	Marginal Effect Alternative 1	Marginal Effect Alternative 2
Importance of reports, correspondent etc.	0.052	-0.029	-0.023
Holding driving license	0.117	-0.027	-0.089
Ideology about the impact of telecommuting on reducing traffic congestion	-0.112	0.062	0.05
Ideology about the impact of telecommuting on work efficiency	-0.076	0.041	0.033
Home to work trip mode choice: Car	-0.110	-0.059	0.048
Work experience in current job	0.008	0.004	-0.004
Importance of special places (Lab/Studio...)	0.040	-0.022	-0.018
(Women) Job categories: Management/Supervision	0.370	-0.318	-0.051
(Women) Number of children	0.077	-0.042	-0.037
(Women) Ideology about the impact of telecommuting on family wellbeing	-0.108	0.400	0.062
(Women) Home to work trip mode choice: Walking	0.269	-0.222	-0.047
(Women) Job categories: Research/Consultation/Expertise	0.078	-0.027	-0.052

## 6. CONCLUSION

Regarding technological advances, telecommuting as a new approach in Transportation Demand Management can play an important role in eliminating or redistributing work purpose trips to off peak hours in order to lessen traffic congestion, and may help achieve sustainable transportation systems. This approach could be improved by considering gender differences and focusing on travel behaviours. This study tends to examine women employees' behavioural characteristics in the context of telecommuting. Three models have been developed and through binary Logit and also ordered probit models, women's preferences towards telecommuting, its location and the frequency of adopting telecommuting discussed. Moreover, the marginal effects of models presented.

Based on results, it can be concluded that by increasing the number of children in a household, women's preference towards telecommuting decreases. However, the family wellbeing and spending more time with family, preferably small size ones, is important for women and encourages them to do more telecommuting. Women's ideology about the impact of telecommuting on productivity could be motivation for involving more in teleworking. Age is another important factor in their decision making, and young women have more tendencies to adopt telecommuting.

In terms of job specifications, women who are involved in management/supervision, advertisement/marketing/sales/customer service and also research/consultation/expertise are less likely to do telecommuting. Women tend to telecommute from the local office where they can be in touch with more clients or colleagues. Those women who are more involved with reports and correspondents, phone and fax machine prefer to telecommute more from home. Travel time plays an important role in this context, and by increasing spent time in commuting, women's preference toward telecommuting increases. However, those women who walk to work or use the organization's car for commuting prefer primary offices to work.

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# Left holding the baby or increased career opportunities? The gendered consequences of regional enlargement and increased commuting

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## ABSTRACT

Greater urbanization has meant that the growth of city-regions is an increasingly common development in many countries. This trend has advantages for economic growth in terms of expanding the labour market, widening job opportunities, increasing choices and facilitating specialization. Improved communication systems, with better public transport, as a result of the development of city regions could be expected to benefit women as well as men – facilitating journeys between home and work and broadening labour market opportunities. However, even in a supposedly gender-equal country like Sweden, women have typically been regarded as less mobile than men, and the female body is often constructed as more spatially circumscribed and place bound. A “masculine” construction of commuting as a necessary evil for male career advancement (reinforcing the male bread-winner model) seems to predominate. In this scenario, men commute further/longer in pursuit of their careers. Women, on the other hand, are left “holding the baby”, taking the main responsibility for the home and the family, often while also engaged in paid (part-time) employment which is restricted to close-to-home opportunities because of their caring responsibilities. An alternative scenario is, nevertheless, possible – a more gender equal alternative – in which unpaid caring work is shared more equally by partners/couples. In this scenario commuting becomes something positive, opening up increased possibilities also for women in the labour market and greater career opportunities. Drawing on theories concerning gender and mobility and using the findings from a questionnaire survey and interviews carried out in two Swedish city-regions, this paper explores the gendered consequences of increased mobility in city-regions in terms of these two scenarios, and considers their implications for transportation policies.

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**KEYWORDS:** Gender; Mobility; City regions; Commuting; Regional enlargement.

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## INTRODUCTION

In Sweden, as in many other countries, regional enlargement has been seen as involving many economic advantages and has become an important goal in regional growth policy (Friberg, 2008; Scholten & Jönsson, 2010). In the current government strategy, *A national strategy for regional competitiveness, entrepreneurship and employment 2007–2013* (Ministry of Enterprise, Energy and Communications, 2007), both regions and citizens are seen as benefiting from the process of regional enlargement and the development of city-regions. Not only is the region’s labour market and its competitiveness expected to be strengthened, but also the range of job opportunities available and the individual’s career prospects are considered likely to improve (Ministry of Enterprise, Energy and Communications, 2007). Greater investment in infrastructure is expected to facilitate commuting (both by car and public transport) enabling citizens to travel more rapidly and easily to work across municipal boundaries and contribute to the development of expanded, more differentiated labour markets and to increased job opportunities. The aim is that:

“Regional enlargement should occur with the least possible environmental impact and on equal terms for *both women and men*” and that it is important to “take into account the different commuting patterns of women and men and the differences which may exist in lifestyle and travel patterns within different professional groups and between people with different educational backgrounds” (Ministry of Enterprise, Energy and Communications, 2007: 23, my emphasis).

It is seen as important, if regions are to continue to develop and prosper in the competitive global economy, that good communications are available to facilitate commuting between municipalities. This is considered to enable citizens to find employment that matches their skills and for employers to obtain the labour power that meets their requirements. However, the strategy does not discuss the gendered

consequences of regional enlargement and increased commuting to work for everyday life. To be able to take advantage of widening labour markets and increased job opportunities, it is necessary to have the time and resources to commute. Women are generally viewed as less mobile, tend to earn less and take greater responsibility for the household and the family, which may limit their ability to benefit from larger labour markets and increased job opportunities.

Two possible scenarios arise – one negative and one more positive. In the first, regional enlargement has negative consequences, reinforcing the gendered division of household/family responsibilities and emphasizing the male breadwinner role and the female role as care giver and mother. In the more positive scenario, regional enlargement offers the potential to break the gendered divisions of paid and unpaid labour. In this view, widening labour market opportunities for both women and men would be accompanied by a more equal division of responsibility for the household and the family, and by improved conditions for commuting by public transport. Drawing on theories concerning gender and mobility, this paper explores these two scenarios in two Swedish city regions using the findings from a questionnaire survey and interviews carried out in the two regions. The paper is structured as follows: it begins with a short presentation of the two city-regions, followed by a brief discussion of gender and mobility. Next the two scenarios are presented and analysed and finally some conclusions are drawn.

## SWEDISH CITY-REGIONS: GÖTEBORG AND UMEÅ

This paper is based on a study of two rapidly growing Swedish city-regions<sup>95</sup>. Göteborg city-region is an expansive local labour market and is the third largest city-region with a population of 950,000. It comprises the central municipality of Göteborg and 12 peripheral municipalities<sup>96</sup>. Umeå city-region is much smaller in population terms, but is one of Sweden's fastest growing city regions and is a key city region in the far north of Sweden. It has a population of 202,000 and comprises the central municipality of Umeå and 6 peripheral municipalities<sup>97</sup>. These regions coincide roughly with the commuting area around both cities, and in both cases the main direction of travel to work is into the regional centre. In Umeå's case, the city region matches the local labour market region. In Göteborg's case, the local labour market comprises an additional 5 municipalities. These were not included in the survey as they were not part of the regional co-operation known as *Göteborgsregion*. A questionnaire survey of 6,000 citizens<sup>98</sup> aged 16–85, with a 60% response rate<sup>99</sup>, was carried out in the two city-regions in 2010<sup>100</sup>. In addition, 24 interviews (12 in each region) were carried out in order to get a deeper understanding of the consequences of commuting for the division of household responsibilities and on leisure activities. The regional growth programmes covering both city-regions (Region Västerbotten, 2012; Göteborgsregionen 2013, 2010) prioritize regional enlargement and focus on investment in infrastructure and city development. However, there is no analysis of the gendered consequences of regional enlargement, and gender equality is not problematized, but is simply included as part of the goal of sustainable development.

## GENDER AND MOBILITY

Hjorthol (2008) suggests that men's and women's daily mobility can be seen as a "barometer" of the state of equality between women and men in society. The power relations relating to gender, class, ethnicity and

<sup>95</sup> These were chosen as part of a larger study of the importance of size for regional identity and engagement in politics. Göteborg region is one of Sweden's major city regions and Umeå region is one of the smaller ones.

<sup>96</sup> Ale, Alingsås, Härryda, Kungälv, Lerum, Lilla Edet, Mölndal, Partille, Stenungsund, Tjörn och Öckerö. Area 3 695 km<sup>2</sup>.

<sup>97</sup> Bjurholm, Nordmaling, Robertsfors, Vindeln, Vännäs and Örnsköldsvik. N.B. Örnsköldsvik municipality was not included in the survey as this only became part of the Umeå region 2013. Area without Örnsköldsvik 9 312 km<sup>2</sup> (with Örnsköldsvik 15 688 km<sup>2</sup>).

<sup>98</sup> 2000 in Göteborg municipality and 2000 in its peripheral municipalities; 1000 in Umeå municipality and 1000 in its peripheral municipalities.

<sup>99</sup> Similar response rates were obtained in both city-regions; however, women and older people were overrepresented in the replies, accordingly weighting variables were used to compensate.

<sup>100</sup> Umeå city region, particularly the peripheral municipalities, were over represented in relation to population size; accordingly a weighting variable was used to compensate.

education embedded in mobility cannot be ignored when focusing on commuting (Uteng, 2009). Accordingly, drawing on Uteng & Cresswell (2008), we locate commuting within a larger framework concerning the social, cultural, technological, infrastructural and political aspects of mobility. Thus

“Understanding motility ... means understanding the observable physical movement, the meanings that such movements are encoded with, the experience of practicing these movements and the potential for undertaking these movements” (Uteng & Cresswell, 2008: 2)

We see mobility as gendered, producing and reproducing gendered power relationships in society. Masculinity tends to be coded as mobile and active and femininity as stationary and passive, thus opening and constraining possibilities for subjectivities and who can be the active citizen. The female body is often constructed as more spatially circumscribed (Sheller, 2008; Hanson, 2010). Girls and boys tend to be socialized into different capabilities for mobility, with girls associated with more sedentary activities, more limited uses of space and greater risk aversion (Young, 1990). In drawing attention to the different ways in which girls and boys move, Young is not suggesting that women should simply be seen as static and men as mobile, but rather that mobility is embodied and enacted in different ways. This difference “acts to reaffirm and reproduce the power relations that produced these differences in the first place” (Cresswell & Uteng, 2008:3), which has implications for women’s mobility in relation to the labour market and commuting, to where and how much women work. In Sweden, for example, women are economically active to almost the same extent as men, but the labour market is highly gender segregated with women working in the caring services, frequently in low paid occupations with very “local” labour markets. Thus women tend to work “close to home” more often than men.

## THE TWO SCENARIOS

Turning to Sweden, and in particular our study of two city regions, we now examine two scenarios – one more negative and one more positive.

### ***Scenario 1: Left Holding the Baby***

Even in a supposedly gender-equal country like Sweden, women have typically been regarded as less mobile than men, and the female body is often constructed as more spatially circumscribed and place bound. A “masculine” construction of commuting as a necessary evil for male career advancement (reinforcing the male bread-winner model) seems to predominate. In this scenario, men commute further/longer in pursuit of their careers. Women, on the other hand, are left “holding the baby”, taking the main responsibility for the home and the family, often while also engaged in paid (part-time) employment, which is restricted to close-to-home opportunities because of their caring responsibilities. As Forsberg (2005) points out, many regional political actors have an overly positive view of the benefits of regional enlargement and fail to see the gendered consequences of increased commuting for individuals and households in their everyday living (Gil Solá, 2013).

Compared to many other countries, Sweden has a large proportion of women in the workforce, and the female economic activity rate is nearly as high as the male. In 2011, the economic activity rate was 82 % for women aged 20–64 and 89% for men, but women work part-time to a much greater extent (32% compared with 10% for men) (Statistics Sweden, 2012). However, as the official government report SOU 2005:66 points out women’s increased participation in paid work outside home has not been matched by men’s engagement in child care and household labour. In other words, women still tend to take the main responsibility for the home and for childcare (Scholten & Jönsson, 2010) and thus may face a double burden (Bergström Casinowsky, 2010). Indeed recent research from Sweden, on the gendered aspects of commuting, suggests that regional enlargement may serve to reinforce traditional gender roles (see Friberg 2004, 2008; Scholten & Jönsson, 2010) and, in effect, essentialize women as ‘mother’ and ‘care giver’. Further, the construction of women’s place as in the home i.e. the private sphere and men’s as in the public, and where the public space is portrayed as fearful and dangerous for women, can also have consequences for their mobility. The threat of violence often serves to make women more risk-averse and limit their mobility and, hence, their commuting patterns (Andersson, 2005). A number of studies (e.g. Friberg, 2004; Hanson, 2010; Sandow, 2011) point out that there are variations in commuting between different groups in society, and women have been shown to be less likely to commute than men and, if they do, are more likely to commute only shorter distances (NUTEK, 2002).

A further explanation may lie in the highly gender segregated Swedish labour market and differences in labour markets<sup>101</sup> for women and men, with those for men being geographically larger and fewer. Although the number of labour market areas for both women and men more than halved during the period 1970 to 2005, they have reduced faster for men, particularly highly educated men. Larger local labour markets are seen as facilitating specialization, especially for men (Västra Götalandsregionen, 2003). Women, on average, commute less than men regardless of income level, thus their labour market regions are smaller and greater in number (Vägverket, 2005) and in 2005 were 98 for women compared with 68 for men (Gil Solá, 2009). There is also a difference in the number of labour markets according to the level of education, with both higher educated<sup>102</sup> women and men having larger and fewer labour markets (see Table 1 below).

**TABLE 1. Number of Labour market regions in Sweden 1998/99 by sex & level of education**

Level of education	Women	Men	All
High	81	47	71
Low	142	98	124
All	107	79	100

Source: Reworked from Västra Götalandsregionen 2003, based on Statistics Sweden

In 2010, 53% of gainfully employed women worked in the private sector and 47% in the public sector, whereas the figures for men were 84% and 16% respectively (Statistics Sweden, 2012). In the past, women have tended to work predominantly in the public sector, where much of this employment has been in local government in schools, nurseries, and health centres, and these are found in every municipality which means that their employment is more local in nature (Friberg, 2008), making it possible for most women employed in these categories to work in the municipality where they live. Further, a nurse, a nursery school teacher or a primary school teacher is unlikely to increase her/his pay by increased commuting (Vägverket, 2005). In 2010, only 24% of women working in the public sector commuted to another municipality (Håkansson, 2010). There are, however, suggestions that this is changing, and Statistics Sweden reports that the numbers commuting daily to work in another municipality increased by 44% for women and 28% for men between 1988 and 2008. Wages are more differentiated in the private sector than the public, which favours increased commuting even for women (Vägverket, 2005). In the case of those employed in the private sector, women's commuting has come much closer to men's with 33% of women commuting over the municipal boundary compared with 35% of men in 2010 (Håkansson, 2010).

However, despite the faster rate of increase for women, men still account for almost 60% of those commuting over municipal boundaries (Håkansson, 2010). Further, although women's commuting has increased in recent years, their "action space" is still considered to be much more limited than men's as they continue to take greater responsibility for the home and family. This can reduce their labour market choices and reinforce gender differences (Hjorthol, 2008), thus men are considered to have benefited most in terms of career opportunities from regional enlargement (Gil Solá, 2009). In other words, some individuals are more mobile than others and have greater choice and opportunities when it comes to deciding where they want to live and work. This suggests that not everyone will be advantaged to the same extent by regional enlargement or have equal possibilities to take advantage of expanded labour markets (Adolfsson Jörby, 2005). Our study of Umeå and Göteborg city regions showed that, in keeping with the rest of the country, men are still more likely to commute than women (see Table 2). The difference between women and men is less in the Umeå region than the Göteborg region, possibly because most of those who commute within the Umeå region work within the public sector. The universities and regional hospital are major employers for both women and men. Those commuting outside the region are mainly employed in the private sector, which accords with the general tendency for those working in the private sector to commute further than those employed in the public sector. Interestingly, in the Göteborg region, it is almost as common for both partners to commute as it is for the man to be the sole commuter. This may well relate to the fact that Göteborg region is a more densely populated

<sup>101</sup> The labour market areas (LMAs) are constructed by Statistics Sweden (a government agency) using statistics on commuting between municipalities. Changes in the number of LMAs have been used as a measure of regional enlargement. This has been rapid during the last 20 years when the number of labour market areas has decreased by almost 30 percent (SCB 2010).

<sup>102</sup> Above secondary level schooling.

urban region with better a developed public transport system, which facilitates women's commuting as our survey also showed that women tended to use public transport to a greater extent than men.

**TABLE 2. Commuting over municipal boundaries<sup>103</sup>: Commuting patterns in pair relationships in Umeå and Göteborg city-regions (percentages)**

	All respondents	Umeå city-region	Göteborg city-region
Only the woman commutes	12.7	7.7	13.4
Only the man commutes	20.9	10.0	22.6
Both commute	18.9	5.0	21.1
Neither commutes (over the city boundary)	47.5	77.3	42.5
Sum	100.0	100.0	100.0
N	1585	860	725

Note: It has been assumed that the pair relationships are between a man and a woman

There are also differences in both attitudes to and modes of transport used between women and men (SIKA, 2002). Men generally have greater access to motorized transport and more frequently commute by car, whereas women are more positive towards public transport and use it to a greater extent. Women's journeys to work are often more complex and multipurpose reflecting the need to co-ordinate dual roles as mothers and wage-earners – for example, taking children to day care/school then on to work, later collecting children, shopping and home – trip chaining (Turner & Grieco, 2000). A number of studies indicate that having small children under school age may also reduce the tendency to commute (see Sandow, 2011). As mentioned above, women are still mainly employed in low-income occupations and/or work part-time to a much greater extent than men (Statistics Sweden, 2012), which make long-distance commuting less economically worthwhile and attractive than it is for men, with their normally higher-income occupations (Gil Solá, 2009) and fulltime employment. The more geographically even distribution of employment in “typically” female employment such as retail, education, and health care can enable women as a group to work closer to home and commute shorter distances.

Further, there are still differences in norms between women and men concerning good parenting (Bergström Casinowsky, 2010), making it easier for men to combine a career and family life and thus to commute to work. As Sandow (2011) shows, long-distance commuters are most likely to be men, have a high level of education and work in the private sector. There tend to be fewer socio-economic gender differences among long-distance commuters compared with women and men commuting short distances. She also points out that long-distance commuting tends to be associated with higher earnings; but, because men dominate this category, they benefit economically correspondingly more than do women. Although commuting to work can be advantageous in terms of income and career opportunities, it can also mean less time for family and friends and can lead to stress and health problems. It can also lead to relationship problems and, according to Sandow (2011), the risk of separation is 40 percent higher among long-distance commuters than among other couples.

As mentioned earlier, local labour markets have enlarged to a greater extent for men than women, leading to a greater tendency for men to commute longer distances. As long-distance commuting reduces available family time, the non-commuting spouse often takes on a larger share of household commitments. Sandow (2011) shows that men's long-distance commuting may, therefore, serve to reproduce and reinforce traditional gender roles on the labour market and within households. She suggests, on the other hand, if more women commute long-distances, this might lead to more gender equal relationships in the labour market and within households (Sandow, 2011). However, the findings from Bergström Casinowsky's (2010) study of work related travel and the gendered division of domestic responsibility do not support this. She found that when the work traveler was a man, there was a reduction in his relative share of responsibility for the home and the family, but when the work traveler was a woman, the allocation of home-based responsibility remained largely unchanged. We have found a similar pattern in our study as the following quote and Table 3 illustrate:

<sup>103</sup> This is the definition of commuting used by Statistics Sweden. The municipalities in the Umeå region are much larger in area than those in the Göteborg region. E.g. Umeå municipality has a population of nearly 120,000 and an area of 2,317 km<sup>2</sup> while Göteborg has a population of over 500 000 and an area of only 451 km<sup>2</sup>. This can help to understand why fewer “commute” in the Umeå region. However in both cities over 40% of commuters are women (SCB Kommunfakta 2013).

“It’s mainly my wife who takes care of household matters. Partly because she’s home much more than I am and partly because ... well I’m out often in the evenings. She usually complains that I don’t help ... I mean I can do all that cooking, cleaning, washing and all that. But I’m away much more ... and she’s home alone so she takes care of all that.” Interview 2012, man aged 57, married, 4 grown up children, long distance commuter.

“During the week my husband cooks and shops ... but at the weekends I do most of the rest (housework) ... and the fourteen year old (daughter) helps a little.” Interview 2012, woman 49, 3 children 20, 14, 10 (eldest left home), long distance commuter.

**TABLE 3. Division of household responsibilities, according to men and women (percent) in Umeå and Göteborg Regions, 2010**

Household responsibility	I have the main responsibility, according to:		We share the responsibility, according to:		My partner has the main responsibility, according to:	
	Women	Men	Women	Men	Women	Men
Buying groceries	40.6	14.5	48.3	54.2	8.5	20.0
Cooking	50.0	11.5	38.0	43.3	9.7	42.4
Laundry	66.5	8.4	25.3	32.7	5.6	55.8
Cleaning	44.3	8.9	47.0	57.4	5.5	30.2
Repairs/maintenance	5.4	69.7	30.0	22.0	58.1	1.7
N	1267	1107	1267	1107	1267	1107

Note: The wording in the question was “Which one of you – yourself or your husband/wife/cohabitant/partner has the main responsibility for the following”. The response alternatives were I; we share; my partner; not relevant.

The above table shows that the division of tasks in the household follows a traditional pattern in the sense that women have the main responsibility for most household activities, apart from those that concern repairs or maintenance. There is general agreement among men and women about this. Nevertheless, there are clear differences in how this is assessed by men and women. Both tend to overestimate their own contribution in the opinion of the opposite sex, i.e. men’s estimation of their contribution to the household is greater than women’s estimation of men’s contribution and vice versa. However, men are more likely than women to claim that household responsibilities are shared. Repairs/maintenance and laundry are the tasks that are the most unequally distributed, followed by (in this order) cooking, cleaning and buying groceries. Shared responsibility for cleaning and buying groceries is fairly common whereas it is less common that cooking and laundry are shared.

However, if we look at responsibility for household tasks and commuting (Table 4), it brings into question our argument that commuting reinforces the traditional gender roles. It appears to make little difference whether the man or woman commutes or not, i.e. there continues to be a very traditional division of labour for unpaid work regardless of commuting. The only difference is when it comes to activities concerning children. Here there is a much greater propensity to share the task regardless of whether it is the man or the woman who commutes. The tendency is particularly noticeable when it comes to men who commute. This may be a necessity to enable both parents to commute and/or a way of compensating for being away from the children through travel to work. Further, Sweden has one of the most generous parental leave provisions in the world<sup>104</sup>, with two months specifically earmarked each for the mother and the father<sup>105</sup>. The remaining 12 months can be divided as the parents see fit. This has contributed to creating a norm in society where fathers are expected to be actively involved with, and take responsibility for, their children.

<sup>104</sup> 480 days paid leave – 16 months.

<sup>105</sup> These earmarked months (60 days each for the mother and father) are forfeited if the father/mother does not take them.

**TABLE 4. Commuting and household responsibilities Umeå & Göteborg Regions 2010**

Activity	Woman Commutes						Man Commutes					
	Yes			No			Yes			No		
	Does self %	Part. does %	Share %	Does self %	Part. does %	Share %	Does self %	Part. does %	Share %	Does self %	Part. does %	Share %
Food shopping	43	7	46	40	9	49	13	28	55	15	28	54
Cooking	45	11	41	52	9	37	12	38	47	12	44	43
Laundry	65	5	26	67	6	25	9	53	33	8	57	33
Cleaning	45	6	45	44	5	48	9	32	53	9	29	59
Repairs	4	63	28	6	56	31	71	1	23	69	3	22
Leave/fetch child day care/school	8	6	24	8	2	15	4	6	31	2	4	15
Leave/fetch child from activities	7	5	33	8	3	15	7	3	37	4	3	18
Help child with homework	12	4	26	9	2	14	3	8	30	3	5	19

To try to understand the variation in responsibility an “I have the main responsibility-index” was constructed (explained in appendix) see Table 5 below.

**TABLE 5. Explaining variation in having the main responsibility for the household**

OLS regressions, dependent variable: I have the main responsibility-index

	All respondents		According to female respondents		According to male respondents	
Constant	2.544***	1.869***	1.554***	0.552	0.987***	0.653*
Gender	-0.859***	-0.956***	-	-	-	-
Own commuting	0.012	0.014	0.049	-0.103	-0.027	0.072
Partner's commuting	0.214***	0.081	0.271**	0.015	0.131	0.075
Age	-	0.013***	-	0.024***	-	0.001
Have children age 0-16	-	0.151*	-	0.223*	-	0.009
Level of education	-	-0.087	-	-0.215**	-	0.018
Household annual income	-	0.051**	-	0.050	-	0.058**
Left-right position	-	0.030	-	0.078	-	-0.040
City-region	-	-0.066	-	-0.154	-	0.068
Centre-periphery	-	0.095	-	0.359**	-	-0.137
R Square	0.134	0.167	0.011	0.094	0.004	0.024
Adjusted R Square	0.132	0.161	0.009	0.082	0.001	0.009
N	1548	1301	843	692	704	609

Note: The coefficients are B values of OLS regressions. Levels of significance: \*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001. See appendix for explanations of the variables.

This table shows that women are consistently more likely to have the main responsibility for the household, even when controlling for other possible explanatory factors. If a woman commutes it does not make it more or less likely that she will have the main responsibility for the household. However if her partner commutes it becomes more likely that she will have the main responsibility. However, the impact of the partner commuting disappears when account is taken of other explanatory factors. For women, the likelihood of having the main responsibility for the household is reinforced by age, having young children, and level of education, i.e. women who have the main responsibility for the household are mainly elderly or have young children or a low level of education. Men, on the other hand, are more likely to regard themselves as taking the main responsibility when the household income is high.

Further, living in the suburbs seems to be a “gender trap” for women. When all other explanations have been taken into account, women take the main responsibility for household matters if the family live in the suburbs. This coincides with findings from a study of the Copenhagen region. Naess (2008) showed that differences between women’s and men’s access both to job opportunities and leisure activities were considerably greater in the municipalities in regional periphery than in the central area. The smaller range of employment opportunities in the suburban municipalities meant that women’s options in the labour market were considerably more limited than men’s who had access to a much larger labour market.

**TABLE 6. Commuting over municipal boundaries: Commuting patterns in pair relationships in core city and suburban municipalities (percentages)**

	All respondents	Core city	Suburban municipalities
Only the woman commutes	12.7	10.8	15.2
Only the man commutes	20.9	16.7	26.5
Both commute	18.9	3.6	38.7
Neither commutes over municipal boundary	47.5	68.9	19.6
Sum	100.0	100.0	100.0
N	1585	860	725

Note: It has been assumed that the pair relationships are between a man and a woman

It is interesting to note from Table 6 that all types of combinations of commuting are more common among couples living in the suburbs than in city core. It is also decidedly more common that both the man and the woman in a couple commute in the suburbs than in the city. This seems to be part of an urban lifestyle particularly in Göteborg suburban municipalities, but is very unusual among those living in the central city municipality, particularly in Umeå.

### **Scenario 2: increased career opportunities**

Having found that commuting does not necessarily affect the gendered distribution of household responsibilities, an another scenario is explored – a more gender equal alternative – in which unpaid caring work is shared more equally by partners/couples. In this scenario commuting becomes something positive, opening up increased possibilities also for women in the labour market and improved career opportunities.

Associated with the development of city regions is investment in infrastructure to facilitate commuting by public transport as well as by car. The implications of this could be especially important for women as a group, particularly if improvements in bus and rail networks lead to greater opportunities to commute to work thus, expanding women’s labour market. As the number of women in the workforce has increased, women’s overall travel patterns have begun to change and have begun to look more like men’s (Scholten & Jönsson, 2010). Increased possibilities for women to commute could have a positive effect in terms of opening up employment opportunities and challenging existing gender inequalities in the labour market (Sandow, 2011). Indeed, there are signs that the gender gap in commuting is slowly reducing. Gil Solá (2013) looking at commuting generally in Sweden, shows how between 1994/95 and 2005/06, the difference in the distance commuted by women and men has decreased in both absolute and relative terms (see Table 7).

**TABLE 7. Journey to work: average distance and time 1994/95 och 2005/06, Sweden**

		1994/95	2005/06	Absolute change	Relative change
		%	%	over time, km	over time %
Journey length	Woman	11.3	13.7	+2.4*	+21*
km	Man	16.1	18.2	+2.1*	+13*
	Difference	4.8*	4.5*		
	Gender <sup>106</sup> Index	42 %	33 %		

<sup>106</sup> Gil Solá (2013) uses the relative measure *gender index* to compare women’s and men’s journey times and distances. It is calculated as follows: 
$$\frac{\text{Value for man} - \text{value for woman}}{\text{Value for woman}}$$

A positive value should be read as men commute X percent longer than women A negative value means that women commute further than men (Gil Solá ,2013: 82).

**TABLE 7 (continued). Journey to work: average distance and time 1994/95 och 2005/06, Sweden**

		1994/95	2005/06	Absolute change	Relative change
		%	%	over time, km	over time %
Travel time, minutes	Woman	23	27		
	Man	24	27	+4*	+18*
	Difference	0.6	0.1	+4*	+15*
	Gender Index	3%	0%		

Source: Adapted from Gil Solá (2013: 104). Women 1994/95 n = 4840, men 1994/95 n = 5750, women 2005/06 n = 6780, men 2005/06 n = 7550. \*Statistically significant difference,  $p < 0.05$

A general trend in Sweden is that families with small children tend to move from the central city to the suburban areas where housing is cheaper. This is the case in both the Göteborg and Umeå Regions and has led to increased commuting in both regions. It is above all women who have increased their commuting in the last decade, which has placed greater demands on public transport as women choose to commute by bus, train or tram to a larger extent than men (Fredberg, 2012). Both the Göteborg and Umeå Regions are working to encourage commuting by public transport. Göteborg Region is a more densely populated region and has a well developed network of commuter trains and fast bus traffic that comprise the framework that links the various parts of the region (Göteborgsregionens kommunalförbund, 2009). However, although more sparsely populated, even the Umeå region is working to encourage commuting by public transport through, for example, its *Be Green Umeå* project. In 2012, commuting by public transport reached an all-time high (Umeå Kommun, 2013). An important contributory factor has been the development of a new railway line *Botniabanan* which has opened up rail connections between Umeå, Nordmaling and Örnsköldsvik. This has expanded the Umeå Region labour market, particularly for women who account for the greatest increase in commuting between Örnsköldsvik and Umeå (Umeå Kommun, 2013).

Other changes in society such as cutbacks in the public sector and privatization of welfare services may also have consequences for women's propensity to commute over the municipal boundary, i.e. their work places may become less "local". In Sweden, prior to the 1990s, women worked more in the public than the private sector. However, cutbacks in staff in both national and local government and the transformation of public utilities (such as the Post Office, and the National Telecommunications Administration) into commercial enterprises have meant that in 2010 women worked slightly more in the private sector than the public (Statistics Sweden, 2012). In 1999, 53% of women in employment worked in the public sector and 47% in the private. By 2010 the situation had been reversed, and 53% work in the private sector and 47% in the public. Men work mainly in the private sector, 80% in 1999 and 84% in 2010 (Statistics Sweden, 2000 and 2010). The increase in women's employment in the private sector appears to be accompanied by a greater propensity to commute. In 2010, only 24% of women working in the public sector commuted over the municipal boundary compared with 33% in the private sector. This latter figure is approaching that for men, i.e. 35% of men working in the private sector commuted in 2010 (Håkansson, 2010). Indeed it has been shown that those women who commute longer distances are largely employed in the private sector and have a higher level education, compared to other gainfully employed women (Bengtsson, 2008).

The belief that women tend to stop commuting when they start a family is also being brought into question. According to Bengtsson (2008), the commonly held view that it is only men who are long-distance commuters under a longer period, and that women will stop when they start a family and have small children, is challenged by the statistics on commuting. His study of Statistic Sweden's regional register of labour markets and employment shows that this is not the case. He found surprisingly many similarities between female and male long distance commuters. Indeed slightly more women (18%) than men (17%) had children aged 0-6 years, (although it should be noted that women only account for about 30% of long distance commuters). This seems to suggest that, contrary to the commonly held view, having children does not necessarily make it harder for women than men to commute long distances to work.

Our study of the Umeå and Göteborg regions shows that, while more women than men have a journey to work of less than 5 kilometers and more men commute over 50 kilometers, there are very small differences between men and women who travel between 5 and 50 kilometers (see Table 8 below) to work or study.

**TABLE 8. Gender and Journey Distance (kilometres) Umeå and Göteborg**

Distance	Women (% of total)	Men (% of total)	Total
Under 5 km	31.8% (59%)	22.4% (41%)	27.2%
5-10 km	17.3% (50%)	18% (50%)	17.6%
10-30 km	33.2% (46%)	39.4% (54%)	36.3%
30-50 km	11.6% (51%)	11.4% (49%)	11.5%
Over 50 km	6.1% (41%)	8.8% (59%)	7.5%
Total	100%	100%	100%
N	2156		

When it comes to the length of time spent commuting, we found surprisingly few differences between women and men (see Table 9). One explanation may be, that although women tend to commute slightly shorter distances than men, they choose slower methods of transport. Our study shows that it is more common, for example, for women to walk, take the bus or tram to work and that it is slightly more common for them to cycle. Although men and women take the train to roughly the same extent, it is decidedly more usual for men to drive to work (this is the predominant mode of transport for men) and it is more usual for women to be a passenger.

**TABLE 9. Gender and Journey Time (minutes) Umeå and Göteborg**

Time	Women (% of total)	Men (% of Total)	Total
Less than 10 minutes	14.7%	14.5%	14.7%
10-20 minutes	29.4%	28.5%	29.0%
20-30 minutes	21.5%	22.5%	22.0%
30-40 minutes	14.9%	13.2%	14.1%
40-60 minutes	13.7%	14.1%	13.9%
Over 60 minutes	5.8%	7.2%	6.5%
Total	100%	100%	100%
Pearson Chi-Square	.237 (not statistically significant)		
Likelihood Ratio	.236		
N	2310		

These tendencies match the overall picture for commuting in Sweden. As Fredberg's (2012) analysis of Statistics Sweden's commuting statistics shows, taking the car is the dominant way of travelling to work particularly for men in all types of municipalities. Commuters in the 3 major cities (Stockholm, Malmö and Göteborg) travel least by car, 50% of men and 25% of women (Fredberg, 2012). Whereas the car is the dominant mode of transport in smaller, more rural municipalities, where 80% of men and 60% of women travelled to work by car. In total, 57% of women and 72 % of men travelled by car for at least part of their journey to work, while the corresponding figures for using public transport were 28 % for women and only 13% for men (Fredberg, 2012).

Our study shows, as do the statistical studies of labour market enlargement and commuting in Sweden in general, that women are increasingly economically active and increasingly commute (Bengtsson, 2008; Håkansson, 2010; Fredberg, 2012). This would seem, at least on the face of it, to be enabling them to develop their career opportunities. However, if they still continue to take the main responsibility for the home, then there is a risk that commuting becomes a double burden. Turning to the latest time-use study carried out by Statistics Sweden (2012), this shows that women aged 20–64 have increased their gainful employment over the last 20 years by, on average, 3 hours per week from 27 hours in 1990/91 to 30 hours per week in 2010/11. Men have, on the other hand, decreased their gainful employment during the same period from, on average, 41 hours per week in 1990/91 to about 37 hours per week in 2010/11. Has this led to a decrease in women's and an increase in men's unpaid labour in the home? The overall figures for Sweden suggest that this has not happened. Women continue to spend more time on unpaid housework than men – although the hours spent have reduced from an average of 33 hours per week in 1990/91 to 26 hours in 2010/11. Despite working less in paid employment than 20 years ago, men have not increased their share of unpaid labour in the home which remains the same as in 1990/91, i.e. on average 21 hours per week.

Turning to the Umeå and Göteborg region, questions concerning responsibility for household tasks were used to construct a “we share-index” (see Appendix) (see Table 10). Five household tasks were included: food shopping; cooking; laundry; cleaning; and repairs/maintenance in the home. If all these tasks were shared the score was 5, if 4 were shared the score was 4 and so on.

**TABLE 10. Explaining variation in sharing responsibility for the household**  
OLS regressions, dependent variable: We share-index

	All respondents		According to female respondents		According to male respondents	
Constant	2.242***	3.423***	2.636***	4.011***	2.553***	4.088***
Gender	0.246***	0.445***	-	-	-	-
Own commuting	-0.112	-0.110	-0.161	-0.018	-0.059	-0.200
Partner's commuting	-0.211**	-0.029	-0.269**	-0.091	-0.127	0.056
Age	-	-0.029***	-	-0.030***	-	-0.029***
Have children age 0-16	-	-0.227**	-	-0.246*	-	-0.196
Level of education	-	0.184**	-	0.203*	-	0.168
Household annual income	-	-0.018	-	-0.038	-	0.004
Left-right position	-	-0.072	-	-0.089*	-	-0.048
City-region	-	0.142	-	0.193	-	0.081
Centre-periphery	-	-0.299**	-	-0.352**	-	-0.238
R Square	0.017	0.110	0.015	0.121	0.002	0.086
Adjusted R Square	0.015	0.103	0.012	0.109	0.000	0.072
N	1548	1301	843	692	704	609

Note: The coefficients are B values of OLS regressions. Levels of significance: \*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001. See appendix for explanations of the variables.

Table 10 shows that own commuting does not make it more or less likely to share the main responsibility for the household, but if the partner commutes it becomes less likely that functions are shared. However, the impact of the partners' commuting disappears when account is taken of other explanatory factors. It is more likely that the responsibility for the household will be shared if you are young, have no young children, are highly educated or live in the city, rather than the suburbs. Interestingly, women on the left of the political scale more frequently state that the household functions are shared (whereas men are consistently more likely to claim that the household responsibilities are shared). This remains when controlling for other possible explanatory factors. This may reflect a more collectivist ideology in the family, with the expectation that responsibilities should be shared rather than individualized. In the case of men, only young age significantly explains why they share the household functions. This perhaps gives some hope for changes in the future.

## CONCLUSIONS

Neither scenario holds completely. It is still more common that men commute than women. Nevertheless, there are some signs that women are able to take advantage of regional enlargement and, where there are good public transport systems, expand their job market. However, class plays a role here, and those women who seem to be best able to take advantage are those with a higher education, working in well paid jobs in the private sector. A “commuting lifestyle” where both men and women commute is more common in Göteborg than in Umeå; and in the suburbs rather than in the city. This is possibly facilitated by the well-developed fast-bus/commuter train network, particularly given women's preference for commuting by public transport. These findings have implications for transport policy.

Surprisingly, our study shows that, while the division of tasks between men and women mainly follows traditional paths, this is not primarily related to commuting, i.e. the gendered division remains regardless of commuting. Other factors appear to be more important – in particular, age, whether one has young children, level of education and household income. Being elderly, having young children, a low level of education and low household income are associated with women taking the main responsibility for the household. Residing in a suburb also significantly explains how household functions are divided, with women more likely to take the main responsibility if the couple lives in the suburbs rather than the city core. Hence, commuting disappears as

an explanation when other factors are taken into account. Particularly striking is that suburban living, rather than commuting, ties women to a traditional role.

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## APPENDIX

### Variables in the OLS regression analyses

Variable	Question/variable construction	Variable values
Indicators of the dependent variables		
I have the main responsibility-index	<i>The number of household activities for which the respondent has the main responsibility compared to partner: Buying groceries, cooking, washing, cleaning and repairs/maintenance.</i>	Index 0-5
We share-index	<i>The number of household activities for which the respondent shares the responsibility with partner: Buying groceries, cooking, washing, cleaning and repairs/maintenance.</i>	Index 0-5
Indicators of the independent variables		
Gender	<i>Are you a woman or a man?</i>	1 Woman 2 Man
Own commuting	<i>Are you commuting at least once per week for work/studies to other municipality than you home municipality?</i>	1 No 2 Yes
Partner's commuting	<i>Where does your husband/wife/cohabitant/partner work/study?</i>	1 In home municipality 2 In other municipality
Age	Number of years	18-
Children age 0-16 years	Has children in the age 0-16 years	1 No 2 Yes
Level of education	<i>What is your highest level of education?</i> Seven response alternatives were reduced to three for the analysis	1 Compulsory school, etc. 2 Upper secondary school, etc. 3 University, college
Household annual income	Total income for all persons in your household before tax (SKR)	1 = 100 000 or less 2 = 101 000-200 000 3 = 201 000-300 000 4 = 301 000-400 000 5 = 401 000-500 000 6 = 501 000-600 000 7 = 601 000-700 000 8 = More than 700 000
Left-right position	Self-assessed position on a left-right scale	1 Clearly to the left 2 Leaning towards left 3 Neither/nor 4 Leaning towards right 5 Clearly to the right
City-region	The city-region of the resident	1 Umeå city-region 2 Göteborg city-region
Centre-periphery	Location of the resident's home municipality in the city-region	1 The city of Umeå or Göteborg 2 Other municipality in the city-region

# Gendered mobility and work in Berlin's post-socialist suburbia

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## ABSTRACT

Using the example of the Berlin hinterland, this paper examines whether residence in a mono-structured suburban area imposes constraints on women's day-to-day life despite the social impact of post-Fordism and post-Socialism. The assumption of gender-specific differences stems from an "anti-woman" image that has been associated with the suburbs for decades.

The way in which the residents of ten selected study areas are constrained regarding their work and related daily mobility will be highlighted. In addition, the question is examined of whether, and to what extent, there are resources available in terms of social capital which may compensate for these potential restrictions.

By analysing employment statistics, I have looked at the study area's job provision. Moreover, a mixture of qualitative and quantitative survey methods has been used in order to collect data on labour context, mobility patterns and the local social capital available to suburban residents. The results of the analysis show a low provision of employment opportunities that are both close to home and suitable for women. When combined with the traditional division of labour also frequently encountered in the households of couples in the study, this leads to the majority of female suburban residents facing some form of restrictions. Considerable significance for work and mobility can be ascribed to the distinguishing feature of socialisation, as those persons socialised in East and West Germany still appear to be rooted in the respective formative societal models of marriage of both German states. A further finding is that female suburban dwellers are only to a limited extent able to compensate for the constraints with the resource of social capital.

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**Keywords:** Gender; Mobility; Work; Suburbia; Berlin's hinterland.

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## 1. INTRODUCTION

The question of whether the dichotomy of "mobile men" and "immobile women" is seen in suburbia is closely connected with the hypothesis that living in a suburban area restricts women's day-to-day life.

The latter assumption is rooted in a model of housing and living characterised by Fordist values, which was the case for the classic phase of suburbanisation in many industrial western countries in the 1960s. This model is based on a prospering economy with "permanently assured income, low biographical pressure to be mobile and clearly structured patterns of everyday life, both in terms of the separation of productive and reproductive labour and the gender-specific distribution of roles" (1), (p. 409), (tr.). Standardized privately-owned homes, with their accompanying arrangement of everyday life – a productive, mobile husband working in the city centre and a wife working at home, who is thus relatively immobile – were now made possible at the urban fringes through mass motorization.

In the Berlin environs, the question whether these ideas of daily life still correspond to reality is of great relevance. Germany remains in a post-Fordist phase, although individual Fordist societal characteristics still exist in parallel. Post-Fordism is used here not only in the sense of replacing large-scale mass-production by small flexible manufacturing units, but also in the sense of a new gender order contrasting with the "traditional" Fordist gender roles (2). Taking gender-roles as an example, it does not mean that the post-Fordist generation has substantially different gender roles to previous generations.

Alongside post-Fordist influences that affect society as a whole, the Berlin hinterland's specific course of development must also be taken into account. On the one hand, therefore, it is a post-socialist city region that has simultaneously undergone processes of transformation and contraction, and whose development cannot therefore be viewed in the light of the Fordist background of a thriving economy. On the other, East German socialisation instils a different understanding of gender roles in large parts of the population – above all regarding female labour participation. For the Berlin hinterland, the question thus arises: do typical suburban

implications that applied under Fordist conditions still obtain today? In light of a post-Fordist and post-socialist framework, the following article establishes in concrete terms whether, and how, suburban residence restricts women's day-to-day lives.

This question is pursued by taking the pivotal factors determining everyday activity patterns: work, mobility and social capital. Work is generally considered to determine gender roles significantly, both in terms of productive and reproductive labour (3). The differing mobility of the genders also affects suburban life in connection to work. Geographical features, particularly workplace provision, influence access to work and its distribution between men and women – and thus also mobility in terms of journey length and duration. In addition to the restrictions arising from work and mobility, I will establish how individually and collectively available social capital can alleviate everyday constraints.

In addressing female restrictions regarding work and mobility, this study follows a tradition within gender research. However, this paper, which is based on my doctoral thesis (3), will stress not only restrictions, but also opportunities to overcome gender-specific limitations. These have previously only been referred to sporadically in similarly undertaken research.

## 2. CONCEPTUAL BACKGROUND

This article defines work, mobility and social capital as the three primary parameters of daily activity patterns. Whilst the analyses of work and mobility patterns emphasize the extent to which women are restricted in day-to-day life, the concept of social capital helps identify resources which can offset everyday constraints.

### 2.1. Work

Work is understood as “purposeful, planned and deliberate human activity that takes place using physical and mental (intellectual) capacities” (4), (p. 86), (tr.). Despite this generally held definition, work is mostly equated with paid work and unpaid reproductive labour is often ignored. Paid work is thus defined as “activity that is performed as market-determined, organised work for the acquisition of a monetary return in order to provide a livelihood” (5), (p. 54), (tr.). Additionally, an important characteristic of paid labour is that, alongside its income gains, it is distinguished by working times that can be isolated (6). Reproductive labour, in contrast, is characterised thus: “without pay, without societal recognition and without end: this work is never finished and always starts again afresh with the same tasks” (5), (p. 59), (tr.).

Alongside actual housework (shopping, laundry, cleaning etc.) and skilled manual work (gardening, building work etc.), this study also examines child care and accompaniment (taking children to school etc.) and the care of other household members and third parties outside the household. Reproductive labour thus encompasses various forms of work, namely “mental, manual, and emotional – aimed at providing the historically and socially, as well as biologically, defined care necessary to maintain life and to reproduce the next generation” (7), (p. 13). The statistics indicate non-perception of a large proportion of overall work: only paid work is commonly recorded, whilst unpaid reproductive labour (still primarily performed by women) remains mostly invisible in statistical terms (4). There are (at best) some time budget studies that give some data on reproductive labour. So necessary does the temporal recording of reproductive labour appear, however, and also so problematic, that the “recording technique of particular contents and structures of reproductive labour [has become] unsuitable” (5), (p. 65), (tr.). The activities of reproductive labour often do not take place – as is necessary for survey design – in succession, but rather in parallel. Furthermore, reproductive labour is characterised by frequent underappreciation of its extent, due to a perception of it being carried out in passing, whilst doing other things.

This paper is based on a study that views work holistically and includes both productive and reproductive labour in the term.

### 2.2. Work Mobility

Work patterns influence daily mobility decisively. As with the general understanding of work, work mobility is mostly seen as productive labour mobility, in effect commuting. As stated above, this study sees work holistically, which is why accompanying trips and those for care purposes, undertaken in the performance of reproductive labour, are understood as part of work mobility.

The analysis of paid work mobility records the time spent and distance covered to an external place of employment. I have classified those who accomplish this type of work mobility as commuters and taken the following as their definition: "Workers, pupils and students whose place of work or education is not at their place of residence are classed as commuters" (8), (p. 11), (tr.).

In Germany the number of commuters working and living in different municipalities is growing continually, while the number of "intra-commuters" (commuters within a municipality) and home workers is in steep decline. Some gender-specific differences stand out: men generally cover longer distances to work than women – this difference increases further out of town. The differences between the lengths of journeys to work are thus the greatest in rural areas (9). Differences in commuting times also arise depending on the productive labour hours. Other studies show that, for women especially, commuting times vary strongly according to employment mode – the shorter the working hours, the shorter the trip to work (10).

In contrast to precisely recorded paid work commuting, travel connected with reproductive labour is hardly surveyed in transport statistics. There is a problem here of distinguishing reproductive labour mobility and reproductive labour itself, as trips related to reproductive labour are often classified as work rather than mobility. As opposed to paid work mobility, most reproductive labour trips do not constitute a journey to defined places of work. Due to its different structure, the definition of reproductive labour mobility is not analogous to that of productive labour mobility: "Reproductive labour mobility as a whole encompasses trips undertaken in the context of taking care of oneself, the family and other closely associated persons" (11), (p. 3), (tr.).

### **2.3. Social Capital**

Social capital is the third essential parameter that structures daily life and can be used to offset constraints. With the use of social capital, women living in suburban areas can counter restrictive structures with resources that mitigate the disadvantages. In practice this means employing interpersonal relationships to ease everyday life through mutual support, e.g. in child care.

My application of the concept of local social capital (12) in identifying (female) social resources in suburban districts is based on the constructs of Coleman and Putnam.

Though Coleman distinguishes between human and social capital, he stresses the "interaction effects" of both: his starting point is a network of individuals, in which the individual nodes constitute human capital and social capital resides in relationships between at least two individuals (13). Every individual is embedded in social relationships – Coleman denotes social capital as the utilisation of these relationships. It is here, through their social relationships, that individuals access the human capital of others. In order for this network to be equally profitable for all involved, two conditions apply: trust between individuals and the availability of certain norms of reciprocity, which assure a service being returned. Beyond that, Coleman highlights social capital's quality as a public good, i.e. that "no individual ownership [can] be granted [to it] or made effective [on it]" (12); (p. 69). While Coleman considers social capital to be an "instrumentally applicable, individual resource, though not independent on others", Putnam views it as a "resource of societies" (14), (p. 62). Putnam's definition of social capital seems suitable for identifying and formulating collective problems, and the activation of community engagement with the aim of their eventual elimination: "Social Capital here refers to features of social organization, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions" (15), (p. 167). Social capital is a precondition for collective action, as there is only a preparedness for such actions in communities with a high level of social capital.

Both Putnam's collective effects and Coleman's individual use are examined using the concept of local social capital, as "both perspectives are of interest in the neighbourhood related context [...] as the sum of individual effects in the neighbourhood also produces contextual effects" (16), (p. 491). It is the residents of a given area, here the suburbs, who can use this localised form of capital.

## **3. METHODS AND STUDY AREA**

A mix of methods comprising quantitative and qualitative procedures was used. The data used in the analysis were collected in the scope of the project "(Post-)Suburban Daily Mobility in the Berlin Hinterland", supported by the German Research Foundation. This project was carried out at the Geography Department of the Humboldt University of Berlin in 2006–2010. A quantitative survey gave an overview of Berlin's suburban

residents' gender-specific work and commuting. To that end, residents were surveyed in 2007 by means of a standardised questionnaire ( $n = 1,135$ ). In addition, households received trip diaries ( $n = 2,527$ ) in which one day's trips were noted two days a week (one workday and one Saturday). The qualitative study helped in learning about the motives and subjective background conditions of these patterns. Guided interviews were conducted in summer 2008 with selected residents who had already taken part in the quantitative study. In addition to our own survey, I also evaluated employment statistics from the Institute for Employment Research (IAB). The aim pursued was to assess the regional facilities of the study area in terms of the differing gender-specific employment opportunities, as these have an influence on women's opportunities to earn.

The empirical survey took place in residential areas in the Berlin hinterland, which is part of the federal state of Brandenburg. Here, ten different study areas were selected, three of which were situated west of Berlin, three to the east and the remaining four to the south. Various criteria were used to choose the research areas: Besides the distance to the city centre, I tried to get a more or less equal amount of people who are originally from West and East Germany. The second criterion refers to the presence of work, shopping and leisure facilities in potential research areas, as these might be of great importance for mobility. Therefore, three different suburban settlement types were chosen. First, isolated dormitory suburbs where there is hardly any access to facilities. Second, grown centres, which are suburban residential areas in proximity to an old town with some facilities nearby. And last, suburban residential areas close to a new centre, i.e. a location with so-called "post-suburban" facilities. Due to the specific suburban development path, the average occupancy of the residents ranged between three and eight years for the various settlements as of 2007. Most of the respondents had lived in Berlin before they moved to the suburbs – the exact places of origin of the new suburban residents were the following: 35.8% had lived in suburbia before, 64.2% moved there from the outside. Of this 64.2%, 76.3% had lived in Berlin previously. The main causes for moving to the suburbs were lower rents, being able to buy a home, larger residential spaces and the desire to live in a green and quiet environment.

The study areas were built in the mid-1990s – no spread into the environs had been possible previously, due to the division of Germany. In 1992, residential suburbanisation around Berlin got underway and peaked in 1998 before declining due to reduced state support for the building of new housing (17, 18). In terms of building structure, large regional differences arose, so that both apartment blocks characteristic of the East German suburbanisation process and detached homes and terraced housing typical of the construction of West German suburbs can be found.

## 4. RESULTS

This chapter examines the secondary statistics analysis findings on the provision of workplaces and then also the quantitative and qualitative survey results on work, labour mobility and social capital.

### 4.1. *Employment structure in the Berlin hinterland*

Analyses regarding gender-specific employment show that typically female employment sectors are underrepresented in the Berlin hinterland.

The situation regarding workplaces in Berlin and its hinterland is as follows: Whilst there are 3,375,200 registered residents in Berlin, of which 1,754,100 are in employment, Brandenburg has a population of 2,449,500, of which 1,073,900 are in work (19). The number of jobs per head of population in Brandenburg is almost 10% lower than in Berlin. Even greater differences arise when looking at the sectors people are employed in: Berlin is a service sector centre, which employs 87.5% of all workers, with only 12.5% in the industrial sector. In Brandenburg, no less than 23% of the workforce are employed in the industrial sector, 74% in the service sector and just under 3% work in agriculture and forestry. Of those employed in industry in Brandenburg, most can be found in manufacturing (57.5%) and construction (32.6%).

We may assume that even with the provision of jobs close to the place of residence, they would not in the main be taken up by local residents, as spatial proximity is only one of several central factors in job selection (20, 21). I essentially share the assumptions of the proponents of the jobs-housing imbalance hypothesis, that proximity of places of works and workers will rarely be achieved, as decisions concerning the location of home and work are made independently of each other (21, 22). Nevertheless, employment near where people live influences the division of productive and reproductive labour within households. For each study area, the

available jobs according to occupation were analysed to see if they are undertaken predominantly by men or women.

Occupations were classified as being female or male if one gender held at least 70% of those jobs (3), (p. 109). This study asks what the proportion of jobs for women in the Berlin hinterland is compared to that in Berlin itself.

**TABLE 1. Women's occupations in study area in comparison to Berlin**

Female occupations	Study area	Berlin
Textile workers	x	x
Sales personnel		
Communications		
Office workers	x	x
Other healthcare workers	x	x
Social care	x	x
Personal hygiene	x	x
Hospitality	x	
Domestic services	x	x
Bank and insurance sales	x	
Writers, interpreters, librarians	x	
Total women's occupations	9	6

Source: (3), (p. 109)

Comparing the number of female professions in the study area as defined by statistical criteria with those of Berlin, we see that Berlin as a whole evidences fewer women-dominated occupations.

The total of all persons employed in female occupations within a 30-minute radius of the study areas amounts to 35.7% of the total employed there. Those in female-classified occupations in the study areas amount to 47% of all employed in Berlin. It seems that in the metropolitan region of Berlin, typically female employment sectors are concentrated in the inner city. In other German cities, the central districts also display the highest proportion of women's productive occupations (9).

The gender specifics of work, mobility and social capital are viewed in the following in light of this labour provision.

## **4.2. Gender specifics of work**

Alongside the characteristics of regional employment provision, other factors also influence Berlin hinterland residents' gender roles. The division of labour within households is fundamental here, as the "allocation of work along gender lines [is] one of the most striking forms of the division of labour in our society" (23), (p. 67), (tr.) and "one of the fundamental causes of the economic and social inequality between the genders" (24), (p. 89), (tr.).

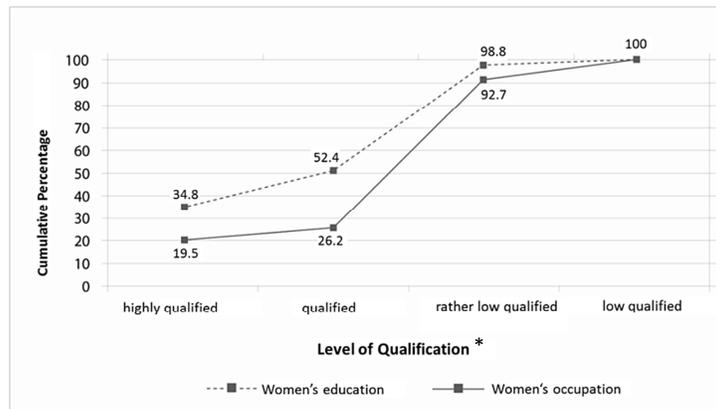
### **4.2.1. Paid work**

Regarding productive labour working times, it is clear that having children influences women's time utilisation greatly, but not most men's. On average, women from the sample ( $n = 434$ ) work 34.9 hours and men ( $n = 316$ ) 41.3 hours per week. Among men and women with no children at home, a relatively balanced ratio of productive labour working hours can be seen, with this group of women involved in productive labour for 38.4 hours/week – on average only 2.6 hours less than men at 41 hours. Mothers, on the other hand, pursue productive labour for 32.9 hours/week, on average almost ten hours less than fathers at 42.6 hours. The difference between mothers and childless women is highly significant (T-Test result  $p = < 0.001$ ,  $\alpha = 0.05$ ), whilst that between fathers in reproductive labour and childless men likewise employed is insignificant. We also see a positive correlation among women between the presence of children and time spent in paid work. Among men, in contrast, there is only a negligible correlation which can thus be disregarded (Women:  $C = 0.3$ ,  $\alpha = 0.01$ , Men:  $C = 0.08$ ). This establishes that the difference in paid work hours is not due to sex per se, but rather the distribution of gender roles amongst couples.

Concerning the influence of socialisation, we see that fathers who grew up in the old East Germany (“East-socialised” from here on), at 41.5 hours, pursue reproductive labour for negligibly less time than those from the West, who average 43.5 hours. The difference (as expected) becomes clearer amongst mothers – women of West German origin work on average 29.7 hours/week, and thus a good five less than the 35 hours worked by mothers who grew up in East Germany. Mothers socialised in both East and West significantly differ from childless women with the same background, who respectively work 38.7 and 38.1 hours in productive labour. Therefore there is a very significant difference among women of Eastern origin, and a highly significant one among those from the West (T-Test result Eastern-socialized women:  $p < 0.01$ ,  $\alpha = 0.05$ . T-Test result Western-socialized women:  $p < 0.001$ ,  $\alpha = 0.05$ ).

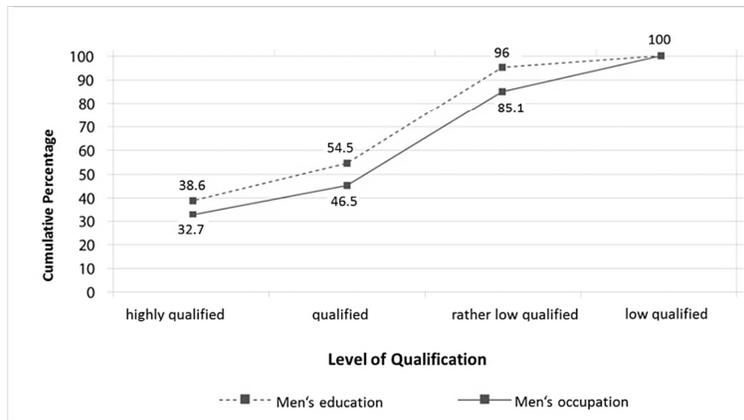
Because children significantly influence women’s time utilisation and reinforce gender role-specific differences, the following focuses on parents.

Alongside shorter working hours, we see another “female” characteristic of productive labour: jobs in “substandard employment” (25), (p. 25), (tr.). Gender role-specific differences are stark among parents: in our sample, 52.4% of mothers have some level of qualification, but only 26.2% work in the field for which they qualified, whilst fathers show negligible discrepancy between qualifications and current field. (cf. Figure 1 and Figure 2).



**FIGURE 1. Qualification discrepancies among mothers [n = 164] with children under 18.**  
Source: (3), (p. 125)

\* The following classification was used to identify qualification levels:  
 a) Qualification levels in education: low qualified: no school exams, left school 14-16, in lower categories of German system; rather low qualified: school exams at 16 in middle categories of German schools; qualified: secondary school leaving exams for higher education; highly qualified: degree level.  
 b) Current productive labour qualification levels: low qualified: untrained, in lower grades of civil service or low grade work; rather low qualified: skilled worker/junior tradesperson/middle grade civil servant/qualified employee; qualified: master craftsman or foreman/upper level civil service grades/other professionally qualified work; highly qualified: the professions/high level civil service/highly qualified employees.



**FIGURE 2. Qualification discrepancies among fathers [n = 101] with children under 18.**  
Source: (3), (p. 124)

Figures 3 and 4 show differences according to the surveyed women's socialisation. West German-socialised women's work corresponds to their education, especially at the highly qualified level, contrasting with that of East-socialised women.

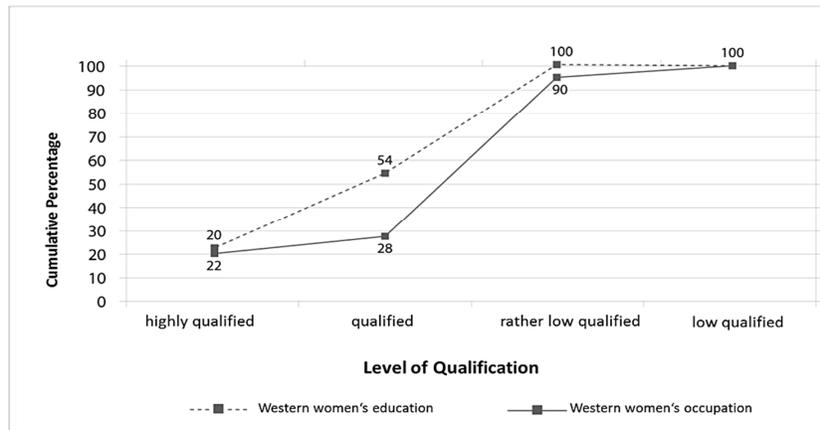


FIGURE 3. Qualification discrepancies among West-socialised women [n = 50] with children under 18.  
Source: (3), (p. 126)

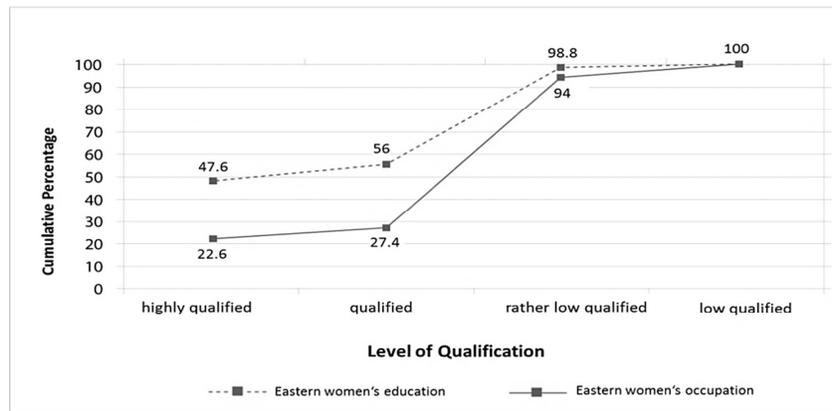


FIGURE 4. Qualifications discrepancies among East-socialised women [n = 84] with children under 18.  
Source: (3), (p. 125)

While West-socialised women more frequently shorten their working hours, East-socialised women tend to work below their qualifications and close to home. Both strategies save time in order to better deal with suburban life.

The differing job locations of East and West-socialised women confirm these results. Whilst, at 58.5%, comparatively few East-socialised women in the research area are in paid employment in urban areas, at 83.1%, most West-socialised women are. Analogously, women from West Germany also commute longer than those from the East (cf. Chapter 4.3.1). West-socialised women thus react to the low provision of suburban part-time jobs by accepting long commutes to get part-time work.

#### 4.2.2. Reproductive work

It is (still) women who primarily do reproductive work. Analogously to men's and women's productive labour hours, gender roles influence who does reproductive labour greatly. Based on all surveyed, women (n = 573) perform on average 23.8 hours/week of reproductive labour, whilst men (n = 409) do 13.3 hours, a significant difference (T-Test result:  $p < 0.001$ ,  $\alpha = 0.05$ ).

As expected, hours spent performing reproductive labour rises with children at home. Whilst childless women (n = 157) perform on average 14.1 hours of reproductive labour, childless men (n = 152) do 12.5 hours. By contrast, the surveyed women with children at home (n = 328) spend 30.8 hours on reproductive labour, whilst fathers (n = 180) do 15.2 hours.

The differences between mothers and childless women are enormous (T-Test result:  $p < 0.001$ ,  $\alpha = 0.05$ ), those between fathers and non-fathers are insignificant. There is a clearly significant correlation between women's reproductive work hours and the presence of children, though nothing similar among men (Women:  $C = 0.4$  ( $\alpha = 0.01$ ), Men  $C = 0.1$ ).

This correlation between reproductive working time and children applies to women socialised in both East and West. The difference in time doing reproductive labour among East-socialised mothers (25.6 hours) compared with the childless (14.3 hours) is correspondingly high (T-Test result:  $p < 0.001$ ,  $\alpha = 0.05$ ). There is likewise significant differences among West-socialised women: childless (15.8 hours) and mothers (35.6 hours) (T-Test result:  $p < 0.001$ ,  $\alpha = 0.05$ ). Among West-socialised men, the childless perform on average 14.4 hours of reproductive labour and fathers 16.2 hours, whilst childless East German men do 12.0 hours, fathers 14.0 hours.

Consequently, we see that the presence of children has no influence on men's reproductive labour hours, regardless of socialisation. Regarding reproductive labour hours, there is no prevailing equality between the genders from East or West.

### **4.3. Gender specifics of work mobility**

The previous section discussed if gender roles and regional job environments influence the work of the suburbanites. This section discusses the characteristics influencing work mobility.

#### **4.3.1. Paid work mobility**

Work mobility is closely connected to the times and form of paid work. Again, the difference in men's and women's commute times is due to gender roles.

The majority of the suburbanites surveyed work in Berlin (62%). The average commute time confirms that most jobs in Berlin entail long commutes: 70 minutes/day for the journey to work, whilst in rural eastern Germany – which includes the Berlin hinterland according to the Federal Office for Building and Regional Planning's (BBR) – the average commute time comes to 51.1 minutes/day (9). That the difference in men's and women's commute times is not due to sex per se is shown by the comparison of couples with and without children at home. In childless households, the difference is negligible: men commute 72.7 minutes/day ( $n = 74$ ) and women 73.3 minutes/day ( $n = 100$ ) – women take marginally longer. Among parents, however, we see gender-specific differences. Mothers in productive work ( $n = 244$ ) commute only 65.4 minutes daily, almost eight minutes less than childless women ( $n = 100$ ) and fathers ( $n = 74$ ) likewise employed. This confirms the often-quoted hypothesis that children indeed have an influence on women's productive labour and commuting patterns, to which fathers are relatively immune (10).

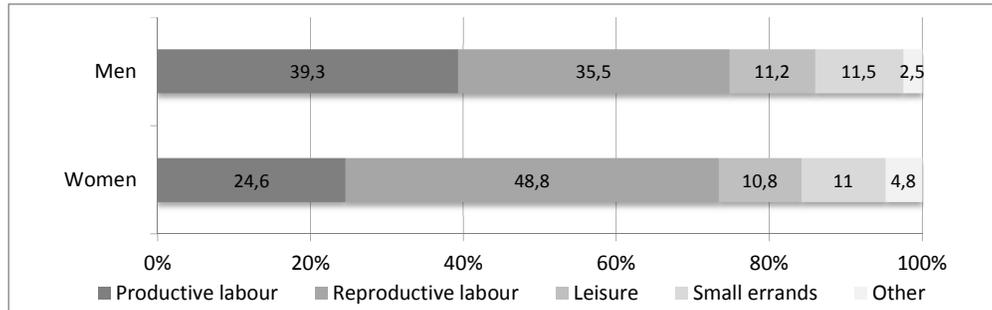
The differences in journey times between differently socialised women, particularly among mothers, are larger than those between gender, employment mode and presence of children. East-socialised mothers ( $n = 135$ ) thus commute on average 61.8 minutes and Western mothers ( $n = 74$ ) 71.8 minutes daily; among childless women commuting times hardly differ between Western ( $n = 31$ ), 74 minutes, and Eastern women ( $n = 56$ ), 73.6 minutes. These differences between women with and without children are significant among Easterners (T-Test result:  $p < 0.05$ ,  $\alpha = 0.05$ ), but not Westerners. These commuting times, varying between East and West-socialised women, correspond with the finding from chapter 4.2.1: that East-socialised mothers tend to work below their qualifications, mostly full-time and close to home (only 58% work in Berlin), whilst West German-socialised mothers prefer part-time work in Berlin (82%), and further afield.

#### **4.3.2. Reproductive work mobility**

We can trace the higher number of trips made by women back to their primary responsibility for reproductive labour and its associated mobility. For instance, men (total trips  $n = 442$ ) make on average 3.7 journeys/workday, and women (total trips  $n = 516$ ) 4.4. The gender-specific divergence becomes clearer when looking at persons in paid work with children, who, as previously mentioned, are under greatest time pressure, with fathers averaging 3.9 trips/day ( $n = 131$ ), and mothers ( $n = 166$ ) 5.1.

The distribution of daily journey times in carrying out individual activities confirms that the proportion of reproductive labour journeys made by mothers in paid work ( $n = 564$ ) turns out to be much higher than those made by fathers ( $n = 321$ ) (Figure 5).

Whilst commuting forms the lion's share of fathers' daily trips, the figure drops among women in paid work, whose commutes form 24.6% of daily trips, whilst almost half are reproductive labour-related trips at 48.8. The proportion of trips for leisure, small errands and other purposes is relatively equal.



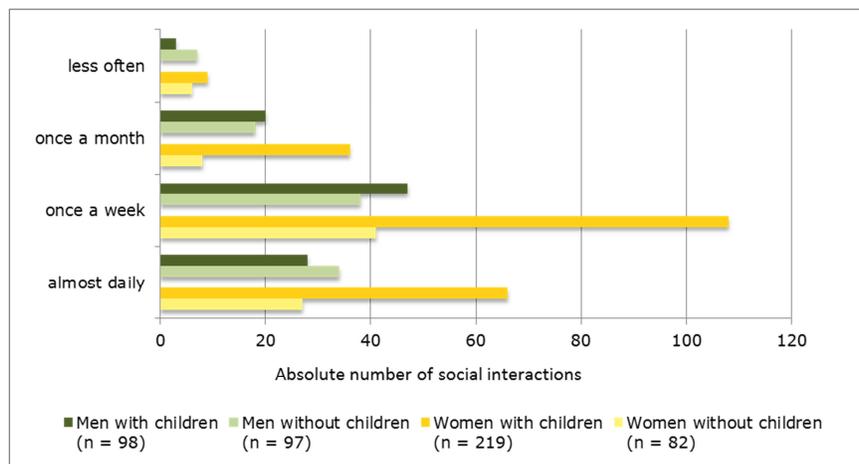
**FIGURE 5. Parents in paid work's workday trip purposes.**

Source: (3), (p. 53)

The time spent by men and women on journeys relating to reproductive labour correspond to the percentages of trips made, men (n = 202) spending on average 26.1 minutes/workday, and women (n = 333) 31.5 minutes. In line with the higher number of trips, men in paid work with children spend only negligibly more time, 27.5 minutes. The difference becomes clearer between mothers in paid work compared to childless women, with mothers spending 37.9 minutes.

**4.4. Gender-specific resources via local social capital**

The empirical findings concerning mobility, work and workplace availability confirm the hypothesis that deficient job provision and services in suburbia creates restrictions in work and mobility, particularly among women. I have also therefore examined whether the resources of social capital can offset this, and whether women thereby succeed in compensating for, or at least in alleviating, the restrictions affecting them. The corollary is whether gender-specific differences may be seen in the forming and use of social capital. Because social capital forms in interpersonal relationships, one may assume that the frequency of neighbourly contacts influences local social capital's development and strength. Precisely in the area of intensive local contact, i.e. getting together with neighbours at least once a week, the differences between mothers and childless women – and between mothers and men, both with or without children – are very striking.



**FIGURE 6. Men's and women's local social contact.**

Source: Own survey 2007. Author's own chart.

Based on contact frequency, the prerequisites of forming neighbourly networks, particularly of mothers, are present. The following examines whether they use this contact as local social capital, thus easing their daily lives, and mitigating work and mobility constraints. This was pursued using interview statements analysis.

It was first examined whether mothers, in terms of local social capital, use their social interactions not only for bilateral exchanges, but rather whether they also interact in their environment in a way that may benefit the collective. I then asked how the available local social capital affects individuals, and what alleviation this represents for women.

Interviews show that mothers' willingness to engage in their local area and campaign for local issues is middling. I found significant engagement in children's welfare among most mothers, with them often being involved in kindergarten associations. There is, however, very little visible readiness to get involved in the local area with the aim of benefitting all residents. Ms Schulte's stated views are typical:

CR: "Is there anything like an initiative which says, 'we have so many children here, we now demand better transport connections?'"

FS: "There have been some attempts, yes, but it all fizzled out, because nothing really comes from that kind of thing."

*Ms Schulte (pseudonym), 40, Mittenwalde, West German, self-employed dietician, spends 20 hrs/week in paid work, 2 children.*

As to whether social contact eases daily life, two forms of benefits that freed up mothers everyday life were seen: reciprocal child care arrangements and car-pooling.

The respondents frequently arrange reciprocal child care, especially drawing on neighbourly support in emergencies. In contrast, when car-pooling, they primarily draw on bilateral friendships. Daily assistance depends on individual social skills.

In conclusion, mothers have greater potential for social capital at their disposal through their local social contact than men and childless women. This is, however, to a large extent not used in relieving daily conditions.

## 5. DISCUSSION AND CONCLUSION

Does living in suburban areas restrict women's daily lives? My answer has various aspects.

The provision of "women's jobs" in the Berlin hinterland demonstrates that suburbia is (still) relatively manufacturing-based. Since the total of all persons employed in female occupations in the study areas is almost 11% less than in Berlin it becomes obvious that "typical" female jobs are underrepresented.

Due to this lack of jobs and resulting longer commutes, we see that women, particularly those with children, often reduce their working hours or work below their qualifications. Significantly, West German-socialised women, in line with the "housewife model of marriage with a male breadwinner" prevalent in the FRG, more often reduce their hours, whilst East German-socialised women, following the "double-provider model" of the GDR, more frequently work in substandard employment nearer home.

Having children tends to have the opposite effect on men than on women, with fathers doing marginally more productive labour. Other studies had already confirmed this correlation, reasoning that founding a family noticeably displaces productive labour hours within the household, with men increasingly in the role of "family breadwinner", often associated with "retraditionalising" gender roles (25), (p. 36), (tr).

We also see gender-specific differences in the division of reproductive labour. Both the original West German "housewife model" and the original East German "double-provider model" have marked gender roles so that women still overridingly perform this unpaid work. As with productive labour, there is a significant correlation in reproductive labour between the number of reproductive work hours and the presence of children.

As with productive labour hours, children impact women's but not fathers' commute times. With the majority of their jobs located near home, East-socialised mothers have considerably shorter commutes than those from West Germany. In step with their prime reproductive labour responsibilities, women also make more trips in connection with it. Mothers therefore make more reproductive labour trips than to productive work.

Amongst women, children not only impact work and mobility but also their embedding in social networks. Correspondingly, mothers establish and maintain far greater neighbourly social contact. In this, children play an important role as a "binding factor" to the place of residence. We again see women do not network better by

virtue of their sex, but that children reinforce traditional gender roles. But mothers do not use this social capital to its full extent to overcome restrictions and alleviate everyday conditions.

Based on the presented results, we see that suburban residence impacts women's daily lives, even under post-Fordist and post-socialist conditions. It became clear that differences cited here in work and associated mobility have not arisen due to sex per se, but have rather been formed by gender roles. Fundamentally, we see the cause of persisting traditional gender roles in men's and women's still starkly differing income levels in Germany and elsewhere, so that household budgeting and finance decisions lead to traditional division of labour. The classic gender-specific division of labour, with its accompanying manifestation of traditional gender roles, are thus influenced at the social, not the regional, level. In the Berlin hinterland it is nonetheless clear that structural context can further reinforce pre-existing traditional gender roles. Alongside the poor provision of workplaces close to home, mothers' prime responsibility for journeys accompanying children can be considered to be a fundamentally restrictive factor in most female suburban dwellers' daily lives, so that the majority of women clearly encounter constraints in this regard due to their gender role. The widespread (feminist) assumption that suburban living often involves the role of "female chauffeur" is thus borne out around Berlin.

The prerequisites for creating local social capital are good but not optimal. Women spend more time on a daily basis in their neighbourhood, which explains their higher amount of social contact. Of interest here is whether they can mitigate daily life constraints with this contact, using it as a social capital resource. I found only a modicum of civil engagement in local issues. It is clear, however, that neighbourly help is often employed, although primarily based on bilateral relationships. Women's local social capital is thus greater than men's, but overall poorly developed. Social capital can therefore only in low measure compensate for constraints stemming from suburban residence that increasingly affect women, particularly mothers.

In order to build local social capital, everyone needs to take part in its production and utilisation. For this to happen, the affected persons need firstly to be aware of their restrictions in terms of location, and should try to develop appropriate strategies that can combat these restrictions. Until now, their (typically suburban) family and privacy-oriented way of life has hindered the development of feelings of solidarity and community with other women. A certain type of institutionalisation in support services would be necessary to make this accessible for all, independently of individual social connections.

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## EXPLANATORY NOTE

Quotes in the above text marked "(tr.)" have been newly translated, for ease of understanding, and are to be viewed in this light and not as existing translations of the originals.

# Voices of expatriate and bus user women in Abu Dhabi (UAE). Constraints and detour strategies

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## ABSTRACT

In the United Arab Emirates, urban development has followed the construction of a dense road network built to ensure economic development and better connectivity across the territory. However, an efficient intra-urban public transport system was lacking until the modernisation of the bus network, part of the Abu Dhabi 2030 Vision (UPC, 2007, DoT 2008). Abu Dhabi has grown to being a place of highest investment of benefits from an oil and gas economy in a car-centric urban development model, in a very highly socio-economic stratification. As a consequence, daily mobility is highly dependent on private and independent modes of transport. How does the non local women population of Abu Dhabi use the network in a transit unfriendly environment? This article aims at investigating the constraints and the detour strategies of the expatriate women in Abu Dhabi using the limited informal qualitative tools available for research.

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**KEYWORDS:** Public transport, Commuting, Abu Dhabi, Choice, Constraints, Women, Expatriate.

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## INTRODUCTION

The issues women may encounter in public transportation are a concern that has been extensively researched by American scholars such as Rosenbloom in 1978 and Blumenberg in 2004, as well as by European scholars like Dupont-Kerlan and Fontaine in 2002 and Fagnani in 1984. The signs of an underway remodeling of the commuting system provided to women has been acknowledged in the USA by Rosenbloom. Furthermore, there is a real scientific interest to analyze the cultural differences that lead to specific accommodations needed for women in public transportation in a cosmopolitan city located in a country where the population is composed of 85% foreigners. On another level, the USA has shown in the past the will to take into account the migrant population in its urban policies and the urban structure in itself (Sanderlock, 1998), whereas the United Arab Emirates has focused on segregating the actual population, but rarely the urban mobility.

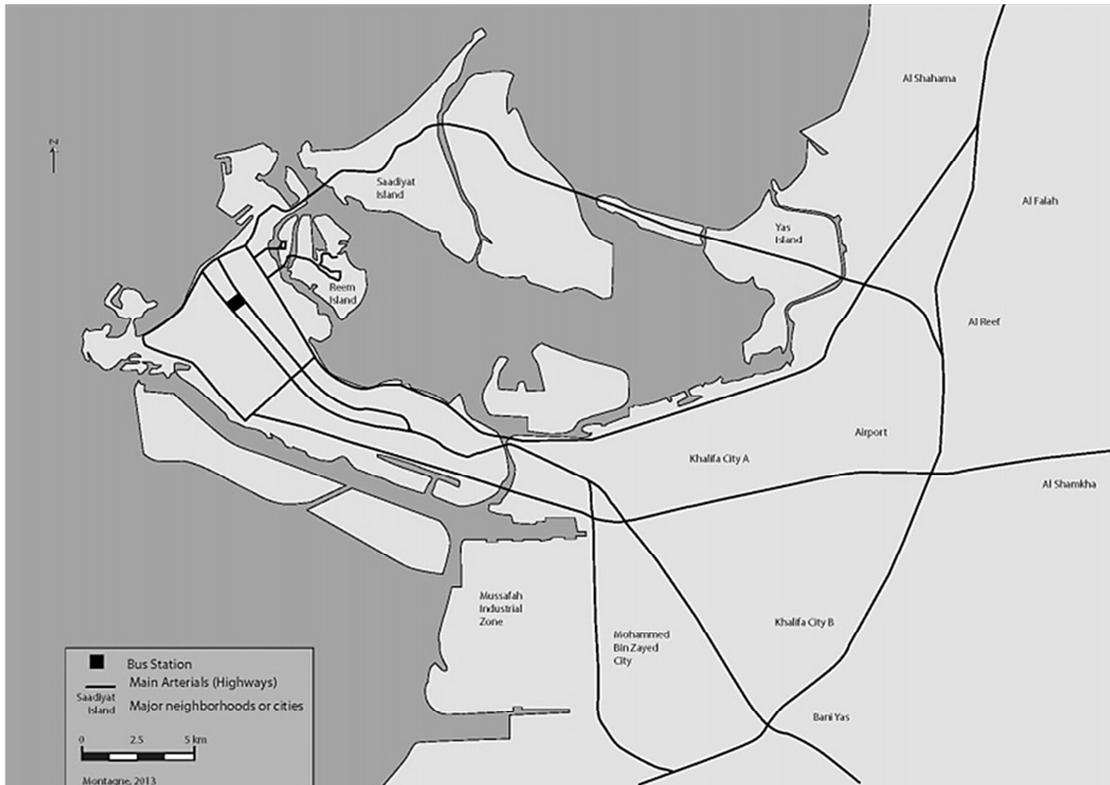
The present analysis aims at shedding light on the non-local group of women in Abu Dhabi and considering the gender issues in the transportation service policy in the United Arab Emirates. Capital of the United Arab Emirates, located on the southern shore of the Arabian-Persian Gulf, Abu Dhabi is a very rich and powerful city, since most of the country's oil and gas production are under its jurisdiction (Heard-Bey). The objectives of this paper are to investigate the constraints and the detour strategies of the expatriate women in Abu Dhabi using the limited informal qualitative tools available for research. After exposing the background and the methodology, this paper will focus on the constraints that were listed in the interviews on social, timing, economical and psychological aspects. The following step will be to list how women have justified their experience on the bus and how they have dealt with the mentioned constraints.

## BACKGROUND

Abu Dhabi is a sprawling city deprived of a real public transport network.

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**MAP 1. Abu Dhabi Metropolitan Area (C. Montagne, 2013)**

Abu Dhabi urban planning strategies favor a modernist approach that gives more importance to car transportation. Because of the tropical climate with long summers, and also because of the need to build transport infrastructures in a vast territory where the population is small in number, the use of a personal vehicle has appeared convenient, more efficient and comfortable to cover long distance trips. Indeed, in Abu Dhabi, driving your own car seems to be a key asset for intra-urban mobility; thus, it also even defines a lifestyle. That is why for most of the daily commutes (grocery, school, workplace, leisure), driving your car around the city is the answer; hence, an intensive use of private cars in Abu Dhabi. Having a driving license makes all the difference for the expatriate women, no matter if they are working or not. Major expenditures are made on transportation infrastructures, in order to build state of the art highways, tunnel, roads and flyovers for a car-oriented urbanscape. Incidentally, the urban mobility is directly linked to the growth of private car number. The DoT figures reveal that the number of vehicles registered in Abu Dhabi has increased 49% between 2006 and 2008 (DoT, 2009: 17). The need to rely on the car has also increased accordingly. In 2008, more than 48% of the overall trips are made by car.

The architecture and urban design of the city has followed the same trend and has favoured development of detached villas. The suburbs are sprawling and form a landscape of undefined cities, as Bani Yas, Khalifa City A, Khalifa City B (Map 1). Commuting between the main island, where most of the jobs are located, and the other locations, where more and more residents have to resettle, has become a daily routine for most of the Abu Dhabi population. The North-East of the city is dense and driven by an urbanite lifestyle in the neighborhoods, called Tourist Club Area, Al Marzakiyah, Al Khalidiyah and Medinat Zayed. There are some recreational structures (movie theater, bookstore, malls), grocery stores, specialized shops (house appliance, electronics), and diverse workplaces. But everywhere else in the city is made of a low rise and detached villa urban pattern. Middle rise and high rise buildings are less and less frequent once past 15<sup>th</sup> street (Map 2). For the majority of inhabitants, having an extended mobility thanks to their car is a must for any of their daily needs. Consequently, only the driving license holders, wealthy enough to possess a car, have all the freedom of action to move and access the city. What Y. Elsheshtawy has written about Dubai that “[there is a] *feeling and an atmosphere of despair in the suburbs*” (2010) is palpable in the streets of Khalifa City B, where the only way to reach the next suburbs is to take the only bus that passes by every hour.



**MAP 2: North of Abu Dhabi main island**

(C. Montagne, 2013 after Cadène & Dumortier, 2012)

### ***Lacking a structured and modern public transport network until 2008***

More than a third of all the commutes are made through private company buses (DoT, 2009). As such, public transport remained undeveloped until 2009 and was rather associated with low status, low paid Asian and Arab migrants. During the past 30 years, the city bus network has had no schedule and was only operating in a very small area of the urban space. Only 100 old buses were on duty (Table 1). This former public network gave a negative image of the service to the residents. It also led to the idea that public transportation was only suitable to the poorest expatriates.

**TABLE 1. Bus office statistics showing an increasing passengers trips rise**

	2009	2010	2011	2012
Number of bus passengers	33 000 000	58 000 000	64 000 000	67 000 000
DoT operated bus routes in Abu Dhabi	25	35	40	51
Number of in service buses	615	615	630	575

(DoT, Bus office, January 2013)

A recent transport policy was drafted in 2008 for the *Surface Transport Master Plan*, an official document approved in 2009, by Sheikh Khalifa, ruler of the Abu Dhabi Emirate. The goals and the objectives pursued by the STMP insist particularly on “*protecting and enriching people’s lives by maximizing safety and access to opportunities for all*” (DoT, 2008: 6). Today there are more than 500 buses in service, operating on 50 different routes, in the Metropolitan Area of Abu Dhabi. The current system is offering a large choice of destinations to all the districts of Abu Dhabi, for the population deprived of car mobility. With constant improvement, brought by the Bus Office and a small team of transportation engineers, as well as urban and transportation planners and a couple of short term consultants, the network counts now more than 100 lines on an urban and suburban coverage, and also more than 50 million passengers a year (*The National*, 2013). The network is covering the main avenues and the most populated neighborhoods of Abu Dhabi. The two following maps describe precisely the areas served by this public transport network (Map 3). The objectives are also to offer a minimal service of one bus every hour, while ensuring that on some of the main lines (100, 105, 405, 305) there is 24 hours service (Map 4).



MAP 3. Bus Network Plan in 2013 in Abu Dhabi, Reem, Saadiyat Islands and the Metropolitan Area (DoT, April 2013)



MAP 4. Bus Network Plan in 2013 in Abu Dhabi (DoT, April 2013)

Immediate positive impacts have been noticed by all the residents who were living in Abu Dhabi before the modernization of the bus network. One of them mentioned that when she went from the Sport Zayed City bus stop to Mussafah Shabiyat 10 to pick up her laundry:

*“before the new system, if I had missed the company shuttle, to go from my home to my office, I would have had to go there by shared taxi, which used to smell very bad, from Etisalat Tower (across Electra street and Airport road). From there, I used to take another shared mini-bus which used to take me to South Bani Yas.*

*Then, I had to take another shared mini-bus for the last 5 km to reach the neighborhood called, Al Neda Al Jadeeda. The total cost of my transportation was over 50 Dhs [10 euros]. As a matter of fact, I rarely missed the company shuttle. And I was lucky to have the company providing it”.*

### **Abu Dhabi's multi-ethnic urban population and highly stratified on busses**

STMP is expected to be a success in the modernization of the bus network because “at first this seems a big obstacle to overcome, but less so when it is considered that much of the expatriate population is accustomed to using public transport in their home countries” (STMP, 2009: 22). Clearly, the argument refers to the vast majority of South Asian expatriates, namely, Indians, Pakistanis, Bangladeshis and Nepalese, but also to the East Asian migrants that are the Indonesians, Malaysians and Filipinos. Indeed, like other countries of the Gulf, the United Arab Emirates host a majority of expatriates. The capital of the Arab Emirates federation counts 75% of foreigners in its urban population. Indeed, according to S. Khalaf, the Gulf Oil City is “a cultural kaleidoscope of urban lifeways and identities, all with their different nationalities, religions, physical types, dress, food, music, smells, and even localized suburban environment” (2006: 259). This cohabitation of multiple nationalities is respectful of differences in ways of life and in attire. This can be observed in public spaces like the malls (Camelin, 2012), in the bus and in the streets.

The essential feature of the Gulf city is to be a “highly stratified society” (op.cit.: 256) where “laws and politic of exclusion maintain sharp economic disparities that favor nationals and render large numbers of immigrants susceptible to exploitation” (op.cit.: 256). Consequently, there are strong socio-economic inequalities between residents. Disparities appear more clearly as the lower-class faces less opportunities to access the city. The working class ranges from the Filipino engineer to the Malayalam nurse, whose respective salaries range from 1500 Dhs (€300) to 5000 Dhs (€1,000). Wages are indexed on nationality (cost of life) in home country, which implies, that for the same job (sale assistant, administrative assistant etc.), an Egyptian, a Chinese or a Filipino will earn a different salary that ranges between 3500 (€700) to 7000 Dhs (€1,400). A return ride between the suburbs and the city center costs daily at least 10 Dhs (€2) on the public buses, between 20 to 30 Dhs (€4 to 6) on private mini-buses and approximately 80 Dhs (€8) for a cab ride. Besides, some workers are compelled to take the bus, because of their contract, in which transportation fees are not included, or because they cannot afford to buy a car<sup>108</sup>.

Although, an important fact is the overrepresentation of expatriate men in public places and public buses that reflects the unequal demographic balance in the UAE. Knowing that expatriates are hired to build infrastructures and skyscrapers, the immigration policies favor issuing visas for men coming from the Indian subcontinent. The immigration rules are not in favor of family reunification, and vary depending on the monthly salary and the size of the accommodation that is provided. Thus it is made very difficult for spouses to join their husband in the UAE (Camelin, 2012). Only one expatriate out of five are women, according to the UAE Statistic Center (2010). A great number are working in the service industry, principally in administration, retail or in the health sector. According to estimations, it means that about 250,000 to 300,000 foreign women live and work in the Abu Dhabi.

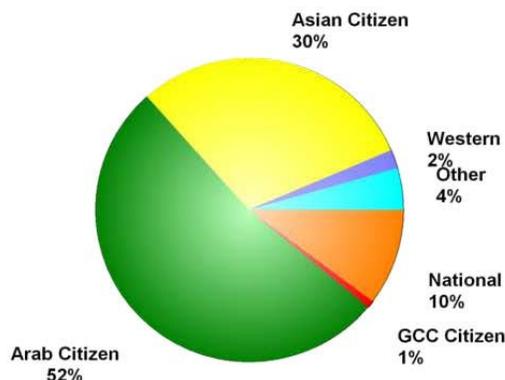
Given the policy framework and its objectives, the first surveys about customer satisfaction of CATI 2010 and 2012 (UAE, Al Ain University) that have been conducted on bus passengers' feedbacks show that less than a quarter are women – the same as in taxis – and that they are essentially young and single<sup>109</sup>. Women are underrepresented as bus users, since they only represent 10% of the passengers, which is only reflecting the socio-economic strata of the Abu Dhabi non local. Between 75 and 85% of the passengers are men, based on a group of interviewees of 1,500 people during the 4 waves of the survey (Figure 1). This strong presence of men

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<sup>108</sup> It is important to underline that national policies regarding the employment of Emiratis usually place them in the highest position; therefore, they do not take the bus. The Westerners benefit from higher wages and then do not ride on city buses. It is rare to see any of them taking the bus, since they can afford higher expenses (owning a car, etc.).

<sup>109</sup> This survey has been conducted by CATI, a consulting office managed by a sociology professor from United Arab Emirates University base in Al Ain. It is a survey that has been requested by the DoT, one year after the implementation of the modernization and which mainly aims at a satisfactory survey, though we are using some of the output in framing our research. Based on 2,802 interviews with 2,521 users of public transportation means and 283 non users, meaning just standing next to a bus station, the survey has proceeded with most of the questionnaire done face to face in public areas in a 3 month length period. The questionnaire is mainly focused on the used transport and on the detailed satisfaction questions.

in the bus, which only reflects the demographic unbalance of the UAE, is a social constraint for women, who would hesitate to take the bus and sometimes be discouraged to use this transportation system.



**FIGURE 1. The nationality distribution in the public transport network (taxi and buses) in Abu Dhabi**

(DoT, CATI, ARA Research survey in 2010, data collected in 2013)

### ***Similarities and differences with other gulf countries***

Contrarily to what A. Le Renard observed and reported about Riyadh (Kingdom of Saudi Arabia), there is no such thing as strict gender segregation or Islamic laws implying that women are banned from driving or that they cannot take the bus and subway with men (Le Renard, 2006: 184). In the United Arab Emirates, there are no religious police that monitor and control women’s access to the public space. Arab expatriates and local young women have their family still closely controlling their daily commuting, although the legal, social and cultural environment allows women and young adults to drive and be independent, according to their age. In Abu Dhabi, the situation is that most Muslim women do not work outside their homes, so their movements are limited. There is little occasion for them to go out, for grocery shopping, to drop and pick up their kids or to visit their friends. Nevertheless, A. Le Renard pointed out the social status and the nationality as an important factor of the possibility of mobility or the accessibility to public spaces in the urban space (Le Renard, 2006: 34).

## **METHODOLOGY**

While very little research was conducted about the United Arab Emirates, lately more and more ongoing works and papers are written from the point of view of different disciplines including anthropology, social history, gender studies and urban planning on the matter. Yet, the question of the dependence on public transport on a daily basis for expatriate and local women in the capital of the United Arab Emirate Federation has not yet been extensively researched.

The methodology followed for this paper was on a three steps process. As first I have gathered all information available on gender studies in public transport in Abu Dhabi, I have then carried out an open survey with a limited number of accessible women, and last I have proposed a plan for further, more rigorous and in-depth research.

This paper reflects an exploratory qualitative research, conducted in February 2013, in Abu Dhabi, based on 12 interviews and observations of women with different educational backgrounds, social status, age and nationality, and who are short or long-term residents in the city (i.e. the Table 2 below). This was done trying to respect a significant sample of bus users regarding nationality and social status, changing the suburban and urban destinations. The interviewed women were met at bus stations. They decided to share a part of their daily life with me, a bus ride, a meeting, a coffee, a lunch.

This study exclusively sheds the light on expatriate women in Abu Dhabi, since they are often less wealthy than Emirati women, thus their need to use public transportation. The items include a set of generic questions regarding their backgrounds, their daily and weekly mobility patterns, the time and money cost. 50 women were asked more questions on their issues and on their knowledge of the city, as well as on the possibility they have to use the bus or not. The set of questions was quite wide to allow the interviewees to answer

spontaneously “how did you make the commute in Abu Dhabi when you arrived?” “how do you go from one place to another today?” “how much do you spend?” “what is your feeling about the network?” “how do you feel in the city?”.

**TABLE 2. List of interviewees (lifecycle, age, place of interviews)**

		Nationality	Family status	Neighborhood	Age	Life trajectory	Place of interview	Length of interview	Shared Ride on bus
1	Clairol	Filipino	Single administrative assistant	Tourist Club Area, Hamdan Street,	27	Born and raised in Manila province	In her shared room	1 hour	Between Zayed Sport City and Lifeline hospital
2	Amal	Egyptian	Single Sale Assistant	Mussafah, shabiya 12	35	Born and raised in Cairo	In her shared room	1,5 hour	From Dubai to Abu Dhabi, from Mussafah to Mohammed in Zayed City
3	Ese	Nigerian	Married, 2 boys Housewife	Tourist Club Area, Mina Road,	38	Born and raised in Lagos, lived in Kuala Lumpur	In her flat (Mina Road, TCA)	2 hours	Between Abu Dhabi Mall and Hamdan Street, Electra and Mina Road, Mina Port and Marina Mall
4	Hendang	Indonesian	Married, 2 children who are adults Housewife	Al Khalidiya	55	Born and raised in Jakarta, lived in the USA	At the bus stop of Marina Mall	25 min	None
5	Rania	Jordanian	Married, 2 boys Housewife	Al Marzakiyah	32	Born and raised in Aman, lived in Damascus	At the bus stop of Marina Mall	20 min	None
6	Shalini	Indian	Married, no child Housewife	Manasir	34	Born and raised in Bangalore	In her home (Manasir, Muroor Road)	1 hour	From Al Wahda Bus Station to Al Muroor and 25 <sup>th</sup> street
7	Nabila	Sudanese	Single Sale Assistant	Al Marzakiyah	22	Born and raised in Kharthoum	At the bus stop of Marina mall	30 min	None
8	Ming	Chinese	Single Sale Assistant	Tourist Club Area	21	Born and raised near Beijing	At the bus stop and during the ride	30 min	to Mussafah Industrial Area (bus 115)
9	Mariam	Algerian	Married to an Emirati Housewife	Medinat Zayed	56	Born and raised in Algeria, lived for 9 years in Abu Dhabi	At the bus stop on Baynouna	20 min	From Al Bateen (Baynouna and Falah Street) to Khalidiya Mall
10	Nour	Filippino	Married to an Emirati Housewife	Bani Yas	22	Born and raised in south of Philippines	In a café at Al Wahda Mall	45 min	None
11	Fatema and Nour	Sudanese	Single Students	Bani Yas	21 and 20	Born and raised in Abu Dhabi	At the Al Wahda Bus station	20 min	From Al Wahda to Bani Yas (405).
12	Sura	Yemeni	Single Working in a nursery	Bani Yas	19	Born and raised in Abu Dhabi	At the Al Wahda Bus station	20 min	None
13	Mignon	Filippino	Single Fitness trainer	Muroor	30	Born and raised in Manila province	At the Al Wahda bus station	25 min	From Al Wahda to Mussafah Industrial Area (bus 116)

The limits of this study are due to our very little understanding of the Arabic language and to the need for digging more with the non-English speakers. Also, the little information about the Emirati women makes this study hard to compare with our findings on women.

## **WOMEN'S EXPERIENCE OF COMMUTING IN ABU DHABI**

### ***Social and psychological constraints***

#### **"I always see men [in the bus]" (Ese)**

As one said, if it took her so long [almost 2 years] to try to ride the bus it was because "[she] *always saw men* [in the bus]" (Ese). She meant South Asian labor men. Ese mentioned that between 2006 and 2008, she had to endure a lot of constraints in moving around her home, located on Mina Road, in the Tourist Club Area. Until the introduction of both Silver Taxi and DoT buses at the end of 2008, she was "*initially skeptical*". She thought "*I can't use this bus*" because of the overrepresentation of men in the public buses has been surveyed by several studies commissioned by the Customer Satisfaction division of DoT. The strong presence of men in buses, at the bus stops and bus stations is most certainly a reflection of the mentioned unbalanced demographic, along with nationalities and socio-economic differences. This is why the Department of Transport has enforced a special section at the front of the bus for the women.

This presence of men in the bus gives a feeling of uneasiness to the women bus passengers, because they are in massive numeric superiority and also because of their living conditions, far from their families, only amidst men and co-workers. Persistent gazing, the uncomfortable feeling of waiting for the bus surrounded by men, the lack of lights near bus stops create a feeling of insecurity because of a numeric insecurity. The gaze of some men can lack respect and express a need for women's company, as a result of their condition of living far from their family for long years without the possibility of travelling back home or having them visit.

#### **"if you're a lady, you need to sit in the front" (Clairol)**

Indeed this uneasiness felt by most women, due to the unbalanced gender distribution of the resident population, acts as a constraint for most women, especially in the feeling of insecurity. Private mini-buses are another mode used as mitigation against the slowness of the DoT buses: operated from the very same central location, that is, the Al Wahda bus station and from Medinat Zayed bus stops. They are privately run and they connect southern suburbs (Mussafah, Bani Yas, Shamkha) for the labor that lives downtown, in cheap but conveniently located accommodations, in the dense and busy city center. These private mini-buses are very convenient, more flexible than the bus; they are also faster and can drop at the exact location of the final destination.

Though for women, it is not as safe as the public buses. Indeed, when one of our interviewees had to go to Mussafah for a job interview, she could not wait for the public buses to drop her; besides they are packed full during peak hours be it morning or evening. As Clairol told us "*It is also hard to take the sharing taxi. Because it is full in Medinat Zayed – Murror Road*". But she had no other choice than taking the private mini-buses, and she followed very simple and obvious rules according to her: "*Of course if you're a lady, you need to sit in the front, because you'll go with the Pathan, like that. That is the thing, this is the problem. That is why some of the Filipino, even some other nationalities, don't take the sharing taxi. Because they are afraid of those Pathan*". As she told me, "*That's what my cousin advises me even I'll take sharing taxi. It is better to sit in the front*". Sitting in the front next to the driver, where there can be only two passengers is the unsaid rule that applies to women to avoid unwanted physical contact. The fear that Clairol mentioned has nothing to do with physical aggression, or so she told me, but "*just the problem is the way they will look at you. Just that thing. They are very sensitive. You don't want to go near them*".

#### **"Better to be safe than to be sorry" (Shalini)**

Some fears are linked also with the fact that the expatriate women spend a long time in their house, so they feel very long time outsiders of the city. If they are housewives, they have very few options for going out of their home, and if their husband is not connected a lot with social networks from work or from the community, they can have a hard time adapting to their environment. One of our interviewees, although very likeable and friendly, had not visited any of the touristic places after nine months living in Abu Dhabi. She had never left her neighborhood called Manasir, near Mushrif Mall and she feared the city center. She once told me "*you know, being new to this place, I am being extra cautious, because I don't want to get lost, because it is again difficult*".

*to talk to people and ask them the right direction".* She was afraid that if she got lost nobody would be there to help her find her home again. She does speak fluent English and is very well educated. Being born and raised in Bangalore, India, from a middle class family, she used to drive a two-wheeler, she describes herself as *"independent"*, because *"I drive"*. She told me, *"but here we are totally dependent on the public transport. So I am extra cautious on them"*.

#### **"Dependent on public transport"**

As Shalini says, living in the UAE means being less free in one's daily life. For example, as most of the urban population come from the Indian subcontinent, South-East Asia or East Asia, their common mode of transportation is a two-wheeler. But as it is either very difficult for men to get the driving license and very dangerous to ride a motorcycle on most of the road networks in Abu Dhabi, most of them become captive users of public transportation. They become here *"totally dependent on the public transport"*.

Most of the interviewees are praising the current network, even the women who have not really understood how to use other lines than the routes between their home and their places of work, study or leisure (visiting family, retail shopping, grocery shopping, cultural or sport activities). *"It is so much better now"*, Ese tells us, every time we ride the bus with her or that we meet for an interview about her fine knowledge of the several bus routes of the northern part of Abu Dhabi Island. Indeed for her and for all the interviewees who were residents in Abu Dhabi prior to 2008 and the modernization of transit:

*"Before we had then the white and gold taxi. The drivers are so arrogant. Most of time there are cheats. Sometimes the meter will give you a different price. Sometimes you pay your fare and they don't want to give you change. And most it is difficult to get a taxi, you see people standing on the road waiting for a taxi. It was difficult, very very difficult. Very. If you have to go somewhere you have to come out early. Like if I go to groceries shopping at Abu Dhabi Coop sometimes I can wait for hours to get a taxi to come home and my place is very near to the Co-op. but because I can't carry all my shopping so I have to wait for the taxi"*.

### ***Time constraint***

#### **"Schedules and time length"**

One of the main constraints raised during the interviews by the women is the lack of frequent schedules, which is the main constraint either for the ladies who are housewives or for the working ladies. It means indeed that they have to plan ahead all their movements, to be back home in time to take the children, or get the meal ready for their husbands.

As Hendang, an Indonesian, who is 55 years old and married to an American, whom I met during my survey at Marina Mall, dressed in sport wear, told me, she just left the yoga classes at the Sport Club of Marina Mall and she had to take the bus coming in 10 minutes to be on time and be there when her husband comes back for lunch. As she told me, she can avoid using the luxury of taking a cab and waiting for the bus because she *"prepared lunch this morning before leaving the house"*. The same discourse is shared by Rania, a Jordanian lady met just after a book club coffee at Marina Mall. She likes to come and go with the bus to save some money but mostly because she has time and she finds the bus very comfortable compared to what she used to ride in Amman. She enjoyed riding the bus and taking time to travel across the city, for a very cheap price, *"only 2 Dh"* and *"I am back home, instead of paying 50 to 60 Dh"* and *"it is direct"*.

Nevertheless Hendang, Rania and Ese mentioned the slowness of the bus as one of the constraints that they have to cope with to use the bus. Rania says *"the only disadvantage is that it takes a long while"*. Indeed the several stops, the driving conditions of the bus in dense road traffic, and the spread out urban morphology make the bus quite slow when compared to the so-called fast and efficient silver taxis which are unaffordable for most of the unemployed women, housewives, and whose imperative is to save money.

#### **"I take sometimes the taxi"**

Some young, working, unmarried women, like Nabila, who came from Khartoum five years ago to work as a sales officer in a shop in Marina Mall, are claiming that they take the silver taxi, because they are *"always late"*. The real reason is rather that she is hosted by her aunt and she spends the money saved this way in fast transportation. She tells me *"even my family prefers that I travel with taxi"*. Indeed it shows that she is not that free and independent; besides her work place, her neighborhood and the coffee shop she goes to with her cousins with the family car, she does not go out often alone. Contrary to Nabila, the story of Ming is very

different. Being only 22 years old, she came to Abu Dhabi by herself to work in sales 2 years ago, and she wants to shift now to an office job. During her day off, she always pays a visit to her boyfriend who lives in Mussafah. Because she told me *“I am losing time waiting for the bus 52, I am always hiring a cab to reach the bus station and from there I wait for the suburb bus 115, which takes me to Shabiya 12”*. In this case, the constraint that is the valuable time of her day off is more important than the 12Dh paid between her accommodation on Hamdan street and the bus station.

Indeed most of them mentioned that, when and only if they are *“in a hurry, they take a taxi”*. But *“it depends on your finances too”*, says Ese. *“It depends on how much you have. If I have time I go by bus, if I have the time. If I am not in a hurry I can use the bus. But when I am in a race, I have to be home, like my boys are coming back at 3 [pm], I can’t be patient enough to take a bus. So I use the taxi.”*<sup>110</sup>

Because a taxi remains an expensive mode of travel, when it is used daily, it is not obvious that it is the only way of commuting for most of the population living in Abu Dhabi. Hiring a cab is indeed costly, in a city where wages are certainly higher than one could get back home, but still all the other expenses aren’t cheap either. Taking a taxi remains a luxury.

### ***Economic constraints***

#### ***“You got to move according to the money in your pocket”***

In the discourse of middle-income expatriates, it is very clear that such financial issues as purchasing, insuring, maintaining a car is a high constraint to their individual mobility. An interviewee, working as a sales officer, born and raised in Kenya told me once *“if you got no money, you got not choice, but to wait for the bus, dear”*. The budget allowed for their mobility is a large motivation to their mode choices.

As this middle-age Kenyan told us, *“you got to move according to the money in your pocket”*. Indeed it is the major constraint to her daily mobility and made her dependent on the bus, waiting for hours at the Al Wahda Bus Station, when there is only one bus an hour, and because her company does not provide a shuttle to cover the mobility between different offices across Abu Dhabi Island. She was recently fired from a first job, had to buy her visa to remain in the country and start working for this new company. Because of the distances she has to travel, and the difficulties that she has to face since the public buses do not take her where she needs to go in the Mussafah Suburbs because there are no public bus connections, she spends more in private mini-bus *“they rip us off”*.

#### ***“having another other option than taxi”***

Sienna, a Filipina and Selma, an Ethiopian, both working for a famous shop, told me that they preferred to save their money and use the bus since they *“had another option than using the taxi”*, *“which was not the case in 2006”*. Ese, whom we have met on several occasions tells us that the public transport in Abu Dhabi is so *“great”*, it is passing under her home and taking her straight to *“Marina Mall with only 2 Dirham”* in about 30 minutes of driving in an air conditioned bus. She finds *“that it [is] effective, cheap and very convenient”*. She goes on and describes herself as someone who *“like[s] going out. I am not a house person. I like going out. What is the cheapest way of going out? It is the bus. So I use the bus”*. Going out of her place for a cheap price is the main utility of the public transport network.

Money is the reason why so many of the expatriates are living in Abu Dhabi. When Clairol realized that she was not saving enough, at the beginning of her stay in the UAE, she took drastic measures. She told me *“when the times passes, OMG, oh my money it is suddenly gone because I always took taxi. So we try to walk also”*. During her day off, Clairol, (27 years old, an engineer who landed in Abu Dhabi 18 months ago from Manila) and her friends and flatmates very often go to *“Marina Mall and this Heritage Village, near Marina. We always*

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<sup>110</sup> For example, even holding a car driving license from Nigeria, and having the possibility of transferring it to an Emirati Driving License, Ese, has never felt the need for a car-driven mobility. Indeed, even when she left Nigeria for the first time to settle in Malaysia, *“in 2002. We had a car. But I wasn’t driving. Just my husband was driving the car”*. She used to use only taxis to commute for her grocery and her retail shopping, *“So there was this time in Malaysia, you had the phone number of the taxi and the taxi will come and pick you. So I was using that for close to 2 years”*. Her mobility was suddenly getting better when she *“got a maid and then she introduced me to public transport system and it passes right next to my home; the main road”*. She found it *“so efficient and conducive. Very net and very efficient.”* Drastic changes occurred when she came to the UAE in 2006 that she sums up in *“initially it was terrible”*.

go to the Park. Whenever we go to the park, we take a car with our friends, and when going to the bar, we take our car. Whenever we are going to Corniche we take taxi. I know bus going there, and taxi coming back. Even in fish market, there is a bus also. So we take the bus". There is a real need for coping with the expenses and the new regulations<sup>111</sup>.

## **WOMEN AND THEIR COPING STRATEGIES**

### ***Detour strategy: choosing where to live or to work***

#### **"Tourist Club Area is a lively nice place to live"**

Among the constraints dealt with by the women of Abu Dhabi City with the public transport, there are the difficult connections with their final destination and the length of the commute. Indeed, an interviewee told us how she and her flatmates spent in average 2 hours and a half to 3 hours a day in the bus commuting and around 20 to 30 Dh a day. But when she is asked why she would not rather live closer to her office in the area called "Bain Al Jisreen" (between the bridges), on the mainland, she answers "*here, in nice, you can see a lot of people that you know, there are a lot of buildings, and your friends are here, your colleague are here, but in Bain Al Jesrain, it is quiet, and then, still now, I feel that in that area when it's dark I won't feel safe*".

For Selma, the most important budget expenditure goes into housing, she prefers to live far from her job, a tiny room, but on her own. As for travelling across the city and commuting to work, she rides the public buses and walks to the Corniche or along the main streets, "*Khalifa, Hamdan or Electra Street*". Sienna shares a similar daily commute but chose to live with her "*kabayan*", her compatriots, in a large room, in which some partition has been made but where she beats homesickness. But for the two young working girls there is a choice for saving money and using the bus.

This discourse was surprisingly the same with Ese and her family, as she told:

*"When I came to this country, initially a friend of mine was looking for an apartment for me in Manasir area. So I did like that she lived there too. I would like to live around there. I noticed it was difficult to find a taxi in this area at that time [in 2006, only Gold Taxi were operating] and the bus has not yet started operating. So very difficult. Oh, my husband told me it is better if 'we stay here in the Tourist Club Area. It is a location where you can move to any part of the city'".*

#### **"Workplace easily accessible by bus"**

As for Sura, a Yemeni young woman, born and raised in Abu Dhabi, aged only 19, she had no other choice but to find work preferably near her newly married sister's home, near Al Wahda Bus Station. So she can work and save money with the hope of entering a university in Abu Dhabi. So that when she prefers staying at her sister's place, because she is tired and does not want to take the bus again, she can just stay in the city, which she rather prefers.

### ***Detour strategy: convincing herself bus is much better here than in their home country***

The mobility offered by public buses is nevertheless endured by contradictory discourse. In this matter, some of the interviewees, like Ese, exaggerate the freedom provided by the bus, and forget that a few weeks ago they emphasized the slowness and the economic conditions that were ruling her choices, and announced that "*even, during the night, I want to go to the meat market in Meena [the port], I can leave my house at 8 o'clock, buy the meat I need for the dinner, and take a bus back.*" This is indeed a quality of the network operated in a city where outer spaces are entirely under surveillance and closely monitored by cameras almost everywhere. In the case of the fish or meat market, it is very lively during the night, where it is used as an open air restaurant where meat and fish can be bought and barbecued, and then eat on in one of the parks of the city.

Another interviewee told me that she found interesting that in the bus there "is a lot of preference to women. They want to make sure that women are safe. And then, this is something I found quite safe, when I

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<sup>111</sup> Indeed parking places available have shrunk and fines applied are expensive on the Corniche had become more and more difficult, so it is advised not to take a car to reach there.

am travelling alone so I am sure it would not be too much of a pain"; In brief, the public transport is nonetheless acknowledged as a much improved public transport, compared to the one back home, and as such most of the interviewees express their gratitude to the system and accept the challenges and the difficulties raised by the bus utilization.

### ***Detour strategy: bus as a free way to experience the city***

Riding a bus, understanding the map network gave the women met on the bus and at the bus stop the freedom to experience the city and to become familiar with Abu Dhabi. Ese told me *"now I know all buses and I can go everywhere"*. Most of the housewives I have met and interviewed, Hendang, Rania or Mariam were insisting on *"how cheap"* the public transport is and how *"easy"* it is to move around if *"you have time"*. All of them could afford a taxi but they prefer to save and wait for the bus. The advantage of going out more often and more freely is a major tool to appropriate and learn how to move in the city. This is giving them a better understanding of the city even if they usually use only one or two bus lines; with the experience of the network and more opportunities offered, they can use more lines. Once viewed as a constraint, the bus is also understood as an opportunity, a *"free"* way to experience the city.

Even if it not an option, but rather the only affordable mode of transport, bus riding can be also presented as a way to see the city, to travel for nothing and getting to see the buildings, the architecture and the organization. Shalini<sup>112</sup> told me once, while we were talking about the bus network in Abu Dhabi, that she liked that it could take you anywhere across the city, that it was as good as Volvo buses of Bangalore Municipal Transportation Corporation. She enjoyed much her first ride, as she told me *"the first time I took the bus, it was a nice feeling because I could see the buildings; and it was a right hand drive, whereas in India it is left hand drive. So I mean, the road, it is the opposite. It was different, it was a good feeling and I learnt a lot"*.

Indeed most of the women we talked about, because they had to make a bigger effort to know the city, the bus network and the way to get from one point to the other, have started making Abu Dhabi their own home, and this is a detour strategy in coping with economic, time and social constraints. The better they know the city through the bus network, the easier it is for them to extend their radius of weekly trips. As an example, Ese has started social working at the Catholic church Saint Joseph, since she understood how to get there with the bus 32 or 52 depending on where she was in the city. She told me once, *"it is easy. I am familiar. I know where I am going. I know the bus routes now."* Knowing the bus routes helps conquer up their loneliness of staying home due to economic issues.

### ***Detour strategy: how to be independent?***

As an interviewee told us, most of her colleagues prefer to live in the Tourist Club Area, which is a nice and vibrant neighborhood in the north of the Island. As most of them had their office moved out and settled on the main land, either on Al Ain Road in Mohammed Bin Zayed City or in Mussafah, they organized themselves with a paying car-sharing. One of them had to pass her driving licence and bought a car, to drive workmates for a limited monthly sum. This is paying car sharing; it is better to organize it with friends and colleagues rather than with strangers for *"safety"* reasons. That is the solution found by Clairol, *"I will share. There are some Filipino. You know there are some people, who are living in AD, here in AD, and they work in Mussafah, so they go with them every morning and they just pay 200 Dh a month. It is a private car. They have a renting contract"*. This contract is not written, it is *"just verbal. Like everyday you'll take me to Mussafah"*.

Some other students have organized a diversified commuting mode. Two Sudanese, both 20 years old, Fatema and Nour, explained how they commute 3 days a week between Bani Yas, a southern suburb of Abu Dhabi, and their private college located in Satwa. One member of their family drops them at the bus station in Bani Yas, they change bus in Al Wahda Bus Station and once they arrive at World Trade Center stops, another friend who has a car comes and picks them up. Most of the time the same friend drops them back at the bus stop in Jafiliya Seaside, and most of the time they ride back with the bus to Bani Yas. This commuting is possible because there are two of them, so they are authorized by their parents to have this much freedom.

Another woman, from Mumbai, living for the past 10 years in the UAE, just got married to an Indian man. She is the mother of a 3 year-old girl, Neena, and told me that after working a very long time in a saloon, she

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<sup>112</sup> 32 years old, post graduate in Health and Social Studies from a University in Bangalore (Karnataka).

chose not to work anymore. But then because she lives in Shahama<sup>113</sup>, she needs a car to travel across the city. So, once a week she takes the only bus route that crosses Abu Dhabi southern Metropolitan Area to take her driving classes. She hopes to get a driving license soon “*Insha’Allah*”.

## CONCLUSION

This article describes and analyses how expatriate women of Abu Dhabi use the modernized public transport and acknowledges the improvements in mobility of this car-driven city. There isn't a “*quiet revolution*” in women's travel in Abu Dhabi because of the unbalanced demography. Studying the public transport of Abu Dhabi has shown that there is a paradox in the public transport being a source of constraints for the working women – because of schedules and time length of trips – but also a source of mobility freedom for some expatriate housewives. Indeed, the bus network has great adaptability to the local urban fabric in this city based on road infrastructure construction. It has succeeded in widening mobility choices beyond the individual car, which is an expensive option, almost not affordable to most of the large Abu Dhabi working class.

The recent report written for the United Nations on the situation and the legal framework that protects women in the United Arab Emirates is unsurprisingly apologetic for the government and its many efforts towards better opportunity chances and also its recent investment in the urban and public space for a better living environment quality. These improvements have been noticed by all the women who can finally access work or more freedom across the city because of the betterment of the public transport network.

Although the STMP lack measures specifically addressed to gender issues of the population. During interviews operated inside the scope of the PhD thesis since September 2011, with planners and engineers appointed at the Department of Transport, the Urban Planning Council, at the Abu Dhabi Municipality and at the Bus Office, officials are not commenting and criticizing their work but always recollect the improvements made in few years. Few planners have emphasized the very little public expenditure on busses, with a lack of staff, lack of technical and financial means to implement the plan and a decreasing urban sprawl use of car. Although with a very limited staff at the bus office, most of them worked prior to the economic crisis to modernize the bus network in Dubai between 2004 and 2008, the improvements done are very important.

Many transport and urban policies planned in the Abu Dhabi Vision 2030, have been put on hold in the revision of the Master Plan Abu Dhabi 2030 and STMP in 2012 and 2013. It seems, that in spite of all these 2008-2009 policies, such new transit modes as the metro, light-rail, bus rapid transit have not yet been granted funding.

With a new bus master plan coming to accommodate all the new transit modes, the planners would benefit from in-depth research to hear the voices of the users even if they are critical. This research shows that dedicated and extensive studies should be made on the status of a feeling of safety in buses for women, with more qualitative surveys perhaps on a smaller sample of bus users but on a more refined scope. The current studies as the CATI about customers satisfaction do not give information about bus riders' experiences. As a consequence, officials and technicians are not aware of the bus riders' experience, so they cannot improve the service and the network.

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<sup>113</sup> Shahama is a city 30 km on the Dubai highway from Abu Dhabi, mostly made out of villas, it is difficult to reach via buses.

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# Poster Sessions

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# Mobility in the transition to retirement among urban women and men- a time geographic approach

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## ABSTRACT

To retire from work has potential consequences for patterns of everyday mobility in numerous ways. People born during the 1940s and now retiring are more heterogeneous than earlier cohorts of retirees. They experience more years with good health after retirement, engage more in leisure-time activities and make more trips and errands. Among women especially, there has been an increase in holding a driver's license as well as in ownership and use of a car, compared to earlier generations of retired women. According to this knowledge, transportation behavior and mobility patterns among people in this generation can be expected to differ from previous generations. The aim of this study, which is part of a PhD-project, is to explore mobility in connection to the transition from working life to retirement and older people's own perspectives, resources and experiences in the shaping of their mobility. The data consists of travel diaries and qualitative interviews with 24 recently retired women and men living in a medium-sized Swedish city. The time- geographic approach will be used to describe and understand complex spatial and temporal connections between people, places and material artefacts. Currently, two research articles are in progress<sup>114</sup>. Further analysis of the material will take the gender perspective into account which means that women's and men's opportunities for mobility will be analysed based on: where their activities are temporally and spatially allocated; what modes of transport they use; to what extent they have obligations to others such as grandchildren; or if and to what extent they are dependent on others for mobility.

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**KEYWORDS:** Retirement; Mobility; Urban; Time geography; Everyday life.

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<sup>114</sup> Berg, J., Levin, L., Abramson, M., Hagberg, J. E. (In progress). Mobility in the transition to retirement – the intertwining of transportation and everyday projects.

Berg, J. (In progress). The use of places and place attachment among newly retired urban residents.



# Daily organization of trip chains: A gender issue?

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## ABSTRACT

Practices of urban and interurban mobility of women have undergone many changes during the last twenty years. The increase in female employment, a larger motorization or upheavals in the organization of daily schedules, redefines the daily mobility of women. Although the distinction between men and women remains current in mobility studies (Carron, 2007), women have not yet "caught up" the gap behind men (Coutras, 1997). But can we speak of gender equality in the spatial practices of displacements?

The study of "Enquête Ménages-Déplacements" (EMD) carried out in 2007-2008 in the Toulon Metropolitan Area (AMT) will allow a study of the construction of commuting (all movements from home until the individual goes back) for this part of the population. The objective is to observe the characteristics of the organization of the mobility behavior of women and to identify a standard profile based on spatial, demographic and social factors.

Currently, this spatial approach shows that women organize and structure their commuting so as to "optimize" their daily mobility. With the recurring problem of "double day" (CERTU, 2005; Coutras, 1993) coming from the need to manage both work and family life (Gwiazdzinski, 2003), women move nearly as much as men, similar in time, but with shorter distances. However, wouldn't this phenomenon be related to the spatial construction of trip chains for women? This segmentation would result in a reduction of the distances between two places. Women have completely different mobility patterns from men? Or they insert their travel program activities related to household activities in order to move less or less far and then spend more time in consumption activities?

The aim of this work is twofold. On the one hand, discuss and confirm the different logical and spatial organizations of daily mobility between men and women. On the other hand, we observe what the new features of mobility of women are today, and the changes compared to previous generations.

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**KEYWORDS:** Rip chain; Daily mobility; Spatial analysis; Commuting.

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# Elderly women's use of public transport and evolution from before to after retirement

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## ABSTRACT

Policies aiming to develop public transport mainly focus on daily journeys of people going to and from workplaces. In designing and organizing public transport, planners and stakeholders pay lesser attention to the local trips requirements of retired people. However, in western countries, retired people and especially retired women represent an increasing part of the population. Thus, in the perspective of development of transport for all, elderly women's travelling habits and needs should be considered.

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**KEYWORDS:** Ageing; Retirement; Use of Public Transport; Women.

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## OBJECTIVES

This study is focused on retired women's use of public transport. We have examined the aims of the trips associated with their use of public transport. Specifically, the focus was on local bus trips using either inner agglomeration transport networks or district networks linking rural areas to the nearest towns. We have also analysed the reasons that motivate or hinder the use of public transport from the point of view of these elderly women. Additionally, we checked whether women's use of public transport shows continuity or change from the period preceding retirement to the period following retirement.

## METHOD

The data analysed in this paper are taken from a larger survey carried out in 2011. The investigation took place in France in six areas involving four medium sized urban agglomerations (Annecy, Belfort, Cholet, La Rochelle) and two rural districts (Cher, Ille-et-Vilaine). This survey included interviews and focus groups, but it mainly relied on a snail-mail questionnaire (see Keerle, Legendre, Roux, Gonguet, et al., 2013).

**Number of returned questionnaires and response rate per type of area**

	Urban areas	Rural areas	Total
Number	1041	280	1321
Rate	9,67%	6,50%	8,76%

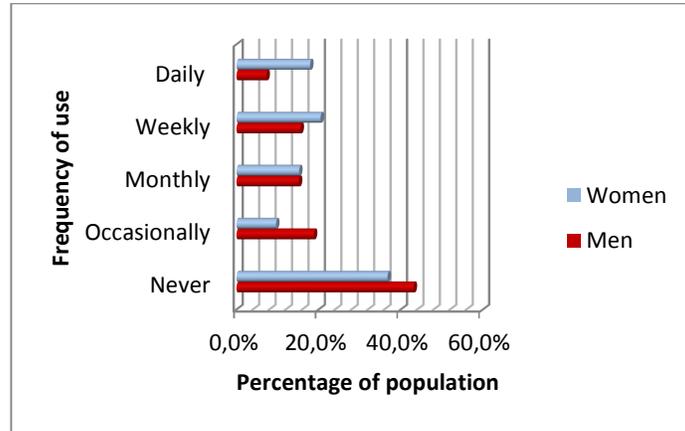
Participants were made up of 744 women and 490 men, whose ages range between 57 and 94, mean age = 68.3 (SD = 5.5). The number of individuals considered in the different analyses varied depending on the missing responses related to the question under investigation.

## RESULTS

### Use of Bus Transport by Retired Women and Retired Men

The comparison of the frequency of use of public transport by retired men and women clearly shows that women use **PT** more frequently than men. *Chi-square test* for these gender differences is significant:  $\chi^2 = 50.37$ ,  $p < .001$ .

Interestingly no significant difference was found among women of different age groups (< 62, 62-67, 68-71, 72-77 and > 77) in the frequency of use of *PT*. Regarding women, their use of *PT* is considerably less frequent in rural than in urban areas,  $\chi^2 = 93.12$ ,  $p < .001$ ; 45.9% of the women reported a daily or weekly use of *PT*, whereas this percentage drops to 9.1% in rural areas.



**Retired Women’s Activities Related to Use of Public Transport**

“*Shopping*” is the major reason mentioned by retired women for using *PT*. However, the most important information brought by this result is that “*Health*” reasons and “*Administrative procedures*” occupy respectively the second and fourth position with more than 45% women mentioning them. Although less important, the mentions of “*Visiting friends or families*” as well as going to “*Club or volunteer work*”, underline the role of public transport in keeping retired women active within a social network.



**Retired women's activities related to u of bus in urban and rural areas**

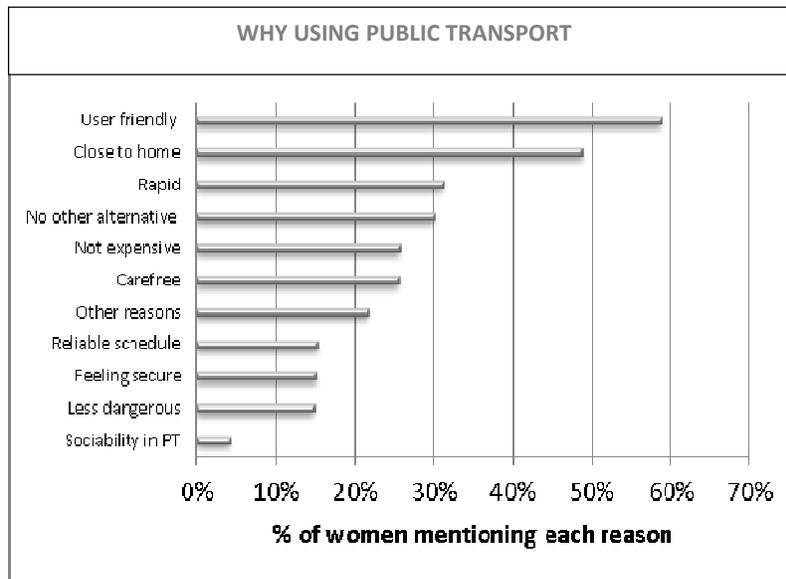
Activities	Shopping***	Health*	Leisure*	Administrative**	Others *
Urban	68.4%	55.0%	49.9%	39.5%	11.0%
Rural	31.6%	40.3%	34.7%	22.2%	20.8%

Overall, this pattern of aims linked to *PT* use is certainly a hallmark of our population. It shows that the use of *PT* by elderly women is not only related to what could be qualified as non-essential leisure activities, but encompasses a large array of living necessities. Furthermore, the importance of the medical visits draws our attention to the fragility and vulnerability of that population to constraints and physical obstacles that may be encountered while travelling by bus or subway.

### Reasons that Motivate or Hinder the Use of Public Transport for Retired Women

The next step consisted in examining the reasons that the retired women mentioned regarding the positive or negative aspects related to their experiences or perceptions when using *PT*.

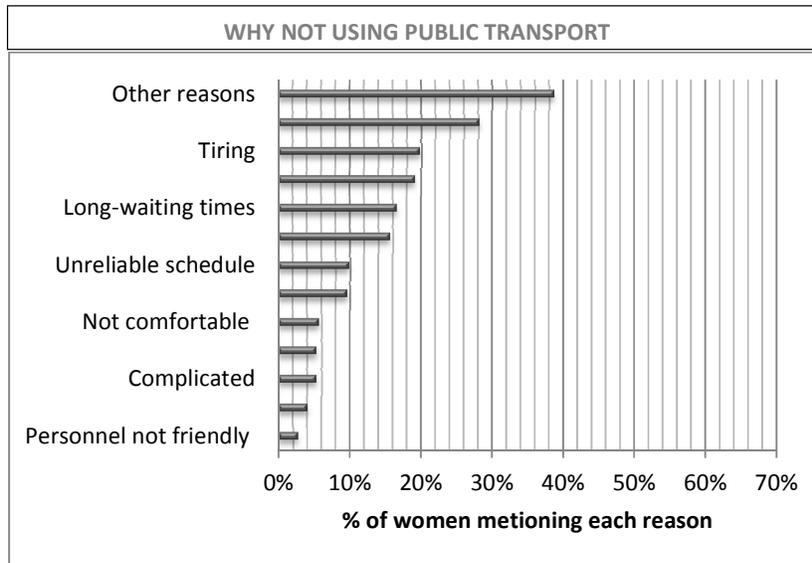
The primary reason mentioned by retired women to explain why they use *PT* is that it is easy to use: "*User friendly*". One can observe that this easiness is mentioned by nearly 60% of women whereas only 5% of them think that *PT* is complicated to use. The fact that the access to *PT* is "*Close to home*" is a particular incentive. Nearly half of the women surveyed explained that it is one of the reasons why they use *PT*, conversely 10% of women explain that their use of *PT* is precluded or restricted because the access is too far from their home. Some reasons reported by the women in favour of *PT* refer to practicalities: "*Rapid*", "*Not expensive*", while other reasons refer to more subjective perceptions such as "*Carefree*". This notion of "*Carefree*" is made explicit in the additional comments of the respondents explaining that using *PT* permits getting rid of the stress related to driving in dense traffic and of parking in city centres. "*Secure feeling*" is more controversial: 15% of the women declared they felt secure in *PT* while 5% of them declared they felt insecure. Explaining why they use *PT*, 30% of the women said that it is because they have "no other alternative". Although this is not a particularly positive motivation, it is an important piece of information that has to be taken into account by those who organise public transport.



While examining the reasons explaining the absence or the restricted use of *PT*, practical reasons such as "*Expensive*" can be spotted. Interestingly, negative opinions are also related to the organization and functioning of the transport network itself ("*Not convenient*", "*long-waiting times*"). However, the bulk of the reasons reported is related to adverse or uncomfortable experiences inside the vehicles ("*Crowded*", "*Tiring*"). These standpoints are further developed in the free commentaries associated to "other reasons" that is the most important item of this series of negative reasons. The commentaries underline the fact that with aging, tiredness and difficulties of moving (e.g. slower movements, fragile equilibrium, problems with standing for a whole journey...) trips in public transport turn out to be a real challenge. Unfortunately, elderly women have the feeling that, instead of encountering support, their difficulties generate intolerance and incivility because they are slowing down the movements to get in or out of the vehicles.

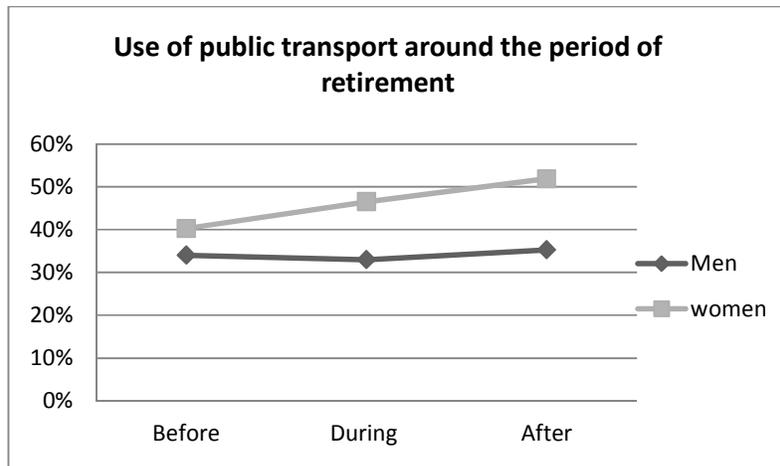
Nevertheless it must be underscored that the positive opinions were more numerous than the negative ones.

Examining the difference between urban and rural areas it comes out that rural women report more frequently that the "*bus stop is too far*" and that the "*schedule is unreliable*". On the other hand, urban women complain more frequently about "*crowding*" and, to a lesser extent, because *PT* is "*tiring, insecure and expensive*".



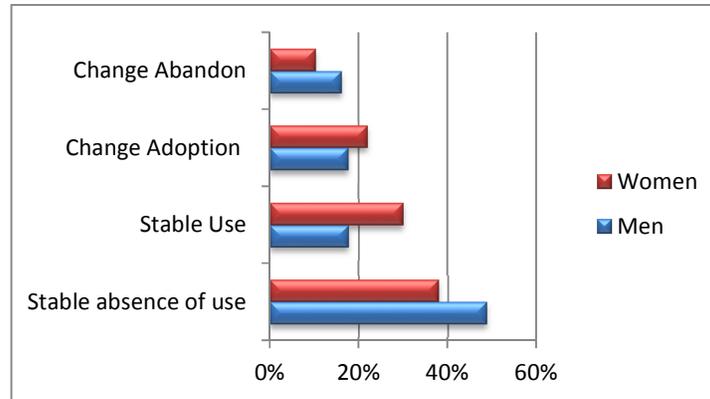
**Evolution in the Use of Public Transport around the Period of Retirement**

To examine how the change of status related to moving from work to retirement impacted the use of *PT*, three five-year periods around retirement were considered: a) the period during which the person retired, b) the period preceding this period and c) the period following the period during which the person retired. The figure shows that the percentage of women using *PT* increases from the period “Before” to the period “After” the period during which the person retired. In comparison, the percentage of men using *PT* remains stable during these three periods around retirement.



**Change in the Use of Public Transport before and after Retirement**

To analyse more accurately how individuals change their habits regarding the use of *PT*, we compared the period preceding retirement to the period following it. Firstly, it can be observed that only 10% of retired women abandon *PT*, whereas twice as many (22%) adopt *PT*. On the other hand, it can be noted that the stability in use of *PT* observed for men at the population level hides the fact that 15% of men abandon *PT* while an equal proportion of them adopt *PT*. The figure also shows that a larger percentage of men as compared to women are stable in the absence of use of *PT* from the working period to the post retirement period. Conversely, women are proportionally more numerous than men in showing a stable use of *PT* during the period pre- and post-retirement.



## CONCLUSION

Results clearly show that more retired women than retired men use public transport; moreover, retired women use public transport more often on a daily or weekly basis. Additionally, it appears that, once retired, the women who were already using public transport before retirement continue to use it, and many of the women who were not using public transport before retirement adopt this mode of transport for their local trips. The findings establish that these trips are associated with a large array of living necessities such as shopping, but also with medical and administrative purposes.

All this evidence should incite those who plan public transport to pay greater attention to the special needs of elderly women. Although retired women have expressed opinions broadly favourable to public transport, they also pointed out some shortcomings of the networks. In particular, they indicated that the number of bus stops is a critical point. Often, the choice is made to reduce the number of bus stops in favour of a more rapid run time. If the public transport networks are to remain accessible to senior citizens, the distances between two stops in residential areas, as well as in commercial areas, should be reconsidered. Mentioning increasing difficulties due to aging, the retired women expressed reservations regarding overcrowding and problems of coexistence on the buses. These concerns could be alleviated by a careful attention to the elements facilitating access to vehicles and the conditions of comfort they offer (e.g. kneeling bus).

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# Changes in driving restriction with aging among women

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## ABSTRACT

Maintaining the well-being and the health status of elderly people is crucial. For drivers, this requires the conservation of driving in a safe way as long as possible. Sensory, functional, and minor cognitive changes appear in the course of normal aging, and are more severe in brain pathologies leading to dementia. They may profoundly affect driving [1], which is a complex task involving all of these functions, particularly attention and decision-making which are necessary for the selection of relevant information and situation-specific action. Many studies show that older drivers modify their driving habits [2, 3]. Driving regulation should have the positive impact of decreasing the risk of accident and, conversely, insufficient driving regulation can have negative consequences in terms of road safety. Excessive regulation leading to a premature driving cessation could, however, increase the risk of social exclusion, depression, loss of autonomy and pathological brain aging [4, 5]. When this regulation process occurs in later life, gender differences have been reported in non-prospective studies [6-10]. Women regulate their driving more than men and do so earlier. Choi et al. suggest that these differences can be understood in the context of "gender roles" [11] with the car occupying a more important place for men than women, in a context of masculinity, speed and power [12]. Men are more often the main driver [13, 14] and have higher mobility by car than women [15, 16]. Women could also have a shorter "career" as drivers than men. They may obtain their license at an older age and stop driving for longer periods [17]. From an organizational point of view, women could also be less dependent on their car for mobility than men [11]. This difference in daily car use could facilitate driving regulation. These gender differences in images and roles could also lead women to enjoy driving less than men or to doubt in their driving abilities, and this could lead to premature loss of mobility [18] and cause more men to make insufficient driving regulation. However the results of prospective studies are controversial. Some show that women are more likely to regulate than men [3, 19-21], while others have found no evidence of greater regulation in women [22-27]. These discrepancies can be partly explained by age, observation periods and different measures of regulation. As for the factors which might explain regulation, to our knowledge, only one prospective study has examined driving cessation factors in men and women separately [28]. However, this study did not include people with low global cognitive score. Nor did it take into account CNS pathologies which are known to change driving habits significantly and possibly differently in men and women. A study by Seiler et al. showed, that in demented people, women were more likely to cease driving than men at a pre-demential stage [29]. It is important to understand the regulation process in men and women, in the general population, in order to identify the factors of this regulation, factors due to pathological aging or not. In order to do so, we decided to study regulatory processes in men and in women, taking into account cognitive performance and CNS pathologies, based on prospective data providing information on changes in mobility, living arrangements, health status, cognitive performances and CNS pathologies over time.

The 490 drivers of this study, 253 men and 237 women with a mean age of 76 years, were drawn from the Three-City Cohort of Bordeaux, a longitudinal study of people aged 65 years and older [30]. The participants were interviewed at home by a psychologist in 2003, 2006 and 2009 on a range of topics, including socio-demographic characteristics, health (measures of motor and sensorial functions and several medical conditions) a cognitive evaluation and driving habits. A dementia diagnosis was also conducted for all participants by a neurologist. Driving restriction covers both driving cessation and a kilometer reduction. To study driving restriction factors, we used several Cox proportional hazard models with time dependent covariables. In this prospective study, the rate of driving restriction is high. Fifty seven percent of participants had restricted their driving over the follow-up. Women restricted their driving more frequently than men: 54% of men and 63% of women reduced their distance driven or ceased to drive over six years. Pre-dementia, Parkinson's disease, advanced age and high initial mobility by car were common restriction factors in both genders. Prevalent dementia, depressive symptomatology, a decline in at least one Instrumental Activities of Daily Living and poor visual working memory

performance were specific factors in men. In women, a low income, fear of falling, a slow execution time or a severe decline in global cognitive performance explain a regulation. This study confirmed that in later life women restrict their driving more than men, and that restriction factors differ according to gender. The pattern of results suggests that, when cognitive deficits are present, women restrict their driving at an earlier stage than men. It remains to be seen if excessive restriction in women could have negative consequences.

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**KEYWORDS:** Driving restriction older gender.

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# Designing women friendly transport interchanges

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## ABSTRACT

Transport interchanges play a crucial role in urban development, embodying an attraction cell of movements and facilitating links among different modes, routes and destinations. Today's women face a number of additional challenges in their daily movements, i.e. transferring from one mode to another while carrying a baby trolley, finding baby caring facilities at terminals, doing household shopping while waiting at a station, feeling safe travelling at night, finding a secure playground for their children while waiting for the next tram, etc. Time saving, along with utilizing waiting time and priority movement and secure mobility for women, are listed among the aspects selected for evaluation for efficient and women-friendly design of transport interchanges.

Towards this direction, this paper aims at identifying the aspects of developing efficiently operated transportation hubs that fit appropriately within an urban environment and effectively serve women's mobility needs, and prioritize their movements. An internet based survey was conducted, in order to investigate the degree of women's satisfaction from the New Railway Station of Thessaloniki transport interchange. In addition, women made proposals for the interchange design and stated their preferences and reactions under different interchange scenarios.

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**KEYWORDS:** Women in transport; Urban transport design; Interchanges; City hubs; Public transportation systems.

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## INTRODUCTION

This paper was developed in the framework of the European project "City-HUB" ([www.cityhub-project.eu](http://www.cityhub-project.eu)). City-HUB project is a 30 month project dealing with the design and operation of seamless, smart and safe intermodal public transport systems. Special focus is given to covering "vulnerable" target groups needs, i.e. the elderly, women, physically and mentally handicapped people in order to be able to adequately benefit from these interchanges. The project aims at developing accessibility to all interchanges by erasing the social exclusion of women, efficiently covering their needs. Five parallel user satisfaction surveys are being conducted in the five pilot case study interchanges of the project: Moncloa interchange in Madrid (Spain), Ilford railway station in London (United Kingdom), New Railway Station in Thessaloniki (Greece), Kamppi terminal in Helsinki (Finland) and Kőbánya-Kispest interchange in Hungary. Especially for the Greek case study, a pilot survey has already been conducted in a representative sample and these preliminary results are presented in this paper, following a gender sensitive approach of analysis.

Women seem to be more affected by interchange design and operation, as they make more intermodal and chained trips [1], and they usually combine different tasks while travelling. Also, women travel much more than men with public transport modes; they have many things to do usually requiring a distribution of movements, they have serious time constraints and thus they are more affected by an efficient use of waiting time while transferring from one mode to another [2].

Urban transport interchanges play a key role as part of public transport networks, facilitating the links between public transportation modes. Time saving, urban integration, better use of waiting time and improvement of operational business models are some of the benefits that result from the development of efficient urban interchanges. However, despite the significant role of transport interchanges in the urban transportation scene, integrated design and operation systems are still missing, causing serious problems and gaps.

The above issues are studied and evaluated in a selected case study, the New Railway Station of Thessaloniki in Greece. The station is the central passenger railway station in Thessaloniki, which is the second biggest city in Greece and the capital of the periphery of Central Macedonia with a population of approximately 1,000,000 residents. The station is located in the urban area of the city and the involved modes are commuter rail, interurban rail, local buses, suburban buses, interurban buses, taxis, bicycle ways, park and ride, kiss and ride, and metro (under construction). Apart from the provision of railway services, the station works as a terminal of the public bus services of the Thessaloniki Urban Transport Organisation (OASTH), while it is also directly connected to the interurban bus station, where scheduled destinations for Athens and other Greek cities are available. The station location is close to the urban central business district, allowing the movement of travelers all around the city.

To address travelers' point of view and actual needs, expectations and proposals for its reformation, regarding the existing conditions in the pilot interchange, an internet based survey was conducted. The survey was implemented with the employees of the Center of Research and Technology (CERTH), which is located in the opposite side of the city's urban area. The reason for selecting CERTH employees as a pilot sample of users was to investigate commuter users of the station in an expanded urban distance. A total number of 70 respondents answered the questionnaire and 46 valid responses were analyzed.

Respondents evaluated the design and spatial development of the transport hub and pointed out the ground for interventions. The analysis of the survey results provided valuable feedback for the validation of the survey design so as to address real needs of station users.

Following the introductory section (chapter 1), the state-of-the-art analysis is presented in chapter 2 and selected cases considered as good practices are presented in chapter 3. The methodological approach of the study is presented in chapter 4. Research results are presented in chapter 5 and specific recommendations are provided in chapter 6. Finally, the most important conclusions are highlighted in chapter 7.

## STATE OF THE ART ANALYSIS

Transport interchanges have gained attractiveness by many research projects, trying to identify the aspects for their efficient design and operation [3-9]. Two of the more representative projects are PIRATE and GUIDE. More than 250 reports were developed from each project, assessing transport interchanges focusing on operation, design and quality.

Transport interchanges act as a junction between the transport system and society [10] and could be further considered as "open gates" to the city, providing access to the central activities and social events. Aspects such as urban design, transportation and economy should be examined in parallel, so as to provide guidance on the proper interchange design and the contemporary city planning.

Travelers tend to use an interchange based on their personal travel needs and perceptions. User perception is most commonly considered when assessing an interchange [6-8, 11] and thus it is crucial to understand passengers' opinions [12]. Local authorities' or transport operators' perspectives may also be considered. The MIMIC project (1999) stands as one of the early projects considering all perspectives [4].

It is commonly accepted that the design and operation of a transport interchange may influence the physical experiences and psychological reactions of a traveler, and thus an efficient design and operation should attract travelers and should be linked to the sustainability of an interchange. The GUIDE project (2000) underlined the major influence that interchange design could have on the general perception of travelers for public transport [5].

Travelers switch from one mode to another, either because there is no direct connection with urban public transportation from their origin to their destination, or because they want to reduce their total travel cost [13]. In both cases, the interchanges work as the main node of the urban transport network and their efficient development and operation is of great importance.

Edwards (2011) [14] perceives transport interchange planning as a challenge for urban design. As he states *"Transport interchange design offers many opportunities to enrich the public realm, to support social sustainability and to create conditions for the economic recovery of inner city areas"*. This statement links to the general belief that transport interchange development should be part of the urban development strategy, aiming to support growth and regeneration in an urban area [15].

Interchanges should not be designed “isolated” from their surroundings, but they should be part of the urban environment. Interchange development should focus on increasing the possibilities of activities for public transport users, who may better utilize their waiting time. Regarding land use development and, from the point of view of an open to non-travelers interchange development, some additional facilities that reduce barriers to interchange should be considered, such as: retail outlets, cash points, telephones, automatic vending machines, refreshment/bar facilities, etc. The planning framework for interchanges differentiates upon interchange categories, characteristics and planning goals [16].

Finally, based on the findings of the PIRATE project [9], interchange location seems to be very crucial to urban development. Strategies have been developed, regarding proper interchange location in order to provide better public transport performance and urban development. Proper interchange design and operation have to be analyzed in a comprehensive framework of indicators evaluation, towards sustainability [17, 18]

## **GOOD PRACTICES**

Considering the state of the art analysis, the identification of good practices can be a useful tool to examine the key indicators that apply to a successful interchange operation. There are many interchanges that could be assessed as good practices focusing on selected criteria. King’s Cross, UK station could stand as an example of defined movement paths, Manchester Piccadilly Station as an example of great connectivity among means of transport, Berlin as an increased security station with way finding, passenger information, and provision of services [19]. Six selected interchanges are briefly presented below concerning different aspects that lead their consideration them as good practices.

### ***Lyon Perrache Railway Station, France***

Lyon Perrache is one of the main railway stations in Lyon, France. Lyon is the second largest city in France with over one million citizens, and the first French city with an urban transport plan. The involved modes in the station are national rail, trams, buses and coaches, metro. The station is considered as a well-designed transport hub for four main reasons: the design, the connectivity among the involved modes, its location in the center of the city of Lyon and the initial planning and vision [20].

### ***Ashford International Station, Kent, UK***

The involved modes in this station are: rail, buses, coaches and taxis. The station is considered as a good practice regarding the urban planning issues. The location of the station was chosen strategically before the opening of the Channel Tunnel and the availability of Eurostar through trains from London and Paris or Brussels. In the terminal and the station buildings, domestic as well as arriving and departing international passengers must be segregated once they have passed the ticket barrier, so separate routes are provided to separate platforms. Domestic passengers have a dedicated subway, facilities for departing international passengers are at the upper level and they have a bridge to the dedicated international island platform, and arrivals use a subway which brings them into the immigration area of the terminal. On the far side of the tracks from the terminal is a high-speed bypass route for non-stop trains. Moreover there are some additional facilities at the station: bars and coffee shops, convenience store, ticket desks, toddlers’ play area, toilets with baby-changing facilities and cash machines able to cover some of the daily travelers’ needs. There is a coach drop-off point situated next to the main entrance, servicing group travelers. Moreover in the ground floor of the multi-storey car park a cycle parking is located, which is free and covered by 24-hour CCTV surveillance. This case of study represents a great example of strategic planning when considering a new interchange development, where all strategic planning components need to be considered and examined in terms of the vision of the total urban and transport development [20, 21].

### ***Manchester Piccadilly Station, UK***

The Manchester Piccadilly Station was the Winner of the UK Integrated Transport Award 2003- Large Interchange Project of the Year. It is a metropolitan railway terminus with buses adjacent and urban light rail below. Piccadilly is the busiest station in Manchester, and it is the fourth busiest station in the United Kingdom outside London, with over 21 million passenger entries and exits between April 2010 and March 2011. According to Network Rail (manager of the station), over 28.5 million people use the station annually. Manchester Piccadilly handles over 83,000 passengers and 1,000 train movements every day. Although the

large amount of movements in a station is usually difficult to handle, according to an independent poll carried out in 2007, Manchester Piccadilly has the highest customer satisfaction level of any UK station, with 92% of passengers satisfied compared with the national average of 60%. The satisfaction measurement was about the overall environment of the Manchester Piccadilly Station (Revamped station tops train poll". BBC News Online (London). 2 August 2007. Retrieved 2008-09-17). The station is now regarded as one of the best stations and interchanges in the UK. Involved modes in the station are: taxis, private cars picking up and setting down, southbound and eastbound buses, the southbound Metrolink light rail, free shuttle buses to the city centre. In addition to the high user satisfaction level in the station, the station is considered among the most accessible ones, considering that there are available: escalators and lifts to all levels, wide access doors and gates, braille signs, hearing loops and disabled toilet facilities [20, 22].

### ***Enschede Station, The Netherlands***

Enschede is the main railway station in Enschede, the Netherlands. The city of Enschede has a modal split of 3 percent public transport; 42 percent cyclists; and 55 percent private motor vehicles within the city ([http://www.civitas.eu/index.php?id=117&city\\_id=194](http://www.civitas.eu/index.php?id=117&city_id=194)). The station is considered as a good practice regarding cycling facilities and promotion of soft modes of transport. There is a cyclist way and parking area near the station, offering the opportunity to move combining modes of travel in the station. The Interchange was the winner of the International Integrated Interchange of the Year, 2003. (This description is based on a paper prepared by Michael Stacey of Brookes Stacey Randall, architects) [20].

### ***Rotterdam Central Station, The Netherlands***

The Rotterdam interchange includes the national railway station and multi-line metro station with trams and buses adjacent. Rotterdam station offers great train connections among intercity trains from all over the Netherlands and with the international highspeed trains (HSL and the Thalys ) that stop in Rotterdam. From the Centraal Station one can easily and efficiently connect with metro, tram and buses. 110,000 transit travelers use the station's operations daily. It has been estimated that in 2025 the daily passenger volumes will increase to 323,000 [20].

### ***Circular Quay Interchange, Sydney, Australia***

Circular Quay Station is listed among the most dramatic scenic interchanges in the world [20]. It is the metropolitan railway- ferry station of Sydney with buses and ferry jetties below. The interchange is the oldest transport hub in Australia and is located at the historic focal point of the city, known as the Sydney Cove, in close proximity to the famous Sydney Opera House on one side and the towering Harbour Bridge. The location of the hub, along with the attractive urban zones and services, enhance the attractiveness using a transit operation from the terminal.

Circular Quay has the most appropriate location to operate, as it is the starting and ending location of almost all Sydney's ferries. There are: 6 ferry wharves with over ten different ferry services operating, 11 stands in the bus terminal with 74 different regular bus routes terminating there, 4 different train lines running through the terminal.

The interchange provides, moreover, an advanced information and ticketing system. There is a transit shop located in the bus terminal of the hub allowing travelers to receive the necessary information regarding their transit trips. Following recent investments, many interchanges incorporate facilities designed to encourage people to walk or cycle to connect with other modes of travel. These facilities include safe walking routes, storage and secure bike racks. Finally, this interchange operates in accordance with the Disability Standards for Accessible Public Transport, and is accessible to the majority of citizens.

Considering the good practice components of the examined interchanges, a list of indicators could be examined according to the level of significance women perceive, by evaluating them in a selected case study.

## **METHODOLOGICAL APPROACH**

Based on the results and assessment of the state-of-the-art analysis, and the components of successful interchange design as arising from the best practices in the previous chapter, key indicators for the design and reformation of transport hubs were identified under nine aspects, thus:

- Accessibility of the station through available modes of transport (car, bus, train, taxi, etc.);
- Accessibility (elevators, ramps, “blind” guides, etc.);
- Environmentally friendly services and infrastructures (e.g. green areas, recycle bins, etc.);
- Soft modes of transport (defined walking path, parking for cycling, etc.);
- Safety and security (lighting, Closed-Circuit Television – CCTV, etc.);
- Travelers’ convenience (e.g. convenience of a mother carrying a baby trolley to move throughout the station;
- Information provision (real time information for delays, cancellations and incidents, pre-trip information for all available connections from the station, etc.);
- Land use (commercial shops, recreational areas, long and short term car parking, etc.);
- Connection of the station with the wider urban area (city center, port, airport, etc.).

All nine indicator categories were used for the setting up of the internet questionnaire survey that was conducted in order to investigate travelers’ point of view regarding the existing conditions at the Thessaloniki railway station, and record real needs, expectations and proposals for the reformation of the station.

The internet based survey method is a commonly used method nowadays. Among the advantages of the method are: low cost, real-time access, automation, convenience for respondents, less time required, no influence from interviewers, more flexible design on the survey presentation and responses. On the other hand, as main disadvantages the following are considered: certain populations are less likely to have internet access and or knowledge to respond, the lack of an interviewer might cause problems in cases where clarifications are required, many receivers will probably delete the survey link before opening it [23]. In the case of the present survey, the advantages overcome the disadvantages, as the survey was well promoted in CERTH, all employees had internet access and qualifications and the authors provided clarifications upon requests.

The survey was conducted among the CERTH employees that are station users. CERTH is the city’s central research centre, with six institutions and about 400 employees. The survey ran for two weeks in February 2013, and 46 (valid sample size) respondents (men and women) evaluated the design and spatial development of the hub, and pointed out the ground for interventions.

The questionnaire was structured in four discrete parts. The first part included questions about the demographic characteristics of the respondents, such as age, gender, education, occupation and income, as well as questions about their traveling habits regarding the specific station, like the transit frequency, the usual purpose of traveling (education, work, shopping, etc.), the transport mode to reach the station (car, bicycle, walking, etc.), etc. In the second part of the survey, the respondents were asked to state their opinion on the existing conditions at the station by grading the above indicators on a 6-point scale ranging from 1 (non-existent) to 6 (excellent), where there was always the option DK/NA standing for “Don’t Know/Not Answer” responses. In the third part, alternative mobility scenarios with respect to the case study characteristics were presented to the interviewees, and their intentions to follow them were recorded. In this case, respondents graded the scenarios on a 6-point scale, ranging from 1 (negative impact/decrease in movements) to 6 (positive impact/increase of movements). Lastly, in the fourth part, the respondents were invited to make any comments or proposals they have for the upgrade of the railway station.

## RESULTS

In this chapter, the results of the questionnaire survey are presented, separated in to three sections. The first section regards the analysis of the respondents’ characteristics, the second one the results of the assessment of the existing conditions at the Thessaloniki railway station, and the third one, the findings of the assessment of the alternative mobility scenarios.

### *Analysis of sample characteristics*

The valid sample analyzed in terms of this study, was composed of 21 men and 25 women. The majority of respondents (78%) were between 26–39 years old, 20% were between 40-59 and 2% between 18–25 years old.

A high educational profile of the sample was recorded, as 85% held a Master degree and 13% of respondents were university graduates. The remaining 2% were high school graduates. Regarding the annual income per capita, 7% of respondent's stated that they have an income lower than €9,000, 71% belong in the category €10,000 to 24,000 and 22% had a higher than €25,000 annual income per capita. Recreation was the main reason respondents visit the station (42%) followed by trips to work (16%). Moreover, 38% of the sample indicated that the station is 5–10 km distance away from their origin or destination, while 17% are less than 5 km away from their trip generator/attractor.

### **Assessment of existing conditions at the station**

The results of the assessment of the existing conditions at the station by the respondents are presented in the following paragraphs. For the assessment, specific indicators per aspect (e.g. accessibility, safety and security, soft modes, etc.) were used, and the results are given in Tables 1–9. In order to record women's point of view and assess potential statistically significant differences in the values of the indicators between men and women. The statistical analysis of the responses was carried out using non-parametric tests, which are regarded as powerful for analyzing data collected through questionnaire surveys [24]. Particularly, the normality of the data was assessed through the Shapiro-Wilk test, which is appropriate for small sample sizes (< 50), while the Mann-Whitney two-sample U testing was performed to assess differences between the responses of men and women.

The first aspect examined was the accessibility of the station through the available modes of travel, such as car, bus, taxi, etc, and the results are depicted in Table 1, where the median rating of each indicator by men and women is presented, as well as the p-value. The rating scale used was ranging from 1 (non-existent) to 6 (excellent).

**TABLE 1. Accessibility of the station through available modes of transport**

Indicators	Median rating		p-value
	Men	Women	
Accessibility of the station by car	3.0	3.0	0.856
Accessibility of the station by bus	4.5	4.0	0.032*
Accessibility of the station by train	3.0	2.0	0.331
Accessibility of the station by walking	2.0	2.02	0.872
Accessibility of the station by cycling	2.0	2.0	0.574
Accessibility of the station by taxi	4.0	4.0	0.628

(\*) statistically significant with  $p < 0,05$

As it is shown in Table 1, statistically significant differences in median rating given by men and women were observed in only one of the six indicators of the specific aspect. More specifically, it was indicated that men are more satisfied than women regarding the level of reaching the station by car. Both men and women assessed the accessibility of the station by bus and taxi as above adequate, while, on the other hand, the train, bicycle and walk connections received low scores, highlighting the problems of the network.

For the evaluation of the accessibility level at the station, seven indicators were evaluated by the respondents and the results are presented in Table 2. In this case, all indicators were evaluated as below adequate and especially for the needs of people with disabilities. Focusing on women, it seems that they consider travelers and the assistance of available personnel as the most important deficiencies at the station.

**TABLE 2. Accessibility level at the station**

Indicators	Median rating		p-value
	Men	Women	
Existence of elevators	2.0	2.0	0.621
Existence of ramps	2.0	2.0	0.710
Availability of personnel	1.5	1.0	0.220
Existence of blind guides	1.0	1.0	0.899
Existence of escalators	3.0	2.0	0.584
Existence of travelators	1.0	1.0	0.907
Existence of way-finding signals	2.0	2.0	0.410

Sustainability, in terms of providing friendly services and infrastructures, as well as promoting soft modes (cycling and walking) was also investigated in the station. Towards this direction, the participants of the survey were asked to evaluate eight indicators regarding the degree of how environmentally friendly the station is, and eight more indicators referring to the enhancement of the use of soft modes. Results showed that travelers are not satisfied at all with the present conditions at the station, since they emphasized the non-existence of green areas and recycle bins, the non-usage of recycled material and power saving features, the non-existence of energy efficiency infrastructure, and the lack of walking and cycling promotion (Table 3). Similarly, travelers, both men and women, addressed the absence of infrastructure appropriate for walking and cycling, and highlighted the need for the reformation of the station, which should provide rights of way to people walking and cycling and proceed with weather protection infrastructure, canopies and stops (Table 4).

**TABLE 3. Environmental services and infrastructures**

Indicators	Median rating		p-value
	Men	Women	
Existence of green areas within the interchange	1.0	1.0	0.153
Existence of green areas outside the interchange	1.0	1.0	0.142
Existence of recycle bins	2.0	2.0	0.377
Usage of recycled material	1.0	1.0	0.781
Energy efficient infrastructure	1.0	1.0	0.582
Power saving features	1.0	1.0	0.688
Promotion of walking	1.0	1.0	0.650
Promotion of cycling	1.0	1.0	0.425

**TABLE 4. Soft modes at the station**

Indicators	Median rating		p-value
	Men	Women	
Provision of right of way to people walking	1.0	1.0	0.708
Provision of right of way to people of cycling	1.0	1.0	0.284
Possibility of transferring bicycles with public	1.0	1.0	0.346
Appropriate signals for cycling and walking	1.0	1.0	0.810
Provision of bicycles (for free or to let) in the station facilities	1.0	1.0	0.754
Canopies and stops for people walking throughout the station	1.0	1.0	0.731
Weather protection infrastructure for people walking or cycling	1.0	1.0	0.406
Demarcation of incoming and outgoing flows for people walking or cycling	1.0	1.0	1.00

Focusing on safety and security, the five indicators used in this case were evaluated as below adequate by the respondents (Table 5), while there were not observed any statistically significant differences between men and women. However, it seems that the presence of police officers and the Closed-Circuit Television systems increase the sense of safety and security for women.

**TABLE 5. Safety and security level at the station**

Indicators	Median rating		p-value
	Men	Women	
Sense of security during the stay at the station	2.0	2.0	0.749
Sense of security when travelling with public	3.0	3.0	0.661
Lighting throughout the station	2.5	3.0	0.956
Closed-Circuit Television	1.5	2.0	0.408
Policing	2.0	2.0	0.682

Travelers' convenience was assessed through three indicators, and once again the difficulties that cyclists, pedestrians and mothers carrying a baby trolley face, were indicated (Table 6).

**TABLE 6. Travelers' convenience**

Indicators	Median rating		p-value
	Men	Women	
Convenience of a mother carrying a baby trolley to move throughout the station	2.0	2.0	0.934
Convenience of a cyclist to move throughout the station	2.0	2.0	0.465
Convenience of a pedestrian to move throughout the station	4.0	4.0	0.982

Regarding information provision, the findings of the survey showed that pre-trip information for all available connections at the station, real time information for delays/cancellations and incidents, station information and provision of information for all available modes and their connections in the station are considered as poor, while the central announcements for arrivals/departures and other events as below adequate (Table 7).

**TABLE 7. Information provision**

Indicators	Median rating		p-value
	Men	Women	
Pre-trip information provision for all available connections from the station	2.0	2.0	0.371
Information for all available modes of transport	2.0	2.0	0.594
Real time information for delays/cancellations and incidents	2.0	2.0	0.919
Station information	2.0	2.0	0.697
Central announcements for arrivals/departures and other events	3.0	3.0	0.625

When assessing the opinion of the respondents on land use (Table 8), it was observed that almost all relevant indicators were rated as below adequate. Especially focusing on issues that are of high interest for female travelers, such as child labor areas and baby care facilities, it is clear that the station does not at all cover these needs.

**TABLE 8. Land use**

Indicators	Median rating		p-value
	Men	Women	
Commercial shops	3.0	3.0	0.806
Recreational areas	2.0	2.0	0.888
Cafe-restaurants	3.0	3.0	0.559
Waiting areas	3.0	2.0	0.067
Long-term car parking	1.0	1.0	0.160
Short-term car parking	2.0	1.0	0.165
Bicycle parking	1.0	1.0	0.270
Motorcycle parking	2.0	1.0	0.446
Taxi stop/parking areas	3.0	3.0	0.961
Cycling routes	1.0	1.0	0.308
Pedestrian routes	1.0	1.0	0.668
Bus stop lanes	4.0	3.0	0.774
Platforms with waiting area	3.0	2.0	0.05*
Kiosks with canopy	3.0	2.0	0.131
Luggage storage areas	2.0	2.0	0.811
Public toilets	2.0	2.0	0.820
Child labor areas	1.0	1.0	0.417
Baby care facilities	1.0	1.0	0.720
Pharmacy	2.0	1.0	0.666
Banks/ATMs	2.0	2.0	0.786

(\*) statistically significant with  $p < 0,05$

The last aspect tested was the connections of the station with the wider urban area. In this case, due to the advantageous location of the station and the high bus connectivity with the majority of the urban destinations, the opinion of the respondents was rather positive (Table 9).

**TABLE 9. Connection of the station with the wider urban area**

Indicators	Median rating		p-value
	Men	Women	
City center	4.5	4.0	0.588
Universities	5.0	4.0	0.697
Technical schools	4.0	4.0	0.986
Hospitals	3.0	3.0	0.267
City Hall	4.0	4.0	0.798
Historic center	3.0	2.0	0.403
Central shopping center	4.0	3.0	0.636
Intercity bus station	5.0	4.0	0.202
Port	3.0	4.0	0.257
Airport	5.0	3.0	0.045*
Industrial area	3.0	3.0	0.837

(\*) statistically significant with  $p < 0,05$

### ***Assessment of alternative mobility scenarios***

The findings of the assessment of fifteen alternative mobility scenarios are given in the following paragraphs. Once again, the normality of the data was assessed through the Shapiro-Wilk test, and the Mann-Whitney two-sample U testing was performed, in order to investigate if there are any differences in the respondents' intentions in relation to gender. Respondents graded the scenarios on a 6-point scale, ranging from 1 (negative impact/decrease in movements) to 6 (positive impact/increase of movements). The results of the assessment of the above scenarios, in terms of whether the movements of the respondents under each alternative scenario would be affected, are presented in Table 10.

In general, results showed that the movements of the respondents under the fifteen scenarios would be affected, and, specifically, it seems that interventions, such as the provision of real time information, the increase of the frequency of the public transport routes connected with the station and the increase of the reliability of the movements related with the station, would increase the number of their movements.

Focusing on women, it is indicated that important parameters affecting their movements are the sufficient connections of the station with the rest of the public transport network, the frequency of the public transport routes connected with the station and the reliability of the movements related with the station. On the other hand, it seems that the connection of the station with cycling path or the bounding of walking paths inside the station would not be of high priority for their movements.

**Table 10. Respondents' perceptions under alternative mobility scenarios**

Scenarios	Median rating		p-value
	Men	Women	
Scenario 1: The station is connected with cycling path	4.0	3.0	0.262
Scenario 2: Bounding of walking paths inside the station	5.0	4.0	0.166
Scenario 3: Improvement of the station environment	4.0	4.0	0.772
Scenario 4: Real time information provision	5.0	5.0	0.815
Scenario 5: Organized parking area	5.0	5.0	0.636
Scenario 6: Organized free short-term parking area	5.0	5.0	0.482
Scenario 7: Direct connection of the station with crucial destinations (i.e. hospital).	5.0	5.0	0.899
Scenario 8: Development of bicycle parking area	4.0	4.0	0.809
Scenario 9: Provision of bicycles in the station facilities	4.0	4.0	0.936
Scenario 10: Construction of ramps	4.0	4.0	0.515
Scenario 11: Operation of more commercial centers	4.0	4.0	0.824
Scenario 12: Sufficient connections of the station with the rest public transport network	5.0	5.0	0.488
Scenario 13: Increase of the frequency of the public transport routes	5.0	5.0	0.543
Scenario 14: Increase of the reliability of the movements related with the station	5.0	5.0	0.777
Scenario 15: Efficient support of people with disabilities	4.0	4.0	0.660

## **RECOMMENDATIONS**

As part of the questionnaire survey, the respondents were invited to make proposals for the upgrade of the railway station. These proposals have been elaborated and adjusted to women's transportation needs and expectations and are cited below, formulated as recommendations for key aspects of the development and

operation of an urban transport interchange, thus accessibility, safety and convenience, information provision and infrastructure and services:

#### **Accessibility**

- Provision for people with reduced mobility skills and mothers carrying a baby trolley;
- Increase in the connectivity of the reliability of the movements related with the station;
- Promotion of sufficient connections of the station with the rest public transport network.

#### **Safety and convenience**

- Increase of police presence and enforcement;
- Creation of user friendlier station;
- Setting of Closed-Circuit Television throughout the station.

#### **Information provision**

- Development of information systems (voice and visual) for the provision of real time; information for departures, arrivals and delays;
- Information provision for all modes;
- Reduction of waiting time for ticketing.

#### **Infrastructure and services**

- Development of short and long term parking spaces;
- Redesign of the station in a more sustainable way;
- Development of green zones/areas;
- Creation of sidewalks and cycling facilities and infrastructure;
- Promotion of the commercial use of the main station building;
- Creation of child labor areas;
- Provision of baby care facilities.

## **CONCLUSIONS**

In the framework of the present paper, an effort was made to identify the aspects of developing efficiently operated transportation hubs that fit appropriately to the urban environment and effectively serve women's mobility needs, and to introduce a new approach for transportation hubs design, able to fulfill women's needs and prioritize their movements.

Towards this direction, a number of European transport interchanges were studied and mobility transportation needs' aspects relevant to women were indicated. These aspects were then linked to a number of indicators, which were practically tested, through an internet based survey, in the case of Thessalonikis railway station transportation hub in Greece. The scope of the survey was to investigate the degree of women's satisfaction regarding the selected interchange's mobility and spatial theme, to record proposals for its reformation and to address stated preferences and reactions under different development scenarios.

The findings highlight the weaknesses and deficiencies of the station in terms of accessibility, environmentally friendly services and infrastructures, and safety and security. Focusing on women and summarizing the main findings, it was observed that they consider the provision of information for all modes and real time information for delays/cancellations and incidents as of high importance, and they do state the absence of services that are significant for them, such as the child labor areas and baby care facilities.

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# Gendered mobility in Malta: Influencing factors on travel choices

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## ABSTRACT

Malta is one of the smallest member states, but has also one of the highest rates of motorization, in Europe. In 2010, the number of private vehicles per thousand population stood at 555. Seventy-one percent of all trips were carried out by car and only a small percentage of trips (22.6%) were carried out by other means (mainly bus and on foot). Malta's economic development has progressed steadily since joining the European Union in 2004, and the islands have managed to avoid the impact of the global financial crisis, mostly due to island insularity. Heavy car dependence is a cause for concern as it is increasing congestion and pollution, and putting significant strain on infrastructure in an island with limited land and space resources. Gender differences in transport and mobility patterns are high. The 2010 Household Travel Survey reported that, whilst 60 per cent of frequent bus users were female, 61 per cent of non-bus-users were male. This gender disparity is also reflected in the population of licensed drivers and the car ownership patterns. The research aims to (i) study the mobility patterns of men and women in the islands and identify the changes that occurred over the 12-year period between 1998 and 2010, (ii) examine the relationships between transport patterns and selected socio-economic characteristics of females and men such as age, status and employment, and (iii) discuss the policy implications for future transport policy. This research uses the data of the 1998 and 2010 Household Travel Surveys to study the mobility patterns of men and women in the islands. In answering the research questions, descriptive statistics, correlations, co-variance and regression will be used. The research will provide a first ever review of gender based transport patterns in Malta and will highlight some of the more pressing concerns supporting future mobility. The study will conclude with a discussion on the policy implications for future transport as well as some interesting avenues for further research.

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**KEYWORDS:** Gender; Mobility; Malta.

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## 1. INTRODUCTION

Aspects of society and lifestyles are responsible for the demands placed on our transport systems (1). Therefore understanding such aspects and studying their impact might provide useful insights into sustainable future transport policies. One aspect that has gathered interest over the past decades has been the patterns of mobility of men and women within the context of different societies and lifestyle choices. Early studies identified gender differences in travel behaviour (2, 3) and female transport disadvantage (4, 5), whilst later studies provided insights into various societal patterns (6). In the summary to the 4th International Conference on Women's Issues in Transportation, Hanson et al. (2009) identify the need for more research into the historical evolution of gender and transport relationships (7), whilst Murakami et al. (2009) identify the need to study mobility in relation to gender and socio-demographic variables and the implication of such on policy (8).

Malta joined the European Union in 2004 and has experienced a steady economic growth, managing to a certain extent avoid the impact of the global financial crisis, mostly due to island insularity (9). The islands have a total area of 318 km<sup>2</sup> and are home to a population of just over 400,000 people and over a million tourists visiting every year, making them some of the most densely populated areas in the world. Malta's public transport system is based on buses, taxis and ferry services. Rail and tram services provided by the British stopped operating in the 1930s, due to the flexibility and service offered by the bus. In 2010 however the rate of motorization stood at 555 passenger cars per 1,000 inhabitants, a relatively high rate when compared to the EU27 2009 estimated average of 473 (10-12). The high car ownership reflects a very car dependent society where 71 per cent of all trips are carried out by car and only a small percentage of trips (22.6%) are carried out by other means (including bus and on foot) (13). This car dependence however is not gender equal. The 2010 National Household Travel Survey reported that, whilst 60 per cent of frequent bus users were women, 61 per

cent of non-bus users were male (13). This is mirrored in the statistics for driving licences where 78 per cent of males are licensed drivers but only 49 per cent of females are licensed drivers (14), and most probably in the actual car ownership even though this is harder to quantify from official statistics.

This paper reports on the findings from two National Household Travel Surveys carried out in the islands in 1998 and 2010. The research aims to (i) study the mobility patterns of men and women in the islands and identify the changes that occurred over the 12-year period, (ii) examine the relationships between transport patterns and selected socio-economic characteristics of females and men such as age, status and employment, and (iii) discuss the policy implications for future transport policy. As such, Section 2 will review the relevant academic literature. Section 3 will present the case study and discuss the methodology adopted for the research. Section 4 will present the results of three research questions which were formulated to analyse the household travel survey data, and Section 5 will conclude the paper with some suggestions for further research in this area, necessary to assist in policy making.

## 2. LITERATURE REVIEW

Sustainable futures have been associated with shifts towards less energy and carbon intensive transport modes and often towards less, rather than more mobility (15-17). However literature has pointed towards the need for a better understanding of mobility patterns today and in the past, in order to manage transport demand in the future (18, 19). This is particularly true for the need to understand mobility patterns taking into consideration variables such as gender, age, family composition and employment. Frändberg and Vilhelmson (2011) analyse gender and age as determinants of mobility in Sweden (18) and even earlier, Uteng and Cresswell (2008) identify gender differences in activities and travel behaviour (20).

More recent studies have also highlighted the role of the women within society, with particular reference to family and employment as having an impact on travel behaviour (21, 22). Whilst others looked in detail at aspects of gendered travel mode, given specific socio-cultural conditions in the households (23).

Although many studies concurred in the 'disadvantage' associated with female mobility (24, 25, 4) and find support in various studies linking differences to, for example, intention of owning and using a car (26, 27), the presence of children in the family (28), employment and commuting patterns (29), there is also evidence of convergence in some societies between genders (30-34). Scheiner and Holz-Rau (2012) are cautious in their assessment of gender differences and also find some evidence in their study of convergence (23). However it is also noted that in the case of car-deficient households, the effect of preference and agreement between partners on who uses the car might be an influencing factor which cannot be extracted from travel data. This might have significant impact on the view of inequality between genders, as portrayed by some (35, 5).

Aspects related to society and lifestyles have also been considered in the literature as affecting transport choices. The changes to the population are a major contributor; however, increased changes in women's participation in the workforce have been documented as a major determinant. Best and Lanzendorf (2005) note a 23 per cent increase in female employment in Germany between 1975 and 2002 (22), whilst in the UK Biggart and O'Brien (2010) report an increase of female employment from 56.4 per cent in 1971 to 69 per cent in 2008 (36). This and other factors as highlighted by Lyons et al. (2002), to include amongst others the birth rate, male and female life expectancy, household size and status (married, divorced or single), all contribute directly or indirectly to the future demands for transport (1). It is therefore relevant and particularly important for this study to capture that development and project such indicators in the future to direct policy accordingly.

## 3. CONTEXT AND METHODOLOGY

Malta experienced a dramatic modal shift over a relatively short period of time. Figure 1 shows the changes in modal share between 1989, 1998 and 2010, with the largest shift occurring from bus to car during the 1990s and from walking to more car driving during the first decade of this century. This, similar to trends experienced in many other European countries, counters any efforts by the Government to move towards sustainable mobility and its implications on quality of life and overall sustainable development, an important objective for the European Union.

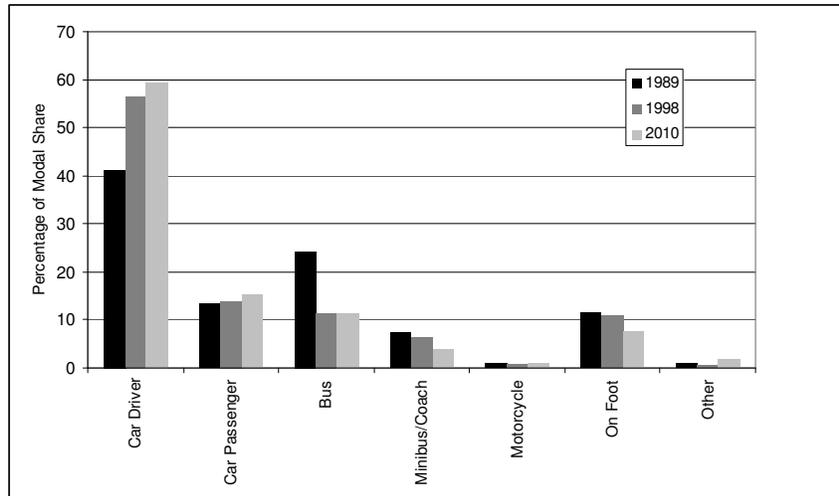


FIGURE 1. The modal share in Malta for 1989, 1998 and 2010 (13).

Malta’s high car ownership and car dependence stem from a number of factors. Over the past two decades, households have seen an increase in the amount of disposable income, a decline in the number of children and therefore smaller households, a higher rate of female participation in employment (even though still lower than the EU average), declining quality of service in public transport infrastructures coupled with an increase in the status symbol associated with driving a car (as opposed to riding a bus) (37-39). Table 1 presents an overview of key indicators between 2000 and 2010.

TABLE 1. Malta socio-demographic and economic indicators 2000-2010 (40, 41)

Description of Indicator	2000	2010
Total land area (incl. Gozo and Comino)	316 km <sup>2</sup>	316 km <sup>2</sup>
Percentage of built-up land	23.6%	26.5%
Population	391,415	417,617
Population density per km <sup>2</sup> of built up area	5,275	4,983
Female participation in employment	27%	32%
Crude Birth Rate	11.4	9.6
Average Household Size	2.9 (2005)	2.9
Number of occupied households	119,479 (1995)	139,178 (2005)
Household Disposable Income	€16,549 (2005)	€25,968
Ratio of female to male licensed drivers	1 : 1.8 (2001)	1 : 1.6
Licensed vehicles on the road	246,825	304,705
Percentage private vehicles	75%	76%
Private passenger vehicles per 1,000 inhabitants	473	555
Estimated annual vehicle km for private vehicles	9,000 km	9,840 km
Share of car as percentage of all trips	70%	71%
Public transport modes	bus, ferry, taxi	bus, ferry, taxi
Public transport patronage in million passengers	31.2	32

The data in Table 1 reflects aspects of Maltese society and lifestyles. It is evident that over the 10-year period a number of significant changes occurred, which in turn have affected the transport system in the islands. The increase in Household Disposable Income, women’s participation in the labour force and the declining birth rate are probably significant. However the increase in the number of vehicles and the increase in the dependence on the car are also worth pointing out. Despite some indicators showing a decline, such as the crude birth rate, the average household size remained unchanged between 2005 and 2010. The slight increase in public transport patronage is due to tourist increases over the years and the booming cruise liner sector,

with thousands of patrons visiting the islands and touring the islands in a day by bus. These key indicators set the scene for the analysis which this study aims to highlight.

This research is relevant for a number of reasons. Primarily, it is the first such study for the islands of Malta. This research will shed light on the development of travel mobility patterns in a fast developing state in the European Union. Second, it is significant for the policy development in transport and land use development in Malta. The future demographic projections in Malta point towards an increased elderly population with a greater percentage of female elderly citizens (54% of people over the age of 60 in 2025 and 53% in 2060) (42), and this study will highlight aspects of gendered mobility, critical for the success of future transport policy and systems. Thirdly, the rapid rise in car dependence experienced in Malta is occurring in other island states across the world and also in similarly sized cities in Europe and beyond. The use of islands as small scale spatial laboratories for more complex politics of larger countries has been highlighted by Enoch and Warren (2008) and earlier King (1993), who used islands as case studies for policies and development studies (43, 44).

The data used in this research comes from national household travel surveys conducted by the Malta Environment and Planning Authority and Transport Malta, the government's regulatory authorities for environment and land use planning and transport. National household travel surveys in Malta have been carried out in 1989, 1998 and 2010. This study uses the data from the 1998 and 2010 surveys to compare the last two decades when increased private motorization and car dependence occurred. In both surveys, one day travel diaries were solicited by post from a number of households to collect data on trips carried out on a typical week day. In 1998 the survey was conducted to reflect the travel patterns of Tuesday the 25<sup>th</sup> of November and in 2010 the survey day was Wednesday the 26<sup>th</sup> of May. There was a good response rate in both surveys with 7,855 households responding to the survey in 1998 (approximately 6.25% of occupied dwellings) and 6,666 responses received in 2010 (approximately 4.8% of occupied dwellings). In 1998, a total of 21,000 individual travel diaries were collected recording 51,329 trips, whilst in 2010 a total of 16,952 individual travel diaries were collected translating into 41,771 trips (13, 45).

Information on trips made on the survey day was collected from all household members aged 11 and over in the form of trip diaries. The diaries included place and time of departure and arrival, mode of transport used and purpose. A questionnaire complemented the trip diaries and included questions about personal and household characteristics, including household size, car ownership, public transport use and the socio-demographic attributes of the residents and place of work or education.

In 1998 the sample of households was apportioned directly at local council level. For the 2010 sample, the local council electoral register was used for the selection and was proportioned to a statistically representative number of households at a district level. The data was ultimately compiled into a MS Access Database and made available for this study by Transport Malta and the Malta Environment and Planning Authority's Transport Planning Unit.

In order to fulfill the objectives of this research a number of questions were posed and a series of tests were run on the 1998 and 2010 Household Travel Survey data. Travel patterns were determined through assessing modal choice, trip purpose and travel times. A number of variables were defined as affecting travel behaviour and used in the analysis of this research. These included gender, age, marital status and employment. A justification for the choice of variables is given in Section 3 below. More specifically, the study sought to answer the following three research questions (RQs) empirically:

RQ1: What mode of transport (car<sup>115</sup>, bus, on foot<sup>116</sup>) would travelers use given their gender, age, marital status, employment status and purpose of trip? Does this pattern change over time?

RQ2: Do significant gender differences exist in the proportions of travelers travelling (i) by car, (ii) by bus, and (iii) on foot in 1998 and 2010? If so, do the gender proportions across the three modes of transport change significantly over time?

RQ3: Does travel time vary as a function of gender during (i) shopping trips, (ii) working trips, and (iii) leisure trips, even after statistically controlling for any effects of age, employment and marital status?

<sup>115</sup> Car here refers to private passenger car which includes small truck, pick-ups and SUV's if registered for private use.

<sup>116</sup> These three modes are the main modes of transport in the island with ferry and cycling having recorded insignificant levels in the overall modal choice.

To answer RQ1, we used multinomial logistic regression. This statistical technique makes it possible to determine which of the following five independent variables – gender (male/female), marital status (married/other), age (11-17, 18-40, 41-60, 61+), employment status (yes/no), and purpose of trip (shop, work, leisure) – could predict three modes of transport (car, bus, on foot). For RQ2, we used cross-tabulations and z-tests to determine how the proportions of those travelling by car, by bus, and on foot varied by gender (male, female) and across time (1998, 2010). In investigating RQ3, we employed analyses of variance (ANOVAs) to determine whether travel time varied as a function of gender during (i) shopping, (ii) working and (iii) leisure related trips. In the presence of a significant F statistic in ANOVA, we used hierarchical regression analysis to determine whether the gender difference was still statistically significant after controlling for any effects of age, employment and marital status. In the presence of a non-significant F statistic in ANOVA, we used stepwise regression analysis to determine whether age, employment and marital status emerged as significant predictors of travel time. It is worth noting that since the 2010 Household Travel Survey did not contain information on the marital status of the respondents, marital status was included as a variable only with the 1998 Household Travel Survey data.

## 4. RESULTS

The data sets for Household Travel Surveys of 1998 and 2010 were analysed and this section outlines the main results and comparisons.

*RQ1: What mode of transport (bus, car, on foot) would travelers use, given their gender age, marital status, employment status, and purpose of trip? Does this pattern change over time?*

The National Household Travel Survey data set of 1998 was restricted to trips related to shopping, work and leisure. This resulted in 15,915 trips of which 66.1 per cent were work related, 23.6 per cent were for shopping and 10.3 per cent were for leisure. The most popular mode of transport was the car (79.9%), followed by the bus (10.2%) and walking (9.9%). The majority of the travelers were male (64.2%), aged 18-40 (49.4%), employed (75.8%) and married (68.0%). After specifying 'car' as the reference category in multinomial logistic regression, the following information was obtained:

- Walking versus using a car was significantly predicted by gender, age, marital status, employment status, and purpose of trip. In fact, travelers who were female, relatively older, not married, not employed and whose purpose of trip was to shop or to work rather than for leisure, were more likely to prefer walking than to use a car. The corollary holds that those who preferred to use a car rather than to walk were more likely to be male, relatively younger, married, employed and who travelled for leisure rather than for work or for shopping.
- Catching a bus versus using a car was significantly predicted by gender, age, marital status, employment status, and purpose of trip. In fact, travelers who were female, relatively older, not married, not employed, and whose purpose of trip was for shopping or for work rather than for leisure, were more likely to prefer using a bus to a car. The corollary holds that those who preferred using a car to a bus were more likely to be male, employed, married, and who travelled for leisure rather than for shopping or for work.

The same analysis was conducted using the National Household Travel Survey of 26th May 2010. In this data set, marital status was not available, and so we used four factors (gender, age, employment status, purpose of trip) in an attempt to predict the mode of transport used (car, bus, on foot). After restricting the data set to trips related to work, shopping and leisure, we ended up with 12,201 trips of which 66.9 per cent were work related, 23.0 per cent were for shopping and 15.1 per cent were for leisure. The most popular mode of transport was the car (85.6%), followed by the bus (8.2%) and walking (6.2%). The majority of the travelers were male (55.0%), aged 18-40 (41.3%), and employed (74.7%). Apart from the omission of marital status, the conclusions drawn from the 2010 data set were exactly the same as those reported for 1998. Summaries of multinomial regression output for the 1998 and the 2010 Household Travel Surveys are presented in Tables 2 and 3 respectively.

The increase in both car use and percentage of employed with the sample tallies with the national statistics of increased motorization and female participation in employment. The results from RQ1 show no significant difference in the patterns of use of particular modes of transport over time, taking into consideration socio-demographic variables. This might indicate a threshold for future mobility patterns.

**TABLE 2. Multinomial Regression Parameter Estimates (1998)**

Mode <sup>a</sup>		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Bus	Intercept	-5.018	.168	889.900	1	.000			
	Age	.424	.041	105.973	1	.000	1.529	1.410	1.657
	[gender = female]	.939	.060	245.158	1	.000	2.556	2.273	2.875
	[gender = male]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[marital_status = not married]	.941	.061	234.849	1	.000	2.562	2.272	2.890
	[marital_status = married]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[employment_status = not employed]	.800	.078	105.888	1	.000	2.225	1.911	2.591
	[employment_status = employed]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[purpose = work]	.885	.118	56.621	1	.000	2.422	1.924	3.050
	[purpose = shop]	1.114	.115	93.731	1	.000	3.047	2.432	3.818
	[purpose = leisure]	0 <sup>b</sup>	.	.	0	.	.	.	.
On foot	Intercept	-3.885	.150	670.652	1	.000			
	Age	.343	.040	72.352	1	.000	1.410	1.302	1.526
	[gender = female]	.931	.063	220.420	1	.000	2.536	2.243	2.868
	[gender = male]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[marital_status = not married]	.451	.065	48.082	1	.000	1.570	1.382	1.783
	[marital_status = married]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[employment_status = not employed]	.948	.077	153.081	1	.000	2.581	2.221	2.999
	[employment_status = employed]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[purpose = work]	-.236	.097	5.942	1	.015	.790	.654	.955
	[purpose = shop]	.421	.089	22.302	1	.000	1.524	1.279	1.815
	[purpose = leisure]	0 <sup>b</sup>	.	.	0	.	.	.	.

a. The reference category is: car; b. This parameter is set to zero because it is redundant  
 Model  $\chi^2(12) = 2210.33, p < 0.001, R^2 = 0.18$  (Nagelkerke).

**TABLE 3. Multinomial Regression Parameter Estimates (2010)**

mode <sup>a</sup>		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
Bus	Intercept	-6.490	.302	460.714	1	.000			
	Age	.126	.049	6.780	1	.009	1.135	1.032	1.248
	[gender = female]	.869	.075	134.305	1	.000	2.385	2.059	2.762
	[gender = male]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[employment_status = not employed]	1.287	.103	156.825	1	.000	3.622	2.961	4.431
	[employment_status = employed]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[purpose = work]	3.085	.272	128.424	1	.000	21.878	12.831	37.305
	[purpose = shop]	3.171	.266	142.081	1	.000	23.828	14.147	40.136
	[purpose = leisure]	0 <sup>b</sup>	.	.	0	.	.	.	.

**TABLE 3 (continued). Multinomial Regression Parameter Estimates (2010)**

mode <sup>a</sup>		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
On foot	Intercept	-4.957	.209	565.147	1	.000			
	Age	.227	.056	16.671	1	.000	1.254	1.125	1.399
	[gender = female]	.919	.088	108.130	1	.000	2.507	2.108	2.981
	[gender = male]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[employment_status = not employed]	1.185	.113	110.556	1	.000	3.270	2.622	4.078
	[employment_status = employed]	0 <sup>b</sup>	.	.	0	.	.	.	.
	[purpose = work]	.702	.144	23.746	1	.000	2.019	1.522	2.678
	[purpose = shop]	1.123	.127	77.779	1	.000	3.074	2.395	3.945
	[purpose = leisure]	0 <sup>b</sup>	.	.	0	.	.	.	.

a. The reference category is: car; b. This parameter is set to zero because it is redundant.

Model  $\chi^2(10) = 1457.77$ ,  $p < 0.001$ ,  $R^2 = 0.18$  (Nagelkerke).

*RQ2: Do significant gender differences exist in the proportions of travelers travelling (i) by car, (ii) by bus, and (iii) on foot in 1998 and 2010? If so, do the gender proportions across the three modes of transport change significantly over time?*

The question sought to determine how the proportion of those travelling by car, by bus, and on foot varied by gender (male, female) and across time (1998, 2010). A series of cross tabulations and z-tests for two population proportions revealed that:

- a significantly higher proportion of men than women use the car to travel, while a significantly higher proportion of women travel by bus or on foot, with the same pattern emerging in both 1998 and 2010.
- a significantly higher proportion of men and women are using the car in 2010 when compared to 1998, while a significantly lower proportion of men and women are travelling by bus or on foot in 2010 when compared to 1998.

A detailed summary of statistical output is presented in Table 4.

**TABLE 4. Comparing population proportions (Summary of Cross tabulation and z-test output)**

Gender	Mode of transport								
	Car			Bus			On foot		
	1998	2010	z	1998	2010	z	1998	2010	z
Women	65.4%	78.6%	-15.46*	17.0%	12.0%	7.63*	17.5%	9.5%	12.44*
Men	88.0%	91.4%	-6.99*	6.3%	5.2%	3.15*	5.7%	3.4%	6.64*
Women	65.4%				17.0%		17.5%		
Men	88.0%		-20.08*		6.3%	21.44*	5.7%		23.20*
Women		78.6%		12.0%			9.5%		
Men		91.4%	-34.09*	5.2%		13.57*	3.4%		13.80*

\* Statistically significant at  $p < 0.001$

These results might not suggest convergence between the sexes; however, the increase in use of the car by females might indicate a greater number of female drivers in the future as socio-economic characteristics within the population change (for example, participation in paid employment).

*RQ3: Does travel time vary as a function of gender during (i) shopping trips, (ii) working trips, and (iii) leisure trips, even after statistically controlling for any effects of age, employment and marital status?*

The analysis carried out for the 1998 dataset revealed the following results.

*Leisure.* The average time for a leisure related trip was 17.72 minutes (SD = 8.43). Females (M = 18.62, SD = 8.95) travelled longer (on average) during leisure trips than males (M = 17.16, SD = 8.78) and ANOVA revealed that the difference in travel time was statistically significant ( $F_{1, 1516} = 9.88, p = 0.002$ ). When age, marital and employment status were entered in the first step of hierarchical logistic regression, only age provided a significant effect on travel time ( $B = -0.61, SE (B) = 0.29, t = 2.06, p = 0.039$ ). When gender ( $B = -1.61, SE (B) = 0.48, t = -3.36, p = 0.001$ ) was entered in the second step, it provided a significant improvement to the previous model ( $F_{4, 1512} = 4.02, p < 0.003$ ). Hence, travelers tend to travel longer in leisure related trips if they are female and relatively older.

*Shopping.* The average time for a shopping related trip was 18.25 minutes (SD = 10.21), while males (M = 18.26, SD = 9.89) and females (M = 18.24, SD = 10.40) did not differ significantly from each other ( $F_{1, 3380} = 0.003, p = 0.955$ ). When gender, age, marital and employment status were entered as predictors of travel time in stepwise multiple regression ( $F_{2, 3375} = 10.21, p < 0.001$ ), travel time during shopping trips was significantly predicted by employment status ( $B = -1.39, SE (B) = 0.36, t = -3.85, p < 0.001$ ) and marital status ( $B = -1.07, SE (B) = 0.41, t = -2.72, p = 0.009$ ). Thus, travelers tend to travel longer during shopping trips if they are not employed and not married.

*Work.* The average time for a work related trip was 18.52 minutes (SD = 9.61). Females (M = 18.83, SD = 9.95) travelled longer (on average) during work related trips than males (M = 18.40, SD = 9.49) and ANOVA revealed that the difference in travel time was statistically significant ( $F_{1, 10471} = 3.86, p = 0.023$ ). When age, marital and employment status were entered in the first step of hierarchical logistic regression ( $F_{3, 10448} = 1.64, p = 0.177$ ), they did not produce any significant effect on travel time. Thus, we could conclude that travelers tend to travel longer during work related trips if they are female.

The analysis carried out for the 2010 dataset revealed the following results.

*Leisure.* The average time for a leisure related trip was 15.95 minutes (SD = 8.43). Males (M = 16.60, SD = 8.37) travelled longer (on average) during leisure trips than females (M = 15.54, SD = 8.44) and ANOVA revealed that the difference in travel time was statistically significant ( $F_{1, 1781} = 6.70, p = 0.01$ ). However, when age and employment status were entered in the first step of hierarchical logistic regression ( $F_{2, 1780} = 9.40, p < 0.001$ ), travel time during leisure trips was significantly predicted by age ( $B = 1.22, SE (B) = 0.30, t = 3.99, p < 0.001$ ) and employment status ( $B = 0.99, SE (B) = 0.41, t = 2.42, p = 0.016$ ) while gender did not provide any significant improvement in explained variance when it was entered in the second step ( $B = 0.37, SE (B) = 0.46, t = 0.81, p = 0.421$ ). The beta coefficients revealed that travelers tend to travel longer during leisure trips if they are older and employed.

*Shopping.* The average time for a shopping related trip was 18.26 minutes (SD = 10.22), while females (M = 18.28, SD = 10.15) and males (M = 18.21, SD = 10.34) did not differ significantly from each other ( $F_{1, 2755} = 0.03, p = 0.862$ ). When gender, age and employment status were entered as predictors of travel time in stepwise multiple regression ( $F_{1, 2755} = 19.81, p < 0.001$ ), travel time during shopping trips was significantly predicted by employment status ( $B = -1.84, SE (B) = 0.41, t = -4.45, p < 0.001$ ). Thus, travelers tend to travel longer during shopping trips if they are not employed.

*Work.* The average time for a work related trip was 20.23 minutes (SD = 10.25). Females (M = 20.60, SD = 10.42) travelled longer (on average) during work related trips than males (M = 20.04, SD = 10.16) and ANOVA revealed that the difference in travel time was statistically significant ( $F_{1, 7702} = 5.15, p = 0.023$ ). However, when age and employment status were entered in the first step of hierarchical logistic regression ( $F_{2, 7701} = 8.58, p < 0.001$ ), travel time for work related trips was significantly predicted by age ( $B = -0.76, SE (B) = 0.19, t = -3.92, p < 0.001$ ) but not by employment status ( $B = 0.36, SE (B) = 0.53, t = 0.68, p = 0.495$ ). When gender was entered in the second step, it did not provide any significant improvement in explained variance ( $B = -0.42, SE (B) = 0.25, t = -1.68, p < 0.094$ ). In fact, the beta coefficients revealed that travelers tend to travel longer during work related trips if they are younger.

In the above analysis, the Levene test was used prior to ANOVA to ensure that the equal variances assumptions could be assumed. In fact, in all cases, the F statistic (which ranged from 0.184 to 2.67) was not statistically significant. In multiple regression analysis, the Durbin Watson statistics which ranged from 1.802 to 1.820 were close to 2, indicating that the assumption of independent errors was tenable (46). Additionally, the VIF statistics were all close to 1 (ranged from 1.03 to 1.12) suggesting that the issue of multicollinearity was of no concern here (46).

Differences were only noted in leisure trips over time. More significantly there were no gender differences in travel time for work and shopping trips between 1998 and 2010. These results do not point towards significant impacts on transport policy, at least looking at the development of mobility over the period 1998 and 2010. The study suggests other socio-demographic factors or maybe household composition as having an influence on the travel patterns of individuals and families (see 35, 36).

## 5. CONCLUSIONS

The analysis of the household travel survey data shows a complex relationship between demographics and transport that changed very little over time. There is evidence of increased car dependence in both female and males, even though some transport “disadvantage” is noted when travel mode is analysed. The higher percentage using walking and public transport are females, and strong relationships are established between mobility choices and particular socio-economic indicators such as employment status and age. This is the first ever study in Malta to highlight such difference. Over the period 1998-2010 there has been some evidence of convergence with females travelling almost as much as males, and using cars as their main mode of transport.

Malta’s steady economic development and rapid motorization during the 90s has had significant impact on the travel patterns of the population. It is evident from the results of this study that the use of the car is pervasive and popular among all sectors of the population and for a variety of purposes. This poses challenges to future policy making in terms of infrastructure provision and cost, accessibility and social inclusion, equity, and environmental and public health. A reversal of trends witnessed during the last decade is necessary to shift the population to more environmentally friendly modes of transport, as well as to relieve the current pressures on the limited transport infrastructure on the island, which as reported in the local press, is increasingly becoming congested throughout the whole day (47).

The results of this study highlight that demographics alone will not have any significant impact on the desired modal shift. Other more restrictive measures will have to be adopted in order to reverse the process of car dependence and growth in private mobility.

This study has also raised interesting questions for future research in this area, such as investigating the potential impact of land use distribution on travel time, and to what extent are residential and work location choices affecting behaviour. It has also raised significant questions with respect to other variables that might influence travel patterns, apart from those identified in this study. Further investigations into the role of children in the household, for example (similar to 35, 36), are necessary to explain further specific patterns of travel behaviour observed in this study and in lieu of Malta’s declining birth rate.

Malta’s case study analysis has shown how, despite being an island, it displays patterns of mobility and car dependence similar to other cities in Europe and beyond. And therefore using such statistical analysis to understand the role played by various socio-demographic and economic indicators in the future is important, as will be their impact on transport policy.

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# Women in transportation are moving the world, is the world moving with them?

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## ABSTRACT

The purpose of this study is to describe obstacles facing women in transportation in the United States. Furthermore, the study explores the steps that private companies and various organizations in the United States are taking to minimize these obstacles and the benefits to encouraging employment of women in transportation. The research findings are intended to help put together recommendations for dealing with these obstacles and ultimately attract women to the industries. This study uses a qualitative method of analysis. In addition to secondary sources, the study has used primary data in the form of personal interviews with a number of sources knowledgeable on the subject matter.

The purpose of this research is twofold: to identify major obstacles facing women in transportation and to formulate recommendations that will assist in overcoming these obstacles and helping industry adjust to accommodate women's needs. To answer these questions the following sub-questions were addressed:

1. What and how difficult are these obstacles for women?
2. What steps are being taken in order to overcome or minimize these obstacles?
3. What are the benefits to the industry?

This study is significant because it recognizes the need of the transportation industry to understand the difficulties women in transportation face. This study helps identify obstacles women are facing in transportation careers. Next, this study focuses on the importance of minimizing obstacles. Therefore, it fills the gap in the literature.

**Research Design and Methodology.** This study used the qualitative method design. The primary sources of data were taken from interviews with women drivers, pilots, associations, panel discussion, teleconferences and e-mails. Secondary source is the data collected from various internet blogs, publications, and journals.

**Organization of the Study.** Chapter One introduces the purpose of this study. This chapter states of the problem with research sub-questions, explains the research methodology, and lists interviews with the authors' names and dates of the interviews. Also, it gives the panel discussions with the place and date of events.

Chapter Two is a review of research sources and literature. This chapter presents opinions of the subject experts and scholars. It lists interviews with trucking associations, various trucking companies, truck stops, airlines, and airports. It presents reports on the truck stops across the United States.

Chapter Three describes women drivers and pilots as sub-cultures of transportation. It compares the airline and trucking industry side by side. It lists similarities, such as that both industries must comply with regulations including the English language requirement, medical requirement, mandatory training, duty hours, and an expectancy of being away from home; it uncovers that heavy-duty truck drivers cannot be younger than 21 while an airline pilot cannot be younger than 23. It reveals that the average age of a female airline pilot and the female truck driver is about the same, about 40 years old. It shows the latest data on the current employment of women pilots which, is 6.3 percent, and women truck drivers which is 5.2 percent.

Chapter Four describes obstacles and analyzes the difficulties minimizing them. It gives the background of the issues. It explains why a transportation career is difficult for women and discusses the actions taken for overcoming these obstacles. This chapter also portrays action taken by various organizations. It points out technology used to simplify life on the road. Furthermore, it lists best practices of American companies, trucks stops and airports. It explores creative ideas. It views improvements in the United States and describes the areas that need further improvements.

Chapter Five summarizes the findings and conclusions of the study. This chapter summarizes the major and minor obstacles, states recommendations, and discusses possible benefits to commerce.

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**KEYWORDS:** Women pilot; Women truck drivers.

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## INTRODUCTION

More women are needed in the transportation industry to meet the growing demands of commerce. According to the American Trucking Associations there is a shortage of 20,000 truck drivers. Airlines will need nearly half a million new commercial pilots worldwide by 2032. It goes unnoticed every day that women bus and train drivers take us to work. Women drive our children to school; women deliver our mail and other goods. They fly us to our destinations. They move the world, but is the world moving with them?

Both the aviation and trucking industries are dominated by men, but they are not equal in how they accommodate women. Women in the aviation careers are provided hotel rooms every night, while women truckers are not provided showers at truck stops. In both industries, unloading heavy cargo, carrying luggage from flight to flight can be difficult. It is hard enough for any mother, with an office job, to keep in contact with children and this is harder for someone on the road or at an elevation of 30,000 feet.

I spent my early professional years in the trucking industry and later in the aviation industry. During my pilot training in flight schools, I realized that even simple things are not designed for women. For example, the seat in a Cessna 172SP was too far away from the controls for me as a petite woman. As a result, I had to carry a special booster chair in order to reach the brakes. Sometimes, I needed help to push the plane in to that perfect parking spot.

While the participation of women in transportation is rising, meeting their needs is not keeping up. What can the transportation industry do to better accommodate women's needs and sustain women in transportation?

# Opening ground to female transit movements. Women's vs. operator's perspective in transit quality of service

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## ABSTRACT

Quality of service undoubtedly became a key issue in attracting public transport users and providing massive commuting. Daily travel needs differentiate between male and female travelers, regarding their overall assessment of quality of service provided by public transport operators, linking to a gender sensitive travel behavior.

It is a matter of fact that today's women desire a higher level of safety and security sense at stops and onboard the vehicle, an accessible ramp to board/alight a vehicle when carrying a baby stroller, anticipate a clean vehicle to seat etc. At the same time, women follow a strict program nowadays, working and baby carrying at the same time, thus they require a reliable public transportation system with real time information provision in emergency cases. These needs of women, are addressed in the present paper, outlining the different perceptions and expectation of men and women regarding their assessment on 26 quality of service indicators of public transportation. The perceived and desired level of transit service quality by women is assessed in comparison with the provided and planned quality from transit operators' point of view.

To address the objectives of the research, an extended bibliography review has been conducted, and a list of indicators were selected and assessed by transit travelers and operators in three major Greek cities: Athens, Thessaloniki and Volos.

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**KEYWORDS:** Women in transport; Public transport; Quality of Service; Transit operators; Public transport users.

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## INTRODUCTION

From a gender perspective, transit movements differentiate among sexes as travel needs are different in terms of motive reasons and movement distribution. Women make more intermodal and chained trips than men [1], as their daily life requires a majority of tasks to be covered (i.e shopping, child accompanying, work, gym etc.), usually distributed in an extended part of the urban area. Moreover, women travel much more than men with public transport and have serious time constraints [2].

Apart from gender categorization of movements with public transport as relying on different needs and habits, it is the matter of service quality that affects transit ridership. Women perceive Quality of Service attributes differently; require more reliable public transportation, frequent lines and reasonable ticket cost. All these aspects are discussed in the present paper, and validated from the paper findings.

The present paper is divided into five sections beyond the introductory section. The first section is a literature review of similar approaches related to quality of services. The second part addresses the methodology used in the study, and the third the research findings. The main conclusions of the paper are presented in the following section (section four). The last section of the paper introduces the authors' suggestions for further research in the domain.

## LITERATURE REVIEW

Quality of service is considered highly important to the vitality of every system, enterprise, organization and service in general. Many researchers examined quality of service in terms of the impact on the consumer and/or user behavior, the general assessment of a service and the firm image.

Researchers have addressed in many studies the differences among actual and perceived service quality [3-5]. Usually quality of service is examined under the perspective of user perception and previous experience [6]. On the other hand, user satisfaction is considered to influence the perception of the user and it is commonly related to the specific transaction [7]. Previous experience is listed among the parameters that formulate the expectations of quality one has from the provided services he experiences. Other factors that formulate user expectations are word of mouth and information provision.

The level of satisfaction results from the comparison of expected and perceived level of service and users are dissatisfied if their perceptions are lower than expectations [8]; otherwise users are satisfied [9].

The role of users in the quality of service formulation is very important. A user is not just the receiver of the service quality output, or the evaluator of the performed QoS. Gronroos et al. [10] consider the user as co-producer of the quality process.

Nowadays, offering high levels of transit service quality is matter of attracting the public to transit services, offering an alternative to car users, protecting the environment and promoting urban sustainability.

Many researchers tried to identify the quality of service components and develop methodologies to properly assess them [10-15]. Service quality assessment comes from social and management sciences, and thus it is a generalized approach that should be applied to any type of operation and decision. Still efforts have been made to measure the Quality of a Service, across different service sectors by many researchers [13, 16, 9, 17]. Outcomes of these efforts were some well known service quality measurement methods with application to a number of sectors, like SERVQUAL, E-S-QUAL and SERVPERF.

The actual need to study the quality of service comes from the need to understand the customer and his/her behavior. In the case of public transportation the customer is the transit user, and the basic behavior is the selection of a public transport mode, instead of a private one, the selection of the mode and the route to follow. Apart from the basic behavior, the traveler could decide to talk to others for his experience (word of mouth), to promote the transit system, to assess it etc.

Following the above reasoning, it is considered that a "positive" customer/user behavior will link to higher returns [18, 19]. The returns in the public transportation case could be attractiveness of the system, higher numbers of travelers, ticket revenues, positive user assessment etc.

To assess QoS in public transport, the generic dimensions of tangibility, reliability, responsiveness, assurance and empathy are usually followed, as proposed by Parasuraman et al. [7] in the SERVQUAL model.

Research so far has proved that population characteristics and public transportation aspects influence generic dimensions. Demographic characteristics are considered to be very important in the quality of service analysis, as gender, age, income, education etc differentiate the performance ratings [20].

Moreover, the lack of existence of a public transportation service quality model requires the add-on to existing business quality models that many times fail to address completely the specific transport quality attributes.

Special focus is given in terms of this research, to the conceptual GAP model [13]. This model correlates customers and service providers outlining the 5 gaps among them:

Gap\_1: difference between user expectations and perceptions (service quality gap)

Gap\_2: difference between users' and operators' expectations

Gap\_3: difference between operators' perceptions of users' expectation

Gap\_4: difference between service quality standards and actual service quality delivered

Gap\_5: difference between service quality delivered to users and the promise of the service quality that should be delivered

In terms of this research the first three Gaps will be investigated in the selected Greek cities sample.

## **METHODOLOGICAL APPROACH**

To assess the service quality, two parameters need to be addressed: user perceptions and expectations and the ability of service providers (transit operators in that case) to meet users' expectations [21, 22]. In terms of

this paper both parameters are examined. Two different surveys were conducted, based on the internet, one for the transit users and the other for the transit operators.

The selection of an internet based method to proceed with the survey is a common approach nowadays, due to the low cost, real-time access, automation, convenience for respondents, less time required to filled in, note influence from interviewers, more flexible design in the survey presentation and responses. On the other hand, the main disadvantages of the internet based surveys, are considered to be: the fact that certain populations are less likely to have internet access and/or knowledge to respond (mainly age and income category influence), the lack of an interviewer might cause problems in the case clarifications are required, and the fact that many receivers will probably delete the survey link before opening it [23].

In the case of the present survey a clarification note was sent to invitation receivers along with the survey link and contact details were given to those interested in receiving more clarifications. The collected sample gaps (in terms of age categories mainly) of the survey method used will be covered with a second round of questionnaires, face to face interview conducted with people with no internet access or qualifications. In terms of this research the internet based data collection is analyzed by gender, having collected comparable sizes for men and women. Regarding the survey developed for the transport operators, the problems of the survey method used were not existent as they all responded to this call.

The users' questionnaire followed the Customer Satisfaction Survey (CSS) approach, and similarly the operators' survey examined operators' level of satisfaction, along with their level of understanding users' expectations.

Based on the results and assessment of the state-of-the-art analysis, 11 main quality of service indicator categories and 26 indicators were selected and examined both by transit users and operators in terms of their level of significance and level of performance (Table 1).

**TABLE 1. General characteristics of transit users sample**

		N	%
Gender	Male	96	45,5
	Female	115	54,5
		211	100,0
Age	<= 20	21	10,0
	21-40	139	65,9
	41-65	49	23,2
	> 65	2	0,9
		211	100,0
Occupation	Private sector employee	28	13,3
	Public sector employee	50	23,7
	Free lancer	50	23,7
	Student	64	30,3
	Pensioner	5	2,4
	Unemployed	14	6,6
	211	100,0	
Mode usually used	Urban bus	152	72,0
	Trolley	3	1,4
	Metro	41	19,4
	Suburban rail	13	6,2
	Tram	2	,9
		211	100,0
Aim of travel	Work	76	36,0
	Study	42	19,9
	Markets/Shopping	20	9,5
	Entertainment	26	12,3
	Doctor/Hospital	3	1,4
	Personal issues	31	14,7
	Other	13	6,2
		211	100,0

**TABLE 1 (continued). General characteristics of transit users sample**

		N	%
Travel Frequency with Public Transport	Daily (>= 5 days/week)	56	26,5
	Many times in a week (3-4 times/week)	49	23,2
	Some days in a week (1-2 times/week)	50	23,7
	Occasionally (1-3 times/month)	36	17,1
	Rarely (<1 time/month)	20	9,5
		211	100,0
General assessment of the PT QoS	Very bad	6	2,8
	Bad	37	17,5
	Medium	101	47,9
	Good	59	28,0
	Very Good	8	3,8
	211	100,0	
Perceived Word of Mouth influence in the assessment of the PT QoS	Not at all influential	80	37,9
	Slightly influential	61	28,9
	Somewhat influential	46	21,8
	Very influential	19	9,0
	Extremely influential	5	2,4
	211	100,0	

All the closed-ended questions were designed to generate responses on a five point Likert scale to measure the importance of service quality indicated as 1 not important, 2 slightly important, 3 important, 4 quite important and 5 very important. Using the five point Likert scale users and operators indicated the actual performance of the transit services as 1 very bad, 2 bad, 3 neutral, 4 good, 5 very good.

The period when the surveys were online was from 1st August to 31st of August, 2012. The sample respondents (users) for the study were selected from the population of the three selected cities by introducing the survey letter in main public transport operators' and organizations' newsletters, emailing universities, organizations, local authorities and enterprises of these cities. In the case of transport operators, the survey questionnaire was introduced in the head of each operation with an official invitation to participate.

Regarding user questionnaires, we collected 250 responses from which 211 were valid and were analyzed in terms of this research. At the same time all public transport operators invited to participate responded positively, providing us with 5 valid operators' questionnaires.

The two samples could not be analyzed in terms of quantitative comparison due to heterogeneity of the two samples (women and operators). Still, operators represent and affect all transit systems in the selected cities (case study cities: Athens, Thessaloniki, Volos). The analysis made to compare the two samples (women and operators) was qualitative and descriptive as it was the more suitable to address the research topic.

The user questionnaire was structured in two discrete parts. The first part included questions about the demographic characteristics of the respondents, such as age, gender, education, occupation and income, as well as questions about their traveling habits like travel frequency, usual purpose of traveling (education, work, shopping, etc.), transport mode usually used, etc. In the second part of the survey, the respondents were asked to assess the level of importance and the perceived level of performance of the general transit system in Greece. The questionnaire for transit operators followed the same structure as the users questionnaire, plus a third part where operators had to state their level of understanding users by stating what they believed users perceive from the actual performance.

## RESULTS

As indicated in Table 1, the sample of the users consisted of 96 men and 115 women, while the majority of respondents (66%) were among 21–40 years old. Almost 30% of transit users were students and a percentage of 24% were public sector employees. Another 24% were free launchers. The urban bus was the mode usually used by 72% of the sample, while 19% usually prefer the metro. The majority of respondents (36%) use the

stated mode of travel for work trips and trips to work, while 20% had as aim studies, 15% personal issues and 12% entertainment.

A percentage of 73% of these trips were made either daily (26,5%) or many times in a week (23%) or weekly (24%).

The majority of respondents (48%) assessed the quality of service in the experienced public transport operations in general as medium. The experienced quality is perceived below as adequate by 20% of the sample, and above adequate by 32%.

Moreover, public transport users were asked to state the word of mouth influence perceived by them in their previous assessment for the general quality of public transport services. 40% believed that it was not at all influential and 29% slightly influential in their decision making process. Only 11% stated a significant influence of word of mouth in their perceived quality of service assessment.

In the user survey, 11 service aspects, treated as main indicators, and 26 service attributes treated as sub indicators, were evaluated by users regarding their level of significance in the general quality of a public transport service (Table 2). Each aspect was linked to one or more of the attributes and the level of correlation between them was examined (Table 2). As a result of this correlation, path ( $r = ,701$ ) seems to be a more important factor in the formulation of the significance perception of the user for the aspect of route characteristics than number of stops and distance between them ( $r = ,540$ ) or bus stop location ( $r = ,438$ ). In the same perspective, attributes 2.2, 3.1, 4.1 & 4.2, 5.1, 6.1, 7.1, 8.2, 9.1, 10.2 and 11.1 have a higher correlation importance with the related main aspects than other attributes under the same aspect category.

**TABLE 2. Service aspects and attributes assessed in the survey**

Service aspects (Main Indicators)	Service attributes (Sub-Indicators)	Pearson correlation (r) between Main and Sub- Indicators *
1. Route characteristics	1.1 Path	,701
	1.2 Number of stops and distance between stops	,540
	1.3 Bus stop location	,438
2. Service characteristics	2.1 Service frequency	,392
	2.2 Daily service time	,551
3. Service reliability	3.1 Reliability of runs that come on schedule	,661
	3.2 Punctuality (runs that come on time)	,564
4. Comfort	4.1 Bus crowding	,646
	4.2 Comfort of seats on bus	,633
	4.3 Air conditioning on bus	,461
	4.4 Levels of noise and vibrations on bus	,473
	4.5 Availability of shelter and benches at stop	,280
5. Cleanliness	5.1 Cleanliness of bus interior, seats and windows	,642
	5.2 Cleanliness of bus exterior	,415
6. Fare	6.1 Ticket cost	,791
7. Information	7.1 Availability of schedule/maps on bus, and announcements	,553
	7.2 Availability of schedule/maps at stops	,400
	7.3 Availability of information by phone, mail.	,340
8. Safety and security	8.1 Safety and competence of drivers	,602
	8.2 Security against crimes on bus	,617
	8.3 Security against crimes at bus stops	,530
9. Personnel	9.1 Personnel appearance	,656
	9.2 Personnel helpfulness	,598
10. Customer services	10.1 Ease of purchasing the ticket	,417
	10.2 Administration of complaints	,550
11. Environmental	11.1 Use of ecological vehicles protection	,796

\* Correlation is significant at the 0.01 level (2-tailed). The p value of the significance is in all correlations < 0.001

All 26 indicators were evaluated by transit users in terms of their significance, along with the perceived level of actual transit performance. The results were clustered considering the gender of users. In Table 3, the level of importance is presented by mean values for men and women and the level of their perception of the actual performance of transit services, regarding Quality of transit Services.

Evaluating the level of importance among men and women, we can see that women give a higher importance on all quality indicators than men. The performance level women perceive is also higher than men in the majority of the indicators, but still they assessed 11 out of the 26 indicators more strictly, than men (indicated with bold in Table 3).

**TABLE 3. Descriptive Statistics of transit users**

Indicators	Level of importance			Level of perception		
	Men (M)	Women (W)	W-M	Men (M)	Women (W)	W-M
	Mean Value	Mean Value	Mean Value	Mean Value	Mean Value	Mean Value
1.1	3,68	4,17	0,49	3,43	3,57	0,14
1.2	3,7	4,09	0,39	3,59	3,72	0,13
1.3	3,52	3,82	0,3	3,44	3,58	0,14
2.1	4,31	4,58	0,27	3,25	3,3	0,05
2.2	4,2	4,45	0,25	3,14	3,17	0,03
3.1	4,53	4,61	0,08	3,16	3,2	0,04
<b>3.2</b>	4,41	4,5	0,09	3,27	3,25	<b>-0,02</b>
<b>4.1</b>	4,21	4,23	0,02	3,09	2,95	<b>-0,14</b>
4.2	3,48	3,54	0,06	3,3	3,34	0,04
4.3	4,14	4,18	0,04	3,44	3,4	<b>-0,04</b>
4.4	3,56	3,64	0,08	3,05	3,19	0,14
4.5	3,58	3,93	0,35	2,88	3,19	0,31
5.1	3,92	4,25	0,33	3,26	3,32	0,06
5.2	2,84	3,14	0,3	3,02	3,28	0,26
<b>6.1</b>	4,44	4,53	0,09	2,7	2,57	<b>-0,13</b>
<b>7.1</b>	3,91	4,04	0,13	2,65	2,64	<b>-0,01</b>
<b>7.2</b>	4,15	4,37	0,22	2,75	2,58	<b>-0,17</b>
<b>7.3</b>	4,02	4,12	0,1	2,99	2,81	<b>-0,18</b>
<b>8.1</b>	3,98	4,43	0,45	3,65	3,64	<b>-0,01</b>
<b>8.2</b>	4,03	4,37	0,34	3,45	3,39	<b>-0,06</b>
<b>8.3</b>	3,89	4,35	0,46	3,46	3,23	<b>-0,23</b>
9.1	3,43	3,58	0,15	3,05	3,1	0,05
9.2	3,61	3,79	0,18	3,14	3,23	0,09
10.1	4,08	4,38	0,3	3,29	3,66	0,37
<b>10.2</b>	3,25	3,45	0,2	2,72	2,6	<b>-0,12</b>
<b>11.1</b>	3,54	4,1	0,56	2,99	2,89	<b>-0,1</b>

Considering the hierarchy of importance, women and men prioritize differently the quality of service indicators. By mean values (Table 3), women perceive as more important indicators: Reliability of runs that come on schedule (4,61), Service frequency (4,58), Ticket cost (4,53), Punctuality (4,5). Men believe that the most important indicators are: Reliability of runs that come on schedule (4,53), Ticket cost (4,44), Punctuality (4,41), Service frequency (4,31), Bus crowding (4,21).

Women consider as less important indicators: Cleanliness of bus exterior (3,14), Administration of complaints (3,45), Comfort of seats on bus (3,54), Personnel appearance (3,58). Men assessed as less important indicators: Cleanliness of bus exterior (2,84), Administration of complaints (3,25), Personnel appearance (3,43), Comfort of seats on bus (3,48).

In terms of performed services, women prioritize: Number of stops and distance between stops (3,72), Ease of purchasing the ticket (3,66), Safety and competence of drivers (3,64), Bus stop location (3,58), Path (3,57). At the same time men prioritize: Safety and competence of drivers (3,65), Number of stops and distance between stops (3,59), Security against crimes at bus stops (3,46), Security against crimes on bus (3,45), Bus stop location (3,44) and Air conditioning on bus (3,44).

Operators believe that users prioritize the following quality indicators: Number of stops and distance between stops (3,8), Availability of information by phone, mail. (3,8), Path (3,8), Bus stop location (3,8), Use of ecological vehicles (3,6).

Operators on the other hand (table 4) recognize a higher importance level on: Reliability of runs that come on schedule (5), Punctuality (4,6), Ticket cost (4,6), Safety and competence of drivers (4,6), Security against crimes on bus (4,6) and Use of ecological vehicles (4,6). They recognize as less important aspects the: Availability of shelter and benches at stop (3,2), Comfort of seats on bus (3,2), Cleanliness of bus exterior (3,4), Number of stops and distance between stops (3,4), Availability of schedule/maps on bus, and announcements (3,6), Bus stop location (3,6).

Operators evaluated the level of performance of these indicators, stating a high quality performance on Number of stops and distance between stops (4,4), Punctuality (4,2), Safety and competence of drivers (4,2), Security against crimes on bus (4,2), Use of ecological vehicles (4,2), Availability of information by phone, mail (4,2), Path (4,2). A low quality performance is related, from operators point of view with indicators: Availability of schedule/maps on bus, and announcements (2,6), Availability of schedule/maps at stops (3), Availability of shelter and benches at stop (3,2), Cleanliness of bus exterior (3,2) and Bus crowding (3,2).

From the qualitative comparison of the descriptive statistics for both women and operators, the first gap among their different opinions, level of perception, and significance is obvious. To address that fact, an additional question on how operators perceive users' responses was addressed by the survey.

Operators perceive that users recognize a higher level of quality than they actually do. Operators believe in a higher score of 3.8/5 evaluation (for indicators: 1.1, 1.2, 1.3, 7.3), while users actually perceive a high score of 3.66/5 (for indicator: 1.2). The opposite gap of perceptions among users and operators exists in the lower ground. Operators believe users give in general the lowest evaluation in 7.1 factor of 2.2/5, while users actually perceive the lower quality level (2.63/5) for the 6.1 factor.

**TABLE 4. Descriptive Statistics of transit operators**

Indicators	Level of Importance (A)	Level of actual performance (B)	Estimated user evaluation level (C)	A-B	A-C	B-C
	Mean	Mean	Mean	Mean	Mean	Mean
1.1	3,8	4,2	3,8	-0,4	0	0,4
1.2	3,4	4,4	3,8	-1	-0,4	0,6
1.3	3,6	3,8	3,8	-0,2	-0,2	0
2.1	4,2	3,6	3,4	0,6	0,8	0,2
2.2	4	3,6	3,4	0,4	0,6	0,2
3.1	5	4	3,4	1	1,6	0,6
3.2	4,6	4,2	3,4	0,4	1,2	0,8
4.1	3,8	3,2	2,8	0,6	1	0,4
4.2	3,2	3,8	3,2	-0,6	0	0,6
4.3	3,8	3,6	3,2	0,2	0,6	0,4
4.4	3,8	3,8	3,4	0	0,4	0,4
4.5	3,2	3,2	3	0	0,2	0,2
5.1	3,8	3,6	3,2	0,2	0,6	0,4
5.2	3,4	3,2	3	0,2	0,4	0,2
6.1	4,6	4	2,6	0,6	2	1,4
7.1	3,6	2,6	2,2	1	1,4	0,4
7.2	3,8	3	2,6	0,8	1,2	0,4
7.3	4,2	4,2	3,8	0	0,4	0,4
8.1	4,6	4,2	3,4	0,4	1,2	0,8
8.2	4,6	4,2	3,2	0,4	1,4	1
8.3	4,2	3,8	3,2	0,4	1	0,6
9.1	4,2	3,6	3,4	0,6	0,8	0,2
9.2	4,4	3,8	3,2	0,6	1,2	0,6
10.1	4	3,6	3	0,4	1	0,6
10.2	3,8	3,8	3,4	0	0,4	0,4
11.1	4,6	4,2	3,6	0,4	1	0,6

Analyzing operators' statements and evaluation, it is worth mentioning the differences among their stated level of importance of the examined indicators and the level of quality they perform. Column A-B in Table 4, represents this information, pointing that 4 factors (1.1., 1.2, 1.3, 4.2) are over-performed regarding their importance. This actually indicates a gap on proper planning considering the fact that operators perform better on less important quality indicators. Factors 4.4, 4.5, 7.3 and 10.2 are performed in a quality level that covers the level of significance, while all other factors have a lower quality performance than operators' perceived importance (vary from 0.2-1/5).

Another, element worth mentioning comes from the A-C column differences. This actually represents what operators believe is the gap the user understands. Operators believe that users are satisfied from 1.1 and 4.1 indicators performance (equal importance/perceived level) and over-satisfied from 1.2 and 1.3 factors. Moreover, operators believe that all other aspects do not satisfy users (in a range from 0.2-2/5).

Finally, comparing B and C columns from Table 4, we can address the gap operators believe exists owing to the difference on the actual performance and the user perception operators estimate.

Except from 1.2 indicator (Number of stops and distance between stops) which according to the operators, users totally recognize in the performed service quality, all other aspects are perceived in a lower quality level from users than actually performed (vary from 0.2-1/5).

## CONCLUSIONS

In terms of this research an effort was made to identify actual and perceived quality of service in public transport systems from points of view both women and operators.

Considering the Gap model approach, the findings of the present paper could identify the first 3 gaps in the interaction of women transit travelers and transit operators.

By mean values, women perceive as more important indicators: Reliability of runs that come on schedule (4,61), Service frequency (4,58), Ticket cost (4,53), Punctuality (4,5). Operators on the other hand (table 4) recognize a higher importance level on: Reliability of runs that come on schedule (5), Punctuality (4,6), Ticket cost (4,6), Safety and competence of drivers (4,6), Security against crimes on bus (4,6) and Use of ecological vehicles (4,6).

In terms of performed services, women prioritize: Number of stops and distance between stops (3,72), Ease of purchasing the ticket (3,66), Safety and competence of drivers (3,64), Bus stop location (3,58), Path (3,57). Operators prioritize the actual performance: Number of stops and distance between stops (4,4), Punctuality (4,2), Safety and competence of drivers (4,2), Security against crimes on bus (4,2), Use of ecological vehicles (4,2), Availability of information by phone, mail (4,2), Path (4,2).

Operators believe that users prioritize the following quality indicators: Number of stops and distance between stops (3,8), Availability of information by phone, mail (3,8), Path (3,8), Bus stop location (3,8), Use of ecological vehicles (3,6). Thus, clearly there is a gap on understanding users' perceptions.

All these differences among women's importance and performance evaluation, operators' importance and performance assessment and operators' understanding of users' perception, sketch up the quality of service framework and outline the existing gaps that should be addressed to increase the quality of service in a transit system.

## RECOMMENDATIONS AND FURTHER STEPS OF RESEARCH

The analysis of the combined assessment of the two surveys provides the means for developing a set of recommendations to transport planners, policy makers and authorities for improving quality of service, encourage women's transit mobility and improve public transport attractiveness for women.

Further steps of the research is to address and measure all the 5 gaps, according to Parasuramans' et al. model [13] in the selected case study area and propose improvements in the transit quality of service.

Moreover, this research opens ground to investigate new planning processes grounded on a participatory/voluntary base.

The present paper is part of the research conducted within the frame of a dissertation thesis that plans to investigate moreover the impact of service quality to actual user behavior and transit movements' distribution.

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# Picking up children from day-care centers following a disaster: Working mothers' attitudes and behavior in Tokyo at the time of the Great East Japan Earthquake

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## ABSTRACT

In this study, we examine difficulties related to picking up children in metropolitan Tokyo after natural disasters by analyzing events surrounding the Great East Japan Earthquake of March 11, 2011. After the earthquake, when public transit was paralyzed, many people working in central Tokyo were unable to return home, while others walked for 10 hours or more to do so. This exposed a serious social challenge for a resilient society, in that parents who could not pick up their children from day-care centers experienced psychological stress. We evaluated the challenges and related factors surrounding picking up children in Tokyo after the earthquake. The goals of this study were:

- To demonstrate the actual difficulties of picking up children in the Tokyo metropolitan area after the Great East Japan Earthquake, and
- To analyze the factors affecting the physical and psychological difficulties.

We conducted a web survey in April 2012 of 647 mothers working in central Tokyo who had children in kindergarten at the time of the disaster. Before the questionnaire, to explore the items for the survey, we conducted face-to-face or e-mail-based semi-structured interviews with a total of 14 women in their 30s who lived in Tokyo and left their small children at day-care centers. We asked respondents for detailed information on their child pick-ups and return home after the earthquake. The interviewees provided a variety of child pick-up and return home behaviors. For example, some respondents asked their partners, their parents (grandparents of the children), or relatives who were close to the day-care center to pick up their children, while others decided not to go to the day-care center because they had great confidence in the day-care center workers. There was a respondent who continued to work until 5 p.m because she did not consider it appropriate to leave her office before the normal work end time.

The results indicated that some of the respondents picked up their child before the expected time, but some picked up their child as late as after midnight. The peak expected time of child pick-up was 18:00; the actual time was 16:00 (the earthquake occurred at 14:46). In cases where the mother could not pick up the child, she tried to make use of a network of personal contacts, such as her husband, relatives, and friends. Indeed, 81.3% of the respondents were due to pick up a child, but only 39.7% succeeded; 26.7% of children were picked up by the father (respondent's partner), 10.0% by other families, and 13.6% by relatives.

The main mode of contact with the day-care center was the telephone, but the telephone network was down part of the time, so there were many people who could not communicate with the day-care center by phone. In fact, 39.7% succeeded in communicating by telephone while 37.9% did not. In Japan, there is an emergency back-up system in case the phone network is down. This is known as "Disaster Message Dial". Disaster Message Dial is a voice message board used in disaster situations such as earthquakes, provided by the phone company NTT East. However, people's awareness of it was low; therefore, it is important to increase awareness of this system. Additionally, the establishment of other communication method(s), including e-mail, Twitter, and SMS should be explored.

Regarding employers' decisions after the earthquake, 21% of the respondents were not allowed to return home before the normal work end time. However, 34.3% were provided with assistance to return home by their employer, such as water, maps, and helmets.

Although more than half of the respondents had not discussed child pick-ups from the day-care center with their partner before the disaster, after the disaster, almost half had such a discussion. The experience became a chance to better prepare for future disasters.

A multiple regression analysis showed that respondents who did not know their walking route to return home suffered from higher physical and psychological difficulties in picking up their child. This issue could be resolved if people understood their walking route to return home in advance. One of the interviewees said that her company had distributed walking maps for returning home to all employees as a disaster prevention countermeasure.

Respondents who had good relationships with the day-care center suffered from more psychological difficulties in picking up their child. The reason was not clear from this study. One possible explanation could be that respondents worried about the burden on the nursery teachers if they could not contact the day-care center. Thus, it is possible that this result might be related to communication methods between working mothers and day-care centers. This issue requires further examination.

A limitation of this study was that we used only cognitive factors, such as “difficulties”, for the analysis. By using the location of a respondent’s home and workplace, and their location at the time of the disaster, we could calculate the approximate distance between them using a geographic information system (GIS). We could then assess whether the actual distances should reasonably cause physical and psychological difficulties in pickup of children. In addition, the difficulties of the respondents should also be further analyzed quantitatively.

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**KEYWORDS:** Picking up children; Disaster; Multiple regression; Working mother.

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# Creating work trip differences between women and men. The role of gender contracts within the household<sup>117</sup>

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## BACKGROUND AND AIM

In Sweden the policy of regional enlargement – i.e. promoting the geographical extension of labor markets and associated longer commuting distances – is embraced as a means of stimulating economic growth. However, since women generally and historically commute considerably shorter distances than men do, in Sweden as in other countries, a critical issue is whether women and men can participate in this process of enlargement to the same extent. Furthermore, the role and consequences of still longer work trips in people's daily living are seldom highlighted in this political discussion.

How do cohabiting women and men negotiate and respond to needs and claims for longer work trips? This poster highlights the role of gender contracts (an analytical concept developed by Hirdman 1990, 1993, 2003) within the household in the understanding of work trip differences, as well as their consequences in the daily life of women and men. In current research, aspects related to the home and household, such as being married/cohabiting and the presence of children, have been shown to affect the commuting of women and men differently, as well as how the consequences of work trips are evaluated. However, most studies are statistical explorations, and do not investigate how existing differences are created, negotiated and practiced among the household members in the context of everyday life.

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**KEYWORDS:** Commuting; Gender; Gender contract; Regional enlargement; Work trip.

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## DATA AND METHODS

This study is based on 20 in depth interviews with parents with small children living in the Gothenburg urban region, being highly skilled with specialized labor markets, and recently having moved to a new residential location. Special attention is paid to women's and men's everyday activities; their wishes and values concerning housing, work, mobility and family life; experienced restrictions in relation to the work trip; and decision processes within the household. The study also investigates consequences of the work trip for individuals and households.

## THEORETICAL APPROACH AND CONCEPTS

Discrepancies in actual mobility between the sexes are seen as an expression of the relationship between women and men found in the homes, places of work and in the transport system. Focusing on the role of the household, the concept of gender contract is used in order to understand existing mobility choices and decisions made within households. The concept implies an agreement between women and men containing mutual commitments, liabilities and rights regarding how the individual is expected to be and act, in this case as regards travel-related issues. The agreement is understood as having advantages for both parties. In this particular study the agreements concern, for example, who has the "right" to use the car, or who should leave the children at the day-care center in the morning.

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<sup>117</sup> This poster is based on the PhD thesis (Gil Solá, 2013) Towards gender equality? Women's and men's commuting under transformation and negotiation (original title På väg mot jämställda arbetsresor? Vardagens mobilitet i förändring och förhandling).

## MAIN RESULTS AND CONCLUSIONS

Overall, the study shows that the role and implications of the work trip for individuals (and their households) on everyday life and welfare are shaped by surrounding structures such as conditions in the labor market, the housing market and the design of transport systems. This shaping appears in slightly different ways for women and men, to a great deal depending on the (explicit or silent) gender contract that defines their room to maneuver. The analysis highlights two distinctive and contrasting types of gender contracts: the traditional gender contract and the equal gender contract. The traditional gender contract describes women and men as different, expresses an unequal (male dominant) power relation between female and male attributes and roles, and leads to the man limiting the woman's activity space and range in the labor market. The equal gender contract, on the other hand, assigns women and men different roles within the household as well, but the roles are not taken for granted to the same extent. Furthermore, power relations between the roles are not distinct, and the man does not limit the woman's action space.

In the interviews these gender contracts are clearly expressed as regards: 1) The use of the car: In many families who own one car, car-driving is equally distributed. Still, in more traditional households, women's need of the car is not perceived important, motivating the economic cost that a second car constitutes (though the same argument is seldom applied to men). In this case, both women and men argue in terms of a "taking for granted" of men dominating, or women not dominating, the use of the single car of the household; 2) Household responsibility: While households with equal gender contracts distribute household responsibilities largely according to direct needs and restrictions, traditional households have the woman taking most responsibilities, even when commuting long trips or difficult hours, resulting in a more burden some commuting. 3) Career: In some traditional households the woman's wish to pursue a better work opportunity is not considered a valid reason for the household to support her – for instance with a car or to have reduced household responsibility, if this is needed – even when she is overqualified for her current job.

In sum, results show that gender contracts within the household influence the consequences of regional enlargement for the individual. The consequences depend on how the household succeeds in handling existing restrictions, as well as making use of possibilities, imposed by surrounding socio-spatial structures. Households with equal gender contracts show a greater variety of possible solutions in their negotiations, while households with traditional gender contracts more easily get stuck in traditional solutions. Continued progress towards gender equal work trips thus depends on how gender contracts within households are negotiated and further re-negotiated, as well as how future societal structures support households decision making in a more equal direction.

# Stranded... And a long way from home: Women, transport, and displacement

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## **ABSTRACT**

Much has been written about women's gender roles since 1989 when Hochschild described the "second shift" that working women engage in at home. That is, when women engage in labor outside the home, the first "shift" of work, they face a second work shift—cooking, cleaning, laundry, shopping, dependent care—within or for the household. Hochschild and others also have written about a third shift of "relational maintenance and repair work." This poster explores how displacement due to planned relocations and extreme events—natural disasters or anthropogenic actions—may exacerbate the second and third shifts, or create even a fourth shift by imposing new or unfamiliar transportation constraints on women's access and mobility. That is, due to gender roles, women's mobility needs may differ from men's when displacement occurs.

I draw on research conducted by me and colleagues among public housing residents relocated in Tampa, and persons who experienced hurricane evacuations and tornados in Hillsborough County, Florida. The poster also presents findings from interviews of women who have lived in Syria and visited refugee camps and internally displaced persons. I also draw on the research findings of others who have written about displacements, most recently the floods in Northern India. As planned relocations and extreme events continue, consideration of women's travel needs as related to personal safety, security, modes, etc., becomes increasingly important in the sustainability pillars—economic, societal, and environmental considerations. That is, how will sustainable transportation infrastructure, systems, and modes meet women's mobility needs in the case of displacement? For women who work outside the home, displacement may limit access to employment, decrease access to goods and services, and so forth. Societal impacts may include disruption of supporting networks, e.g. daycare, healthcare providers, etc. The poster also includes suggestions for future research, particularly regarding women's experiences in refugee encampments and their attempts to conduct first, second, and third shift work.

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**KEYWORDS:** Displacement; Relocation; Extreme events; Personal safety; Security; Gender roles; Access.

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# Epidemiology of injured cyclists in Rhône, France. A standard crash configuration study to better understand primary safety aspects; determining gender as key factor or explanatory variable

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## BACKGROUND

Cycling is increasingly promoted as an alternative transportation mode, because of the health benefits that can be obtained thanks to active travel. However, it is somehow risky. The French annual incidence rate of cycling injuries is estimated at 70 per 100,000 inhabitants. Therefore, to better evaluate risks and benefits of this alternative mobility, cycling safety is a main concern. Most of the existing studies are based on police data and they suffer from a lack of statistical significance to enable strong conclusions. In this work, we propose to study cyclist accidents, based on a survey sent to individuals identified in a medical registry composed of emergencies and hospitalized patients in a French department (Rhône, around Lyon).

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**KEYWORDS:** Accidents typology; Cyclists; Injuries; Gender; Survey; Medical registry.

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## OBJECTIVES

As a recent study shows an increased risk of accident for women cyclists compared to men after controlling for the mileage, the main objective of this work is to explore if gender differences in cycling accidents are due to specific cycling practices for men (i.e. sport and commuting) compared to women (i.e. leisure ride and utilitarian trips), or if they are mainly due to differences in socialisation and risk taking. Based on a survey sent to 3,500 cyclists injured in 2009-2011, we built a typology of cycling accident configuration, thanks to data mining techniques such as MCA, AHC, and clustering. Halfway between accident mechanisms and accidents factors, configurations aim to take into account random multifactorial aspects without the chronological complexity we can find in sequences analysis of the different situations. We explore factors by cycling practice one at a time as well as the accordance between typology and injuries (severity and area). This typology allows us to explore the linkages between the key variables of the typology (collision, single crash or avoidance of another road user), the type of bike usage (sport practice, commuting or leisure ride), and also to determine whether these risk factors are gender specific or related to the bicycle practice.

## METHODOLOGY AND RESULTS

The survey response rate is 43% (N = 1,078). Compared to non-respondents, respondents were older, more often women and more often cycling on urban roads. They were also more often involved in collisions and therefore more seriously injured. One crashout of 5 occurred on a leisure ride, for women as for men, and 38% of crashes happened while practising sport (20% for women and 44% for men). Main differences are observed on utilitarian trips (18%) and while commuting to/from work or study place (23%) where women have proportionally more accidents than men riding for utilitarian purpose (25% vs. 15%) or commuting (30% vs. 20%). Most of the accidents happened on main roads (52%) and 30% on a cycling infrastructure. Women more often have accidents on a dedicated infrastructure than men (43 vs. 28%), but they less often have a crash on a flat surface than men (20% vs. 34%) while cycling on an utilitarian trip (28%). In case of commuting trips, however, there are no longer gender specificities: for both groups 76% of these accidents occurred on a flat road. Some logistic regression models adjusted on sexes and type of practice are proposed and discussed.



# Harassment and public transportation in Los Angeles: Designing effective transit policies that meet the needs of female identified riders

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## ABSTRACT

Women and men experience public spaces differently and in particular transportation, which has a significant impact on their mobility through the city (Loukaitou-Sideris and Fink, 2009). However, currently the City of Los Angeles lacks comprehensive transportation policies that prevent sexual assault and harassment on its public transportation system. Given the lack of data on sexual harassment that occurs on public transit, this poster highlights the need for effective policies that prevent crimes against women, such as sexual assault and verbal harassment, in and around Los Angeles. It also critiques current public transportation policies in the U.S. that fail to incorporate a gendered approach to urban planning. In doing so, it provides a comprehensive understanding of how the absence of anti-sexual harassment policies in public transportation impacts the travel behavior and mobility of women in the City of Los Angeles.

Research for this project consists of an on-board survey of female identified passengers on the 720 Rapid, one of Metro's busiest lines in Los Angeles, as well as ethnographic research examining the experience of being a woman and riding subways at night and in the early morning hours. The resulting data will offer a more nuanced understanding of how, when, and where sexual harassment occurs on both the bus and rail system. Such information can be utilized to implement a system-wide sexual harassment policy for Metro in the City of Los Angeles, that includes a task force of grass roots community organizations that can administer the program and monitor its efficacy. Due its size and dynamic demographic profile, Los Angeles is an illustrative case study for better understanding how other cities might deal with similar issues of sexual harassment, public space, and transit planning.

### Topics for further research

1. Investigate the efficacy of sexual harassment policies that transit agencies have implemented around the U.S.
2. Develop metrics to evaluate sexual harassment policies on transit
3. Examine the differences in the transportation needs of female identified service workers: those employed in the restaurant industry are more likely to travel late at night. Los Angeles has the largest restaurant industry in the U.S., most service workers are women.

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**KEYWORDS:** Transportation policy; Safety; Security; Gender and Policy.

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# Self-perception of career prospects of women in shipping: Some evidence from a pilot survey among the shore personnel of traditional maritime countries

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## ABSTRACT

The paper aims at measuring the perception of career prospects that working women have in relation to shipping careers ashore. The authors distinguish between the personnel working in shipping and shipping management companies and the personnel working in auxiliary businesses related to inputs to shipping, which range from spares and parts to shipping finance. The analysis is based on the results obtained through an online questionnaire survey aimed at identifying the self-perception career prospects by women working in large clusters of shipping and shipping related companies internationally.

The survey focuses on the self-perception of career prospects by introducing additional variables – beyond pay-gaps, promotion procedures etc. – such as job satisfaction and its contribution to happiness. The main survey results are derived from completed questionnaires in – but not exclusively – European traditional maritime countries, especially from the largest shipowning community currently, i.e Greece.

The introduction is followed by a section on the existing literature on career satisfaction. In Section 3, the authors focus on the nature of work in shipping and on its requirements, which may be of research interest for job satisfaction or for gender issues, and present the context within which a shipping related career ashore evolves. Section 4 discusses the survey methodology and the results of the completed questionnaires. The paper concludes with suggestions for further research on a topic which has attracted little academic interest, while having direct implications for the industry through the recent focus on staff turn-over among charterers and the shift to quality management.

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**KEYWORDS:** Women; Job satisfaction; Happiness; Shipping; Shore personnel.

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## 1. INTRODUCTION

Despite the economic crisis, more evident in the developed economies, which included until the start of this century the leading traditional maritime countries, and a global job crisis evident worldwide, career satisfaction remains an issue both for industry and research. This is especially valid for skilled personnel in demanding industries such as shipping and can be a preoccupation for employers even in this era of apparently excessive labor supply. The lack of a satisfying pool of seafaring personnel, for instance, has been highlighted repeatedly by relevant industry organizations and has led to a substantial number of research publications. A quantitative and qualitative shortage of seafarers was anticipated by studies of major maritime organizations (1) even before the impressive almost doubling of the world fleet in the present century (2). Despite the presence of significant economies of scale in shipping management and in many of the shipping related activities, this development emphasizes the value of retaining shore personnel, including women, who have acquired a significant presence in maritime professions over the past decades.

Career satisfaction is closely related to staff retention. In an industry like shipping, staff retention is deemed of importance not only– as would be expected by employers –but also by buyers of shipping services. Staff retention is for instance one of the Key Performance Indicators (KPIs) which are included in the voluntary, but well by now customary, Tanker Management and Self-Assessment (TMSA) code. The code is used by the oil industry and its chartering side to assess the quality of prospective suppliers of tanker shipping services, who undergo a company self-evaluation process calculating the degree of effectiveness of their provision of services through the level of attaining the highest percentage of KPIs possible (3); these KPIs reflect the – currently admitted – goal standards in the process of continuous improvement of the company (4). Staff turnover is among the key areas which need to be addressed through such self-evaluation and self-improvement

processes, as any low rate of retention indicates loss of experience, predicts lack of coordination, and ultimately may reveal an inherent weakness in the overall management of a company.

The issue is not merely one of interest from the employers' side or from an academic angle. Through backward and forward linkages, shipping creates a multitude of employment posts adding to Gross Domestic Product (GDP) growth, often most substantially, as in the case of Greece and other maritime countries which participated in the survey. Career satisfaction is directly related to staff retention, with the latter being anymore a key factor of competitiveness in a highly competitive environment, such as world shipping and related industries which are practically all fully globalized.

The paper is divided into five sections. After a short introduction the authors review the literature on women in shipping's shore personnel. In Section 3, the authors focus on the nature of work in shipping and requirements which may be of research interest for job satisfaction or for gender issues, and present the methodology on which the survey was based with a focus on the enhanced perception of career and career satisfaction. The fourth section discusses in length the analysis of the responses received through the questionnaire. Finally, the paper concludes with a summary of the survey limitations and related suggestions for further research on women's satisfaction in the wider transport sector.

## 2. STATE OF THE ART

### 2.1 Job Satisfaction

Management, along with policy makers, should be taking into account issues related to subjective well-being when making decisions on organizational, corporate and governmental matters. This is especially significant due to the importance that shipping may have in a national economy. According to the data published by the NSSG (5) concerning the second quarter of 2013, the active workforce in Greece (4,982,619,00 people) represents 42.5% of the total population. The labor force is composed by 59.66% men and 40.34% women. Salary-related data from all sectors of the Greek economy show that women are paid an average 16.5% less than men for the same work. More specifically, the average salary for men amounts to 1,415 Euros whereas the equivalent for women is barely above the 1,181 Euros benchmark. The number of workers in the shipping industry is around 200,000.

Well-being does not relate only to pleasant life conditions, but is also beneficial to the national and corporate environment (6). Since the beginning of the 20th century, social scientists and psychologists have made efforts to answer questions such as "What is happiness? Can it be measured? What causes happiness?" (7). Up to the present, research on the theoretical frameworks and the methodology for quantifying Subjective Well-Being (SWB) have considerably increased (8). Amongst the most widely applied methods to measure subjective well being are the Experience Sampling Method (ESM) also known as time sampling or beeper studies, the Ecological Momentary Assessment (7), and the Day Reconstruction Method (DRM), which according to (9), seems to be the most practical method.

According to (10) job satisfaction is one of the domain satisfactions among others, such as health, financial, housing, leisure, environmental, social life, marriage, etc. Regression type models were developed using data from household surveys for Germany and England and compared the results. Job Satisfaction was modeled as a function among others of age, income, working hours, children and number of adults in the household.

The literature includes many causes of a person's subjective well-being/satisfaction in a job-environment such as workload (11), good management and supervision (12) and level to which the job fits the personality of the individual (13). Furthermore (14) proved that the level of control someone has over the work conditions is related to greater well-being (15) reviewed the literature on the characteristics of rewarding jobs, identifying ten key job features that are associated with employee well-being: opportunity for personal control, opportunity for skill use, externally generated goals, variety, environmental clarity, availability of money, physical security, supportive supervision, opportunity for interpersonal contact and valued social position. Higher job-feature values are accompanied by greater job-specific well-being (16) highlighted the importance of non-economic factors in order to increase satisfaction in the workplace and boost employee productivity and company profitability. In addition, happier people seem to earn higher incomes and to perform better at work than unhappier ones.

### **2.1.1 Women's Perceptions regarding Work**

Earlier work for the Pythagoras project (17, 18), which started in January 2005 and finished in June 2008, focused on identifying the job-related satisfaction and activities of Greek working women. The data collection methodology involved 200 questionnaires collected via personal interviews. The sample was diversified as to the place of the respondent's provenance in order to assure the highest representativeness of the population possible (16% of the respondents came from the Greek Islands, 75% from the Attica region and 9% from the mainland). Approximately 60% of the currently employed women worked in the private sector, while 19% in the public sector. Their contracts were, in the majority of cases, full-time ones; in fact only 21% worked part time. The results show that only 9% of the companies encourage their employees to take up teleworking, indicating the fact that teleworking is far from being widely known or understood by the business world. It is hardly surprising then, that a meagre 3% of the sample teleworks. In addition, almost 10% of the sample's working women admitted to working extra hours from their homes, usually after the end of their official working day, for an average 30 minutes to 1 hour per day. In the same context, women stated that their average working day consists of 8.3 hours/day, while 11% are working overtime. The research investigated the satisfaction with salaries. 40% of women were more or less dissatisfied with their salaries, whereas only 9% totally satisfied by it; 34% tends to disagree with the statement that "Women receive equal wages with men", while 38% to agree with it. The respondents also replied to seven questions from which can be inferred the degree of influence their circle of relatives and relations has over them and their career related decisions. The majority of women stated that they made all decisions regarding their career on their own; however, there seems to be a clearly marked tendency to consult others before deciding about anything of great importance, while the father's opinion is more influential than the mother's or other relatives.

A small number of EU projects have dealt with the employees in the shipping industry. The most relevant project, which included a large scale survey regarding job satisfaction of workers in the shipping industry, was SLIM-VRT (19, 20) which was completed in June 2005. The main objective of the SLIM-VRT "Self Learning Integrated Methodology – Virtual Reality Tool project" was to provide an integrated maritime training, onboard and ashore, using interactive multimedia and virtual reality technology. One of the main purposes of SLIM-VRT was the identification of gaps in supply and demand for job positions and skill qualifications. Work involved data collection and analysis of employees, including skills, qualifications, job description, satisfaction with work, training needs, learning styles and career development prospects in the shipping industry. The methodology relied on the development of two major types of questionnaires addressed to employees and employers. The data collection was based on questionnaires that were distributed to 5,000 employees (1,195 responded) and 200 shipping related companies (62 responded). The sample is composed of 710 employees, with the following nationalities 710 Greek, 115 British, 85 Spanish, 160 Philipinos, 45 Cypriots, 10 Norwegian, 18 Polish, 25 Ukraine and the others are from many non-European countries (a fairly representative sample). The seafaring profession remains a difficult job for women, as 95% of the personnel is male. From this sample: 64% are single, 34% married and the rest 2% divorced. With regards to the future career objectives of the employees, 59% want to get a promotion, 15% want to change career and the rest (26%) want to stay in their current position. The results of the seafarers show that a very small percentage answered that they are completely satisfied with their wage, while the higher percentage declared that they were partially satisfied. Particularly, 5% of the respondents denoted fully satisfied, 22% somewhat satisfied, 52% indifferent, 12% somewhat dissatisfied and 9% denoted not satisfied at all. With regards to the question regarding the overall satisfaction concerning the seafaring career, almost 32% answered that they are satisfied, 23% answered that they are not satisfied and the rest (45%) was indifferent. These results, in a cross tabulation with the respective job position, shows that the higher ranks are well satisfied while others are not. Examining also the salary scale, it may be concluded that there is a big difference between the captain's or chief engineer's salary and the rest. Obviously, the duties and the responsibilities vary a lot according to the position in a demanding industry such as shipping.

## **3. WORKING IN THE SHIPPING INDUSTRY: SETTING THE PILOT SURVEY CONTEXT**

Employees in the shipping industry must adapt and perform successfully in a continuously changing organizational, business, and employment environment. Common career paths in the shipping industry may require alternate career changes and job rotation, such as acquisition of different positions onboard, work on different types of ships, and employment at an office position related with the shipping and port operations management (19). In the shipping sector ashore, the management of ships is done on a 365/24/7 basis across

the entire globe, as is the case for ocean going ships which constitute the largest part of the world tonnage, without physical access to the production site of shipping services, often difficult communications and in an international context.

In addition the shipping industry is a multicultural environment where employees are asked to constantly interact with customers (authorities, agents, traders, etc) and co-workers of varied locations operating themselves often in equally demanding environments and different contexts. Women must therefore possess a number of soft skills if they want to build a career in the shipping industry. Such soft skills are divided into two categories: 1) The first category includes friendliness, teamwork, ability to fit in, spoken communication skills, and appearance and attire; and 2) The second category is called motivation, taking in characteristics such as enthusiasm, positive work attitude, commitment, dependability, and willingness to learn (20). The development and cultivation of such skills can be promoted by appropriate human resource management; however, no management techniques can totally alter the subjective perception of employees with regard to their career prospects which are reflected in the level of job satisfaction and happiness in general which they enjoy through their work. This is especially true for managerial positions where the nature of tasks and demands from employees may differ considerably due to the nature of the industry itself. Length and patterns of working hours and level of time-pressure, along with the possibility for flexibility in daily work and commuting obligations are obvious, but not exhaustive, (11) factors influencing career satisfaction and happiness.

Shipping is a highly demanding business which operates across time-zones, within constantly changing external conditions, be they of the economy or of natural elements. In the era of modern shipping, quality provision of maritime services is translated into market rewards, whether this relates to the basic characteristics of the "hardware" of shipping, i.e. the ships (21), or whether this is associated with what can be termed the software of shipping which includes strategy and procedures (22) as well as the human element. Quality of service is not defined only by the timely transport from A to B but also by the absence of claims (23) which can arise not only through failures in technical equipment but through related or unrelated human errors and omissions. Such mishaps, which can severely affect not only the reputation but the finances of a shipping company, can be avoided through retaining experienced personnel, as the intricacies of shipping, through the number of factors intervening in most types of its daily transactions, is such that experience is essential, on an equal par with education and basic skills.

### **3.1 Conducting the survey**

The research of this study consisted of two main phases: (1) the development of an on-line survey; (2) data collection and descriptive analysis.

The main objectives for the development of this survey include, on the one hand, the aim to identify the main factors that influence the career choice of women in the shipping industry and their working conditions, and, on the other hand, the investigation of eventual discrimination issues between male and female shore personnel. Furthermore, the authors aimed to measure the stated level of satisfaction of respondents in relation to general aspects of their everyday life, their commuting habits and their teleworking activities.

The data collection took place from March 2013 until June 2013. The research team was facilitated in conducting the survey by the Greek branch of the Women's International Shipping & Trade Association (WISTA), i.e. WISTA (Hellas). Through this network organization, whose parent has branches in most of the maritime countries, the authors contacted a number of WISTA national associations, in order to obtain a representative sample for women shore personnel in the international shipping industry. The questionnaire was available in web format. The first step of the research was to initially circulate the questionnaire to all WISTA members in Greece in March 2013. As the response rate was too low, a second reminder was sent to the WISTA Hellas, Denmark, UK, USA, and Norway associations after two months, on the 13th of May 2013. An effort was made at the same time to circulate the questionnaire via social virtual networks such as Facebook.

In total, 147 respondents attempted to complete the survey. From those only a rather small number, thirty-two respondents, completed the questionnaire fully. A high share, 78% of the initial respondents, abandoned the questionnaire on the first question when respondents were asked to state their graduation year from university, an indication of their age. Therefore, women were unwilling to give information that might give out their age. In addition the nature, the working times and the pressure which characterize the business of shipping made it very difficult for them to fill out the questionnaire when they were at work.

#### 4. ANALYSIS OF THE FINDINGS OF THE SURVEY

Table 1 summarizes some of the respondents' general characteristics. It appears that the majority of the respondents hold managerial positions (45%). In addition, the larger percentage works in the sales and purchase department (18%) and as Marine Lawyer and in Ship Management Company (12% each). The average work experience of the respondents is around 6.76 years. The vast majority of the respondents have a full time contract and no sea service. According to the country of residence of the respondents, all but two work in Europe. Greece is the most represented country, with a total of 52% of respondents of the overall entries, followed by 24% of responses from the UK, and the Netherlands with 15% of the total entries. The majority of the sample is aged between 35-44 years old. With respect to tele-working, 73% of the respondents work from their home for 5.31 hours on average and state that they save 1.5 days per week from going to work. Only 21% of the respondents, however, seem to work in companies promoting teleworking.

**TABLE 1. Respondent's Characteristics**

Questions	Levels	Frequencies	Percentage
Current Position	Owner	5	15%
	Top Managerial	6	18%
	Managerial	15	45%
	Below Managerial	7	21%
Job Title	Sales and Purchase department	6	18%
	Marine Lawyer	4	12%
	Ship Management company	4	12%
	Ship Broker	3	9%
	Public Sector	3	9%
	Other	13	40%
Years in the current position	Mean	Not Available	6,76
	Standard Deviation		6,72
Contract type	Full time	30	90%
	Other	3	10%
Sea Service	Yes	29	88%
	No	4	12%
4G Phone	Yes	13	40%
	No	20	60%
Driving license	Yes	32	97%
	No	1	3%
iPad	Yes	17	51%
	No	16	49%
Children	Yes	13	40%
	No	20	60%
Age	25-34	9	27%
	35-44	13	40%
	45-54	7	21%
	54-64	4	12%
Country of residence	Greece	17	52%
	UK	8	24%
	Netherlands	5	15%
	USA	2	6%
	Norway	1	3%

**TABLE 1 (continued). Respondent’s Characteristics**

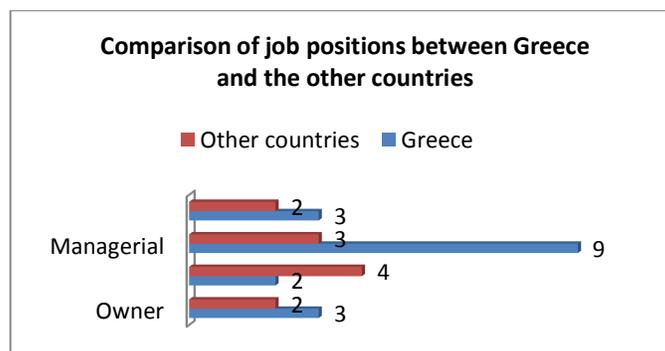
Questions	Levels	Frequencies	Percentage
Tele-work	Yes	24	73%
	No	9	27%
Hours tele-work	Mean	Not Available	5,31 hours
	Standard Deviation		5,04 hours
Days save from tele-work	Mean	Not Available	1,46 days
	Standard Deviation		2,73 days
Company promotes tele-work	Yes	7	21%
	No	26	79%

Table 2 presents travel characteristics of the women who participated in the survey. Considering vehicle ownership, each respondent’s household owns 2 cars and 2 bikes. The respondents who use car travel commute faster (20, 43 min), while commuting to work by bus takes them 41.71 min on average. The standard deviation of travelling times presents high values from around 19 min to 24 min.

**TABLE 2. Respondents Travel Characteristics**

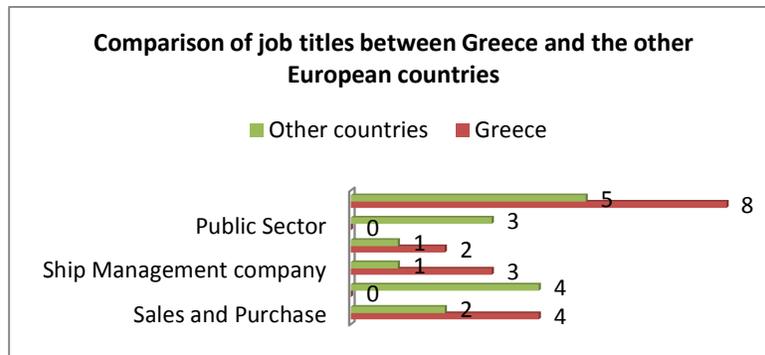
Characteristics		Value
Nr of vehicles- Cars	Mean	2
Nr of vehicles-Motorcycles	Mean	0
Nr of vehicles- Bikes	Mean	2
Time to reach work- Bus	Mean	41,71 min
	Standard Deviation	23 min
Time to reach work- Car	Mean	20,43 min
	Standard Deviation	18,56 min
Time to reach work-Bike	Mean	35,33 min
	Standard Deviation	23,19 min
Time to reach work-Walking	Mean	32 min
	Standard Deviation	18,56 min

Figure 1 presents the job position of respondents per country of residence. As shown, 9 respondents from Greece hold managerial positions and 3 are owners of their own companies. On the contrary, the highest number of respondents’ from the other countries’ occupations are top managerial. The higher participation of women’s lower job positions can be explained by the fact that they may have more time available.



**FIGURE 1. Job Comparison of job positions between Greece and the sample’s rest countries**

Women that work in the sales and purchase department in Greece present a higher participation in the survey, which is not unrelated to the S&P strategy that has been identified, as a strategy at the base of the survival and success of the Greek-owned fleet in recent decades (24), with a number of larger companies including separate S&P divisions (25).



**FIGURE 2. Comparison of job titles between Greece and other European countries**

The respondents were asked seven questions concerning the degree that influence from their relatives and friends had over their career related decisions. Their related answers are presented in Table 3. A seven-point Likert scale, ranking from “Strongly Disagree” to “Strongly Agree”, was used to indicate the level of agreement. The majority of women stated that they made their career decisions on their own; however, there seems to be a tendency to consult their father, their siblings and their friends before making important career choices.

**TABLE 3. Career related decisions**

Factors affecting the career related decisions (1 = strongly disagree, ..... 7 = strongly agree)	Average	Standard deviation
1. The opinion of my mother influenced my career choice	1.6	1.6
2. The opinion of my father influenced my career choice	2.6	2.1
3. The opinion of husband influenced my career choice	1.8	1.6
4. The opinion of my siblings influenced my career choice	2.1	2.1
5. The opinion of my other relatives influenced my career choice	1.6	1.6
6. The opinion of my friends influenced my career choice	2.1	2.0
7. I made all my career decisions on my own	6.2	6.2

Respondents were asked to state their degree of agreement with the statements presented in Table 4, in a similar scale of 1 to 7, where 1 corresponds to “strongly disagree” and 7 to “strongly agree”. On average they agree that they can influence the conditions of their work, and they seem to disagree that they face problems at work caused by their colleagues. They are neutral that their salary corresponds to their work effort. With regard to the availability of free time for their personal life and hobbies, their agreement level is around Level 4. The overall standard deviation for these three statements is around 1.6. As for the statements regarding the discrimination between the two sexes, the stated agreement of the respondents is around level 4. Finally, (Statement 12) they do not seem to look for a better job.

**TABLE 4. Factors Representing my Career Choice**

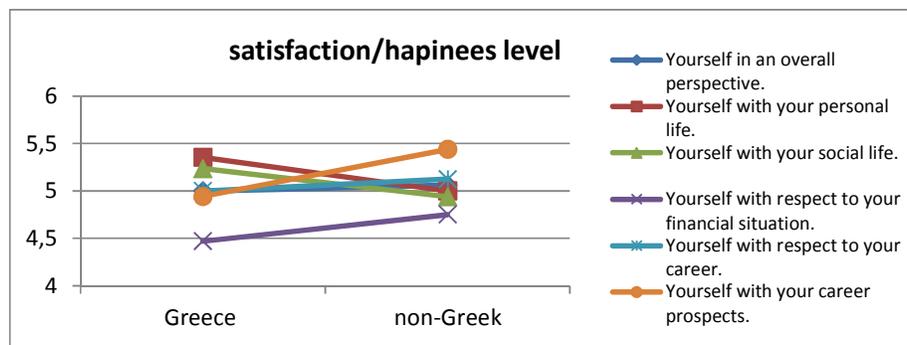
(1 = strongly disagree, ..... 7 = strongly agree)	Average	Standard deviation
1. Frequently there are problems at work caused by colleagues.	3.2	2.0
2. I can influence the conditions of my work.	5.0	1.7
3. My work gives me the opportunity to evolve personally and professionally	5.6	1.5
4. My salary corresponds to my work effort.	4.4	1.9
5. Because of my job obligations I do not have enough free time for my personal life.	4.6	1.7
6. Because of my job obligations I do not have enough free time for my hobbies.	4.6	1.6
7. Overall during my career I had the same recognition as my male colleagues.	4.5	2.1
8. Overall during my career I had the same pay as my male colleagues of the same level.	4.0	2.0
9. Overall during my career I was offered the same promotion opportunities as my male colleagues.	4.3	2.1
10. Overall during my career I had the same fringe benefits as my male colleagues.	4.3	2.1
11. Overall during my career I had more recognition compared to my male colleagues.	3.4	1.9
12. I am looking for a better job.	3.4	2.5

Table 5 shows the average rank on stated happiness in different life domains. The lowest value of satisfaction concerns the respondents' social life; the demanding pace and long working hours in shipping related careers may eventually be the underlying reason for this. Women feel satisfied with their career and their career prospects (Level 5). Overall, respondents feel satisfied with their lives (Level 5). The standard deviation observed in this group of questions is around 1.8, in which statements and statement 1 the higher and the lower deviation, respectively.

**TABLE 5. Satisfaction/Happiness level**

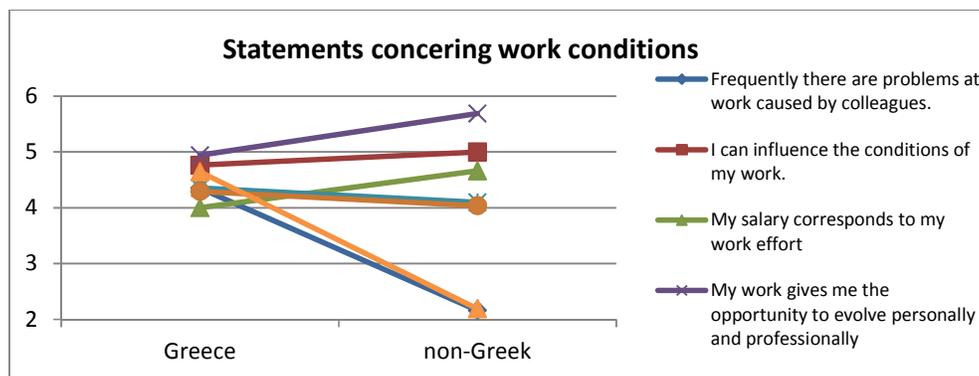
Satisfaction/Happiness level (1 = very unhappy, ..... 7 = very happy)	Average	Standard deviation
1. Yourself in an overall perspective.	5.0	1.5
2. Yourself with your family life.	5.2	1.8
3. Yourself with your social life.	2.1	1.6
4. Yourself with respect to your financial situation.	4.6	1.8
5. Yourself with respect to your career.	5.1	1.6
6. Yourself with your career prospects.	5.2	1.6

In Figure 3, the satisfaction and happiness level of women working in Greece is significantly different from the respondents of the rest of EU countries. The women working in the Greek shipping industry are less satisfied with their carrier prospects and their career in general. As expected, due eventually to the economic situation, they are dissatisfied with their economic situation. On the other hand, compared to the rest of the sample, they seem to enjoy their social life more and they are happy with their personal life.



**FIGURE 3. Comparison of satisfaction/happiness level between Greek and non-Greek respondents**

Women working in Greece state that they face more problems caused by their colleagues and feel underpaid compare to women working in the rest of Europe. In addition, they all agree that they can influence the conditions of their work (Level between 5 and 6). Finally, in spite of the unemployment in Greece, respondents residing in Greece are searching for a better job.



**FIGURE 4. Comparison of statements concerning work conditions between Greek and non-Greek respondents**

Figure 5 represents the level of agreement of respondents concerning gender discrimination in the work environment. Overall women working in Greece feel more underpaid compared to their male colleagues. It also appears that all the respondents agree that they have the same fringe benefits, recognition and promotion opportunities as men working in the shipping industry. On the other hand, they all admitted to having less recognition than their male colleagues.

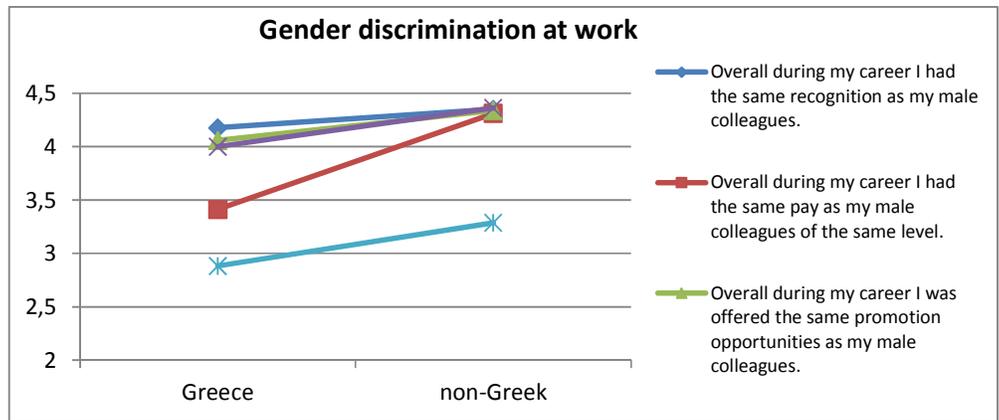


FIGURE 5. Comparison of gender discrimination at work between Greek and non-Greek respondents

Figure 6 compares the factors affecting work related choices. Overall, the respondents from Greece are clearly less influenced by their family and relations when they have to make important decisions regarding their career choices. Although women working in the other EU countries that participated in the survey strongly agree that they make their career decisions alone, they present a higher tendency to consult others before deciding anything of great importance. Non-Greek respondents working in the UK seem to consult their husband more regarding their career decisions.

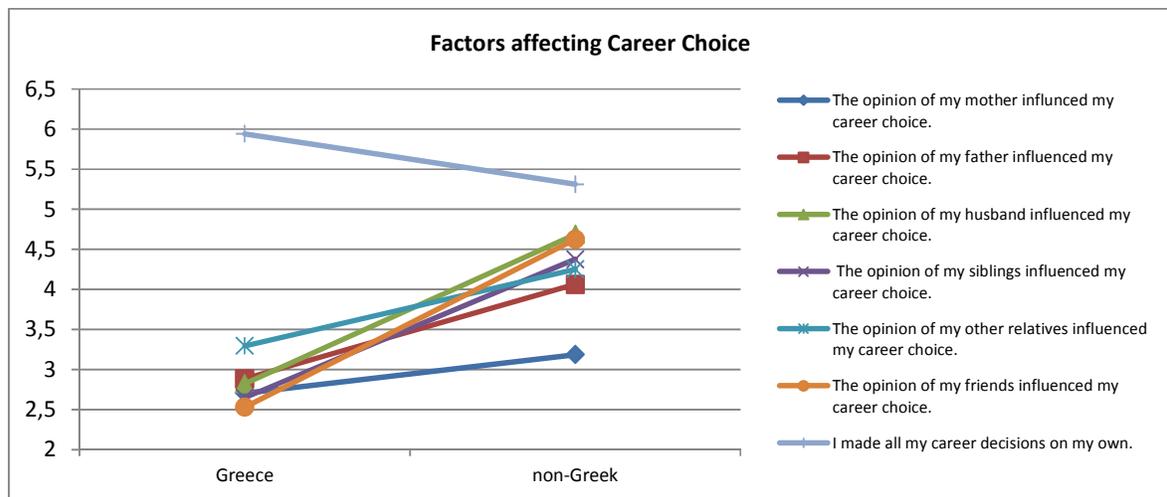


FIGURE 6. Comparison of factors affecting work related decisions between Greek and non-Greek respondents

## 5. LIMITATIONS OF THE RESEARCH

This section discusses the implications of the findings of the current research. The most important problem noted was the low response rate in the web questionnaire, limiting the ability to draw indicative conclusions regarding the job satisfaction of women working in the shipping industry. Readers should therefore approach the current findings with caution. The fact that women abandoned the survey relatively quickly requires the redesign of the questionnaire. Continuing the research and trying to increase the sample size is therefore critical to making broader generalizations of the survey outcomes.

## 6. CONCLUSIONS AND FURTHER RESEARCH

As suggested by the results of questionnaire surveys among women seafarers in the past, an impressive share of women seafarers were committed to pursuing their careers, despite the recorded problems associated with employers' attitude and crew attitude which were not insignificant. The low response rate purports that the results cannot be representative of the sample. A preliminary analysis of the responses indicates a similar attitude in the international sample surveyed through the electronic questionnaire among women in shipping related careers.

Policies promoting the well-being of women in the work-environment are crucial, as it has been proven that companies with satisfied employees have more satisfied customers. Happier employees are more productive in their working environments and in the very competitive maritime environment. Preserving an important resource – in the form of experienced personnel – has been acknowledged recently as a competitive strength as the emphasis of many buyers of shipping services has shifted, be that belatedly, into the human element. Monitoring and devising strategies for improving career satisfaction, and, furthermore, identifying any gender issues which must be taken into account will require further research with larger samples in order to confirm the indications provided in this pilot survey.

Preliminary linear regression and ordered probit models which show a relationship between age, salary, etc. have been developed, but due to the lack of data, the researchers were not confident with the model coefficients. Future research will concern more data collection from various countries, over time, in order to:

- (1) Estimate time series ordered probit models of perceived job satisfaction;
- (2) Develop advanced econometric models to quantify the impact of job satisfaction on the overall happiness of female workers in the shipping industry (see for example (17) for similar applications).

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# Urban transport driver: a male occupation? The difficult change in the professional gender identity

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## ABSTRACT

This research aims to explore how a company's strategic turnaround can affect identities construction and the ideal employee model. It is drawn on Ely and Padavic's research agenda, according to which the organisations' structures shape its members' professional gender identity and on Bellini's work on calibration processes. Research is carried out in a bus company located in France. It shows that, although the company's strategic re-orientation leads to a feminization of the driving occupation, neither the management nor the drivers seem ready to fully integrate the female new recruits.

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**KEYWORDS:** Gender identity; Strategic turnaround; Driving occupation; Resistance.

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Most research into gender equality in the professional sphere agrees that organisations are gendered and that gendering moulds individual identities and influences women's integration and advancement (Angeloff and Laufer, 2007; Halford, 2007). However, fewer works have documented the gendering process when building employees' identities in a period of strategic change. Accordingly, this article aims at examining these links with an answer to two questions: how a change in a company's strategy affects gender identities and the ideal employee model? And what effects will this process have on individuals? To do this, on the one hand, we used the Ely and Padavic (2007) research agenda, according to which the organisations' structures shape its members' professional gender identities, by creating a model of an ideal employee; on the other hand, on Bellini's work (2010) which shows how the model of the ideal employee becomes the standard to compare, promote or exclude individuals at work. We decided to work with Transco (a pseudonym), a French bus company, at the time of a major change in its strategy, challenging the masculine culture which historically is the characteristic of the transport sector and particularly the driving occupation. Our research shows that drivers' predominantly male identity was historically formed around the statistical over-representation of men and the masculine portrayal of the occupation. Secondly, it stresses that the strategic re-orientation the management set up introduced new expectations for the drivers, requiring mentalities considered to be more feminine, and making women a priority target for recruitment. Finally, our study shows that women's integration and advancement are slowed down by male resistance and the management's hesitation on insisting on new excellence criteria.

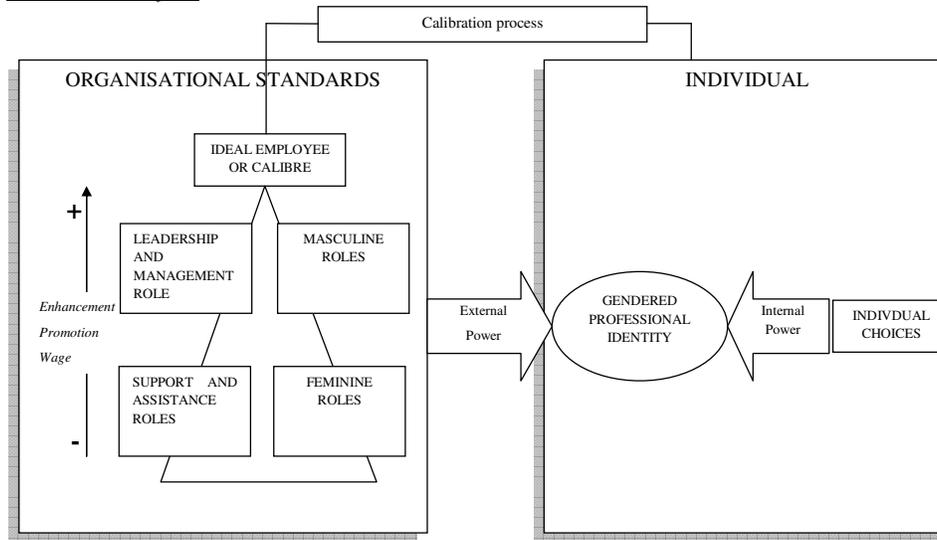
## IDENTITY, GENDER AND POWER IN THE LABOUR ORGANISATIONS

In social science, the works of Goffman (1963) and Berger (1974) made the concept of "identity" popular. It then became widespread, including in the public sphere (Brubaker and Junqua, 2001). Identity is a practical category in the sense that it is used by individuals to take a close look at themselves and their activities, their common points and their differences with others (Brubaker and Junqua, 2001). It is also an analytic category, used by researchers to understand how individuals make sense of themselves in relation to others. In *gender studies* the concept of identity has enabled light to be shed on the gendered social practices and the construction of the distinction between male and female (Malbois, 2011). In particular, it was used to show that belonging to one gender category was not only dependent on the biological sex, but was linked to all the normative elements contained in an individual's affective, cultural and social environment (Goffman, 1977). As Mondada says (1998: 261), the gendered identity is not an "evidence given in principle that would only speak out or emerge, but a categorisation which is achieved in and through social activities".

By adapting this analysis to labour organisations, Ely and Padavic (2007) suggested that building professional gender identities' formation occurs in the interplay between two forces. Power operates externally through the organisational structure, which contains gender presuppositions and in part shapes their professional and gendered identity. These structures determine both gender roles and professional roles; in other words, socially shared expectations on the attitudes and individual characteristics of each gender and each professional category (Eagly and Karau, 2002). In addition, the masculine role personified by most men coincides with the most valued professional roles, such as leadership and management. The support and assistance roles, less valued and less well paid, on the other hand, are presumed to be more suitable to women. In this way, the gender identity is doubly interwoven with the notion of power. On the first level, for each gender, the normative environment determines the viable and suitable gender identity associated with it. On the second level, the gender itself is a power relationship since it separates and creates gender hierarchies in favour of men and masculinity, and since it produces minimised and stigmatised identities (Bereni, 2012). Nevertheless, Ely and Padavic (2007) explain that professional gender roles may sometimes run counter to the gendered roles in society disrupting the binary gender system. Furthermore, the identities are not entirely shaped by pressure from the environment. They also result from choices made by individuals, who can decide, more or less consciously, to conform to or to resist the organisational gendered standards and rules. This "internal power" enables them to re-interpret and change the model of the ideal employee, the gendered social rules and even the significance of the sex categories. Ely and Padavic's work (2007) may be usefully supplemented by the calibration theory of Bellini (2010). The calibration is an implicit mechanism of comparison between an individual and the model of the ideal employee called, in its work, the "calibre" at the time of deciding to recruit, to train, to promote or to exclude him/her from the organisation. If this individual comes close to the calibre used as a benchmark, he/she will be valued; otherwise he/she will be discarded on the grounds that he/she does not meet the legitimate and rational requirements of the working world (Bellini, 2010).

The calibration process generates stereotypes both in the group of employees close to the standard and in the others: some will be presumed to hold naturally the characteristics required for labour organisations to work; others will be considered as less suitable. The calibration also leads to focusing the analysis on individuals and neglects the relation between the individuals and the organisation. For example, men are generally seen as having the qualities of the ideal manager while femininity associated with women is viewed as less congruent with managerial positions and women are thought to be less interested in those holding positions. But the organisation context in which men and women evolve is under-estimated in this analysis. Companies' role in organising working hours or career paths is neglected, as well as the lack of work-family support. The calibration process also implies that certain criteria are over-estimated in the explanation of the professional social phenomena. Bellini (2010) takes the example of the age criterion systematically used as the main variable for explaining professional burn-out or resistance to change. Similarly, the sex criterion is often brought up to understand phenomena as complex as forms of management and leadership or decision-making. This gives the illusion that men and women are two different groups and respectively uniform. Finally, as Bellini (2010) emphasises, calibration is a self-feeding process. Similarly to a self-fulfilling prophesy, individuals accept the stereotypes provided to build their professional identity and act as expected of them. We are now proposing to study the case of Transco, using the two theoretical frameworks we set out on the building of gendered professional identities and the model of the ideal employee.

Research in chart form



**METHODOLOGY**

**Introduction to the company**

Transco is a subsidiary of an international bus company. The holding has a proactive policy of feminization and professional equality, certified by a *Label Egalité*<sup>118</sup> since 2010. Its objective is to implement the certification process in the subsidiaries including Transco. Transco employs 656 employees, of which 492 are drivers. Less than 20% of the drivers are women and 6.67% are group management staff, responsible for supervising the drivers. The occupation of driver consists in doing regular rounds in the city and nearby suburbs to take passengers from one stop to another. At Transco, from time to time, on a voluntary basis, drivers may also supervise new recruits as a tutor for one week or alternate their duty periods several half-days per month with assignments to check tickets or to intervene and settle disputes (AIR – intervention and settlement officer).

The aim of our intervention in the company was to provide support for drawing up, then negotiating, an equality agreement. Transco had not yet specifically dealt with the subject of male-female equality before our intervention, even though recently it had been leaning towards including women among its drivers, as we will see later.

**Qualitative methodology**

The information used in this contribution was part of the work for a thesis on the integration of women in a male-oriented company with a comparison between the levels of commitment in the subsidiaries and the end results. It was collected by means of a series of 21 interviews, including 20 drivers and 1 group supervisor, 12 women and 9 men. The interviews were all held in the same room, which allowed the discussion to be kept confidential. A broad interview guide was used during the series of interviews and was made up of three topics:

1. Daily life and the characteristics of the occupation of driver: tasks, current assignment, how the working day is organised, the organisation's expectations, how bonuses work, internal services and competitions.
2. Changes in the company concerning the external environment, the internal atmosphere, the rules, working tempo and the arrival of women into driving.

<sup>118</sup> The *Label Egalité* was instituted in France in March 2004. It is a tool for setting up practical methods to encourage professional equality in organisations and to lead an equality policy. It is granted by AFNOR – Association Française de Normalisation (*the French Standardisation Agency*) – after the application for equality certification has been examined and an opinion given by the certification committee, made up of the social partners and State representatives. Once certification has been granted, the certified company or body ensures that the methods stipulated in the terms of reference are implemented, terms of reference which include eight mandatory criteria and ten optional ones, structured around three fields: culture, HRM (Human Resources Management) and the concept of parenthood.

3. Relations between men and women in the company. Our interviews were conducted during a turbulent period when the contract was being renewed and roadworks were slowing up the traffic on the network. This context had a marginal influence on the drivers' answers. Our arrival also inevitably disrupted the organisation. However, we took care to minimise these effects, and we think another researcher would have indeed obtained the same results. Notes were taken during the interviews and they were recorded. Significant facts provided by the interviewees were transcribed word for word, and two additional analyses were made on them (Gavard-Perret and Helme-Guizon, 2012): the vertical analysis enabled us to realise the individual logic in the development of the interviewee's professional identity, then a horizontal analyses made it easier to pinpoint common elements among the interviewees to understand the regularities in the identity of the occupation of driver. Our information was supplemented by a research journal containing field notes capturing comments made during the presentation of the results to the management committee, then to the health and safety committee, as well as off-the-record comments and ad hoc conversations during lunches or meetings. We also had access to the company's comparison situation report and to the drivers' job description sheets and those of the group managers.

## RESULTS

### 1. *Bus driver, a male occupation*

The term "male occupation" is commonly used to describe an activity socially built as masculine or being more suitable for men (Zolesio, 2009). This construction is based on a statistical record of men's over-representation in an occupation and a historic record of women's exclusion (Zolesio, 2009). It also stems from a more subjective portrayal consisting of considering that the attributes and qualities required for such an occupation are naturally held by men. Such is the case with the occupation of bus driver (Scheller, 2009).

#### 1.1. Men's over-representation in the occupation

Historically, in the majority of cases, the occupation of driver was carried out by men. According to the national transport council, 97% of drivers were men in 1983, taking all types of transport into account (Blatter, 2002). Twelve years afterwards, in 1998, more than 9 drivers out of 10 were men. In urban passenger transport, less than 10% of the workforce were women in the 1990s (CTUE, 2004). Despite the slow integration of women into transport companies, the occupation of driver today is still mostly carried out by men. In Transco, less than 20% of the drivers are women and this proportion has not increased since 2008. This gendered distribution of the workforce creates expectations on individuals' preferences depending on their gender (Eagly and Karau, 2002). Men's numerical superiority in the occupation of driver gives the impression that men are more interested in, and have a greater ability than women for, driving.

*"There are occupations that attract men more than women [...] I do not see myself as a secretary, on the other hand it doesn't bother me to drive." Philippe, driver-conductor and AIR.*

For a long time, Transco reinforced men's over-representation in driving: for convenience, it targeted male candidates from the army, either after their military service, or when reconverting after a military career because they already had a passenger transport driving licence. This was the case of several drivers interviewed.

*"I was lucky to get all my licences in the army. [...] So, initially, I was ready for an army career but I decided to leave and I found myself a civilian [...] and of course as I had all the licences, I looked for a job in transport." Guy, driver and ticket inspector.*

The arrival of the first women into this world over-represented by men was very difficult and was seen as an intrusion. To become integrated, the pioneering women drivers tried to "neutralise their femininity", according to Laufer's expression (1982).

*"When I arrived, there were a lot of older drivers and, yes, the male/female sector was well established because, there, there were remarks such as 'women have no place here' [...] And I kept quiet so that I would not be overwhelmed. One must be serious, one must have charisma all the same to say 'you're not going to give me trouble otherwise I'll give it up'. And afterwards, it's true that nobody gave me any trouble but I wear a mask all the same, immediately. [...] I've managed to break into it; they're a bit afraid of me. But there, I was forced to do that to make them accept me." Sylvie, driver.*

## 1.2. The harsh working conditions at the core of the male portrayal of the occupation

The occupation of bus driver historically required characteristics that were socially seen as masculine: physical strength, coping with flexible working hours and acceptance of the risk of attack.

The need to be physically strong stems directly from the size and the bulk of buses difficult to manoeuvre. As in other physical occupations (in the building trade for instance), strength has become an ability rooted in employees' identity and body (Gallioz, 2009). The "female" social category, on the other hand, is historically and socially seen as weaker (Gallioz, 2009). As a result, for a long time women were kept out of driving on the physical strength criterion.

*"The large steering wheel with the driver behind it is still the image, for me it's a man's job. It is true that when we women are together or even with men, we admit that it's a man's job, that's clear." Aurore, driver.*

Passengers and road users contributed to reinforcing this association of men, and driving large vehicles also had an influence on developing the occupation of driver as being more suitable for men. Women drivers also told us of passengers' comments, surprised to see women at the wheel of the bus.

*"In the buses, you are a woman, you are young, so, customers are surprised because it's more a man's world. Car drivers also look at you a lot because you are at the wheel of an 18-metres bus and you are young." Virginie, group leader, former driver.*

The occupation of driver is also characterised by the difficulty of the working hours (Scheller, 2009). Drivers work over wide-ranging times and their shifts change from one week to another. All drivers, regardless of their age and seniority in the company, are subject to these atypical working shifts. At Transco, drivers can work during the day or night, for 5 days or 4 days. But regardless of their choice, their working hours are always variable and flexible. This system has an effect on their physiological equilibrium and compels them to adapt their private life to their job (Scheller, 2010). Historically, this working pattern was a constitutive reference in the occupation incorporated into their identity (Scheller, 1996). The difficulty in the working hours makes a distinction between those who can withstand it and the others, pushing out the women suspected of not being able to keep to the pace due to their family and domestic obligations. The older drivers have maintained this argument.

*"The women come in and after a while they don't want to drive anymore because it is too hard for them. At the beginning, the company shortened their shifts. And then it proposed them to go into the offices." Marie-Céline, driver and AIR.*

Finally, the drivers have always had to endure the risk of being attacked and managing incidents occurring during their tour of duty. These incidents may be more or less violent. They include decompressing the doors, getting in without a ticket, theft, getting in drunk, damaging the vehicle, threats, verbal attacks, spitting or again throwing objects. The risk of conflict creates a stressful and potentially dangerous working environment. Working areas recognised as such have been more or less taken over by the men, who see in them an opportunity of making themselves seem virile and infallible (Ely and Meyerson, 2006).

*"I have never been attacked. I have been shouted at sometimes but that's all. [...] But now, it passes over me, or I say it to myself. I'm growing old. When I was 23, it was not the same, I was more hot-headed then but now, I don't have the physique anymore." Philippe, driver and AIR.*

Projecting the occupation of bus driver as a masculine role makes it more difficult to insert women into this occupation. Women can see a threat to their gendered identity there as the definition of the qualities required by the occupation contradict the traditional "femininity" markers (Cayado et Almudever, 2011). Furthermore, the older women drivers have often adopted masculine attitudes, language and behaviour to fit into the working group.

## 2. A strategic turnaround which is forced on the employees

### 2.1. The company's strategic turnaround

Transco is developing in a strongly competitive context in which the profit margins are low in comparison to the contractual risks taken with the transport organising authority (Allain, 2007).

Furthermore, it has to prove to its institutional customer that, in addition to its technical know-how, it is a socially and ecologically responsible partner. Moreover, Transco has to meet the needs of its other customers, the passengers, the majority of whom are women. Similarly to other transport companies in devising its

proposals, for a long time Transco had concealed the specific features of female mobility while, on average, women made up two-thirds of the passengers (Duchène, 2011). For instance, the itineraries were determined in accordance with the population's home/work routes, without taking shops into account, in this way making women's journeys longer and more complex and constraining non-working women's journeys. Transco is also subject to internal constraints. It has a particularly unbalanced age pyramid with an ageing workforce and great difficulty in recruiting drivers.

To cope with these challenges, the company has initiated a strategic re-orientation. To attract more young people, Transco is increasing its external communications, offering career prospects for drivers and paying high salaries. It is also trying to diversify its recruitments, particularly by recruiting more women and by fostering the insertion of people at a distance from work. The company has also set itself the object of increasing security on the network, by tackling the issue of anti-social behaviour on the one hand, and by improving the signage and lighting at bus stops on the other. About five years ago, Transco also created a new position: intervention and settlement officer, whose role is to travel around the network assisting and informing drivers of changes in routes. The official also intervenes when there are incidents on the bus or to calm down a confrontational situation, which provides better security for the drivers and considerably reduces the occupation's hazardous aspect. With regard to its transport service, Transco has increased the number of vehicles in circulation, spread its services over longer times and optimised the runs. The company has also extended its transport mode by adding self-drive car-sharing, bicycles and a tram to the buses. More recently, Transco has started another project aimed at improving relations between the drivers and the passengers, training them to be polite, diplomatic and ready to listen.

This strategic re-orientation gives rise to a new definition of the occupation of driver, the attitudes he needs and the persons targeted for the job.

## 2.2. Women: new recruitment targets

In feminising the occupation of driver, the management sees opportunities to rapidly implement the stakes in its strategy while responding to its institutional customer's expectations. First of all, women are a large pool of potential candidates to meet its labour needs. Furthermore, recruiting them can be seen as an enhancing action in favour of gender mixing, asserting the company's role as a socially responsible actor and as a provider of jobs in its activity area. The management moreover wishes to modernise the company, and sees in the gender mix an effective way of overturning the conservatism which characterises the business and the sector (Scheller, 2009). By recruiting more women, it also hopes to improve the quality of service, suggesting that women naturally have communications and relational skills. Finally, by having more women among the drivers, it intends to cope with the increased insecurity in transport. Women are seen as 'pacifying elements' according to Gallioz' expression (2009), in the sense that we feel they personify a mediation role in confrontational situations and, by their sole presence, they bring peace wherever they may be. As Ely and Padavic (2007) or again Bellini (2010) have explained, these stereotypes of women's role have performance-related effects: they were seized on and internalised by the women drivers in their own affirmation. They often see themselves as nicer than their male colleagues and assert that they have a more flexible and more economical way of driving. Some of them also feel that they are more concerned about passengers' comfort than the men, and that they are more skilful at managing conflicts. These portrayals are passed on in reports on the feminisation of public passenger transport and shared by the Transco management, the drivers and the customers.

*"Women are gentler, more flexible when they drive, and the customers say so." Sylvie, driver.*

*"A woman may be needed in the group as she expresses herself more quietly. So she can calm down situations." Guy, driver and ticket inspector.*

Women's arrival can also be envisaged because the traditional obstacles to the occupation were removed when the equipment became modern, with power steering in the vehicles, smaller steering wheels and the installation of GPS in the vehicles, which enables drivers to contact the radio control station when they encounter the least difficulty during their tour of duty.

## 2.3. The role of the new recruits

The women recruited influence the renegotiation of the identity of the occupation of driver. As they do not automatically take the traditional identity, they change the way in which the driver's assignments are carried out, particularly in the interaction with passengers. Their arrival in the company also led to questions being asked about the strict separation of private and professional spheres and on the organisation of the terminals

and rest rooms. Transco particularly had to install toilet facilities and new cloakrooms and took advantage of this to make the duty room more user-friendly. These changes have a substantial effect on the traditional driver's gender identity and the content of the model of the ideal employee. It is no longer directly linked to men and masculine characteristics. It requires new abilities, traditionally related to women and femininity, such as courteousness, advice and listening (Nixon, 2009). However, the drivers do not passively accept these changes, which slowed down women's motivation to become integrated and to progress within the company. The management itself does not seem to be ready to insist on the new standard, as we will see in the next part of our comments.

### **3. The difficult internalisation of the new model of ideal employee**

The driver's professional identity and the standard to which the employees are compared is in a transitional state: traces of the old model are still to be seen and the new gender directives are struggling to take hold. Two sources were identified through our interviews, which explain this situation: the men's resistance and the management's hesitation.

#### **3.1. The men's resistance**

Men are resisting changes in the occupation, as they feel threatened by women's arrival into the company. It is not so much the fear of losing their job that leads to these reactions, as the fear of seeing the occupation's constitutive references disappear. Consequently, the older ones exaggerate the differences between the new recruits and the traditional workers to reinforce their feeling of belonging. For instance, the tutors, responsible for supporting the new recruits around the network for a few days, tend to stress to the young women what is at stake in their integration into a world of men.

*"It's true that in a male environment, in addition she is a young and very pretty girl, she was put ... finally she was given a little warning because it's true that as it's a male environment, there are more of us, but she settled in very well." Roger, driver, AIR and tutor.*

Another indication of this incomplete integration is in the drivers' obligatory clothing. Several items in the clothes given each year to the drivers are for men. This reinforces the feeling of strangeness among the women in this environment and goes against organisational expectations, which make the physical appearance one of the major characteristics in the job.

*"Ah it would be interesting [...] that the clothes we are given, some should all the same be women's sizes, as I have the impression that we are taken as men when we are dressed. And I have several colleagues who agree with me. [...] The bomber jackets are men's models, and even if we are sized XS, they are still too big." Lucie, driver.*

The women also tend to be considered as second-class employees: more delicate, less available and less capable of withstanding the working pace and the flexible working hours. They are always suspected of being more frequently absent, particularly due to domestic chores which are supposed to be a priority for them.

*"Women always have the same problem, seeing that the children are looked after. So we, as men, it's often the women to look after that, but it's more or less everywhere. For instance if you have young children, if you are single and you finish at 10 p.m, what do you do for your kids? It's dead so you don't take the job." Philippe, driver and AIR.*

The women must also extricate themselves from the seduction relations into which several of their male colleagues try to put them, with the risk of losing their professional credibility and getting a bad reputation. Their behaviour is closely scrutinised and they have less latitude to interact with their colleagues than the men, who can be extroverted, make spicy jokes and have physical interactions.

*"As I am a woman, if you start to laugh with everyone, that's bad. If you start to laugh with all the men, oh yes, you are taken for someone quite easy it will be said and as a result it all goes to hell." Virginie, group leader, former driver.*

*"For me, at work, it's not the skirt, it's the trousers. It's the question of the work, with the customers and colleagues. Like that, there are no insinuations, there are no incitements, it's as clear as that." Jacqueline, driver.*

Finally, there seem to be fewer opportunities for women to move up to the status of supervisor. Drivers may be promoted to this level if they succeed in the written examinations, then the interviews. The proportion of actual women supervisors is only 6.67% over several years, which means a total of 2 women for 28 men.

Several of the women interviewed do not dare to sit for the examination because they are afraid that they will not be capable of supervising the drivers. As Pruvost (2008) observed in the police, height and corpulence are still considered to be major assets for a team manager. Strength of character is also often mentioned as a characteristic required to win the drivers' respect.

*"There are not a lot of women supervisors because I think that perhaps we hesitate to apply for the job. Personally, I would like it but I feel that I'm not big enough. You must have a heck of authority all the same. You must have quite a strong temperament, must be able to order everyone around like that." Aurore, driver*

Appointing women to the job of supervisor sounds like challenging the established order. The fact of there being very few of them increases the attention they are given. They must then assert an authority which is not naturally recognised in them, without being contrary to the qualities of diplomacy and gentleness that are expected in a woman (Fels, 2004). The potential candidates are tested, destabilised, even intimidated by remarks or jokes (Cayado et Almudever, 2011).

*"I already have a problem ... at least I have a complex due to my size [1.48m]. It's true that at work they often joke about it because everyone teases me a bit about it but now I laugh about it, there is nothing to worry about, I don't take it seriously, even me because in any case it's better to laugh but they say 'when you are supervisor, we won't be able to see you behind your desk' and it's then that I tell myself 'there, it's impossible' we laugh among colleagues but behind the jokes, I tell myself they are absolutely right. It's not possible, I cannot, I don't see myself." Aurore, driver.*

### 3.2. The management hesitating to insist on the new standard

For its part, the company's management does not seem to be prepared to insist on the new standard that its strategy has laid down. It is adopting a somewhat passive attitude consistent with waiting until the women themselves apply, then adapting to the unchanged organisational structures. For example, on reading the job description for the group leader, the relational and listening skills seem to be crucial to the first three assignments, namely: 1. Organise the drivers on a daily basis based on the results the company expects and on the occupation's basic elements; 2. Take part in integrating the drivers and contribute to improving their skills; 3. Be ready to listen to the drivers taking their suggestions and requests into account. Nevertheless, this same job description highlights 'relational and teaching qualities' as abilities and not as skills. These qualities are also under-valued in favour of more virile aptitudes such as discipline or charisma. The company kept the old criteria on which promotion and performance are based, which do not allow a change in the employees' description of what being a group leader means. Another organisational area widely dominated by the men is that of ticket inspection, that the volunteer drivers can handle at the same time as the driving tasks. This activity is also open to women, but an unwritten professional rule restricts their access to it. In fact, a lone woman, or even a group of women, cannot inspect transport tickets without a man being present. Their autonomy in this assignment is therefore limited. Their presence is appreciated just to calm down confrontations with passengers without tickets. Under these conditions, it is of no interest to open up ticket inspection to women.

*"Four women, it's enough to come across a big man who doesn't want to hear anything, who doesn't want to pay and who will do anything to get out of it, he will manage to do so or we are able to fight back, which is not the case, therefore one man at least is needed. The men are bigger. But one woman at least is needed who all the same knows how to manage conflicts, who calms things down." Véronique, driver and ticket inspector.*

Finally, women's access to the job of radio controller (PC) seems problematic. In theory, it is open to them; nevertheless, there are no women there. When we asked why not, the systematic reply was that the company already let a woman do it but that it was a failure. This negative experience seems to cut off access for all women from now on as if they were a homogeneous group and all identical.

*"There are no women in radio control room. In the past, there was one in the team. But the, the men took it very badly. With the drivers, all went very well, she expressed herself well. But apparently it was the supervisors who, at the time, took it badly that there was a woman in the radio control room. [...] After this experience, it's strange that no woman has been selected." Jacqueline, driver*

Apart from the management being overcautious about changing the criteria for access to certain jobs, questions arise about the method of tackling anti-social behaviour. Passenger transport companies, such as Transco, can assess the extent of anti-social behaviour by means of the report forms filled in by drivers when they encounter a problem during their round (Bishop et al., 2009). However, the drivers interviewed told us that reporting incidents was exceptional. In general, they prefer to play them down and not to spend time on

them. This emotional detachment is a constitutive reference of the occupation, rooted in the drivers' identity (Nixon, 2009; Bishop et al., 2009).

*"Another time, stones were thrown at me, but I don't see that as an attack, it's nothing. In my opinion, they are not after me. I was just in the wrong place at the wrong time. [...] Even if someone insults me, I don't take it as an attack. I don't care." Philippe, driver and AIR*

Even if the drivers consider it an incident, they prefer to manage it themselves rather than to report it. Managing conflicts on their own responds to a need to be in control of themselves and others; a central reference in the masculine hegemonic identity of the operational employees (Ely and Meyerson, 2006; Bishop et al., 2009; Nixon, 2009). In this way, by managing incidents on the network themselves, even if it means using physical force, the drivers reinforce their feeling of belonging to the "male" social category. Similarly to some of their male colleagues, women stigmatise drivers of both sexes who do not demonstrate courage and responsiveness when attacked.

*"So it's up to us to stand for ourselves, at night we don't have much choice. [...] For instance, there is someone [passenger], I am at war with him. A bit nerve-racking when I go to work at the moment because I say to myself "if I come across him, there'll be problems." And I already warned the supervisors by saying "I'm warning you if I come across him, I don't know what I'll do". Because he is aggressive, he is vulgar, he insults me, he belches in my face." Josiane, driver on night shift*

It is also rare that incidents are reported, as they may disqualify a driver applying for the position of group leader. When a driver applies, his file, which contains his absences, his assessments, passengers' complaints and also reports of incidents, is studied. A large number of reports is seen as a driver's inability to manage confrontational situations on his own and may therefore cast a doubt on his ability to supervise a team of drivers. Which, *in fine*, means that the drivers must manage attacks themselves, at the same time reinforcing the driver's hegemonic masculine identity.

## CONCLUSION

Transco's development is in a transitional stage. Up to now, the management accepted its image as a masculine company, and the bus driver's standard was a reflection of this portrayal: a rather strong and virile man, independent in the exercise of his occupation, tolerating a stressful and wearing working environment. Transco's strategic re-orientation is bringing about a modification in the standard, as what is expected of the bus driver is changing. Even if driving was the driver's main task in the past, today it seems to have been sidelined in favour of customer relations, which becomes the critical and differentiating skill. The management moreover is tending to recruit people with profiles more in line with this new approach to the occupation. On the other hand, it has not yet changed its management rules, its organisational structures and its performance criteria to align them with its strategy and to establish the new standard. It seems that it recognises attractive qualities in women to implement its new strategy, but it is not ready to entrust them with more responsibility. These two attitudes may have one and the same motive: the still very stereotyped view that the management has of women and the occupation.

We have identified several limits in this study. Firstly, it is based on a unique case, making it difficult to generalise the results obtained. However, we endeavoured to show how our results are similar to other studies carried out in passenger transport companies in France (Scheller, 1996, 2009, 2010) and abroad (Bishop et al., 2009) or in other professional contexts (Ely and Meyerson, 2006; Pruvost, 2008). Secondly, we excluded from our analysis the concept of *critical mass*, according to which a certain number of women taking on a masculine occupation can tip over the masculine organisational culture (Lepinard, 2007). This threshold is often set at 30% (Igalens and Sahraoui, 2010). In Transco, less than 20% of the drivers are women. In theory, we were not able to observe substantial changes connected solely with women's arrival. It would be interesting in a later study to compare Transco with a company in the same Group, but in which 30% or more of the drivers were women. Finally, after our study, we were able to highlight many human and financial costs related to the process of identity building, particularly the fact that the company is not attractive to women, that the specificities of female mobility are concealed, that attacks and incidents are not reported, and the costs related to aggressive driving. We feel that exploring this avenue in terms of costs and benefits in the gender aspect of the culture and professional identities could be profitable.

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# Women's perception on building more sustainable transport environment

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## ABSTRACT

The dynamic transport development that has started at the end of XIX century is producing negative effects for all human beings, which is today visible worldwide. The male-dominated car industry, created in order to serve and help people, exceeded the accepted level of sustainability, with human and environmental needs. This created a dramatic number of deaths in traffic accidents, unacceptable air pollution and degradation of our planet. Social transitions in gender equity in education and professional careers give way to implementing women's attitude into environmental actions. Selected research results are presented in the paper, showing gender differences in attitude to sustainable transport development. The social aspects of differences in brains between genders may explain the potential role of women in engineering, in building strategies, and searching for human directed solutions in the creation of sustainable transport.

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**KEYWORDS:** Mobility; Safety; Road transport; Environment.

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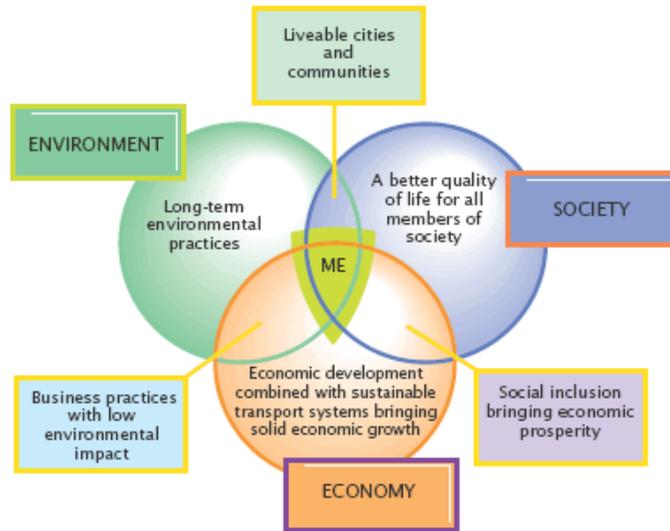
## 1. INTRODUCTION

The main assumptions of the work presented are based on the following reasoning:

- 1) The process of industrialization and the transport changes from the beginning of the motorization area were ruled by the male-controlled engineering world.
- 2) The male-dominated car industry, created in order to serve and help people, exceeded the accepted level of sustainability with human and environmental needs. This created a dramatic number of deaths in traffic accidents, unacceptable air pollution and degradation of our planet.
- 3) The vision of future disasters caused by continuing industry and transport development, make people look for sustainable solutions.
- 4) Social transitions in gender equity in education and professional careers give way to implementing women's attitude into environmental actions.
- 5) Today new trends are observed and the necessity to gather all human potential, including women's in engineering, to correct and work on climate changes and related fields.
- 6) Transport engineering is producing the majority of air pollution and, together with globally increasing mobility, needs urgent thinking on sustainable transport.
- 7) The social aspects of differences in brains between genders may explain the potential role of women in engineering, in building strategies, and searching for human directed solutions to create sustainable transport.

## 2. Sustainable development

Sustainable development is defined as balancing the fulfillment of human needs with the protection of the natural environment [1]. A common definition of sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The field of sustainable development can be conceptually broken into three constituent parts: environmental protection, economic sustainability, and social justice.



**FIGURE 1. The Concept of Sustainable Development** (Source [1]: Adapted from Ralph Hall, Introducing the Concept of Sustainable Transport to the U.S. DOT through the Reauthorization of TEA-21)

All the selected parts of sustainable development, environmental protection, economic sustainability, and social justice are related to transport sustainability in the modern urban world. Sustainable transport systems are bringing solid economic growth and a better life quality in cleaner environment, especially in cities and in the large metropolitan areas. The task of creating sustainable transport development is a multi-criterion issue. Moreover, all citizens, as active transport users, are directly or indirectly involved in the process of shaping the local systems of transport.

### 3. SUSTAINABLE PUBLIC TRANSPORT

Public transport offers many advantages over individual transport modes. It:

- costs less to the community,
- needs less urban space,
- is less energy-intensive,
- pollutes less,
- is the safest mode,
- improves accessibility to jobs, and
- offers mobility for all.

Public transport contributes to all aspects of urban life, and consequently transport appraisal needs to consider all of the following areas:

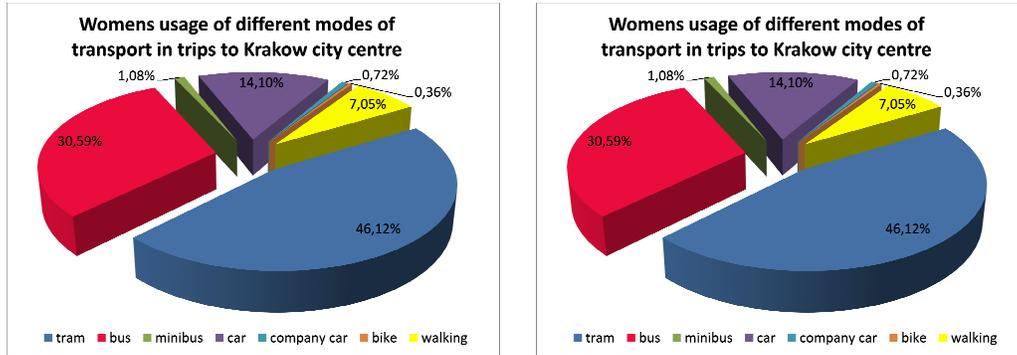
- Economic – public expenditure and income, user time savings, reliability and wider economic impacts;
- Environmental – noise, air quality, greenhouse gases, landscape, townscape, historic heritage and water environment;
- Social – safety, security, accessibility, mode interchange, land-use policy, physical fitness and journey ambience

### 4. Research methods and analysis

Public transport appraisal has traditionally concentrated on assessing specific infrastructure projects, but there is increasing need to assess transport policy itself. Demand management schemes are being identified as a possible solution to tackle the congestion that hampers inter-urban and urban mobility. However, such options are difficult to assess with conventional appraisal. The very limited experience and number of practical case studies in demand management make accurate appraisal of their benefits difficult. Furthermore the

impacts of demand management are also very broad; their diffuse impacts are difficult to separate from background 'noise' and are complicated to measure (Zakowska, 2005) [1].

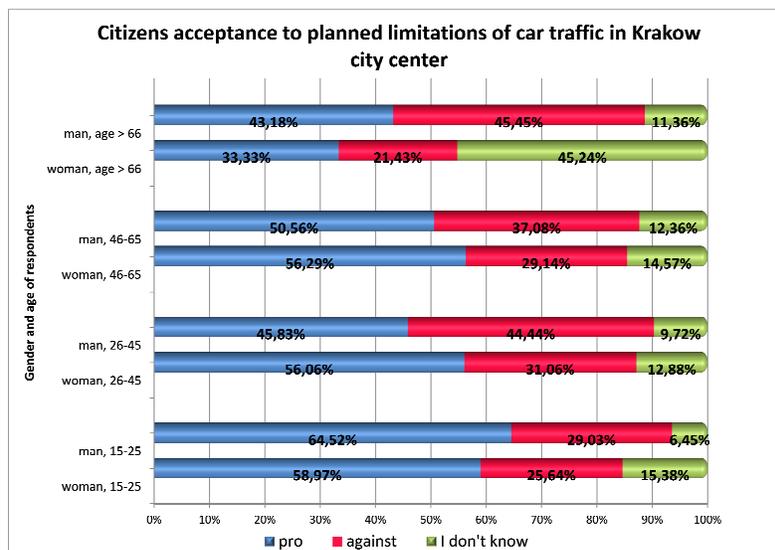
Several survey studies have been conducted in order to get insight into the gender-related aspects of sustainable transport use. Part of the results of research conducted in 2003 among Krakow metropolis inhabitants is shown in Figure 2. The research took into account transport behaviours and had included 1,500 inhabitants (Comprehensive Traffic Research 2003).



**FIGURE 2. Comparison of the usage different modes of transport for women and men - in trips to Krakow city centre** (Source: authors research based on Comprehensive Traffic Research 2003)

The general comparison between men and women considering the usage of different transport modes shows that women more seldom choose the car in travelling to the city center. The car is a favourite mode to travel for about 23% of men and 14% women. Women also choose more often public transport – taking into account trips to the city center, slightly more than 75% of women use public transport, while around 60% of men use tram and bus. It is important to notice that only trips to the city center, with its good accessible public transport service are taken into account [8]. However, the difference in the usage of cars between men and women is similar in trips to other destinations as well.

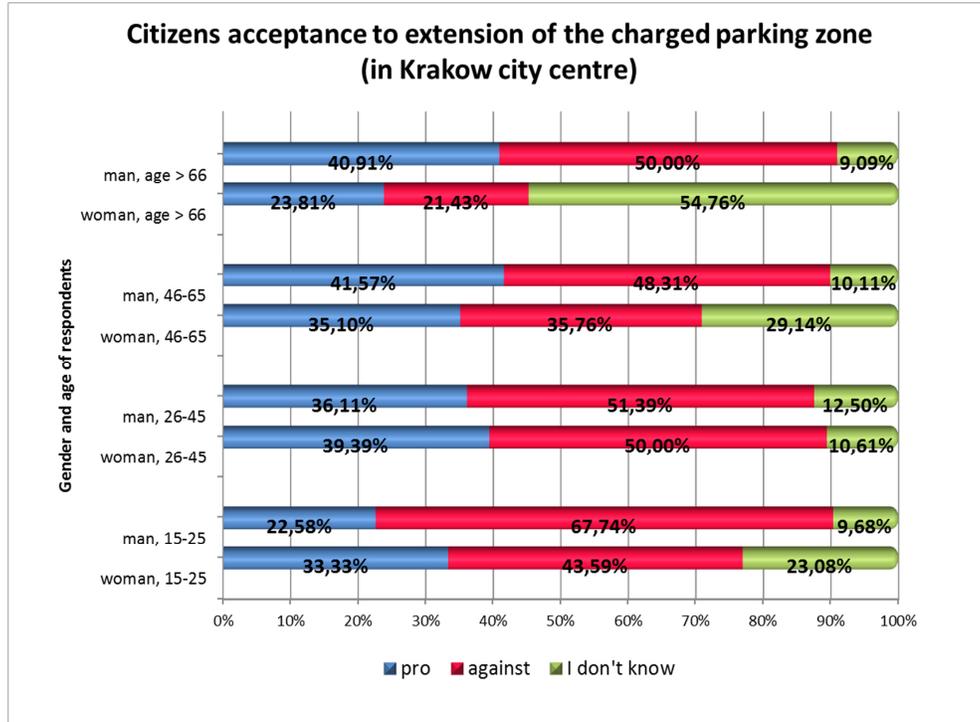
Focusing on aspects of sustainable transport ideas and supporting activities, the selected results of the research on Krakow suburbs' population preferences are presented below. The research was conducted on order of the Municipality of Krakow in 2007 and had included 500 inhabitants of the Krakow agglomeration suburban area. The respondents were asked about their level of acceptance of the changes related to the implementation of difficulties for car users.



**FIGURE 3. Citizens acceptance to extension of the charged parking zone in Krakow city centre.** (Source: authors research based on Comprehensive Traffic Research 2007)

Analysis of the research results shows that slightly more women than men find the implementation of limitations of car traffic in the city centre a good idea (54% of women and 49% men). In general women were less decisive in perceiving such restrictions. Strongly opposed are 28% of women (and 40% of men). The results are differential in various age groups. Particularly among young women and men, there is a tendency toward increasing acceptance of planned limitation changes related to the reduction of car traffic.

As shown in Figure 3, fewer women than men disagree with car parking restrictions in their cities while considering all age groups of respondents. There are significantly more men than women who oppose the planned extension of a charged parking zone, in each age group considered. The biggest differences between men and women in the level of acceptance of such changes can be seen in the two age groups, namely the elderly and the young.



**FIGURE 4. Citizens acceptance to extension of the charged parking zone in Krakow city centre.**

(Source: authors research based on Comprehensive Traffic Research 2007)

The results of the oldest age group (+65) are interesting, because they show that over fifty percent of female seniors have no opinion (Figure 4). Among women over 66 years old, there are 23 percent who disagree and 21 percent of those who agree with car parking restrictions in the area they live. This may result from the fact that women in the older generation were not used to driving the car, when in their generation one car in the family was a standard and driving this car was a male dominated task.

Several barriers to using the energy transport were identified during the SIZE project results analysis [6], as mostly connected to the existing bad social attitudes, poor safety and security level and finally not proper infrastructural design. Walking, cycling and using public transport can be as beneficial for individual seniors as for all society; sustainable mobility increases energy efficiency. Many trips in urban areas can be shifted to sustainable modes, since physical accessibility has improved in recent years. There are still mental barriers, and it is necessary to convince older people that there are convenient alternatives. The recommendations developed constitute basic principles for the implementation of measures (Risser & Haindl, 2007; Zakowska, 2005). Transport and mobility preconditions will improve the quality of life of senior citizens if they are shaped according to the needs and interests of senior citizens, and if information about existing options and possibilities is distributed accordingly. Finally, most of the measures that bring more friendly transport to elderly women are also good for all transport users, especially for young pregnant woman and those with small children.

## CONCLUSIONS

Both theory and practice show that sustainable transport systems are bringing solid economic growth and a better life quality in a cleaner environment, especially in cities and in the large metropolitan areas. Building sustainable public transport in Europe is considered as a high priority and urgent task. Recent research studies in the European Community are directed to multi-criterion public transport appraisal, considering economic, environmental and social aspects of transport needs and practices.

Selected research results presented in the paper show the gender differences in perceiving sustainable transport development. Women, equally with men, participate in social life, but they use urban facilities and public transport in a more sustainable way. Women appreciate social and environmental issues in selecting their transport needs and transport behaviour. The social sensitivity of women make them an important and significant actor in the engineering world, in building and searching for human directed solutions in the creation of sustainable transport and better life quality.

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# Plenary Sessions Contributions

<i>Femmes, concept entre nature et culture.</i> Ariane Dupont-Kieffer	705
<i>Représentations de genre conscientes et inconscientes. Leur impact sur le monde du travail.</i> Sylvie Pouilloux	711
<i>Hypothèses sur la mobilité des femmes.</i> Jean Dekindt	715
<i>Planning and designing transport systems to ensure safe travel for women.</i> Geetam Tiwari	721



## OPENING SESSION

Chaired by **Therese Mc Millan**, US DPT (Federal Transit)

**Françoise Thébaud**, University of Avignon.

**Sandra Rosenbloom**, The University of Texas at Austin.

**Sophie Tekie**, Road Management System, Namibia.

**Roselyne Bachelot**, Former Minister of Ecology and Sustainable development (2002-2004) and Former Minister Of Health (2007-2010) and Former Minister of Social Inclusion (2010-2012).

## BRIDGING THE GAP 1: BRIDGING THE GAP BETWEEN MEN AND WOMEN

Chaired by **Mary Crass and Ariane Dupont-Kieffer**

*Panelists:*

**Françoise Milewski**, Economist, Sciences Po sur Présage: Training on gender.

**Sylvie Pouilloux**, Psychoanalyse, Gender perception in Society and Work.

**Jean Dekindt**, Porte-parole des employeurs dans le dialogue social sectoriel européen pour le TP urbain et

**Alain Sutour**, Président du Comité TP Urbain de ETF.

**Silvia Maffii**, Managing Director, TRT Trasporti e Territorio srl, Transport as a key element for women to participate to social activities and work.

**Susan Handy**, Professor, University of California-Davis, Women activities, location and their mobility patterns.

**Nato Kurshitashvili**, ERBD, How to include women in development planning?

## BRIDGING THE GAP 2: RESEARCH-POLICY

Chaired by **Janet Oakley**

*Panelists:*

**Ann Brach**, Director, Strategic Highway Research Program, Transportation Research Board.

**Ann L. Schneider**, Secretary, Illinois Department of Transportation and Chair, National Transportation Freight Advisory Committee.

**Joan McDonald**, Commissioner, New York State Department of Transportation.

**Dr. Barbara Lenz**, Head of the Institute for Transport Research at the German Aerospace Center (DLR), Berlin-Adlershof.

**Jean-Marc Delion**, CEO-General Delegate at RAILENIUM.

## BRIDGING THE GAP 3: BRIDGING THE GAP AMONG COUNTRIES

Chaired by **Stephen Perkins**

*Panelists:*

**Patricia Hu**, BTS data and measuring investment for gender oriented transport policy.

**Geetam Tiwari**, Indian Institute of Technology Delhi, Safety, Security, urban design and infrastructure investment.

**Andrew Trotter**, Chief Constable, British Transport Policy: Security, safety and gender in public transport and public spaces.

**Veronica Raffo**, World Bank, Latin America and Caribbean Region.

**Socheata Sann**, HIB Cambodia, Road Safety and gender in South East Asia.

## TRANSPORTATION PROFESSIONS SESSION

Chaired by **Marsha Anderson Bomar**

**Katy Ware**, Head of International Maritime Co-ordination – Permanent Representative of the UK to the IMO.

**Katie Turnbull**, Executive Associate Director, Texas A&M Transportation Institute; Director, Transportation Economics Center and Past chair of TRB Technical Activities Council.

**Susan Kurland**, Assistant Secretary of Transportation for Aviation and International Affairs.

## EQUITY IN TRANSPORTATION: ACTION COST TEA

Chaired by **Floriea Di Ciommo**

*Participants:*

**Karen Lucas** from ITS-Leeds University: "The equity in transport: a key point for transport inclusive policies?"

**Maria Pilar-Marchones**, Centro, UK: "Local UK Authorities perspective for embedding equity in transport policies."

**Rebecca Shliselberg**, by civil society side (Transportation Engineering and Planning): "Spatial justice and transport".

**Ioana Adamescu** (DG research, EU): "Transport and Research EU – Social effects of European TRI: equity in transport, a key issue".

## WRAP UP SESSION

Chaired by **Therese Mc Millan**, U.S DPT (Federal Transit)

**Catherine Coutelle**, Elected official. Députée de la Vienne, Présidente de la Délégation de l'Assemblée nationale aux Droits des femmes et à l'égalité des chances hommes et femmes, élue à Poitiers en charge des transports et présidente de femmes en mouvement (<http://www.catherinecoutelle.fr/>)

**Laurie Pickup**, Researcher.

**Inès Kawgan-Kagan and Adeel Yousaf**, PhD students.

**Lito Achimastos**, COLAS.

**Camelia Ravanbakht**, PhD, Deputy Executive Director, Hampton Roads (Virginia) Transportation Planning Organization.

**Lynn Peterson**, Secretary, Washington State Department of Transportation.

# Femmes, concept entre nature et culture

Ariane Dupont-Kieffer

Bonjour, je suis une économiste des transports et historienne de la pensée économique. Porter une démarche historique permet d'identifier les continuités et les discontinuités dans la production du discours scientifique sur les phénomènes économiques. Cette démarche permet de voir que la question des femmes et des transports n'est pas un cas particulier de l'analyse économique mais une question qui pousse au renouvellement des outils conceptuels et méthodologiques, de la même manière que l'explique Françoise Thébaud (2007) pour l'histoire des femmes.

Le concept de « genre » est un hybride particulier au sens de Bruno Latour, dont le sens a évolué à travers le temps et les disciplines, hybride particulier à inscrire dans notre modernité. Depuis Hobbes et Boyle, les « modernes », auraient fondé leur paradigme sur l'identification et la distinction de deux forces : la force sociale (le pouvoir) et la force naturelle (le mécanisme) (*ibid.*, chapitre 2). Cette distinction engendrerait ensuite deux pratiques, celle de la « traduction » et celle de la « purification », et deux types de pouvoir, celui du « savant » et celui du « politique ».

- Le travail de *purification* tente d'établir « une partition entre un monde naturel qui a toujours été là, une société aux intérêts et aux enjeux prévisibles et stables et un discours indépendant de la référence comme de la société » (*ibid.*, 21) ;
- Le travail de *traduction* tente d'établir sur la base d'identification de réseaux la chaîne entre les préoccupations des scientifiques et celle des hommes politiques et de la société civile, entre les différentes disciplines scientifiques, entre les « stratégies savantes et industrielles », *etc.* (*ibid.*, 21)

Dans ce cadre, la distinction entre ces deux forces conduit à la distinction entre deux pouvoirs, le pouvoir scientifique représentant les choses et le pouvoir politique représentant les sujets (Latour, 46).

Pour en saisir toute la complexité des concepts de genre et de sexe, il faut donc précisément développer une approche multi-disciplinaire. Ces concepts sont des points d'entrée qui permettent de renouveler tant les analyses que les politiques de transport ou les politiques économiques et sociales. Il est à la fois représentatif de la fin de la dichotomie entre objet et sujet mais aussi de la fin de la dichotomie entre pouvoir scientifique et pouvoir politique. En effet, la vision et la représentation de l'être humain, particulièrement depuis les « modernes », a été andro-centrée puisque l'être humain est désigné par le terme « Homme », faisant alors de la femme une déviation de l'homme et établissant ainsi une hiérarchie implicite (Agacinski, 2012, 13). Pour revenir à mon approche en termes d'hybrides, l'analyse avancée par Sylviane Agacinski est utile pour comprendre que les différences et les interdépendances opérées entre « sexe » et « genre » permettent de voir comment le phénomène d'hybridation est à l'œuvre sur les questions des femmes, notamment en économie et au-delà de la question du capital humain. Ainsi, je m'inscris dans la lignée de Sylviane Agacinski (2012) qui montre qu'il ne peut y avoir de dichotomie entre « sexe » et « genre » ou « rapports sociaux de sexe » (Agacinski, 2012, 8) car, en effet :

« si l'on ne tient pas compte de la différence sexuelle, donc du pouvoir propre des femmes (enfantement), on ne peut pas saisir les modes d'appropriation dont elles ont été ou font encore l'objet » (Agacinski, 2012, 10).

En effet, les différentes théories récentes sur les femmes ont bien tenté de séparer ce qui relevait du sexe donc de la « nature » (et par conséquent la capacité à engendrer) et de l'inné et ce qui relevait « genre » donc du rapport social et culturel. On aurait ainsi deux objets d'étude distincts : le corps de la femme et le comportement social de la femme, sachant que certains courants du genre, comme les travaux de Judith Butler, nient la dimension biologique. Le travail de séparation des concepts « sexe » et « genre » s'est construit depuis la « modernité » et le siècle des Lumières avec l'imposition d'une partition-séparation entre deux groupes d'êtres humains (Bereni, Chauvin, Jaunait, Revillard, 2008, chapitre 2). Les femmes et les mâles étaient pensés encore au Moyen-Âge comme un continuum d'un même corps et d'un même être connaissant des développements physiques différents. Depuis le siècle des Lumières, on voit s'opérer un premier travail de séparation autour de la définition des éléments physiologiques, biologiques, psychiques qui vont caractériser l'être féminin. Mais ce travail s'est heurté à de nombreuses pierres d'achoppement (taille, gêne et ADN). Le

travail de séparation s'est ensuite porté sur les fonctions différenciées entre hommes et femmes pour montrer en quoi la place et le rôle de la femme dans la société conditionnent et même déterminent leur identité de femmes (Bereni, Chauvin, Jaunait, Revillard, 2008, chapitre 2 ; Héritier, 1996, 2002).

La recherche sur les femmes délaisse de plus en plus les questions de « sexe », sauf en médecine, pour se concentrer sur les questions de « genre ». Le terme, importé et mal traduit des recherches menées aux États-Unis, revêt un ensemble de concepts et le concept peut sembler fourre-tout tant il recouvre de théories et d'approches. Le terme « genre » est utilisé pour imposer l'idée d'une neutralité et la possibilité d'incarner la notion d'être humain sans hiérarchie entre les êtres, notamment féminins et masculins.

Ce point d'entrée à partir des « femmes » permet de revoir le développement des institutions à partir des relations de pouvoir et non l'inverse. Les travaux des anthropologues comme Françoise Héritier (1996, 2002) ou des historiennes comme Michelle Perrot (1998) montrent que le « genre » ou le « rapport social de sexe » ne transcende en rien les autres catégories explicatives avec lesquelles il entre toujours en composition. Mais ces analyses pour être fructueuses doivent bien avoir en tête que les rapports sociaux de sexe se fondent justement sur une appropriation des corps féminins pour leurs dispositions sexuelles précisément (l'enfantement et la reproduction). Ces rapports d'appropriation qui déterminent le « genre » sont marqués historiquement, géographiquement et culturellement, et ce relativement au statut d'épouse et de mère que les femmes tiennent dans les différentes sociétés, statut lié à leur capacité d'enfanter. Cette contextualisation peut expliquer que le concept de « genre » soit si flou, notamment quand on se penche sur les voyages au quotidien et la création des espaces d'activités.

Je pars de l'économie des transports, puisque que les inégalités d'accès au transport, permet de mieux saisir l'ensemble des autres inégalités. Ce point d'ancrage me permet de retracer l'histoire de la mesure de ces inégalités économiques (en partant notamment des travaux de Bernard Gazier et de Françoise Milewski, mais aussi des débats sur la prise en compte du travail domestique dans les différents cadres de comptabilité nationale (*Systems of National Accounts*), entre sexe et genre. À partir de cette histoire de la mesure des inégalités, à travers la focale de la mobilité, je peux plus aisément saisir la complexité du processus par lequel les économistes, au moyen de ces mesures, ont renouvelé d'une part l'analyse économique et l'histoire économique et d'autre part la conduite des politiques publiques, dans le champ du transport mais plus largement pour l'ensemble des activités privées et sociales. Scott (2012, 12) montre qu'« en renvoyant ces intérêts [l'exploitation économique, l'autorité politique, la conquête impériale, les intérêts d'État, de race ou d'origine ethnique] au genre (littéralement ou métaphoriquement), les hiérarchies et les inégalités sont naturalisées ; on finit par croire qu'elles sont de l'ordre de la nature ».

Les questions de 'sexe' sont prégnantes dans le champ du transport depuis plusieurs décennies, notamment sur les questions de sécurité routière, et plus particulièrement sur le niveau d'adaptation au corps féminin des véhicules à la conduite et à la protection adéquate contre l'exposition au risque routier<sup>119</sup> et sur l'influence du rôle social et familial sur l'exposition au risque routier et sur les types d'accidents dans lesquels les hommes et les femmes sont impliqués, les types de blessures auxquels ils sont confrontés, les conséquences des transports sur leur santé et leur bien-être, leurs attitudes et comportements concernant la sécurité et la sûreté dans les transports. Mais partant de ces questions très physiologiques, les recherches sur femmes et transport se sont portées sur la prégnance des représentations sociales sur les choix de mobilité et de mode des hommes et des femmes, ainsi que sur leur espace d'activités. L'analyse économique des transports a été questionnée notamment sur les questions de valeur du temps, mais également sur la difficulté à mesurer la part du transport dans la capacité des femmes à accéder au marché de l'emploi, à l'éducation et à la santé ou pour le reformuler la contribution du transport dans les inégalités hommes-femmes. Si la production académique mais aussi opérationnelle sur ces sujets a pris beaucoup d'ampleur et d'importance depuis trois décennies, cette histoire n'a jamais été écrite et les différents enjeux théoriques et méthodologiques pas encore analysés.

Comme le rappelle Scott (2012, 18), le concept de genre a été introduit par les féministes anglo-saxonnes pour montrer que la distinction entre les sexes porte en elle une forte dimension sociale. Il est important de

<sup>119</sup> Dans le premier cas, il s'agit dans le cas de l'adaptation du poste de conduite notamment des poids lourds et des bus à la morphologie des femmes (distance entre le siège et le pédalier). Dans le second cas, on peut citer à titre d'exemple la nécessité d'adapter la ceinture de sécurité pour les femmes enceintes ou bien de renforcer l'habitacle au niveau des jambes pour les femmes car pour un choc de même nature et de même force, elles souffrent de blessures plus graves aux jambes que les hommes du fait d'une plus grande fragilité osseuse liée notamment à l'ostéoporose.

garder les « femmes » comme catégorie opératoire dans la démarche de connaissance comme le montre Joan Scott (1986 réédité In 2012, 14-54) dans le champ de l'histoire puisque :

« les études sur les femmes feraient non seulement émerger des sujets nouveaux, mais imposeraient également un réexamen critique des prémisses et des standards de la recherche universitaire » (Scott, 2012, 19).

Pour reprendre une analyse très latourienne, la « modernité » a tenté de séparer le sexe du genre. Or, dénaturiser le genre est impossible puisque le sexe conditionne la construction du rapport social.

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# Représentations de genre conscientes et inconscientes. Leur impact sur le monde du travail

**Sylvie Pouilloux**

Psychoanalyse, Gender perception in Society and Work

Supposer que les représentations sociales de genre conscientes et inconscientes puissent « impacter » le monde du travail, c'est considérer, comme le développe Castoriadis, que la perception de la réalité sociale se trouve inextricablement liée à sa composante imaginaire effective.

Pourquoi se mobilise-t-on au travail ? Parce qu'on en attend de la reconnaissance et parce que, comme le rappelle Christophe Dejours, on en attend outre la rétribution de salaire, une rétribution morale et symbolique. Autrement dit, le travail témoigne d'un rapport au groupe. Il suppose une intériorisation des lois et des normes sociales, laquelle intériorisation, a tissé pour le sujet une identité collective. Et parce que les idéaux impliqués dans les projets collectifs de la culture participent à la construction psychique des sujets, en particulier par le processus de l'identification (Giust Desprairies), cette intériorisation est bien d'ordre psychique. Les chercheurs ont donc caractérisé les représentations sociales, comme des formations intermédiaires entre le psychique et le social (René Kaës, 1980).

Qu'est-ce que cela implique du point de vue de la psychoanalyse ?

Cela implique que les représentations sociales, non seulement mobilisent le sujet à son insu, mais encore qu'elles dessinent un cadre restrictif à l'expression des pulsions, qu'il s'agisse de pulsions partielles ou de la pulsion sexuelle globale qui met en jeu l'ensemble du rapport du sujet à la culture. C'est dire que l'identité sexuelle ou plus exactement la représentation que chacun a de son identité sexuelle conditionne encore les possibilités de réalisation du sujet et dessine les bornes de sa jouissance.

Mais exprimer les choses de cette façon demeure évidemment abstrait. Cela ne permet pas de comprendre à quel point les représentations sociales peuvent inhiber la réalisation des personnes ; aussi je vais prendre un exemple. Parmi les représentations de genre, conscientes, il y a l'idée que les sexes sont désormais égaux devant le travail et que les salaires devront attester bientôt cette égalité. Parmi les représentations de genre conscientes, il y a aussi l'idée que les sexes étant égaux devant le travail, les femmes devront occuper à terme des postes à responsabilité et des postes de direction. Mais les représentations de genre inconscientes ne suivent pas tout à fait cette acceptation formelle de l'égalité. Car dans la famille et dans le couple, si l'égalité est tenue pour légitime, s'il est admis qu'une femme puisse temporairement ou durablement percevoir un salaire plus élevé que celui de son époux, cette situation encore exceptionnelle produit sur le conjoint un effet parfois dévastateur. Pourquoi dévastateur ? Parce que la puissance masculine s'éprouve dans un lien étroit avec la puissance sociale, puissance reflétée par le pouvoir et renforcée par le pouvoir phallique de l'argent.

Dans la situation inverse, lorsqu'une femme se plaint de gagner moins que son époux. La clinique montre qu'aujourd'hui encore, elle le fait sur le mode narcissique. Elle se sent dévalorisée dans son être de sujet. Elle peut alors trouver une réparation dans les représentations sociales qui la montrent dans la norme, et relativiser ainsi sa souffrance. Si la relativisation s'avère difficile au point qu'elle veuille changer sa situation, elle mettra un certain nombre d'années avant d'y parvenir.

Deux différences apparaissent ici : premièrement le rapport à la norme. Il est encore majoritairement influencé par l'organisation patriarcale de la société. Deuxièmement le rapport au temps. À la différence de ce que vit une femme, le sentiment d'impuissance sexuelle chez l'homme provoque chez lui une angoisse vécue dans l'urgence. Il y a d'autant plus d'urgence à sortir de l'impuissance sexuelle que le parallèle est vite tracé entre impuissance sexuelle et impuissance au travail comme le souligne encore Castoriadis.

Les représentations sociales de l'identité sexuelle ont pourtant considérablement varié au cours du XXe siècle. Freud en 1914 désigne encore l'enfant fille comme affecté d'une infériorité organique, qui la voue d'abord à une revendication phallique puis une passivité sexuelle. À partir de là, toute activité chez la petite fille et plus tard chez la femme sera envisagée comme tendance masculine. Ceci impacte bien évidemment le rapport au travail et aux infrastructures. Il suffit de se référer à la clinique des analysants pour voir combien le

rapport des mères et des grand-mères au travail ou au sport, a soulevé de tabous dans les générations précédentes, et combien ces représentations sociales continuent d'être vivantes.

Pourtant Freud reconnaissait qu'en chacun des deux sexes se partageaient des tendances masculines et féminines. Lacan ira plus loin en affirmant que les positions masculines et féminines sont des positions de discours. En effet, écrit Lacan « La loi primordiale est celle qui réglant l'alliance (interdisant l'inceste) superpose le règne de la culture au règne de la nature livré à la loi de l'accouplement ». De sorte que ce n'est pas la réalité qui est aliénante, mais la valeur qu'on lui donne, c'est-à-dire le signifiant qui impose le sens. Positions de discours donc, le masculin et le féminin n'en sont pas moins déterminés, chez cet auteur, par rapport au manque en la mère, c'est-à-dire par rapport au « phallus ».

Ceci pose plusieurs questions. La première est celle de ce qu'on pourrait appeler la double aliénation des femmes. Si la féminité et la masculinité sont des positions de discours, contraindre l'identité féminine à se trouver représentée par un signifiant masculin, voue le féminin à une double disparition, celle du fading qui frappe tout sujet représenté par le signifiant et celle d'une aliénation supplémentaire qui consiste à disparaître en tant que féminin dans la langue. Cette disparition du féminin de la langue, en particulier de la langue professionnelle, contribue à donner aux femmes un sentiment d'illégitimité à occuper la sphère publique. Le vocabulaire guerrier de la conquête des marchés (se battre sur le front des prix, défendre une position etc.), en donne d'ailleurs un exemple.

La deuxième question soulevée par la position lacanienne est la question du père réel, ramené par Lacan à la fonction de représenter la loi par l'intermédiaire du « nom du père ». Au regard de la fonction paternelle et du nom du père qui ouvre la voie aux alliances, le père réel (selon Lacan) est toujours inadéquat à sa fonction. Mais là encore, n'est-ce pas un peu vite envisager la question de la paternité réelle et un sujet peut-il échapper à la toute puissance de la jouissance maternelle avec un père que la caricature réduit à la fonction d'agent séparateur ? Cette question n'est pas sans incidence sur le monde du travail puisque les hommes peinent encore à prendre leurs congés de paternité ou à rentrer suffisamment tôt pour partager la vie domestique.

Même si la réalité précède toujours plus ou moins la théorie, et la fait paraître quelque fois obsolète, il est néanmoins très difficile de changer les représentations sociales de genre. Et c'est bien là toute la question. Lorsque j'évoquais un peu plus haut l'éprouvé d'impuissance, il faut insister sur le fait qu'il ne s'agit pas d'un éprouvé conscient, et quand bien même cet éprouvé deviendrait conscient, s'en défaire met en jeu une représentation de soi, et de sa famille dans la société qui, elle, reste majoritairement inconsciente.

Cela revient à dire que les représentations sociales de genre (conscientes et inconscientes) influencent les relations au travail, (et si l'on prend l'exemple du transport, les déplacements et la manière d'en user) par le biais de mécanismes inconscients, mécanisme d'internalisation comme l'introjection ou mécanisme de projection.

J'explique un peu ces termes. L'introjection renvoie à ce qui a été internalisé durant l'enfance. Or, bien que les relations entre les genres aient infiniment évolué au cours du XXe siècle, ce qui a été internalisé par les sujets d'aujourd'hui renvoie à l'inconscient de leurs parents, voire très souvent encore, à celui de leurs grands-parents, c'est-à-dire à des rapports de genre et à une division du travail encore fondamentalement influencés par l'organisation sociale d'il y a une cinquantaine d'années, voire plus. Ce sont à ces représentations déjà anciennes qu'est arrimée la fidélité inconsciente aux injonctions surmoïques héritées des anciens.

Par exemple, des chercheurs ont remarqué que l'occupation des cours de récréation dans les établissements scolaires traduisait une répartition fille garçon assez traditionnelle, les garçons au centre avec des jeux de ballons, les filles à la périphérie sur des bancs. La difficulté pour les femmes à occuper le centre dans les espaces publics, qu'il s'agisse d'autobus, d'agora, de tribunes, ou d'assemblées pose toujours la question du pouvoir des femmes. Comme l'image d'un pouvoir au féminin n'existe toujours pas sans qu'il soit référé à celui de la mère, l'incarnation du pouvoir au féminin jouit de la double aura que lui donnent la sphère privée et la sphère publique. Mais cette double aura joue en la défaveur du pouvoir féminin qui renvoie femmes et hommes à la position particulièrement aliénante de l'enfant face à la mère. Les uns et les autres se trouvant confrontés au risque que comporte la représentation de la mère toute-puissante dans l'imaginaire infantile.

En outre, il n'y a évidemment pas que le genre qui intervient dans l'intériorisation des représentations parentales ou grand parentales, il y a aussi le sentiment d'appartenance à une classe sociale, comme le montre De Gaulejac dans *La Névrose de Classe*. Il faudra tenir compte de ces deux paramètres, qui s'interpénètrent : le

genre et la classe d'origine, laquelle permet des écarts plus ou moins grands par rapport à ce que permet la norme commune. Ceci pour l'introjection.

La projection est plus simple à comprendre : c'est ce que chacun de nous projette sur autrui de ses représentations inconscientes. Ce qui a été introjecté et qui provoque croyances, préjugés, phobies ou agressivité est l'attribué à autrui, au risque de perpétuer notablement les représentations sociales. Voilà qui complique encore plus la situation. Et c'est la raison pour laquelle les représentations sociales, en particulier de genre, n'évoluent pas vite, parce qu'il ne suffit pas de comprendre ou de connaître pour atteindre le soubassement de la résistance inconsciente.

Alors que faire ? Peut-être une solution se trouve-t-elle dans la formation ? Dans les groupes d'analyse des pratiques qui jouent sur l'interface entre situation professionnelle et situation personnelle...



# Hypothèses sur la mobilité des femmes

Jean Dekindt

Porte-parole des employeurs dans le dialogue social sectoriel européen pour le TP urbain  
Avril 2014, Conférence WITL

1) Il est important en tout premier lieu de rappeler que l'existence des moyens de transports et leur usage est intimement lié aux conditions de développement industriel ; des rapports de production au sein de ceux-ci et des modalités d'organisation sociale (rapports sociaux) qui en découlent.

2) En un bref rappel historique, je voudrai rappeler que :

- i) Les modes de transport mécaniques apparaissent avec la société industrielle. Auparavant, seule la traction animale et le bateau (« inventé » il y a 5000 ans) étaient en mesure d'assurer tant le transport de marchandises que de personnes.
- ii) Dans la première phase du développement industriel, celui de l'apparition de l'industrie lourde, les modes de transport émergents sont le train et les transports publics urbains. Ces deux modes de transport introduisent un nouveau rapport au temps et à l'espace.

Le nouveau rapport au temps est celui de la régularité<sup>120</sup>, de la ponctualité, de la prévisibilité du temps de déplacement. Le nouveau rapport à l'espace est celui de l'apparition de lieux particuliers, clos sur eux-mêmes, dédiés à une activité précise et organisés de façon spécifique en fonction de la réalisation de cette dernière.

Il s'agit de lieux que l'on peut qualifier, pour reprendre Michel Foucault<sup>121</sup>, de lieux « institutionnels » tels que l'usine, l'école, l'hôpital, la caserne, la prison, le logement familial (où, notamment parents et enfants sont isolés), etc. Ce sont des lieux caractéristiques de la formation, toujours dans la ligne de Michel Foucault, des « disciplines » où les rôles assignés à chacun sont réglés de façon précise<sup>122</sup>.

Trains et transport publics ont cependant une autre signature que celle de la discipline. Ils sont en effet aussi des modes de transport de « masse », de « foules », de « publics » qui sont toujours une « épreuve » (Erving Goffman) supposant des « normes d'usage, des rituels de civilité<sup>123</sup> » (Isaac Joseph).

Il faut cependant remarquer encore que nous nous éloignons ainsi des images de la ville du 18ème siècle, où domine l'image de foules opaques au pouvoir, imprévisibles (notez qu'à cet égard elles se voient attachées l'épithète de « femelles »), mouvantes, insécures (voire violentes), sensibles

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<sup>120</sup> « Si nous arrivons tous, sur toute l'étendue de nos réseaux, à respecter l'heure à la seconde, nous aurons doté l'humanité de l'instrument le plus efficace pour la construction d'un monde nouveau » (Audibert, chargé de l'exploitation ferroviaire, cité par Paul Virilio, Traverses n° 13. Réseaux : le modèle ferroviaire).

<sup>121</sup> « Surveiller et punir ».

<sup>122</sup> « [Les disciplines, dit Michel Foucault] fabriquent des espaces complexes à la fois architecturaux, fonctionnels et hiérarchiques. Ce sont des espaces qui amènent la fixation et permettent la circulation » Fixation et circulation. Si vous considérez, de ce point de vue conceptuel les transports que sont le train et les transports publics, ils illustrent à mon avis parfaitement ce diptyque où les points de fixation sont les arrêts, les gares, les stations entre lesquels circulent véhicules et passagers. Le sentiment que ces transports furent, en quelque sorte, des « machines disciplinaires » se renforce encore si l'on rappelle qu'ils ordonnent le temps tel que déjà dit et qu'ils sont organisés de façon réglementaire (les règlements dits de « police de chemin de fer »).

<sup>123</sup> On peut aussi à cet égard citer Marc Augé qui, dans un ethnologue dans le métro, voit dans celui-ci un « fait social total » (Marcel Mauss) qu'il décrit ainsi dans l'interview vidéo suivante : « La régularité des comportements obligatoires [dans le métro] prend un sens plus profondément rituel parce que ça fait partie de ce sens quotidien modeste mais essentiel. (...) L'autre aspect du rituel c'est qu'on ne le fait pas seul. Dans les pulsations quotidiennes du métro, je croise les autres et on ne fait pas ça impunément. (...) Dans le métro il y a (...) ce fait massif qui nous donne l'impression de vivre au même rythme que les autres. Le métro est un peu comme un poumon : flots, flux. Chaque petit parcours singulier se glisse dans cette grande respiration commune. Chaque vie particulière est obligée de côtoyer celle des autres. Marc Augé, territoires du transport et territoires de la ville, Interview vidéo, 1989 (réalisation Jean Dekindt, Georges Vignaux).

aux rumeurs etc. bien que, par ailleurs, souvent solidaires, attachées à des corporations, des métiers, des quartiers etc. (Arlette Farge et Jacques Revel<sup>124</sup>).

- iii) Dans un deuxième temps du développement des sociétés industrielles, celui des industries de consommation, le mode de transport de référence devient celui de la voiture particulière.

Elle marque une rupture forte avec l'univers de la première période industrielle en construisant un imaginaire de la mobilité fait de liberté, d'individualisation, de vitesse et une idéologie d'antagonisme entre monde capitaliste et monde communiste désigné comme celui de l'absence de liberté, de l'assignation, de la stagnation.

En même temps : « La voiture [prendra] sens dans le registre des attributs de la normalité sociale. (...). Cette importance symbolique de la voiture croît au fur et à mesure que l'on descend dans la hiérarchie sociale. (...) Quand on a peu, qu'au moins l'on ait ce minimum [une voiture qui] témoigne et garantit à la fois une certaine normalité. » (Eric le Breton).

- iv) Le troisième temps de la société industrielle est celui, qui s'annonce dans les années 70, de la mondialisation.

Il s'appuie sur deux modes de transport : l'avion et le train à grande vitesse. (Je précise que je fais ici, de façon volontaire et assumée, l'impasse sur la réalité considérable de la mondialisation en termes d'échanges de biens et de services).

Imaginairement donc, ces modes de transport que sont l'avion et le TGV, font éclater, par une vitesse toujours plus grande, les distances et les séparations et construisent un monde dit (Jeremy Rifkin) « de l'accès<sup>125</sup> » (je précise alors que, accès, vient du latin *accedere* qui signifie : « se rapprocher »).

Mais pratiquement, l'accès est de plus en plus régi par des barrières à franchir : « Aujourd'hui où vous possédez des langages, donc de l'éducation, donc de la capacité à manier des symboles, où vous êtes beaucoup plus exclu que vous ne l'étiez auparavant (...) vous êtes l'homme 'invisible'. Notre société a une proportion sans cesse croissante d'hommes et de femmes invisibles. » (Alain Touraine<sup>126</sup>)

Ainsi, si imaginairement, « l'hyper-vitesse » tend à rapprocher, en réalité elle dresse toujours plus de barrières à une telle finalité. Se pose alors la question, soulevée de : « comment réduire les écarts de vitesse qui déstructurent la ville et le corps social ? » (Luc Boltanski et Eve Chiapello<sup>127</sup>). Question à laquelle je ne tenterai pas d'y répondre ici sinon en rappelant que les auteurs mentionnent à ce sujet de la nécessité « d'un ralentissement des épreuves ».

Un dernier mot cependant pour souligner que ces trois étapes de développement des sociétés industrielles et des modes de transport qui, à chaque fois les ont accompagnés, ne doivent pas être envisagées comme des substitutions d'une étape à l'autre mais bien comme une accumulation progressive des différentes étapes entre elles.

3) Pour donc entrer maintenant dans la problématique des relations « femmes / transports », il me paraît important de fixer quelques repères sur l'inscription des femmes dans le monde industriel et la constance de ces formes de leur inscription au cours des étapes préindustrielles, industrielles au sens propre du terme (industrie lourde ; industrie de consommation) que postindustrielles comme l'on qualifie parfois l'époque de mondialisation.

À cette fin, permettez-moi de m'appuyer sur Joan W. Scott qui, dans son article « la travailleuse<sup>128</sup> » permet de dégager quelques enseignements tout autant utiles que fondamentaux.

Premièrement, l'âge industriel n'a pas fondamentalement modifié l'éloignement des femmes du foyer. Certes, comme elle l'explique « le lieu du travail [entre la société préindustrielle et la société industrielle] a pu

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<sup>124</sup> « Logiques de la foule ».

<sup>125</sup> Jeremy Rifkin : « L'âge de l'accès : la vérité sur la nouvelle économie ».

<sup>126</sup> « L'échange, l'acteur et la ville » interview vidéo RATP 1989 (réalisation : Jean Dekindt, Georges Vignaux).

<sup>127</sup> Luc Boltanski, Eve Chiapello, « Le nouvel esprit du capitalisme ».

<sup>128</sup> In « Histoire des femmes, le 19<sup>ème</sup> siècle », sous la direction de Geneviève Fraisse et Michelle Perrot.

changer, mais cela ne signifie pas que le rapport entre foyer et travail ait été modifié pour les travailleuses elle-même ; pour la grande majorité des femmes, le travail les avait déjà éloignées de chez elles. »

Deuxièmement, le travail féminin est un travail « à bon marché », et précise l'auteur : « le fait d'embaucher des femmes signifiait que l'employeur avait décidé d'économiser sur la main d'oeuvre ».

Troisièmement, « le salaire de l'homme était essentiel pour les familles, il couvrait les frais de reproduction ; le salaire de la femme était un salaire d'appoint compensant certains manques, ou apportant de l'argent au-delà de ce qui était nécessaire à la simple survie. »

Quatrièmement et bien que complémentaire au deuxièmement ci-dessus, il importe de remarquer que la qualification des femmes ne les promeut pas vraiment dans le monde préindustriel ; industriel ; postindustriel. Voilà encore ce qu'en dit Joan W. Scott : « Dans les aires du travail spécialisé et en « col blanc », les femmes étaient toutes désignées. Dans l'enseignement et la puériculture, on disait qu'elles soignaient les enfants, la dactylographie ressemblait au piano, et le secrétariat était supposé convenir à leur docilité, à leur goût du détail et au fait qu'elles toléraient bien les tâches répétitives. Ces traits étaient jugés naturels, comme le fait que le travail des femmes coûtait forcément moins cher que celui des hommes. »

Elle précise encore à ce sujet : « le directeur des services britanniques du télégraphe notait en 1871 que « les mêmes salaires qui attiraient des ouvriers masculins d'une classe modeste, attiraient des femmes d'une classe supérieure. » Son homologue français, qui avait attentivement étudié l'expérience britannique pour l'emploi de personnel féminin, faisait ce commentaire en 1882 : « le recrutement de femmes s'effectue à un niveau de formation généralement supérieur à celui demandé à des employés débutants ». Pour des raisons semblables, mais avec plus de réticences, à la fin des années 1880, l'administration du télégraphe allemand employait des femmes comme « assistants » (position qui les distinguait des hommes par le grade et le salaire.) ».

Résumons-nous : 1) l'assignation des femmes au foyer et leur absence consécutive de mobilité procède d'une certaine « légende » sociale ; 2) le travail féminin est sous-payé car ; 3) l'homme doit demeurer le reproducteur économique et social de la famille quand la femme s'inscrit, au regard de celle-ci dans une logique de reproduction biologique et de participation marginale à la reproduction économique ; 4) les qualifications obtenues par les femmes sont dévaluées par une procédure de naturalisation des compétences acquises. Naturalisation qui en permet la dévalorisation économique.

Bref, si les femmes ont longtemps été des citoyennes de « seconde zone », cet état de « seconde zone » persiste, au-delà des principes d'égalité proclamés, dans la sphère économique-financière.

Et cet état de « second role », qui les rend parfois « intrus dans le monde socio-économique » se retrouve dans les transports.

Prenez les transports publics comme le train ou les transports publics urbains dont j'ai dit plus haut qu'ils avaient une signature « disciplinaire ». Si une telle « signature » est relativement indifférente au « genre », on se heurte très vite aux limites d'une telle signature, dans des modes transports où l'une des caractéristiques principale est celle de la promiscuité des personnes et des corps.

Laissez-moi illustrer ceci par un exemple, celui d'une étude que j'avais réalisée à Alger il y a une trentaine d'années. Il m'avait été expliqué que les Algérois n'appréciaient pas que leurs épouses utilisent les transports publics.

Pourquoi ? Parce que, m'était-il dit, dans les transports publics les femmes sont susceptibles d'attouchements volontaires ou involontaires. Or, dans la société algéroise de l'époque, le corps de la femme (épouse ou fille) était considéré comme le prolongement du corps du mari (ou du père ou du frère). Une sorte de « double corps de l'homme » s'il m'est permis de paraphraser Kantorowicz.

Toucher le corps d'une femme dans des situations de proximité, était alors considéré comme une atteinte à l'honneur de « l'homme tuteur ». Or, dans l'espace du transport public, surtout si la femme s'y déplace « seule », ledit « homme tuteur », n'a pas la possibilité d'engager une procédure de réparation de son honneur à l'encontre de celui qui l'a profané.

Il s'ensuit que les hommes, craignant ou assurés qu'offense sera faite à leur honneur en laissant leur femme ou leur fille prendre le transport public préfèrent, autant que possible, qu'elles « évitent » de telles situations.

C'est évidemment là un exemple un peu extrême même si, autre extrême, dans certains pays (y compris à ma connaissance d'Amérique latine), la solution adoptée est, dans les métros, d'assigner des voitures différentes aux hommes et aux femmes<sup>129</sup>.

Bref, l'univers disciplinaire est un univers fragile qui ne résiste pas bien aux phénomènes de foules : vous le savez tous, monter dans des véhicules de transport publics bondés, crée des « échauffements » dont les femmes sont rapidement victimes.

Je voudrai cependant compléter ici par une autre remarque de nature différente.

J'ai pu observer au cours de certaines de mes études, notamment à Rio de Janeiro et Bogota, là encore il y a une trentaine d'années, que les « pauvres » devaient souvent, pour travailler, couvrir des distances bien plus considérables que les distances parcourues, dans ces mêmes villes par les « riches » qui, généralement concentrent sur des portions de territoires exigües, leurs activités professionnelles, sociales et familiales.

Pour les pauvres donc, c'est généralement l'inverse<sup>130</sup>. Mais, dans la logique que j'évoquais en citant Joan W. Scott, les pauvres des pauvres sont souvent les femmes qui, non seulement doivent travailler pour des salaires réduits mais qui, en plus, pour les gagner, doivent parcourir des distances importantes dans des conditions de déplacement souvent rudimentaires.

De toutes ces remarques, et d'autres que je pourrai encore faire, il s'ensuit la conclusion hypothétique suivante : les femmes ne sont-elles pas pour leurs déplacements susceptibles d'adopter des stratégies d'itinéraires, de moments de la journée ou de modes différents que ceux des hommes, quand du moins cela est possible<sup>131</sup> ? Je pense que ces distinctions que je ne peux présenter que comme anecdotiques et hypothétiques mériteraient probablement d'être plus systématiquement explorées.

Mais j'en viens à la voiture particulière comme symbole de l'industrie de consommation. J'ai dit qu'elle était un symbole fort de liberté. Je vous épargnerai les remarques caustiques que je pourrai faire sur certains États où les femmes sont toujours interdites de permis de conduire.

Mais, là encore, je voudrai faire remarquer que les voitures des femmes, sont souvent dans les foyers considérées comme, selon l'expression de marketing automobile, des « deuxièmes voitures ». Sous-entendu, des voitures d'appoints (comme le sont les salaires) mais permettant, si vous me permettez l'expression, « l'existence d'itinéraires féminins<sup>132</sup> » sous forme de courses, de conduite des enfants à l'école, et autres déplacements « domestiques » que n'aura pas à faire la « première voiture », celle de « Monsieur ».

Mais ne peut-on pas alors se poser la question de savoir si, une telle « deuxième voiture », ne constitue pas au final une sorte de cadre paradoxal de libertés qui, sinon plus du moins tout autant, assujettissent que libèrent ?

Il reste ici à évoquer le cas de l'avion et du TGV que nous avons désignés comme les modes de transports attachés au processus de mondialisation.

Le constat à cet égard s'impose rapidement. On le sait, les déplacements d'affaires liés à ce processus de postindustrialisation s'imposent majoritairement comme des déplacements masculins du fait qu'ils sont des déplacements de personnels dirigeants ou d'experts auxquels les femmes n'ont encore qu'un accès minoritaire

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<sup>129</sup> Si des telles solutions permettent aux femmes de se déplacer plus tranquillement et d'accéder aux différentes activités urbaines (notamment le travail) pourquoi pas ? Mais réduire cette séparation à une « fonctionnalité » de préservation de l'intégrité de leur corps physique ne doit pas empêcher de penser à l'autre aspect du corps de la femme, celui qui, symboliquement, ne lui appartient pas mais appartient à « un homme tuteur ». Certes, on peut penser que les activités sociales et notamment le travail ou les études participeront d'un modèle d'affranchissement de la femme. Mais n'est-ce pas là aussi en partie un pari qui n'est pas nécessairement gagnant à tous les coups ? Car rien ne dit « automatiquement » ici que la séparation fonctionnelle ne renforce pas aussi, dans une certaine mesure, cet autre aspect, symbolique, du corps de la femme comme « double corps de l'homme » ?

<sup>130</sup> Sauf dans certains cas, comme celui par exemple à Rio des favelas qui sont accrochées à des collines inconstructibles mais proches des centres urbains où les pauvres trouveront plus facilement à s'employer.

<sup>131</sup> Je m'étais encore entendu dire à ce sujet en Algérie et bien que ce soit un souvenir lointain, que la petite ville d'El Oued, à l'Est du Sahara algérien, était plus ou moins organisée en fonction d'itinéraires réservés aux hommes et d'autres aux femmes, de telle façon que les unes et les uns, se rencontrent le moins possible au cours de leurs déplacements.

<sup>132</sup> Qui ne sont peut-être pas ici sans rapport à ceux que je décrivais plus haut en parlant du corps de la femme comme « double corps de l'homme ».

même si la quantité de femmes munies de diplômes de haut niveau qui, en principe sont nécessaires pour ouvrir les voies vers de tels postes, dépasse désormais quantitativement les hommes.

S'opposent aussi aux femmes pour de tels déplacements, qui sont souvent de plusieurs jours, les « obligations familiales » auxquelles elles restent soumises.

Enfin, il va de soi encore que, dans certains contextes internationaux, la présence de femmes comme « dirigeantes » ou « experts », n'est pas vraiment souhaitée de la part de ceux qui auraient à les recevoir ès qualités.

Quoiqu'il en soit, tout ce que j'ai écrit ici, concernant la « place » des femmes dans les différents systèmes de transport comme à la fois reflet des rapports de production, des rapports sociaux et des mentalités n'est qu'un ensemble d'hypothèses et non pas de conclusions.



# Planning and designing transport systems to ensure safe travel for women

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## 1. INTRODUCTION

Safe travel for all road users is a prerequisite for ensuring sustainable and inclusive cities. Providing safe transport systems is an objective for sustainable transport, because risk of injuries and deaths from traffic crashes has become a major public health concern worldwide (WHO, 2011)<sup>133</sup>. At the same time safety of pedestrians, bicyclists and public transport users also has an impact on the choice of these modes. Risk to pedestrians, bicyclists and public transport users can be reduced by appropriate street designs and neighbourhood environment. Safer pedestrian and bicycle infrastructure results in increased use of these environment friendly modes (Tiwari et al., 2012)<sup>134</sup>. Safe travel options for women in general and, specifically low income women, are important for addressing livelihood and poverty issues for a significant proportion of urban population in low income countries like India. In this paper we present data from two Indian cities- Vishakhapatnam (a city in South India with a population of 1.7 million persons) and Delhi the capital city of India having 16.4 million residents to compare the travel patterns of women and men. The household survey in Delhi focused on low income settlements since poverty adds another dimension to gender bias. The survey, repeated after ten years, shows that the travel patterns remain unchanged. Women travel shorter distances, are dependent on lower cost modes-walking and public transport – and perform multi-purpose linked trips. In view of the sustainability requirements, lower mobility of women must be addressed by ensuring safe accessibility to employment opportunities by walking, bicycles and public transport. The paper concludes with possible interventions required to ensure safe and secure travel of women at the land use planning level and the street design level.

Worldwide, men have a higher risk of getting involved in traffic crashes than women (WHO). This is primarily attributed to the lower presence of women on the road as compared to men, and differential risk taking behaviour observed in men and women. Safety and security of transport systems may have an impact on not only the choice of destination and mode used but the decision to travel itself.

That travel patterns of men and women are different has been reported by different researchers for a long time. Travel patterns of men and women differ across geographical locations, city size and income groups. In general women travel shorter distances, are more dependent on non-motorized modes of transport and public transport. Hanson (2010)<sup>135</sup> concludes that the fact that women have lower mobility than men causes many feminist researchers to see spatial mobility as empowering and not oppressive. Lower mobility as shown by shorter distances travelled, mostly dependent on walking and public transport, is equated to lower access to employment opportunities and lower status of women. However, the understanding of sustainability will require revisiting the interpretation of lower mobility in view of the requirements of sustainable development and sustainable transport. Empowerment of women will have to come through enhanced accessibility to various opportunities without dependence on motorized mobility.

## 2. SUSTAINABLE TRANSPORT: ACCESS VS. MOBILITY

Sustainable transport is often defined as one that meets the mobility needs of all users with the least adverse effects on users as well as non-users. Adverse effects are in the form of poor air quality, risk of traffic crashes, lack of activity leading to obesity and other life style related diseases. Least adverse effects on users and non-users is possible when the majority of city residents have to travel short distances thus reducing the exposure to air pollution as well as risk from traffic crashes. Short distances are conducive to travel by active (walking and bicycling) transport which is environment friendly along with giving health benefits to the users.

Walking, bicycling and public transport have the least adverse effects on the environment both local and global. These are also known as active transport, because the users are involved in physical activity which results in health benefits.

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<sup>133</sup> WHO (2011). World Health Statistics, World health Organisation, Geneva.

<sup>134</sup> Tiwari, G., Jain, D. (2012). *Accessibility and safety indicators for all road users: case study Delhi BRT* – Journal of Transport Geography, 2012.

<sup>135</sup> Hanson, S. (2010). Gender and Mobility: new approaches for informing sustainability, *Gender, Place and Culture: A journal of Feminist Geography*, 17:1, 5-23

In the past few decades sustainable transport has become one of the main goals of transport planning and policy in many countries. Sustainable transport has also been viewed as the expression of sustainable development (Castillo and Pitfield, 2010)<sup>136</sup>. There is no universally accepted definition of sustainable transport. Often the sustainable transport concept has been framed by proposing principles and desirable attributes of the system. "Sustainable transport", arising from the concept of sustainable development, decouples dependence on oil; constrains GHG emissions; encapsulates having accessibility to basic daily needs consistent with human and ecosystem health; and meets affordability, equity and efficiency requirements by providing fairness across and within. (Bongardt et al., 2011; ECMT 2004; CST 2002; May et al., 2001)<sup>137</sup> proposed five objectives for sustainable transport:

- i. Liveable streets and neighbourhoods;
- ii. Protection of the environment;
- iii. Equity and social inclusion;
- iv. Health and safety;
- v. Support of a vibrant economy.

Protection of the environment is an important objective which includes both the local environment and global environment. These can be achieved by addressing a) urban structures and land use plans which affect the distances people have to travel to access various activities, b) modes that people choose to travel, c) vehicle technologies and d) type of fuel used in different vehicles. Liveable streets and compact mixed use neighbourhoods allow people to make short trips. These trips can easily be made by walking and bicycles which have the least adverse impact on the environment. When the majority of trips are by walking and bicycles, it causes the least damage to the environment. Longer trips which are dependent on motorized modes cause the least damage to the environment if most of it is by public transport: the majority by bus and maybe some long trips by rail based systems. Lastly, trips which are made by personal motorized modes, cars and motorized two wheelers, must have the smallest share, as small as possible, and the adverse impact caused by them can be minimized by efficient vehicle technology and cleaner fuels.

The distinction between the concepts of accessibility and mobility is important for the sustainable and equitable transport debate. Accessibility is a description of the proximity to destinations of choice and the facilitation offered by the public transport systems to reach them (Anand, 2007)<sup>138</sup>. Accessibility as defined by Burns (1979) includes the ability of an individual to be able to participate in an activity or set of activities (Odoki et al., 2001)<sup>139</sup>. This definition has been extended to include temporal and individual components along with spatial and transportation components (Geurs and Ritsema van Eck, 2001)<sup>140</sup>. A transport project has both positive and negative impacts on the accessibility possibilities of all road users depending on the type of mode being used. People make travel choices so that they can participate in production, consumption and leisure activities of their choice. Hence, accessibility cannot be measured just by mobility, i.e. the distance travelled or by destinations in reach for a particular mode-user group.

<sup>136</sup> Castillo, H., & Pitfield, D. E. (2010). "ELASTIC – A methodological framework for identifying and selecting sustainable transport indicators." *Transportation Research Part D: Transport and Environment*, 15, (4).

<sup>137</sup> Bongardt, D., Schmid, D., Huizenga, C., & Litman, T. (2011). "Sustainable Transport Evaluation – Developing Practical Tools for Evaluation in the Context of the CSD Process: Commission on Sustainable Development: Nineteenth Session, Background Paper No. 10." United Nation Department of Economic and Social Affairs, CSD19/2011/BP10.

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<sup>138</sup> Anand, A. (2007). *Socio-Economic Impact Assessment (SEIA) Methodology for Urban Transport Projects*. Indian Institute of Technology.

<sup>139</sup> Odoki, J. B., Kerali, H. R., & Santorini, F. (2001). "An integrated model for quantifying accessibility-benefits in developing countries." *Transportation Research Part A: Policy and Practice*, 35, (7), 601–623.

<sup>140</sup> Geurs, K. T. & Ritsema van Eck, J. R. (2001). "Accessibility measures: review and applications; Evaluation of accessibility impacts of land use transport scenarios, and related social and economic impacts." National Institute of Public Health and the Environment, Netherlands, RIVM report 408505 006.

Mobility is both the ability to travel to destinations of choice and the amount of movement necessary to do so. By definition, the ability to travel of the household is seen as positive mobility from the socio-economic perspective, because it indicates that people are traveling for employment, education and other purposes, thus enabling value addition to the households. On the other hand the amount of movement is seen as negative mobility from the socio-economic perspective, because it uses resources of the household, like time and money, which could have been better utilized to upgrade the quality of life of the household.

Women's travel patterns need to be examined in the context of a sustainable transport system, as discussed in the previous section with an added dimension of a transport-shelter-livelihood link.

### 3. THE SHELTER-TRANSPORT-LIVELIHOOD LINK

The intimate interconnections between urban transport and land-use patterns are well-known, though there has been little analysis of the connections with poverty (which are somewhat complex). Common features of the land-use patterns of large, low-income cities in Asia include: high urban densities (usually well above 150 persons per hectare) despite a generally low-rise built fabric; intense mixing of different land uses at a fine scale, especially in inner areas; low-income settlements interspersed or mixed with other land-uses throughout the urban area; a high proportion of jobs (in both secondary and tertiary sectors) located in the central and inner areas of the city; however, within this inner area jobs are often relatively dispersed with no intense concentrations of employment (Barter, 1998)<sup>141</sup>.

Such land-use features, developed in response to the requirements of transport systems, are dominated by non-motorized transport, buses, and para-transit systems. They also developed in ways that tended to minimize the need for expensive motorized travel. For example, high densities and intense mixing of land uses allow for many daily trips to be very short and thus able to be made by foot or by non-motorized vehicle. Once a city grows too large to be served primarily by non-motorized transport, a relatively centralized pattern of employment maintains a potential to support plentiful bus and jitney service (although for various reasons this potential is not always realized). Although there are some problems associated with high levels of crowding, such an urban form is apparently in many ways intrinsically pro-poor, in the absence of significant numbers of private cars.

However, a number of trends associated with motorization (and other factors) have begun to undermine the pro-poor features of many large Asian cities (and have created other transport-related problems). As upper and middle-income earners have acquired private vehicles, real estate developers increasingly locate new developments to be easily accessible by private vehicle, even if this leaves them inaccessible by public transport and non-motorized transport. To the extent that high-speed, high-capacity roads have been built, they have tended to encourage haphazard development in long corridors, resulting in longer trip distances for residents of such areas. Although Asian cities have spread out to some extent as they have motorized, this is a slow process and most still retain high urban densities, especially in their inner areas. High-density cities are unsuited to high rates of private car use and inevitably have low levels of road capacity. Congestion has therefore become serious even at low levels of motorization. The rise of private vehicular traffic has decreased bus speeds and service levels drastically and made non-motorized transport dangerous and difficult. Travel for the poor has thus become slower and more difficult, even as other economic and planning forces have caused many of them to be displaced from central informal settlements to more peripheral locations (Immers and Bijil, 1993)<sup>142</sup>.

Many economic development programs completely miss the link between housing location, livelihoods of the poor and transport. Access to affordable transport is one of the most important factors in determining livelihoods for the urban poor. A survey by SPARC in central Bombay of pavement dwellers showed that 80% walked to work. Their choice came down to: "they were willing to live in congested dwellings without safety or security just so they could walk to work" (Gopalan, 1998)<sup>143</sup>. Other studies have found similarly very limited

<sup>141</sup> Barter, A. R. P. (1998). "Transport and Urban Poverty in Asia: A Brief Introduction to the Key Issues."

<sup>142</sup> Immers, B., & Bijil, J. (1993). "Slum Relocation and NMTs in Bangkok." Transportation Research Board, Paper # 93CF105.

<sup>143</sup> Gopalan, P. "Circumscribed Existence: Women's mobility and settlements development.", In SUSTRAN Network General Assembly, June 2-5, 1998, Manila, Mumbai: Swayam Shikshan Prayog – SSP.

Habitat, U. "Mumbai: Swayam Shikshan Prayog – SSP.", In SUSTRAN Network General Assembly – June 2-5, 1998.

mobility by the urban poor. Some of the urban poor have to make a different trade-off by accepting long travel distances from a peripheral location in order to obtain affordable but secure housing. For some this trade-off is forced on them, since in many cases relocation sites (after evictions) are often in remote locations that take little or no account of access issues (Fernandes, 1998)<sup>144</sup>.

Urban transport interacts with employment issues for the poor in two main ways: indirectly, by providing access to employment opportunities and directly, through employment of low-income people in the transport sector. The relative immobility of the urban poor, especially poor women, is a central fact in their lives and severely limits their employment options. It has already been mentioned above that the poor must trade off the time and cost required to access livelihood opportunities against security and quality of housing.

Understanding of gender issues in the transport context is of vital relevance. Six out of ten of the world's poorest people are women who must, as the primary family caretakers and producers of food, shoulder the burden of tilling land, grinding grain, carrying water and cooking (UNDP, 2014)<sup>145</sup>. This has marginally changed since 1995 when women were estimated to account for 70% of those living in poverty worldwide (UNDP, 1995). The growing literature on women and transport has also clearly shown that they tend to have different travel needs, deriving from the multiple tasks they must perform in their households and in their communities (Greico and Turner, 1997)<sup>146</sup>. Low-income women tend also to be less mobile than men in the same socio-economic groups. They are more dependent on walking and tend to have less access to any bicycles or motorcycles in a household. Social restrictions hinder women's mobility in many cultures (Gopalan, 1998). Efforts to increase the mobility of poor women may face stiff resistance from those who feel threatened or offended by such direct empowerment of women (UNDP, 1998). Sexual harassment on streets and on public transport is also an issue. Since many more women than men are the care-givers of frail-elderly people, people with disabilities and of children, the transport problems of these disadvantaged groups also impact disproportionately on women. Poverty, of course, compounds each of these disadvantages.

Gender bias can result when there is a failure to recognize that the same service delivers different benefits to men and women. For example, the poorest households are often located on the edges of urban centres where public transport services are infrequent. In Delhi, for example, the relocation of squatter communities to the outer periphery of the city has been especially damaging to women's ability to earn a living. Female unemployment in the new squatter camps rose by 27% compared to 5% for men (Moser and Peake, 1987, cited in Alling et al., 1997)<sup>147</sup>.

## 4. TRAVEL PATTERN OF WOMEN IN INDIAN CITIES

Differences in travel patterns between men and women are different. This been reported by earlier studies from Delhi (Anand and Tiwari, 2005)<sup>148</sup> and Chennai (Srinivasan, 2008)<sup>149</sup>. This section reports data from a smaller city compared to Delhi and Chennai-Vishakhapatnam, and revisits low income households in Delhi to understand the time trend of women's travel.

Visakhapatnam is the second largest urban agglomeration in Andhra Pradesh with a population of about 1.73 million (Census, 2011). It has been and continues to be a hub of economic activity in the region, thereby leading to more and more people migrating to the city. Table 1 shows the travel pattern of men and women as recorded in a recent survey<sup>150</sup>.

<sup>144</sup> Fernandes, K. (1998). "Forced Evictions and Housing Rights Abuses in Asia (Second Report 1996-1997)". City Press, Karachi, Pakistan.

<sup>145</sup> Gender and Poverty reduction, UNDP, [www.undp.org](http://www.undp.org)

<sup>146</sup> Grieco, M., and Turner, J. (1997). Gender Poverty and Transport, UN International Forum on Urban Poverty (HABITAT), Florence, <http://www.art.man.ac.uk/transres/gender.htm>

<sup>147</sup> Alling, G., Brazier, E., Burjorjee, D., Camoens, A. and Webber, A. (1997). Mainstreaming Gender in Transportation projects: A Toolkit, Report to the Gender Analysis and Policy Group, The World Bank mimeo.

<sup>148</sup> Anand, A., Tiwari, G. (2006). A gender perspective of the shelter-transport-livelihood link: the case of poor women in Delhi, *Transport Reviews*, Vol. 26, No. 1, pp. 63-80.

<sup>149</sup> Srinivasan, S. (2008). A partial exploration of the accessibility of low-income women: Chengdu, China and Chennai, India in *Gendered mobilities*, ed. T. Cresswell and T.P. Uteng, 143-58, Burlington, VT, Ashgate Publishing Co.

<sup>150</sup> LCMP for Vishakhapatnam, by ITRANS as part of UNEP funded project – LCMP for Indian cities, 2012.

**TABLE 1. Trip Purpose of Women and men in Vishakhapattanam**

Purpose	Women		Men		Total	
	Nos.	%	Nos.	%	Nos.	%
Work	420	11.0%	2868	62.7%	3288	39.2%
Education	1246	32.7%	1331	29.1%	2577	30.7%
Access to PT	0	0.0%	1	0.0%	1	0.0%
Access to Auto (3 wheeler taxi)	0	0.0%	0	0.0%	0	0.0%
Shopping	200	5.2%	105	2.3%	305	3.6%
Recreation	35	0.9%	34	0.7%	69	0.8%
Social	6	0.2%	11	0.2%	17	0.2%
Religious	1880	49.3%	99	2.2%	1979	23.6%
Personal	18	0.5%	117	2.6%	135	1.6%
Others	9	0.2%	8	0.2%	17	0.2%
<b>Total</b>	<b>3814</b>		<b>4574</b>		<b>8388</b>	

(ITRANS, 2012)

Work trips among females are less than males, and religious trips (going to place of worship) are much more amongst females as compared to males. Trips made for all other purposes remain more or less the same. Table 2 shows use of different modes.

**TABLE 2. Travel mode of Women and men in Vishakhapattanam**

Mode	Women		Men		Total	
	Nos.	%	Nos.	%	Nos.	%
Car	31	0.8%	97	2.1%	128	1.5%
M2W	195	5.1%	1061	23.2%	1256	15.0%
Bus	482	12.6%	968	21.2%	1450	17.3%
Auto - Direct	205	5.4%	293	6.4%	498	5.9%
Auto - Shared	114	3.0%	175	3.8%	289	3.4%
Walk	2711	71.1%	1616	35.3%	4327	51.6%
Bicycle	29	0.8%	265	5.8%	294	3.5%
Cycle-Rickshaw	1	0.0%	10	0.2%	11	0.1%
Company Bus	33	0.9%	49	1.1%	82	1.0%
Taxi	2	0.1%	1	0.0%	3	0.0%
Others	9	0.2%	37	0.8%	46	0.5%
<b>Total</b>	<b>3812</b>		<b>4572</b>		<b>8384</b>	

(ITRANS, 2012)

Walking has the highest share of trips; however, this is much more the case for women than men. The use of motorized two wheeler and bus transport is more marked for men.

Tables 3 and 4 show trip distance and trip time. Women travel shorter distances; however, travel time is similar, showing the dependence of women on non-motorized slower modes of transport.

**TABLE 3. Trip length (km) of Women and men in Vishakhapattanam**

Distance (km)	Women		Men		Total	
	Nos.	%	Nos.	%	Nos.	%
< 1	2678	70.6%	1810	39.7%	4488	53.7%
1-3	510	13.4%	1010	22.1%	1520	18.2%
3-5	223	5.9%	545	12.0%	768	9.2%
5-10	222	5.8%	656	14.4%	878	10.5%
> 10	162	4.3%	539	11.8%	701	8.4%
<b>Total</b>	<b>3795</b>		<b>4560</b>		<b>8355</b>	

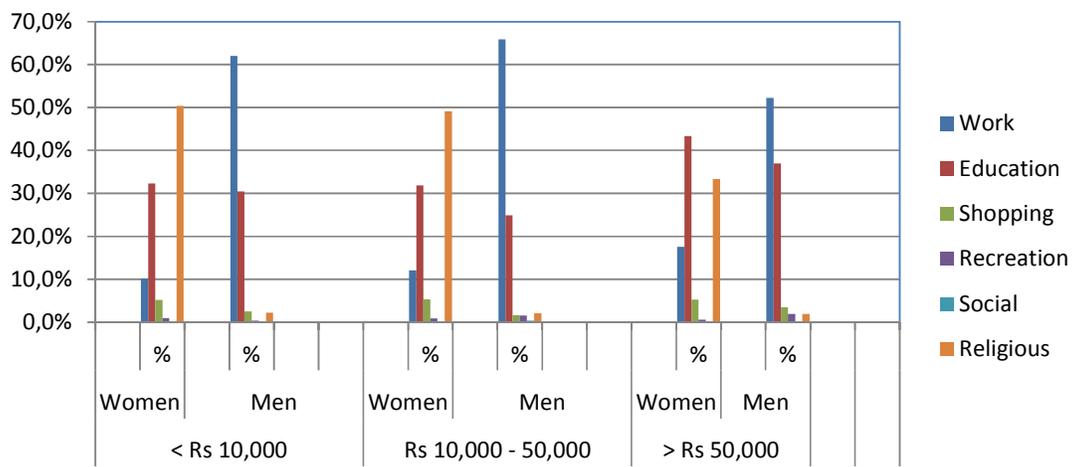
(ITRANS, 2012)

**TABLE 4. Trip Time of Women and men in Vishakhapattanam**

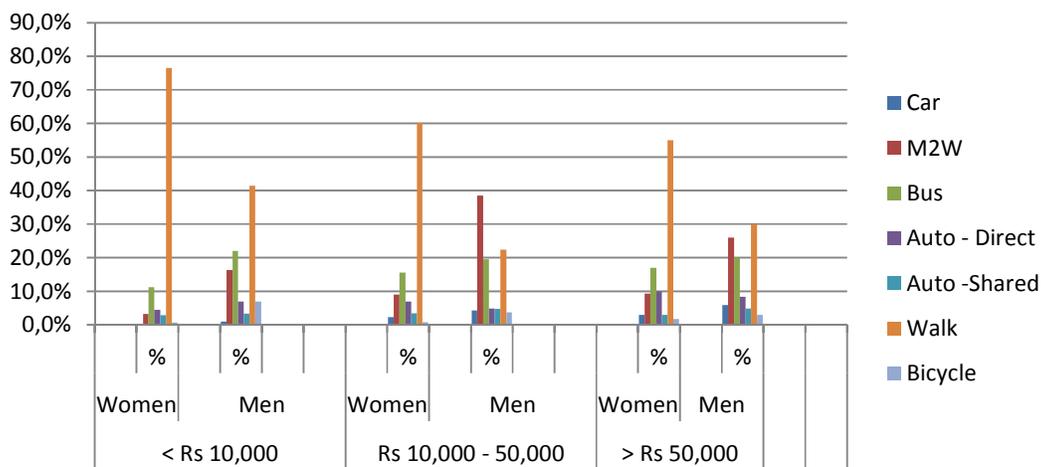
Time (mins.)	Women		Men		Total	
	Nos.	%	Nos.	%	Nos.	%
< 10	1767	46.3%	1146	25.1%	2913	34.7%
10-20	1180	30.9%	1488	32.5%	2668	31.8%
20-30	404	10.6%	874	19.1%	1278	15.2%
30-50	306	8.0%	595	13.0%	901	10.7%
50-70	103	2.7%	289	6.3%	392	4.7%
> 70	54	1.4%	182	4.0%	236	2.8%
<b>Total</b>	<b>3814</b>		<b>4574</b>		<b>8388</b>	

(ITRANS, 2012)

Figures 1 and 2 show trip purpose and travel mode used by income groups.



**FIGURE 1. Trip purpose of Women and Men in different income groups**



**FIGURE 2. Travel Mode of Women and Men in Different income groups**

With an increase in income, the share of work trips increases for women; however, it remains lower than for men. Share of religious trips seems to decrease amongst women with an increase in income. Figure 2 shows dominance of walk trips amongst women as compared to men; however, with an increase in income this gap seems to reduce. Similarly with an increase in income, the gap in public transport trips amongst women and men seems to be narrowing; higher income men and women have a similar share of trips on public transport. Bicycle users are more amongst men as compared to women.

These trends are similar to those reported by earlier authors showing 83% of women's trips were walking trips and 63% of men's trips were walking trips in Chennai, India (Srinivasan, 2008)<sup>151</sup>. Anand and Tiwari (2006) reported similar trends observed in Delhi in 2001 of low income households. Women either walk to work or use public transport. The share of women walking to work is much higher (52%) than men (26%).

A follow up survey (TRIPP, 2012) done in Delhi of low income households, shows more women employed in informal employment as compared to men (86% vs. 74%). Amongst employed persons, women are more dependent on walking as compared to employed men. Use of bicycles is negligible amongst women, and bus use is much less than for men. Differences in travel trends observed in 2001 remain unchanged after ten years.

**TABLE 5. Travel mode used by employed men and women**

Mode of Travel	Employed Persons	Unemployed persons	Employed Men	Employed Women
Walk	49%	87%	34%	86%
Bicycle	15%	2%	22%	1%
Bus	23%	8%	27%	13%

(Low income households in Delhi, 2012)

Two important conclusions emerge from this data. Women are dependent on walking regardless of income differentiation. There is a significant difference in distances travelled by women and men; however, travel time is similar, implying that men have higher spatial accessibility. Lower use of bicycles and public transport has been observed earlier (Anand and Tiwari, 2006). In lower income groups, women may have lower access to bicycles both due to lower ownership of vehicles as well as inequality amongst men and women in households. Men have the 'first right' over the vehicle owned by households. Lower use of public transport by low income women is also due to cost implications of public transport. A subsidized public transport also remains prohibitively expensive to a significant proportion of the population (Tiwari, 2002)<sup>152</sup>.

For the shortest trip by bus in Delhi the monthly expenditure would be at least Rs.600 per person. If two persons travel in a household, this would require a monthly income of about Rs.12000-15000, assuming at least 10% of income will be spent on transport needs.

## 5. SAFETY PERCEPTIONS OF BICYCLE, PEDESTRIANS AND PUBLIC TRANSPORT USERS

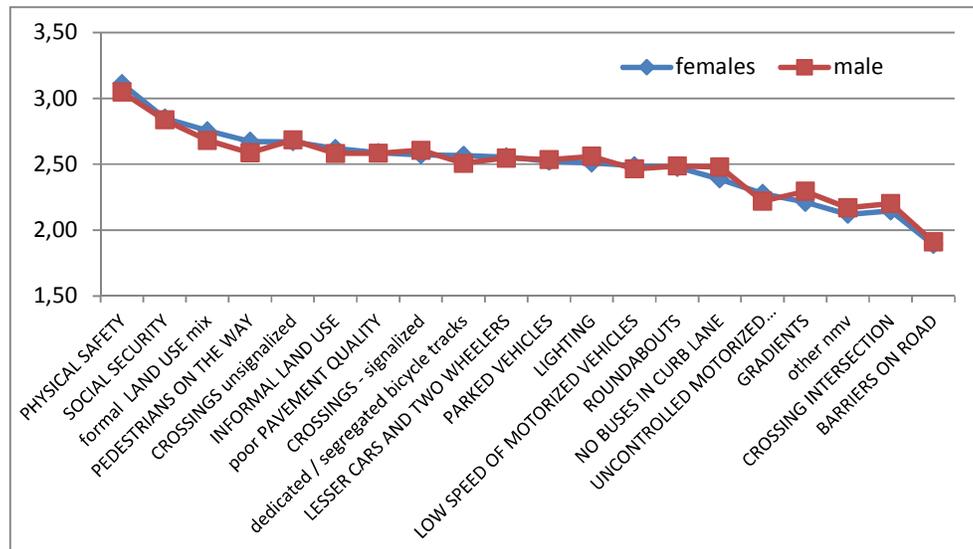
Lower use of bicycle and public transport is observed in middle income and high income households also. Lack of safe infrastructure and fear from crime has been reported as one of the most important reasons for not using bicycles for short trips (Jain and Tiwari, 2011)<sup>153</sup>. This study reported a survey of current bicyclists and potential bicyclists in Pune, India. Most cyclists in Indian cities are not using bicycles by choice. However, there is a huge potential of cycle trips due to the presence of short trips and high ownership of bicycles amongst middle and high income households in Indian cities. The survey targeted current cyclists (captive cyclists) and potential cyclists both. The current captive cyclists and potential cyclists both attach higher scores/ranks (consider it most important or important) to physical safety (up to 75% in captives and 82% in potential cyclists). This is closely followed by the social security (62% in captive users and 58% in potential users). Twenty eight percent of captive and potential cyclists consider conditions at intersections as barriers to cycling. Preferences of women and men for bicycle routes show similar trends except a few variables. Women attach

<sup>151</sup> Srinivasan, S. (2008). A spatial exploration of the accessibility of low income women: Chengdu, China and Chennai, India. In *Gendered mobilities*, ed T. Cresswell and T.P. Uteng, 143–58.

<sup>152</sup> Tiwari, G. (2002). "Urban Transport Priorities: Meeting the Challenge of Socio-economic Diversity in Cities, a Case Study of Delhi, India." *Cities*, 19, (2) 95–103.

<sup>153</sup> Jain H., and Tiwari, G. (2011). Captive cyclists vs potential users: Route choice factors in Indian Context, TRIPP research Report, IIT Delhi.

lower weights to intersections and other barriers as compared to men. Women also gave higher weight to social security aspects, informal land use presence and formal land use mix. This further emphasizes the importance of social security for women.



**FIGURE 3. Ranking of variables for safe bicycle route by women and men** (Jain, 2011)

Perception of high risk from traffic crashes as pedestrian, bicycle user and public transport commuters has been reported by other researchers from other Indian cities as well (Rankawat and Tiwari, 2013)<sup>154</sup>. Rankawat et al. reported the results of pedestrian preferences about the pedestrian facilities, across and along the road, in Delhi, India to understand how built environment could be improved to facilitate pedestrian movement. The study showed that usage of subways is less by female respondents, zebra crossing is convenient in usage but not safe, and usage of the footpaths can be increased by increasing safety. The study also showed that the majority of the people do not find it safe to walk in Delhi with the present state of street lighting. Women and men again showed different trends in using different facilities. The study reported that there was less use of subways by female respondents as compared to their male counterparts, and use of subways was positively related with convenience perception. As the pedestrians perceived subways as more and more convenient, they tend to use it more. Cheung and Lam (1998)<sup>155</sup> also found that pedestrians prefer escalators to stairways. Age, gender and convenience perceptions are statistically significant for the use of zebra crossings, while safety perception is not statistically significant. Use of zebra crossings was preferred by women.

Convenience perception is statistically significant for the use of foot over bridge (FOB). Gender parameter is approximately 83% significant, implying that there was less use of foot over bridge by female respondents as compared to their male counterparts. These findings can be used to redesign safe pedestrian crossing facilities for all in cities.

## 6. IMPACT OF CURRENT PLANNING PRACTICES AND URBAN ROAD DESIGNS

Resettlement Policies of low income residents have led to lower access to employment opportunities for all, but more so for women. Most of urban landuse policies have not been very effective in addressing the needs of poor households who locate close to employment opportunities in the city, often squatting on the land not designated for residential use as per the master plan. However, this location results in short travel distances for pedestrians and bicyclists.

<sup>154</sup> Rankawat, S., Tiwari, G., and Single, N. (2013). Analysis of Pedestrian Perception towards Pedestrian facilities, TRIPP Research Report, IIT Delhi.

<sup>155</sup> Cheung, C. Y., Lam, W. H. K. (1998). Pedestrian route choices between escalators and stairways in metro stations. J. Transport. Eng. 124, 277–285.

## ***Urban planning and Safety***

City planning policies which include the location of different activities, location of residential areas and planning of transport networks influence the choice of transport modes as well as distances that various people have to travel. Thus exposure to road traffic risk is influenced by the planning policies at city level. Mixed land use patterns reduce the length of trips and thus exposure to road traffic injuries. Often poor households are relocated at the outskirts of the city limits where land is cheap. This results in long pedestrian and bicycle trips increasing exposure to road traffic crashes. Thus road traffic risk to different road users is influenced by the city planning policies.

Anand (2007)<sup>156</sup> showed, for poor households relocated to new areas in Delhi to make space for metro construction in Delhi, there was a significant impact on the indicators of accessibility and mobility. The land-use accessibility deteriorated as distance to education, health services and other urban services increased for 52%, 63% and 52% of the households respectively. The transport accessibility deteriorated even more as distance to bus stops increased for 72% of the households and the bus frequency decreased, on an average, from 5 min to 63 min (almost 13 times). The mobility of the households increased significantly. The per capita trip rate for work increased for 49% of the households and decreased for 30%, implying change in the number of trips made for work in the households. The share of bicycles used decreased for 59% of the households. The mobility indicators for travel to work – distance, time and cost – increased for 83%, 82% and 61% of the households respectively.

The case study from Delhi shows how the land use policies supporting the official Delhi Master plan result in relocating poor households to the outskirts of the city to accommodate transport infrastructure like road expansion or the metro. This has resulted in increased travel distances and travel time for most households. The longer walking and bicycle trips on roads without any dedicated facilities for these modes increase the risk of getting involved in a fatal crash. The current relocation policies increase the vulnerability of the current vulnerable road users. The land use policies must ensure that, especially the poor households, who cannot afford any form of motorized travel, are located close to employment opportunities resulting in short travel distances. This will result in reducing the risk of fatal crashes because the distances and travel time will reduce, in addition to increasing the accessibility to education, health facilities and employment opportunities.

## **7. URBAN ROAD DESIGN AND SAFETY**

At the design level, design of road infrastructure (road cross section, carriageway width, intersection design), facilities for pedestrians, bicycles and public transport users influence the risk taking behaviour of road users. This includes observance of speed limits by car and bus drivers, waiting for sufficient gaps by pedestrians and use of zebra crossings and pedestrian subways. A study (Gupta et al., 2010)<sup>157</sup> was carried out at the AIIMS flyover interchange in New Delhi. This intersection carries large flows of bus, pedestrian, and motor traffic. The Ring Road, which is a major arterial road, and Aurobindo Marg form the AIIMS grade-separated interchange. Traffic data collection allowed the study of road user behaviour earlier, when the AIIMS junction was an at-grade, signalized intersection, and presently when the site is a grade separated interchange with no traffic signal control. Analysis produced results pertaining to pedestrian crossing behaviour as a function of observable pedestrian, environment, and traffic characteristics.

The study showed that higher percentages of vehicles are traveling with higher speeds in all categories after reconstruction. Risk to pedestrians has increased because conflicting vehicle speeds after reconstruction are higher, as compared to before reconstruction.

For those pedestrians who crossed at risk, the average accepted gap decreased in the after reconstruction case. They accepted greater risk in each stage of crossing primarily because of the higher average speeds of the vehicle groups. The speeds increased 21.6%, 22.6%, 15%, 31.6% for the heavy vehicle, car, motorized three-wheeler, and motorized two wheeler groups, respectively. The probability of pedestrian fatality with a specific vehicle group increased 67 percent, 100 percent, 100 percent, and 200 percent, respectively.

<sup>156</sup> Anand, A. (2007). Socio-Economic Impact Assessment (SEIA) Methodology for Urban Transport Projects. Indian Institute of Technology.

<sup>157</sup> Gupta, U., Tiwari, G., Chatterjee, N., Fazio, J. (2010). Case Study of Pedestrian Risk Behaviour and Survival Analysis, Journal of the Eastern Asia Society for Transportation Studies, Vol. 8.

Twenty two percent of pedestrians accepted increased risk despite the presence of a nearby pedestrian underpass. The study concluded that, after the construction of a grade separated junction, the risk to pedestrians increased substantially both because of higher speeds of motorized vehicles and because of accepting shorter gaps by pedestrians for road crossing.

The conventional understanding of measuring performance of a transport infrastructure is biased towards the car traffic. Level of service of an intersection is measured in terms of delay faced by the motorized traffic. Therefore, delays faced by motorized traffic at intersections have become a major source of concern for planners, traffic policy and road owning agencies. Road expansion schemes and signal free junctions have become synonymous with “improvement” of transport infrastructure. Since problems faced by pedestrians and bicyclists, the two most vulnerable road users, are not viewed as major transport issues, the “improvement” strategies do not take into account impacts on pedestrian movements. The conversion of the signalized junction at AIIMS in Delhi to a signal free junction has resulted in an increase in motorized traffic and an increase in risk faced by pedestrians while crossing the road. However, when road designs include the needs of pedestrians, bicyclists and public transport vehicles, as the Delhi BRT case study presented, the number of crashes can be reduced<sup>158</sup>.

## 8. WHAT CAN BE DONE?

That women have different travel patterns is universally observed and has been reported several times in the last three decades. The travel choice is embedded in several social context and complex relationships in the society (Hanson, 2010). The debate on sustainability has added another dimension to mobility poverty of women. The sustainability concern requires changing the focus from mobility and enhancing accessibility with less dependence on motorized modes, especially private cars. An important change required at all level of interventions is to accept women centric planning and design as the minimum requirement for inclusive and sustainable development. As argued by Murthy (2011)<sup>159</sup>, urban form and transport needs must be recast based on collective aspirations for public space. In the case of developing countries like India, enhanced accessibility must ensure safe pedestrian and bicycle access to various opportunities. Therefore, planning and designing safe transport systems for women requires intervention at three levels:

- Land use planning
- Street designs
- Public transport infrastructure

Urban planning policies and land use policies decide the location of different activities and the location of residential areas. Most of these policies have not been very effective in addressing the needs of poor households who locate close to employment opportunities in the city, often squatting on the land not designated for residential use as per the master plan. However, this location results in short travel distances for pedestrians and bicyclists. This also provides more employment. The case study from Delhi shows how the land use policies supporting the official master plan result in relocating poor households at the outskirts of the city to accommodate transport infrastructure like road expansion or metro. This has resulted in increasing travel distances and travel time for most households. The longer walking and bicycle trips on roads without any dedicated facilities for these modes, increase the risk of getting involved a fatal crash. The current relocation policies increase the vulnerability of the current vulnerable road users. If the land use policies ensure that especially the poor households who cannot afford any form of motorized travel are located close to employment opportunities resulting in short travel distances, this will result in reducing the risk of fatal crashes because the distances and travel time will reduce, in addition to increasing the accessibility to education, health facilities and employment opportunities.

**Street Designs:** The conventional understanding of measuring performance of a transport infrastructure is biased towards the car traffic. Level of service of an intersection is measured in terms of delay faced by the motorized traffic. Therefore delays faced by motorized traffic at intersections have become a major source of

<sup>158</sup> Tiwari, G., & Jain, D. (2012). Accessibility and safety indicators for all road users: case study Delhi BRT. *Journal of Transport Geography*, 22, 87–95.

<sup>159</sup> Murthy, K. (2011). Urban Transport and the right to the city, accessibility and mobility in Marie-Helene Zerah, Veronique Dupont and Stephanie Tawa Lama Rewal (eds), *Urban Policies and the Right to the City in India: Rights, Responsibilities and Citizenship*, UNESCO, INDIA and CSH, India, pp. 122-132.

concern for planners, traffic policy and road owning agencies. Road expansion schemes and signal free junctions have become synonymous with “improvement” of transport infrastructure. Since problems faced by pedestrians and bicyclists, the two most vulnerable road users, are not viewed as major transport issues, the “improvement” strategies do not take into account impacts on pedestrian movements.

Improving pedestrian safety requires making pedestrian safety audits and pedestrian compliant designs mandatory in cities. While improved geometric standards and operational measures will have an impact on physical safety, policies of encouraging the presence of street vendors and activity along the travel corridor will ensure social security.

Public transport infrastructure: Design of public transport infrastructure, which includes access to public transport stops, the design of the stop, vehicle design, will have to become safety and security compliant. Cardia (2012) has given a list of policy interventions required to improve public transport safety for all. These are:

Public transport safety must be guaranteed during the whole length of the trip: on vehicles, during the waiting time, and on the routes of access to stations and stops. Every access should be checked and improved.

Old people and women are particularly sensitive to the problems of personal safety on public transport networks. Increasingly frequent action is required by the operators.

The need for taking immediate action requires a direct connection between staff, the operational centre and the police.

Lighting, good design, visibility at stops and stations are an essential component in creating feelings of security.

In transportation planning, of course, there needs to be a hierarchy with pedestrians and cyclists (the most vulnerable group) at the top and car users at the bottom. Instead of trend projections from the past, we have to depend on scenario building techniques– for instance, transport planners need to have a city vision; they need to think about how the quality of life in a city would be affected by a particular choice in transport. The choices made will go a long way in determining people’s behaviour and lifestyles. To do this, planners will need to assess the impact their decisions will make on safety, socio-economic benefits to different user groups, and environmental aspects.



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