GENDER ROLES AND HOUSEHOLD INTERACTIONS
IN CHAUFFEURING CHILDREN TO SCHOOL
IN THE PORTLAND METROPOLITAN AREA

DISSERTATION

Presented in Partial Fulfillment of the Requirement for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

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The Ohio State University
2008

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ABSTRACT

Like work commutes, school commutes are fixed in time and space, but they have generated far less research. Travel behavior surrounding chauffeuring children to school is studied in view of gender comparisons and household interactions on the frameworks of time and gender geography. The majority of chauffeuring arrangements are, respectively: (1) men work while women who do not have work trips are mainly responsible for passenger-serving trips to school, 29%; (2) men and women both work and share chauffeuring, 26%; (3) men work while women do not have work trips, but they share chauffeuring, 10%; and (4) both men and women work, but women chauffeur alone, 9%. The study looks at occupations, employment status, industry types, children’s ages, household structure and types of households by number of earners. Findings include that chauffeurs link passenger-serving with work trips and that morning and afternoon arrangements differ. The effect of shift work and work from home on child chauffeuring duties is also investigated. There is significant relationship between school chauffeuring and work travel time that explains household interactions over child chauffeuring duty.

Keywords: chauffeuring children, children chauffeuring, school commute, passenger-serving trip, serve passenger, household interaction, intra-household interaction, gender role
Dedicated to my family
ACKNOWLEDGMENTS

This work has been possible due to the generous assistance of a number of people. I would like to gratefully acknowledge Professor Mei-Po Kwan, my adviser. Her input went well beyond participation in this text and I will not forget her patience and constant support. My heart-felt thanks goes to Professor Larry Brown for his invaluable comments and his willingness to help. I am also indebted to Professor Ed Malecki for his honest critiques and comments.

Special appreciation is expressed to my family, who has always been there for me. I would also like to thank my 3-year-old niece J.J., who has been regularly picked up / dropped off from / to pre-school and kindergarten, and who taught me to be more encouraging and patient, and, my one-and-a-half-year-old nephew, J.J., II, who will be similarly escorted over the next two years.

Much support, both financial and emotional, and statistical consultation have been generously given by Associate Professor Nopparat Runguthaisiri, a Statistician, and Chulalongkorn, university lecturer and researcher and a graduate from University of Texas, A & M, and a spa business founder. Dr Preecha Vichithamaros, NIDA university lecturer and researcher and an alumnus of the Asian Institute of Technology (AIT), enhanced my project by guiding me to generate pairs of chauffeuring and work travel times and offered statistical assurance.
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CHAPTER 1

INTRODUCTION

The problem of gendered inequality in mobility has long been studied. Recent studies focus on women’s travel behavior which are short work commutes, have trip chaining and have passenger-serving trips. This study focuses on children chauffeuring trips to school. It compares the travel behavior of men and women and is geared towards analysis of household interactions surrounding chauffeuring children to school. This research is limited to the study of school driving (not including carpool, bus, and other modes of transport) and therefore also focuses exclusively on families with children.

Research on gender differences in commuting patterns have focused primarily on work commuting and thus the other regular commuting – research on travel to school is lacking. This study analyses the complexity of gender relations in daily lives, and how they are manifested within the micro level of family relations. This study also builds on the concept of the constraint of time geography. These combined
frameworks, gender relations and time constraint, enable the dissertation to link
gender relations on children chauffeuring to school patterns. This is an adjustment to
space and time as well as gender roles.

A combined framework of time geography and gender geography is required
in order to analyze how the constraints of time and social norms shape people’ travel
behavior i.e. who travels, and characteristics such as travel time and trip frequency.
On the one hand, time geography emphasizes how time constrains activity travel
behavior and patterns, whilst, on the other, the concept of gender relations supports
the study of institutional constraints, such as social norms, which state that household
duties are the responsibility of women and that household earnings are that of men.

The space-time context in time geography is not gender-specific and allows
for an addition of concepts and theories. The context is flexible, because all
circumstances and events can be placed in space and time, as well as in space-time.
Moreover, this dissertation applies the concept of authority constraint, for instance
unusual working schedules – such as shift work or working from home.

Normally ignored by time geographers, gender relations and gender roles need
to be examined, as they weave both men and women’s space-time patterns (Rose
1993). These patterns are complex and Rose (1993) explains that women struggle
within these constraints. I have consequently studied variations of these struggles, in
particular, the complex activity travel patterns of genders working within these
constraints.
This dissertation aims to investigate children chauffeuring to school, using the theoretical frameworks, gender relations in gender geography, and the concept of constraint in time geography. Gender geography and time geography allow exploration of the everyday activities of men and women, which are constrained by gender-inherited stances and time. Travel behavior in gender geography pays attention to the mobility of genders, which shows how genders maneuver within constraints, such as social norms. Gender geography focuses on both the importance of, and relationship between, space and gendered activities. Gender relations are socially and economically constructed. Time constraint in time geography focuses on the limitation of time on people’s choice of activity travel.

However, there are non-congruent ideas between the two disciplines. Time geography is universal and states that all individuals have an equal amount of time and therefore have equal possibilities. Time geography, similar to science, expects regularities and aims at generalization. Gender geography pays attention to individuals and specialization and may also allow for study on a regional, or city scale. In the dissertation, I assume that men and women have equal amounts of time and, therefore, possibilities. However, they have different social expectations resulting from institutional structures, which result in distinguishing space-time activity travel patterns. The results of study cannot be generalized and is specific to middle class group of people as well as it tied to space, the Portland metropolitan area.
A framework combining time and gender geography allows a fuller examination of children chauffeuring to schools. The travel patterns are as a direct result of adjustments in space and time, as well as gender relations. The study is built upon the assumption that there are equal time opportunities, but gender-specific ways to determine daily activities.

1.1 Time Geography

Time geography allows for the study of interaction between individuals and societal environments. It provides links between life, space and time, in both man-made and natural environments. Thrift (1977) noted that the capacity of time-geography was to understand which factors and events were linked, and how conditions could be changed, in order to improve the quality of travelers’ lives. Usually, the concept is used as a conceptual model for formulating hypotheses and constraints (Mark 1997).

There are three constraints on a person's mobility: capability, coupling, and authority (Hägerstrand 1970). The first constraint, ‘capability’ determines the ability to travel, by considering a person’s body, biological make-up and their environment. For example, people need to sleep and eat; therefore, they cannot move all the time. Barriers such as fences and rivers obstruct movement, whereas infrastructures, such as roads and bridges, facilitate travel. The next constraint ‘coupling’ is induced by the need for personal activity participation. ‘Coupling’ influences participation in discretionary activities to a greater extent than ‘capability’ (Miller 1982). The inability to be in two places at once is accounted for as either
capability or coupling, due to humans having a non-divisible physical body and the meeting place and meeting time. Thereupon, the final constraint ‘authority’ reflects ‘invisible’ limitations and controls on access, which can happen during business hours. It is pertinent to social norms (Thrift 1977); for example, women have, for a number of years, been limited to be at specific places at specific times (Miller 1982), due to safety reasons.

In this study of spatial behavior, a school driving schedule is considered as an authority constraint, because it provides a limited period of service. Working from home relaxes the authority constraint, as travelers have no exact time limitation set upon them, regarding when to start or end work. Shift work relates to out of the ordinary working hours and requires 8 hours of continuous work. Workers at home may include tele-workers.

1.2 Gender relations in Gender Geography

In recent decades, geographers have begun to recognize the importance of gender in spatial patterns. For example, gender roles influence the mobility patterns of both men and women and consequently their ability to access jobs and, in this study, the education of their children. The involvement of gender in the realm of geography can be measured locally, regionally or globally and the data can also be either historical or contemporary. Studies have often found that cross-cultural comparisons address the commonalities and differences amongst women throughout the world, regarding their struggle for social and economic empowerment. These studies are mainly limited to women, however, this research, in contrast, includes both
genders. However, I have chosen to examine how gender relations, influenced by social and economic factors, shape the experiences of both men and women regarding children chauffeuring to school.

The study of gender relations in gender geography can be divided into three groups. The first is space, place and gender (see Hanson & Pratt 1995, Gilbert 1998 in occupation segregation section in chapter 3). The second is gender roles (Deutsch 1999) and relations in public [on road] (see household burden sub-section in chapter 3) and private spaces. The third covers women’s involvement in the workplace (see the following chapter of women's commuting patterns and occupation segregation). This study falls into the category of gender role.

1.3 Terminology

"The term gender refers to the economic, social and cultural attributes and opportunities associated with being male or female. … Gender attributes and characteristics, encompassing, inter alia, the roles that men and women play and the expectations placed upon them, vary widely among societies and change over time. But the fact that gender attributes are socially constructed means that they are also amenable to change in ways that can make a society more just and equitable." (UNFPA - United Nations Population Fund 2004)

Gender relations are the ways in which a culture or society defines rights, responsibilities, and the identities of men and women in relation to one another (Bravo-Baumann, 2000).

Gender norms are a set of social rules, varied by culture and society, which through time, which shape gender roles.

Gender role is a set of behavior, resulted from gender norms, associates with being a man or a woman.
**Children chauffeuring trips** are trips accompanying children to unidentified destinations. In this study, the term is used for school destination.

**School pick up / drop off** is children chauffeuring to schools.

**Household burden** means household-related duties such as shopping, washing, house cleaning, childcare and picking up / dropping off family members.

### 1.4 The importance of this study

Bhat & Lawton (2002), on behalf of the Committee on Passenger Travel Demand Forecasting at the Transportation Research Board (TRB), suggested directions for future research. One of them is analysis of inter-individual interactions in activity-travel behavior. They gave an example of the study of interactions as serve-passenger and escort activity in which one member in the household may have decided to be together or allocate such activity to other member in the households. The interactions may be affected by the changes in the transportation or land use environment.

I also have personal interest. I, once in a while, drop off a niece to pre-school and kindergarten in the morning by driving and usually go with her father to pick up her in the afternoon by motorscooters. We often made many small snack trips along the way home. In my home town, 200 kilometers from Bangkok, Thailand, schools in the neighborhood are private schools. Children who are from other towns take bus. While I am in the US, I stay in Groveport with a Thai family. In summer, they take turns to drive girls to gymnastic school in the neighborhood and a boy to DeVry University and soccer field near Bethel road as well as drop me off at the university.
Mother is the main responsible person since now she is laid off and looking for job. These duties had belonged to the father while she worked. When school starts, a new schedule begins.

These chauffeuring activities are not made possible without automobiles. The topics of gender roles in travel and of chauffeuring children to school apply to any society where cars (and maybe also motorcycles and motorscooters) are used for personal transportation. Although most of the research reviewed in this study has been conducted in rich countries, such as the US, Europe, Japan, and Australia, the issues are relevant to other societies as cars become more common.

Chauffeuring children to school is both unique and interesting. Such trips are similar to the journey to work, because travelers need to travel there. While work trips need to be completed for financial reasons, school trips are made for the sake of children’s education. I call children chauffeuring to school substitute trips, implying the need to travel to destinations which are fixed in space and time. However, these trips are voluntary as household members choose to drive their children to school, because family members can switch chauffeuring responsibilities and there are other modes of transport available, such as school buses or car pools.

Chauffeuring children to school is important because journeys to school are one of the major sources of traffic at peak hours, which adds to congestion, accidents, and pollution (Joshi & MacLean 1995). A full understanding of trips to school is required if policy makers wish to reduce the number of automobiles making these trips. Moreover, understanding child commitments and children chauffeuring to school improves understanding of adaptive gender behavior, toward space-time
constraints and expectations of social norms. Furthermore, by alleviating household burdens and child care, women should be able to work more for their own personal fulfillment and career advancement.

There has yet to be an analysis made of school commutes in the Portland metropolitan area, which is in contrast to the extensive research which has been performed on work commuting. School commutes are sometimes chained with commuting to work, so that there may be some similarities. Furthermore, research into transportation and transport policies fails to consider the differences between the travel patterns of men and women. Travel demand management (TDM) policies provoked the inclusion of gender into current transportation research. The TDM policies would be enhanced if they included more understanding of women’s travel patterns, transportation conditions and time constraints. Moreover, research has shown that men help with child care, because of having to perform shift work. There has not been a study on trips to school and their links without of the ordinary work schedules, such as shift work and working from home.

Women with children are rapidly entering the labor market. How do they cope with out-of-home activities, work and children chauffeuring? Is there delegation of the children chauffeuring to their male counterparts, since they both work? How does occupation and class determine the daily travel activity patterns of men and women – are they similar or different?
The study of activity travel patterns should not be limited solely to women’s travel activities; it should also include those of men. I have therefore investigated the children chauffeuring to school of comparable genders (i.e. men and women in similar situations) and compared gender characteristics (e.g. men sharing the responsibility of driving to school with their partner vs. men driving to school alone).

1.5 Objectives of the dissertation

The objective of this study is to investigate the travel behavior of and the allocation of children chauffeuring to school of men and women. This study uses the Portland travel diary, which enables the study of all activity travel patterns of gender, except that of ethnicity, because the majority of respondents were Whites. The results of the study can be applied to other places because school chauffeuring happens everywhere having automobiles.

1.6 Organization of the dissertation

The dissertation proceeds as follows: Chapter 2 describes how travel demand analysis evolves. Existing methodologies regarding travel demand analysis are shown. Space-time paths and mathematical models are the major methodologies used. Studies of household interactions are then included. This is to position the study in the academic realm and to show what have been done so far.
Chapter 3 reviews studies of travel behavior. Women’s activity travel patterns are reviewed first. Women have short commutes and trip-chaining as well as passenger serves. Such unique patterns are caused by occupation segregation alongside household burden. On one hand, occupation segregation stems from the process of searching for a job. There are several theories which attempt to explain occupation segmentation. There is sex and race-based occupation segregation. Geographic measurement analyses travel distance and travel time. On the other hand, household burden stems from gender roles and norms and results in shorter commutes for women. The phenomenon of short commutes is termed spatial entrapment, or containment. Entrapment is varied by distribution of jobs, transportation modes, and classes. Flexible work schedules and telecommuting may alleviate household burden and thus is included after the part of household burden. Next, child chauffeuring to unidentified location is shown and then child chauffeuring trips to school in the Netherlands is reviewed.

Chapter 4 presents research questions. There is one main research question, comprising 7 sub-questions. Next, this chapter provides information on the study area, as well as including data from the Portland travel diary. I briefly include studies that have used the Portland travel diary. The methodologies and variables used are also added.

Chapter 5 explains the results of the study. Who are chauffeurs? They are identified by occupation, employment status, and industry type. How do the chauffeurs travel? They link chauffeuring trips to commutes to work and other trips. Women chauffeurs demonstrate more varied activities in their linked trips than men.
Chapter 6 attempts to explain the observed chauffeuring travel patterns. First, the study shows the dependency of children’s mobility on women. Second, the study shows that case studies in this research are upper-middle class and are about half sharing. Third, the study demonstrates a relationship between children’s age and the gender of drivers. Fourth, the travel behavior of children being chauffeured to school is studied by household structure, defined by the number of adults and children per household. Fifth, the number of earners in a household differentiates children’s travel behavior while being chauffeured to school and is also associated with which genders drive. Sixth, household interaction, the allocation of children chauffeuring, is divided into driving alone and share driving. Finally, the study shows the association of shift work and work from home to the state of being chauffeurs.

Chapter 7 gives a summary of findings, the conclusion, and suggestions for further research. The empirical study emphasizes gender roles, with other factors, inducing men’s chauffeuring, based on class and necessity. Single earner households are also associated with men chauffeuring alone. This study recommends incorporating class and the number of earners per household into the research and also into a model for forecasting future trips. Comparative studies of both men and women are important, not just the study of one gender in isolation. Moreover, studies of men with children are recommended. This dissertation insists that gender is crucial to understand these complex travel activity patterns. The framework of this study, including time constraints and gender relations, are appropriate areas for study, regarding the common activity of chauffeuring children to school.
CHAPTER 2

REVIEW OF TRAVEL DEMAND RESEARCH

2.1 Travel Demand Analysis

Transportation research in the 50s-60s was made to support facility construction whilst travel demand forecasting was being developed. According to Pas (1990), the first travel demand analysis, the Chicago Area Transportation Study (CATS) generated aggregate models for prediction, the Urban Transportation Modeling System-1 (UTMS-1). The analysis was included in CATS’ first regional plan (1955-1962). It was the first comprehensive long-range transportation plan for the region and the plan was followed and led to part of the present highway networks. Late 1960s researchers applied a statistical approach, mostly based on econometrics. Consequently, there was a disaggregate behavioral model. The econometric approach focused on sampling, model estimation, and prediction. The econometric theory was used frequently because it was well-established in this field. With concerns of multi-modal and inter-modal transportation, there were discrete choice models. There were
attempts to develop and enhance the theory, and the application, of the discrete choice model. Then, the research trend changed from economic focus to human emphasis. There was an inclusion of attitudes and perceptual factors, such as comfort, convenience, safety and reliability. Quantification or psychological scaling techniques, quantifies the qualitative data to be used in a travel demand model, which is also referred to as a disaggregate behavioral model. The analysis of human activity pays attention to the interaction between individuals, space-time, constraints, household structure and individual roles. The approach explicitly addresses time constraints. The approach was led by Ian Heggie at Oxford University (Pas 1996). With regards to beliefs in derived demand, it focuses on understanding, not prediction, as to why such relationships existed. The purpose of travel demand analyses is to understand travel behavior, not to predict travel demand.

In the mid 1970s, transportation demand management existed, which was driven by external economic forces and policies. Conditions and concerns were the “rising cost of facility expansion, increasing environment concern, expanding public involvement in transportation planning, skepticism about automobile-driven land use development” (Kitamura & Bhat 1999, 113) and the increasing role of telecommunications. Consequently, transportation policy has shifted from constructing facilities, to better use of existing networks. There was an awareness behind using the term ‘activity’, as opposed to ‘trip’, as trips derived from demand for participation in activities. Contemporary transportation methodologies and theories were then assessed. Meanwhile, there were two main research groups aiming to predict demand, versus understanding travel behavior: conventional trip-based and activity-based approach. Conventional approaches used analytical units for
measuring trips. Trip-based approaches had a succession of development, e.g. analogy, the discrete choice model, the disaggregate behavioral model, and the human activity model (see Pas, 1990). Some flaws of the trip-based forecast tool were recognized as being (1) a lack of concern for underlying activities deriving from travel demand, (2) not responding promptly to evolving policies, which shifted to focus upon transportation management, (3) not being sensitive enough to assess policies for new infrastructure construction (McNally, 2000), and (4) a lack of interdependency among travelers in the same household. An alternative activity-based approach focuses on interdependency, particularly within households, which was ignored by trip-based research. The model allows several variables and transport criteria and, additionally, it explicitly addresses time constraints.

Activity-based research was revived when there were emission concerns, both on an international level, such as the Kyoto Protocol, and national levels, such as the Intermodal Surface Transportation Efficiency Act (ISTEA), 1991, and the Clean Air Act Amendments (CAAA), 1990. More seriously, transportation policy aimed to reduce emissions and control automobile use. In fact, there are numerous choices to be made in reducing emissions, for instance, motivating drivers to use public transportation, restricting parking spaces and supporting car pooling. Which policy is appropriate? Where should specific policies be applied? Additionally, recent policies should be flexible, and prompt a changing of considerations and circumstances, as well as be fair for people who are likely to be adversely affected by the new policy (Rosenbloom & Burns 1995). Policies need a better forecasting tool, one which is more sensitive. However, better tools also require a better understanding of travel patterns, and people’s travel behavior.
2.2 Travel Demand Analysis Methodology

Travel demand analysis can measure the space-time path, space-time density surface, geo-visualization, indices and mathematical models. With regards to the space-time path, the activity-travel pattern is shown graphically as lines, or as areas of travel. These lines are the activity paths, within a reference frame of time and space. Hägerstrand (1970) visualized his concept of mobility within time constraints, by showing a graphical representation of 3-dimension space-time, in which space is collapsing into a plane and the time axis is inserted upright into the space plane.

Figure 2.1 A space-time path. X-Y represents geographic space. Z represents time.

The change of objects’ locations was presented as vertical lines. An oblique line represented motion, in both space and time. A vertical line expressed no change in
space, while time passed. A nearly horizontal line showed movement in space, within
a very small amount of time. The line indicated ‘fast’ movement. Additionally, the
meeting of two objects occurred where two lines intersected, which represented the
same place and the same time.

Space-time paths show interaction between family members, using a
household structure or a family life cycle. Kostyniuk & Kitamura (1982) investigated
interaction between husbands and wives. They applied a contingency table to
measure the effects of this interaction. Joint and separate trips are shown in space-
time paths. Kostyniuk & Kitamura (1983) extended their previous work to explain
the differences in path characteristics, using the variables available and to infer the
extent to which various constraints and other factors affected the path’s evolution.

Forer & Kivell (1981) showed a 2-dimensional graph of a visited place and
time. The space-time pattern of housewives was fragmented though their daily
schedules, which included visiting, and revisiting, many of the same places, such as
schools and grocery stores. Household tasks scheduled their daily activity-travel
patterns. Further, housewives did not have efficient mobility. They had long travel
times because they did not have access to automobiles and they depended upon public
transit systems. While the time budget study showed accumulated free time, the
space-time patterns revealed a fragmented schedule, which did not allow women to
have any real leisure time (Palm 1981). Forer & Kivell (1981) explained that the
ability to use facilities at certain locations to reach destinations in a meaningful length
of time depended on various factors. These factors were an available time window,
the mobility of the individual, and the location of one or many facilities, relative to
the individual’s own location.
Fortuijn & Karsten (1989) generalized space-time paths for single parent families and also dual-earner families. The three types of paths were mobile workers, office workers, and homemakers. The first two types of worker had a large amount of time in which to accomplish tasks outside of their homes, whereas a typical housewife had to make many short stops at local destinations, such as school, places to buy food, a supermarket, etc. In the evenings, the mobile type stayed home, while the working group stayed out for recreational purposes.

Kostyniuk & Kitamura (1982, 1983) analyzed evening paths, both joint and separate, for all types of households. The paths showed the roles and responsibilities of household members. These are complicated patterns which elaborately report descriptions of paths and determinants. The researchers extended the work of Jones et al. (1983) and Chapin (1974) in order to describe the effects of interaction in travel patterns in time and space settings.

When comparing the works of Kostyniuk & Kitamura and Fortuijn & Karsten, I have found that Kostyniuk & Kitamura applied national survey data to a life-time scale, but Fortuijn & Karsten applied interviews and studied the daily scale. Kostyniuk & Kitamura concentrated on interactions between husbands and wives, whereas Fortuijn & Karsten focused on the space-time activity patterns of individuals. Nevertheless, both authors came to the same conclusion: that work structures activity patterns.

Shapcott & Steadman (1978) illustrated another form of space-time diagram, in which the z-axis represented days of the week, and the x-y plane was the spatial layout of the city. Time use for activities was presented as a vertical ‘tube’. The paths of individuals were generated by using individual or household characteristics.
The latest space-time path is a technology-motivated extensibility path, which is also referred to as an extensibility path. It shows that communication technology shortens space and that travel is no longer limited by physical movement. This technology-driven space-time path was initiated by Adams (1995). The extensibility path added different branches of communications to the precedent space-time path. The extended paths had no boundaries which inferred authority constraint, or a constraint of access. If an individual calls for an appointment at 9:00, in her path there is a line attached from the caller, to the receiver’s location. Another line is then drawn from the location of the caller, to the meeting place, at the appointed time. These branches show the connection to the receiver and also reveal any unexpected events on the travel path. Kwan (2000a) implemented Adams’ theoretical construct, which is the idea of extensibility. She generated the extensibility space-time path of an individual from experimental data, since there was not yet a communication diary.

To address research question, Kwan (1999) generated space-time activity density surfaces of daily patterns, with time and distances in kilometers in graph form with a standard X/Y configuration, in conjunction with a Z-axis, showing activity density. She compared the space-time activity patterns of three European-American population subgroups, using GIS-based three-dimensional visualization techniques. The space-time activity density surfaces revealed patterns of non-employment activities among full-time and part-time employed women and full-time employed men. The results confirmed the significance of the fixity constraint as a mediating factor in the complex interrelations among the three spheres of women’s everyday lives: household responsibilities, the local labor market or employment status, and non-employment activities.
Regarding ‘Interactive geo-visualization of activity-travel patterns using three-dimensional geographical information systems: a methodological exploration with a large data set’, Kwan (2000b) used point data and developed exploratory 3D geo-visualization of human activity-travel patterns using the Portland data in a space-time context. The geo-visualization of activity density patterns in space-time methods included (1) interactive 3D geo-visualization methods for representing activity intensity or surface in space-time and (2) the geo-visualization of space-time paths. These exploratory geo-visualization techniques were beneficial for further modeling studies.

Kwan (2004) reviewed GIS research methods, based upon concepts in time geography. The methods are geo-computation of space-time accessibility measures and the 3D-geovisualization of human activity patterns in space-time settings. She utilized a space-time path, called an ‘extensibility space-time path’, to show the extremely complex interaction patterns in cyberspace, which were global wide.

Not content with using space-time path, Jones et al. (1983) applied a holistic approach, which resulted in descriptions of travel patterns of a family’s life cycle. Contemporary works, such as Zimmerman (1982) and Collen (1983), also analyzed activities based upon life cycles, classified by the presence and age of children. The findings were crucial in understanding travel behavior.

Pas, Hanson, and Huff attempted to analyze the repetition of travel patterns, so called travel behavior (e.g. Huff & Hanson 1986, Pas 1988, Huff & Hanson 1990) and then generated ways to measure travel repetition and regularity (e.g. Hanson & Huff 1988, Pas 1980, 1983). These indices cover a broader aspect of travel and activity than trip frequency alone. However, the indices were not popular, when compared to
sequencing trip-based models and accessibility measures. Transportation engineers have applied the four-step model, while planners have used accessibility measures. Consequently, travel behavior research diminished. Its revival was caused by the introduction of Clean Air Act Amendments (CAAs) and Travel Demand Management (TDM) policies.

For mathematical models, activity-based travel analysis and modeling differs by the method used (Kitamura, 1988). The variations reflect a variety of underlying theoretical frameworks, such as constraints in time geography and maximizing utility in economics. For example, Townsend (1987) used a utility-maximizing concept while van Wissen (1989) applied a time constraint setting.

The recent research has generated time allocation models, activity duration and time allocation models. Models are either discrete choice models, based on utility-maximizing concepts (e.g. Gliebe & Koppelman 2002; Townsend 1987) or are structural equation models, with observable variables referred to as Simultaneous Equation Models - SEM (e.g. Lu & Pas 1999; van Wissen 1989; Golob & McNally 1997; Goulias 2002).

SEM is flexible because it allows for the investigation of an unlimited number of variables. Moreover, it gives matrices showing the correlation between different variables. For example, Goulias (2002) studied time-allocation and multivariate correlation structures of four independent variables, at each of the levels of household, personal and temporal. Lu & Pas (1999) modeled substitutions of in-home and out-of-home activities between men and women, for the following activities: subsistence, maintenance and discretionary activities. Golob & McNally (1997) explained the household interactions of heads of household with different genders, for main out-of-
home activities. Van Wissen (1989) showed the joint time allocation model of the interaction between household members by gender. Van Wissen (1989) tested theoretical constructs against Townsend’s efficiency, companionship and altruism / power. He supported Townsend’s theory of companionship and altruism / power. The hypothetical constructs are built on a time constraint framework. Their work can be categorized as a segmentation approach, a subset of the activity analysis paradigm, because the results add new determinants, which contribute to creating a better forecasting tool. One of the most striking variables is gender.

Bhat & Koppelman (1999) provided a substantive review of theory and empirical studies of research on time allocation, which aimed to understand travel behavior. Other works (e.g. Golob & McNally, 1997) attempted to adjust the conventional trip-based model to a disaggregate trip-based model. Such an attempt acts as ‘inertia’ (McNally 2000) to the era of an activity-based travel forecasting model. Although the activity-based and trip-based models place similar focus on individual travel, the four-step model cannot incorporate a behavioral standpoint, which is represented by the scheduling of trips and time of travel.

Research on travel behavior and travel demand analysis was revived due to the introduction of the Kyoto Protocol, the Intermodal Surface Transportation Efficiency Act (ISTEA), the Clean Air Act Amendments (CAAs) and also Travel Demand Management (TDM) policies. The new requirements necessitate increased knowledge on, for instance, interactions and interdependence on travel and activities among family members, and the time of travel. These issues cannot be incorporated into conventional trip-based models. Furthermore, the policy should proceed with care, in order to avoid adverse effects on minorities and women who are both time-
and economically constrained. The transportation and welfare policy was not
generated quickly, because the transportation knowledge pool also lacked adequate
understanding of gender differences in travel behavior. Moreover, the conventional
trip-based approach disregarded time and gender. Correspondingly, this dissertation
aims to include gender differences and the concept of time constraint on travel and
activities which are not included in conventional models.

Better models can be obtained by having a better understanding of household
interaction between household members, regarding travel decisions and ultimately
activity travel patterns. This dissertation determines the interaction of workers in the
same household regarding children chauffeuring to school and applies gender
relations to explain activity travel patterns.

2.3 Household Interaction

Household interaction means task allocation among household members. The
decision of one household member regarding one task can affect other members’
decision on performing or not performing activity trips. For example, one person may
chauffeur children to school and, as a consequence, another may become responsible
for shopping. One member chauffeurs children to schools in the morning, whilst the
other picks up the children in the afternoon.

Bhat & Koppelman (2000) invoked research on inter-individual interactions in
the household and time-space interactions in activity behavior. The results
contributed to a better overall specification in travel demand forecasting models.
They refined the comprehensive activity-based travel demand forecasting models,
within the time domain context, e.g. prism-constraint and Comprehensive Activity-Travel Generation System for Workers (CATGW). Moreover, the interaction research helped to address transport flaws and contributed to demand management strategies. Practically, the findings can be used to address omitted problems and to suggest the implementation of appropriate strategies, by taking minorities and women into account.

There have been many attempts to address and model interactions, and the frameworks and variables of these models often vary. Prior research applied physical constraint concepts to investigate activity space of husbands and wives, for both work and non-work activities (e.g. Everitt 1976). The following works used life cycle concepts, defined by the number and age of children and the age of the head of the household: (Kostyniuk & Kitamura 1982, 1983; Jones et al. 1983; Zimmerman 1982; Collin 1983). More recent research has generated time allocation models and activity duration, and also time allocation models. Models are either discrete choice models, based on utility-maximizing concepts, (e.g. Gliebe & Koppelman 2002; Townsend 1987) or based upon structural equation models, with observed variables, so called Simultaneous Equation Models or SEM (e.g. Lu & Pas 1999; van Wissen 1989; Golob & McNally 1997; Goulias 2002).

Structural Equation Models with Observed Variables or Simultaneous Equation Models (SEM) are more flexible, and can be used within any framework. SEM enables researchers to concurrently explore the complex relationships between travel, activity, and indicators of travel and activity. Further, models can be evaluated and compared, and consequently, SEM has continued to gain popularity (Kuppam & Pendyala 2001).

Van Wissen’s (1989) research provides a hypothesis alongside a conceptual framework, before beginning to generate models. Van Wissen (1989) tests theoretical constructs against Townsend’s model of efficiency, companionship and altruism / power. Hypothetical constructs have the added benefit of streamlining research. These steps are pertinent to the objective of the study, by means of a time constraint framework. However, I have focused on explaining child-serving trip patterns to reflect variations within gender, and the relations of working parents, as well as the effect of flexibility beyond gender norms. Instead of using joint time allocation methods, the dissertation will observe separate activities, to investigate the allocation of spouses to school escort duties.

Kato & Matsumoto (2007) analyzed intra-household interaction between a husband, a wife and a child, using a joint time-allocation model. They used information from a Japanese travel diary, which was collated by the University of Tokyo. They found a difference in activity travel, between weekends and weekdays, and a husband’s preference to have joint activity trips with boys, rather than girls.
For the study of intra-household interaction, Kang & Scott (2008) create GIS toolkit to search and extract independent and joint activity/travel episodes. The toolkit has two tools: space-time coincidence analyst and space-time path visualizer. Space-time paths are done using ArcGIS and ArcObjects.

Transport models and activity analyses addressing problems and investigating travel patterns, do not explicitly show gendered time and gendered activity processes. The existing models and analyses only include the activities of men and women. Furthermore, relatively little work has been completed which focuses on the comparable differences between men and women in the same households, so as to distinguish their travel behavior, as suggested by Rosenbloom (1989). Moreover, there is no research into child-serving trips associated with work trips. In addressing these gaps, this study centers on the interaction between genders in the same household, because genders have the same constraints of work and child escorting responsibilities.

I aim to investigate gender-role based interactions regarding children chauffeuring to school travel patterns. To help explain the travel patterns, the time constraint concept from time geography provides a suitable theoretical framework, which explains unusual working schedules – such as shift work and working from home. Research on gender relations in transportation establishes determinants for systematic, empirical research. The major determinants are travel time, household income, the occupation of women in the same household, as well as the age of children. Methods include searching through records and making appropriate selections in accordance with multiple criteria, e.g. gender, shift work, working from home and household income.
CHAPTER 3

REVIEW OF TRAVEL BEHAVIOR RESEARCH

This chapter emphasizes the study of women’s travel behavior: short work commutes, trip chaining, and passenger serves, in section 3.1. Casual factors are the spatial distribution of activity locations and mobility inequality, one of geography’s continuing emphases. In section 3.2, the inequality of mobility is caused by various inter-related factors, such as occupation segregation, sex- and race-based segregation regarding housing and work, and also household burden. Those factors also result in spatial entrapment, section 3.3. In addition, there are the study of women with children. The final section, section 3.4 shows flexible work schedule and telecommuting which closely associates with work from home, an answer available in the Portland travel diary. The new work scheduling results in relaxing authority constraint by providing options to worker to start and end job anytime they would like. In a similar manner, the new way to work, telecommuting allows workers to work anywhere, except offices and anytime.
3.1 Women’s commuting patterns

Women’s travel behavior has become one main issue of study, because of changes in economic and social structures. Now, more women work and drive to work (Beek, Kalfs and Blom 1997; Rosenbloom 1996). Travel to work, therefore, becomes one main facet of the study of women’s travel behavior.

3.1.1 Women’s short commutes

Research indicates that women’s journeys to work are generally short (Chapple & Weinberger 1996; Everitt 1976; Fox 1983; Hanson & Hanson 1980; Hanson & Johnston 1985; Madden 1981; MacDonald 1999; Pickup 1984; Singell & Lillydahl 1986; White 1977). Low earnings discourage women from commuting (Hanson & Johnston 1985; Madden 1981; MacDonald 1999; McLafferty & Preston 1991; Wyly 1996). Additionally, childless, working women in Montreal and Paris preferred to walk to work, because destinations were not too dispersed (Bernard et al. 1996) and thus had a short commuting time. However, just ‘how short’ these journeys are, is not usually defined and most writings are content to compare just travel time, or the distance between genders.

Most research gives comparisons between genders, and whose travel time was shorter or longer. According to Reschovsky (2004), who compared work travel time between genders using the 2000 US Census, if commuting period is grouped into three classes, short (less than 25 minutes), medium (25 to 29 minutes) and long commutes (30 minutes to more than 90 minutes), women in short commuting groups
have relatively longer commutes, whereas women in long commuting groups have relatively shorter commutes. Noted, the research was conducted on a country-wide scale, moreover, there is usually greater job growth in suburban areas, as opposed to central cities. In addition, similarly, women had lengthy commutes as found by Brooker-Gross and Maraffa (1985), who studied university employees in a college town in Virginia.

McLafferty & Preston (1991) found that the difference in men’s and women’s commuting times diminished and often became statistically insignificant when controlling for income, industry, and occupation. In urban areas, gender differences of travel are less than those in suburbs, because urbanites use public transportation, whereas suburbanites rely heavily on the use of automobiles (Preston & McLafferty 1993). Chapple and Weinberger (1996) conducted a study in San Francisco, indicating that suburban women had longer travel times and that urban men and women using public transportation, had a shorter travel time. These travel patterns varied locally. Just ‘how short’ and ‘how long’ these journeys are was never widely agreed.

The other reason for short and long commutes is the scale effect. Taaffe, Gauthier, and O’Kelly 1996 referred to Pisarki 1987, suggesting that commuting patterns vary, determined by the size of the metropolitan area in question. In intermediate-sized metropolitan areas, outward commuting and homeward commuting are more or less equal. In small metropolitan areas, intra-city commuting is predominant, whereas in larger metropolitan areas, suburban-suburban commuting is
most common and also long commutes. In other words, intra-suburban commuting is less predominant when metropolitan areas decrease in size. For instance, working mothers in small and medium-sized towns had the shortest commuting time, in contrast to those in larger metropolitan areas (Fagnani 1987). Working women, with a high education and prestigious occupations could afford to reside in metropolitan areas and thereby reduce travel times, whereas people in suburbs pay less for housing, although travel longer distances (Preston & McLafferty 1993).

3.1.2 Women’s trip chaining

Women frequently had multi-purpose trips, also referred to as ‘trip chains’ (Beek, Kalffs and Blom 1997; Jeff & McElroy 1996). They traveled less distance (Fox 1983; McLafferty & Preston 1991) and often used public transit (Hanson & Hanson 1980; Bernard et al. 1996), whilst men traveled further to work (Jeff & McElroy 1996) and used the most convenient mode of transport, private cars (Bernard et al. 1996). Men were involved in more recreation (Zick & McCullough 1991) and recreational trips (Hanson & Hanson 1980; van Wissen 1989), however, after work women had larger activity space for non-work activities (Kwan 1999).

In Rosenbloom (1987), for children between the ages of 6 and 12, women’s linked trips fell in frequency. Only 50% of mothers with children aged between 6 and 12 chose to link trips together. 80% of women with very young children and 90% of those with teenagers, linked trips.
Fox (1983) added that their multipurpose trip capacity might be constrained by distances between locations, due to the scattering of non-work facilities. It shows trip chaining tends to be more common in the suburbs, than in cities.

Household duties result in trip chaining to and from work, e.g. home – work - grocery shopping - child chauffeuring - home (Beek, Kalfs and Blom 1997; Fox 1983; Misra & Bhat 2000). According to Misra & Bhat (2000), shopping stops are most likely to be linked with other stops. People with a high number of serving-passenger stops are least likely to chain activities, because of the temporal constraint of this activity. Regarding activity sequence, shopping is the most frequent last stop and serving-passenger is the most frequent first stop.

Figure 3.1 Samples of trip chains, before and after work

Comparing females based on their employment status, Hanson & Hanson (1981) show that women in full-time employment are more likely to make single-purpose work trips than other groups. They endeavor to fully utilize the time available, rather than adjust locations for their out-of-home activities. They spend less time for certain kinds of non-work related activities, and also make fewer stops.
Some of their travel is shifted to weekends. They also make fewer stops for non-work purposes than other groups and travel greater distances. There is no evidence for those employed full-time suggesting that household duties confine spatial dimensions of women’s travel patterns.

McGuckin et al. (2005) used the 1995 US Nationwide Personal Transportation Survey and the 2001 National Household Travel Survey. The percent change in trip chaining from home to work was 21% and chains both home to work and work to home were 12%. They found, in two-parent, two-worker households, that dropping off children at school, women are far more likely than men to chain children chauffeuring to school into their work trips, and those trips are highly constrained between 8 a.m. and 9 a.m. The percentage of stops was determined by the purpose of a trip – shopping was measured at 36% and was mostly done whilst returning home from work. Serving passengers was rated at 34% for home-to-work trips and at 24% for work-to-home trips. Trip chaining was often done in private cars. These journeys accounted for over 80% of the total, with other forms of transit being common place activities such as walking, or going by bicycle. Men’s trip chaining was greater than women’s, and increased between 1995 and 2001. Workers are more likely to serve passengers and buy meals or coffee on a home-to-work trip, rather than a work-to-home trip. Oppositely, workers tended to shop, or visit places for personal duties, on the work-to-home route, as opposed to the other way around. Stops for meals or coffee have grown surprisingly over the years, and this phenomenon has been named ‘the Starbucks effect’.
3.1.3 Women’s chauffeuring children

There have been studies of children chauffeuring trips as non-work trips, in Transport Geography or as passenger-serving trips in Transport Engineering or as child mobility in Public Health. Results varied due to the uniqueness of space and place. In Europe, there are studies of children mobility by biking since there are bike lanes available. Walking and biking is a common mode for children in Europe while in the US child mobility depends on automobile and therefore their drivers or parents.

Women made more passenger-serving trips (Bernard et al. 1996). Their passengers can be family members, especially children. This study limits to passengers, children only. This sub-section describes women’s chauffeuring children: to unidentified location and subsequently to school.

Studies of children chauffeuring result in varied facts depending on the place of the study and case study. Issues are (1) at what age rage children tended to be served by parents, (2) the difference between father and mother regarding chauffeuring children, and (3) the link of passenger-serving trip and trip chaining.

According to Rosenbloom (1993b), both mothers and fathers are likely to prioritize driving solely for their children, in the following order: children under six years of age, children between 13 -17 years of age, and finally 6 -12 years of age, regardless of economic and occupational changes (Rosenbloom 1987). More commonly, parents were less likely to chauffeur slightly older children (Rosenbloom 1993b), particularly children aged 18-21 (Jones et al. 1983). As the children grow
older and become more independent, the mobility of parents transfers more to the children. In Rosenbloom (1987), the number of journeys for children under 6 and for those ages 13-17 remained of a similar level.

The passenger-serving trips for children between 6 and 15 years of age had the widest gap between fathers and mothers (Rosenbloom 1995, US study; Jones et al. 1983, UK study). Fathers’ driving frequency decreased when children become older, whereas mothers routinely drove. About 50% of mothers continued drive for their teenagers (Rosenbloom 1993b). Mothers drive for teenagers aged 18-21 as frequently as fathers do (Rosenbloom 1995). Rosenbloom (1993b) pointed out that the trips linked by married men were not affected by the age of their children, and said fathers are hardly the primary providers of transportation for school-aged children. Consistently, Rosenbloom (1987) found married men had fewer and fewer linked work-trips.

The classic example of trip chaining is school chauffeuring on the way to work. Trip chaining is termed ‘tour’ in transport study and a plan for a tour is ‘activity schedule’. That will bring other branch of research and be involving with automated transport modeling as well as the effect of urban forms on tours and activity scheduling. This study limits to trips that are chained with school chauffeuring trips.

Regarding children chauffeuring to school, there is only one article which is current and the most relevant but the study is done in foreign country. In the Netherlands, Schwanen (2007) investigated gender differences in chauffeuring children from / to schools. The study was built upon spatial-analytical and cultural traditions. Used data was directly collected by the author and divided into two
phases. The author applied correlation and qualitative analysis. He found school chauffeuring is mainly done by women while men considered themselves as helpers. Men and women in households or spouses who are parents switched this task to each other, called split-shift chauffeuring. Not only men, but also women juggle work and school chauffeuring. Mostly, men took care of this duty in the morning while women did in the afternoon. Men and women, who could choose starting and ending time of work [it implied they are in managerial level] were partly responsible.

Schwanen’s study limited respondents to parents in households which have dual earners and children aged less than 18 years old. In contrast, the dissertation has respondents as men and women in the household, not limit to parents. However, most are parents. Moreover, households are having children aged less than 18 years old, who were illegal to drive alone.

3.2 Occupation segregation and household burden

Typical travel patterns of women, with short commuting and trip chaining are caused by occupation segregation and household burden. The occupation segregation is both gender- and race-based. Research has been performed on these issues, as follows:
3.2.1 Occupation segregation

Segregation has been occurring since the beginning of the industrial revolution. Cope (1998) used data from 1920-1939, the period of industrial revolution in America, to help measure this. It was found that both men and women worked in mills; however, women had to work harder, in order to earn an equivalent amount of money to that as men. Women were concentrated more in low-paid jobs, whereas men were favored more often in obtaining their preferred work shifts.

Occupation segregation occurs in the process of job searching, or networking, and is set aside from other social and cultural factors. A network of social relations differentiates the type and quality of job resources. A network which is built through workplaces, residential neighborhoods or kinship, will differ depending upon the place where the network is built. Men preferred to network in workplaces, whereas women tended to utilize their networks in the neighborhood (Everitt 1976).

Nevertheless, it is noted that similar people live in the same place and build neighborhood networks, which link together people in the same workplace. This process is called ‘formed looping’. The network was studied in detail by Hanson & Pratt (1995). They used the term rootedness and place, instead of the neighborhood. The term reflects more the importance of relationships between households and communities, than on the impact of relationships on paid employment. Gilbert (1998) further refined Hanson and Pratt’s study in Worcester, by including a racial dimension to the problems of women working close to home. Combining rootedness, gender and race gives rise to the term ‘spatial entrapment’, which will be discussed further.
Networks in residences, neighborhoods and workplaces can be viewed, in retrospect, as constraints if they do not support an individual. Networks for poor working women would have been expected to support job search strategies. Black women prefer to network in the workplace; however, these networks rarely help them obtain jobs. Instead, it is more common to gain employment through kinship networks. In contrast, White women rely on the networks from their workplace and residence. White women find jobs from formal resources, e.g. newspaper, whereas black women find jobs referred to them by relatives. Similarly, both groups of women have less access to automobiles. It is significant that most of the personal contacts women used to find employment and childcare, were of the same racial group. As the networking of women is race-based, Cope (1998) subsequently declared that ethnic groups had their own network, from which they obtained jobs, and therefore, they tended to cluster in particular employment fields.

Human capital theorists claim that women have fewer qualifications than men in predominantly male occupations, occupations which provide better wages, higher job stability, better working conditions, and more possibilities for promotion. The selection process for these jobs may not only depend on qualifications, but may also involve employers’ discrimination. According to Glass (1990), both male and female workers in predominantly female jobs faced the same conditions at work, such as more difficulties, less flexibility, worse promotion policies, fewer breaks, and fewer benefits; however, men still reported receiving greater benefits overall. Research has revealed that job challenges and interests are not affected by gender, but by education, work experience and working hours. The nature of different jobs may or may not differentiate between genders at work.
This type of segregation is slowly being reduced. However, within the twenty years from 1975 to 1995, there was only a 10% increase in the number of women in managerial and professional careers (Hayghe 1996). More importantly, according to Glass (1990), women have lower wages regardless of the composition of sex in offices. Productivity differences between men and women cause wage differentials in similar occupations, although the differential is relatively minor.

Sex-based job segregation seeks to find the reasons for the differences in commuting patterns between men and women. The differences of travel patterns in the same-gender and opposite-gender dominated industry are shown by Chapple and Weinberger (1996). The study, taken in San Francisco Bay area, showed that men in male-dominated industries had the lowest difference in travel time, whereas men in female-dominated industries had the highest differential. However, men in female-dominated industries traveled further, for lower income jobs. Between 1980 and 1990, there was an increase in the commuting time of men in male-dominated industries, whereas there was a decrease in the commuting time of men in female-dominated industries. Women spent less time commuting than men, in both male- and female-dominated industries. In male-dominated industries, suburban White, Hispanic, and Asian women spent less time traveling to work than their male counterparts, while Black women had greater travel time. In suburbs, the difference in travel time for female-dominated industries was generally wider than for Whites and Asians, than for Blacks and Hispanics. The reverse is true in male-dominated industries in urban areas, as Blacks and Hispanics have a wider range of travel times than Whites and Asians.
In female-dominated industries, working women prioritized convenience and thus worked close to home and drove automobiles alone (Johnston-Anumonwo 1988). However, Glass (1990) noted that local jobs in female-dominated industries did not fully facilitate women, because there was no relationship between female job positions and the family-care benefits provided by employers. However, one small advantage was a short commute to work [: convenience].

Occupational segregation is not only based upon sex, but also race. Wyly (1996) found that race and gender-based divisions in the workforce correlated with the spatial distribution of local labor markets. New forms of job division were derived from the economic restructuring, from manufacturing to service-based economies, between 1980 and 1990. Segregation increased by both race and gender, with White men earning more money than Black men, in all areas. Jobs that offered high earnings often forced White men into accepting lengthy commuting times. Black women were in lower prestige, mainly service oriented jobs, for example finance, insurance, real estate, and public sector work, whereas White women were in higher prestige jobs, e.g. sales, teaching, nursing and health. After economic restructuring, Black women replaced White women in service jobs. However, White women shifted to even more prestigious and better-paid jobs, in managerial positions. However, both groups of women remained in pink-collar jobs, often found near their homes. As a result of lower localized wages, job segmentation allows White women to have shorter commuting distance. However, its effect on Black women was inconclusive, perhaps because of the small sample size of African Americans in Wyly’s (1996) study. For White women, the localization of jobs remains, both before and after economic restructuring. Black men remain in low wage, blue-collar jobs. A
covariance structured model allowed Wyly (1996) to identify, significantly, the correlation between occupational segmentation and occupation and industry quotients. The finding indicated localization to Blacks, working in typical industries and occupations, hence having lower earnings, and having [worthy] a shorter commute. For all groups, except White men, the reduction of earnings and better paid part-time work in typical occupations, correlated to a short commute.

The geographic measurement of the occupation segregation is travel distance and travel time. Hanson & Pratt (1995) applied the friction of commuting distance or work travel time and found that workers in female-dominated industries had shorter distance to work. Arguably, Johnston-Anumonwo (1997) shows that women, both European American and African American in Buffalo, NY, had greater access to low-income jobs, regardless of whether their commuting was long or short.

3.2.2 Household burden

Women’s travel time is affected by household structure, categorized by the number of adults and the presence of children. Having traditional gender roles, women tend to travel when shopping or chauffeuring children. Women have more frequent grocery shopping trip than men, regardless of ethnicity (Mauch & Taylor 1997). The number of children aged between 5 and 11 years has a positive influence on passenger-serving, and a negative influence on shopping (Misra & Bhat 2000). Further, passenger-serving stops are least likely to be linked with other stops, whereas shopping stops are more likely to be chained (Misra & Bhat 2000). Perhaps, the division of gender-based duties is one of the answers to men’s and women’s travel patterns.
Household burden is presumed to be one of causes of spatial entrapment, or spatial containment. The entrapment thesis states that work trips close to home are made by women in low-paid jobs. Working mothers cannot travel far, because of childcare and household responsibilities. In female-typed occupations, working women prioritized convenience and thus worked close to home and also drove automobiles alone (Johnston-Anumonwo 1988).

It is debatable whether household burden causes women to live near their workplaces. Many studies say it does (e.g. Ericksen 1977; Hanson & Pratt 1995; Johnston-Anumonwo 1992; MacDonald 1999; Madden 1981; Pickup 1984; Rosenbloom & Burns 1995; White 1977). If this is true, married women could have the least distance to commute. Johnston-Anumonwo (1992) proved that married women had shorter work trip distances. However, Hanson & Johnston (1985) argued that household duties did not account for shorter journeys to work, because the presence of a husband or children did not reduce the distance to work. Women traveled shorter distances to work than men, regardless of their family life cycle group. Household burden induces low mobility, but does not cause a reduction in distance or time.

To explain the phenomenon of women working locally, Hanson & Pratt (1995) applied extended human capitalist theories. The theory suggests that human capital, or resources for women, increases at a slower rate than that of men, because women leave jobs for childcare (Polachek 1981), or work close to home in order to cope with household duties. The human capital theory of economists links domestic responsibilities and the need for working close to home. Hanson & Pratt (1995) add that women work for their own personal satisfaction, to utilize their time and they
choose to work and to have some earnings. Earnings imply well-being, not necessity. Moreover, human capitalist contended that the labor market was structured by preferences, expectation and aspiration. Hanson & Pratt (1995) argue that social networks and labor market outcomes are created by local environments and the social and cultural lives of workers close to the workplace. However, there is no absolute conclusion and the debate is ongoing.

Women are obliged to perform household duties; whist household earnings are traditionally seen as the responsibility of men. The duties may be classified into required and optional duties. Children chauffeuring to school are optional. However, since they are linked to children and are in keeping with women’s duties, they tend to be the responsibility of women, rather than men.

There is a debate in changing divisions of household responsibilities. On one hand, the division has not changed since the industrial revolution, which formed two separate spheres, those of work and home. Housework is a women’s obligation (Martin & Roberts 1984; Lewis 1992; Wilson et al. 1990). Child-related responsibilities, in particular bring more stress to mothers than previously (Ginn & Sandell 1997; Aitken 1998). On the other hand, there is a change. In modern families, men help with housework more than ever (Scanzoni 1977; Kiker & Ng 1990). The recent works explain the change in household decision behavior (Qualls 1987; Malecki & Bradbury 1992) and negotiation power (Hardill et al. 1997; Kiker & Ng 1990) refers to Davis (1976) and Scanzoni & Szinovacz (1980)). Education and career lifts the negotiation power of women close to that of men (Hardill et al. 1997; Kiker & Ng 1990) refers to Davis (1976) and Scanzoni & Szinovacz (1980)). Professional career couples are almost equal with regard to
household decision-making (Malecki & Bradbury 1992), who argue that there is no negotiation power for not performing housework (Meisser et al. 1975; Lewis 1992; Wilson et al. 1990). Rather, men adjust themselves to the changing socio-economic environment. Men help with housework if their wives work (Martin & Roberts 1984; Barnett & Baruch 1987). Due to necessity, the other most egalitarian couples are blue-collar spouses, and blue collar and pink-collar couples (Deutsch 1999). It is unknown whether, or to what extent men help out-of-home child care, particularly in the study of children chauffeuring to school.

3.3 Spatial entrapment

The entrapment thesis says that work trips near homes are made by women in low-paid employment. The theory implies that women live near their workplace. (The closeness of homes and workplaces of women are found in Ericksen 1977; Hanson & Pratt 1995; Johnston-Anumonwo 1992; MacDonald 1999; Madden 1981; Pickup 1984; Rosenbloom & Burns 1995; White 1977). The existence of spatial entrapment is measured by commuting time and distance.

The former section reviewed that household burden was presumed to be one of causes of spatial entrapment. This section furthermore describes other relevant factors. Other causes of entrapment are distribution of jobs, modes of transportation and residential location. Moreover, the workplace location could be construed by residential location decision and an employers’ decision on workplace location. The problem of the entrapment is also caused by sex-based occupation discrimination.
3.3.1 Distribution of jobs

The spatial distribution of employment opportunities and residence explains differences in commuting. Female-dominated employment locations are evenly distributed, so it is not necessary to travel far (MacDonald 1999; Hanson & Pratt 1995). Consequently, women are more likely than men to work in the city, if they already live there, because it is more convenient. Women residing in cities, as a result, have a shorter commuting distance and a shorter travel time than men. This is true for all modes of transport and includes car drivers, passengers in cars, and also passengers on buses (Hanson & Johnston 1985).

3.3.2 Modes of transportation

Commuting time depends on the chosen mode of transport. If workers take subways, they will all have an equal commuting time. In the cities, like New York and Toronto, there is no difference in commuting time between genders (Preston & McLafferty 1993) and none between suburbanites and urbanites. Similarly, one third of commuters using public transport are in New York State (Reschovsky, 2004).

The most popular mode of transport in the US is driving. According to Reschovsky (2004), the study of the Census 2000 revealed that about 80% of White Americans depends upon automobiles for journeys to work. Driving is the only mode which permits women to complete their work, personal responsibilities and household duties, within the limited travel time they have available. Their duties on the road are generated directly by the schedules of both the women themselves, and those of their family members.
Women need automobiles to gain increased earnings, like the part-time female workers did in Hanson & Johnston’s 1985 study; they have a similar distance and travel time to those of full-time employed male workers. Consistently having access to automobiles has encouraged women to engage in long commuting (Pickup 1984; Pazy et al. 1996). Johnston-Anumonwo (1995) adds that driving makes job accessibility more equal between African American and European American women. These 2 groups can have similar commuting times, and highways can make their commuting time comparatively equal. Highways shorten commuting time of urbanite African American women who travel to work in suburbs, to equal to that of suburbanite European American women, who travel to work in suburbs.

Travel reduction programs, such as raising parking prices, increasing taxes on gas, and restricting parking, will not reduce the number of vehicles (Rosenbloom & Burns 1995). Instead, the program will add more stress on women drivers and perhaps increase the likelihood of being involved in a road accident.

3.3.3 Class

Spatial containment applied for women of all races: White, Black and Hispanic, because of gender-based occupation segregation (McLafferty & Preston 1992). The main issues involved are women’s decisions to work close to home and employers’ discrimination against women. Hanson & Pratt (1995) point out the polarized relations of a disproportion number of female workers in low-paying ‘dead-end’ jobs. The extent of these issues varies by place. In their study in Worcester, Massachusetts, sex-based occupational segregation was in Main South, which had an
abundance of male-dominated jobs and a high number of male workers. Sex and class-based occupational segregation was also eminent in other parts of the study area, specifically Upper Burncoat and Westborough. Upper Burncoat has male-dominated jobs, occupied by women of the higher classes, whereas Westborough has the same type of occupations, although rarely hired women. Westborough is the residence of lower class women. Interestingly, the level of class can elevate women to the higher-rated male-dominated jobs, and simultaneously permit them to work in these neighborhoods. The women in these specific circumstances are at an advantage.

Class mutually reflects household affordability and women’s mobility. Fried et al. (1977), in a seminal work of travel behavior research, declared social class as one of major determinants of activity and travel patterns and of the trajectory of adaptations. People of the lower socio-economic sector have a reduced range of adaptation alternatives. People of the higher socio-economic level have more choices and hence are able to tolerate strain induced by the stress of change. This group has high variations of adaptations, because they have less capital constraint. They also have time flexibility because they can buy time. However, time flexibility diminishes when they have an increased number of activities, and more frequent activities. They are furthermore confined by group pressure. Women can also buy time if their households can afford the most convenient mode of transportation – automobiles, which allow greater mobility. Women’s income, it appears, is not the major household income. Income is usually of household, not of individuals. Personal income did not explain conclusively the differences in travel time between men and women (Chapple & Weinberger 1996). Class is indicated by overall household income, not solely women’s income.
Class in Preston & McLafferty (1993) was defined by occupation and income. The study premised that there were differences in household composition and social classes, between suburban and central areas. Preston & McLafferty (1993) compared commuting times and activity travel patterns between genders in Toronto and New York and, although these places differed culturally, they shared the same results. In the central city, gender differences in commuting time were insignificant, given the same income, mode of transportation and occupation. **Having a Professional career (occupation) and higher [household] income is associated with more similarities in gender commuting patterns.**

This finding corresponds with Kooreman & Kapteyn (1987), who found that “if the female wage rate goes up, the female spends less time on household activities, childcare, and obtaining goods and services” (p.243). Moreover, class according to Hanson & Johnston (1985) is inferred by **women’s occupations.** Female professionals do not travel significantly greater distances than other female non-professional workers. However, it is noted that occupation relates more to work-trip length for men, but not for women. **This study therefore decides on identifying class with women’s occupations and household income.**

3.3.4 Women with children

The fastest increase amongst women entering the labor market, are mothers with young children (Popenoe 1993; Rosenbloom 1993b). “In 1960, only 19% of married women, with children under 6 years of age, were either in the labor force or were looking for work. By 1990, that figure had climbed to 59%”. (Popenoe 1993,
Working mothers are the worst cases, constricted by time, as well as the location of schools, work, and homes. In addition, they have to cope with work trips, household duties and child care. They tie activities into one trip, often called ‘multi-purpose trips’ or ‘trip chains’. They have no choice but to drive and because of these responsibilities, they are constrained by time. Although they work and pay taxes, transport systems and policies are not always beneficial because the systems were not specifically designed to meet their requirements. The transport systems were designed for the general public, as a whole. Furthermore, women with children face coupling and capability constraints. Tivers (1988) explained that the coupling constraint limits her mobility and choices to engage in varied activities, while the capability constraint restricts her mobility, convenience and performance, as she is with her children. The nurturing of children discourages mothers from changing to better jobs located further from home. This is especially true for mothers who rely upon public transport (Pazy et al. 1996). Her travel behavior reflects the complexity of the gender roles, which is another constraint placed upon her.

Access to family automobiles is of direct relevance in this study. Women tend to have less access to family cars, which was measured by the number of driving licenses held by women (in Hanson & Hanson 1980). This added another dimension to the issue - mobility constraint. To handle the constraints discussed above, Rosenbloom (1993a; 1993b) showed that working mothers, regardless of marital status, chained their non-work trips. Mothers particularly chained their child escort trips to their work trips. Alternatively, mothers could delegate this task to other family members, such as their spouse. The presence of other adults in the households
reduced participation in serving passengers (Misra & Bhat 2000). The extent to which women’s mobility was constrained, depended on their ethnicity and their class (Tivers 1988).

3.4 Flexible work schedule and Telecommuting

This sub-section is devoted to the category of working from home, which may include flexible work schedules and telecommuting. A flexible work schedule has recently been more common in the US (Staines & Pleck 1983; Florida 2002). The flexible work schedule is concurrent in cities and metropolitan areas, e.g. the San Francisco Bay Area and in the Washington DC. The government offices and employers are concerned with worker’s health and the quality of their work life, as well as their personal lives, including things such as childcare and child-serving trip-making. Transport agencies are aware of the need for clean air and have acted on reducing traffic congestion, resulting in the development of flexible work schedules and a Transport Demand Management (TDM) policy.

Development of the flexible work schedule begins with defining the term. Many agencies define the term by, and for, themselves. The Office of Personnel Management (2006) has two similar terms: flexible hours and a flexible work schedule.

**Flexible hours** (also referred to as "flexible time bands") means the times during the workday, workweek, or pay period within the tour of duty during which an employee covered by a flexible work schedule may choose to vary his or her times of arrival to and departure from the work site consistent with the duties and requirements of the position. (See 5 \textit{U.S.C.} 6122(a)(2).)

**Flexible work schedule (FWS)** means a work schedule established under 5 \textit{U.S.C.} 6122, that --
(1) in the case of a full-time employee, has an 80-hour biweekly basic work requirement that allows an employee to determine his or her own schedule within the limits set by the agency; and

(2) in the case of a part-time employee, has a biweekly basic work requirement of less than 80 hours that allows an employee to determine his or her own schedule within the limits set by the agency.

Similarly, the clean air campaign has the same two terms:

**Flexible Hours:**
Times during the work day, work week or pay period during which an employee covered by a flexible work schedule may choose to vary his or her times of arrival to and departure from the worksite.

**Flexible Work Schedule:**
A full-time employee has an 80-hour biweekly basic work requirement, but may determine his or her own schedule within the limits set by the organization.

According to the Office of Personnel Management (2006), there are a variety of flexible work schedules. For example, in a Compressed Work Week, Workers must fulfill a period of core hours. They can choose and vary their time-in and time-out, which is entitled ‘Flexihour’. The extended office hours are therefore of benefit to offices and their customers. Workers hence have what is known as a Gliding Schedule, which falls within the time slot of the flexible hours provided by the employers. Workers may have a Variable Day Schedule, in which they maintain core hours and must fulfill a 40 hour weekly requirement, which can be completed at anytime, any day of the week. More flexible than the Variable Week Schedule is the Variable Day Schedule with a requirement of 80 hours work time, bi-weekly. The other bi-week schedule, ‘Maxiflex’, requires core hours on fewer than 10 work days and at least 80 hours. This option allows the employee to work a compressed working week.
These flexible working schedules improve the quality of health and also the personal lives of workers. They also help reduce vehicle emissions, thereby improving air quality, saving fuel energy, reducing road usage and the schedule also eases the Transport Demand Management (TDM) policy. For the latest reasons of air emission reduction and transport problems, a combination of the flexible schedule and mode of transportation rings a bell. According to the Office of Personnel Management (2006), the existing packages in Georgia Power/The Southern Company, Atlanta, GA, the Calvert Group, Bethesda, MD, Genencor International, and Palo Alto, CA, Merck, Rahway, NJ, have combined the flexible schedule and mode, but they have failed to take gender into consideration. There could be travel packages that consider gender and mode together, since the flexible work schedule affects the two genders differently.

Adversely, these flexible hours have caused more housework for women, in contrast to men (Staines & Pleck 1983). Likewise, Bohen & Viveros-Long (1981) found that flextime increased inequality in the sharing of domestic work, because women with flextime allocated more time to housework. Having a flexible work schedule increases household burden for women and this is reflected in their travel patterns. Fortunate or not, family roles are independent from whether or not women have flextime, or standard working times. In contrast, Deutsch (1999) reported that flexible work-hours relate to the inclusion of fathers in specific occupations, such as teaching, where men might lessen women’s household burden. Nevertheless, workers with a flexible schedule were satisfied with having more free time in the evening to spend with their children (Winett et al. 1982; Winett & Neale 1980) and doing

Another example of a flexible work schedule is telecommuting. It is defined as using telecommunication technology to work, or to conduct work-related activities at home and to not necessarily use computers. At homes, Mannering and Mokhtarian (1995) found that related characteristics of telecommuters and their households are: they have children, an income, are mobile, have similar work schedules and work status level, and own a computer. Further, family orientation and attitude may affect the decision of telecommuting. In addition, gender does not directly affect telecommuting (Mannering and Mokhtarian 1995), but correlates more with telecommuting preferences, in as much as more women preferred to telecommute than men (Mokhtarian and Salomon 1996). Another factor is the current situation with long commutes attracting the preference and decision on telecommutes. However, commuting distance does not differentiate between choosers and non-choosers, but it does differentiate between those who prefer to, and those who prefer not to (Mokhtarian and Salomon 1996).

Telecommuting certainly reduces the need for commuting, because it yields space-time flexibility and reduces the friction of distance (which is eminent only in e-commerce and distributions & transactions) (Audirac 2002). Sales representatives can be teleworkers at all times, since communications do not have standard working hours. Moreover, they can perform multiple tasks while telecommuting, because sales representatives and customers do not need to have face-to-face contact, and in
this case, telecommuting relaxes both the capability and coupling constraints.

Accessibility to customers and to work is hence increased; although workers in high-tech industries are required to meet customers, due to the nature of their business. Employees can apply both physical and virtual accessibility to approach their customers and the accessibility in the combined function space, also referred to as ‘hybrid space’, increases competitive advantage. Telecommuting, therefore, might be considered complementary, as it does not substitute work.

According to ‘Ridewise’, an affiliate of the Somerset county business partnership (2006), telecommuting has benefits. Telecommuting improves employee productivity, morale, recruitment and retention. It does not suffer with problems stemming from late arrivals, or from absences. Also, it might eliminate unproductive commuting time and the desire to find a job closer to home, as well as the stress caused by long commutes. Office facilities may also be shared by a group of workers who telecommute. There are no reasons for employees not to be doing their jobs, e.g. as a result of car trouble or severe weather. What ‘Ridewise’ does not say though, and nor does any other source, is that offices can refuse to provide fringe benefits to telecommuters.

Telecommuting has an impact on job accessibility, and as a result affects spatial mismatch. However, it is difficult to accurately measure its real impact. It might narrow the disparity of job accessibility and the job search in virtual space provides more opportunity, especially for urban minorities. In retrospect, telecommuting might increase the inequity of opportunities between urban people and their suburban counterparts. According to Shen (1999) (*see graphs on page 350), having telecommuting skills does not necessarily change their transit modes for accessing jobs.
The distribution of Information Technology is uneven (Sohn et al. 2002); and so are the opportunities in hybrid space. The wealthier suburbanites, having cars and computers, are better off than the poorer urbanites, who have to take buses and share public computers. Shen (1999) concluded that changes in accessibility affected by telecommuting skills were not substantial, with the greatest change being only 15%. Telecommuting facilitates transactions and logistics, as well as suburban sprawl and it additionally eases the management of branches. For employees and residents, telecommuting allows for flex workers, who are defined as being self-employed and working part-time and new employment conditions, such as life-long training, holding multiple jobs, and more flexible home-work contracts (Audirac 2002 referred to Castells 1998, 1996a, 1996b, 1989). Workers having these employment conditions and telecommuting facilities could live anywhere, and the commuting distance and time is no longer of concern. In addition, Mannering and Mokhtarian (1995) supported that the commuting distance and time were not statistically significant in explaining the frequency of telecommuting from home. The extent to which telecommuting effects both travel behavior and urban structure is minor, and for this reason - there are not many telecommuters. Mokhtarian (1998) found that only 6.1% of the workforce currently telecommutes and literature agrees that telecommuting has little impact on commuting and hence the reduction of automobile use and car emissions.

According to Mokhtarian (1998), telecommuting is estimated to reduce 75% of commuting vehicle trips. Moreover, a telecommuter reduces 43 vehicle-miles. Vehicle trip means counts of each single vehicle traveling past a trip meter or vehicle counting. The total number of commuting vehicle-miles eliminated due to
telecommuting on a single workday is 561,427. Vehicle-mile means total miles traveled by all vehicles in an area. However, a daily reduction of half a mile per worker is fractional, standing at approximately 2%. The potential for telecommuting to reduce motor vehicle travel is no more than 1 percent of the total household personal vehicle miles traveled (VMT) (Handy and Mokhtarian 1995; Mokhtarian 1998). Mokhtarian (1998) expects that the aggregate travel will be hardly be affected by telecommuting, although it increased considerably. Pratt (1997) added that telecommuting is not a priority and, therefore, has not been implemented by most companies.

3.5 Conclusion

There is an increase of the number of women in labor market, especially women with children (sub-section 3.3.4). This study therefore focuses on households with children aged less than 18. Women’s travel behavior includes short work commutes, trip chaining, and children chauffeuring (section 3.1). The behavior is caused by gender-based occupation segregation and household burden (section 3.2). Household burden is an obvious evidence of the effect of gender role: generally, men are responsible for earnings and women are responsible for household-related duties and child care. To help women to handle household-related duties, driving mode of transportation is required (sub-section 3.3.2). The study limits mode of transportation to private car because automobiles increase women’s mobility. The study attempts to explain gender role based household interactions in school chauffeuring.
First, the study tries to prove high dependency of child mobility on women. Second, class relates to the more-than-one-vehicle affordability and thus implies high mobility of women (sub-section 3.3.3). Class may help explaining why more women drivers chauffeur children than do men. The decision on what gender chauffeurs may depend on the preference on children, regarding age of children (sub-section 3.1.3).

Fourth, household structure (section 2.3, e.g. Kostyniuk & Kitamura 1982, 1983; Jones et al. 1983; Zimmerman 1982; Collin 1983) may influence school chauffeuring travel patterns. Another household-related determinant is the number of earners in the household. Fifth, the study tries to examine the difference of school chauffeuring between single earner and dual earner households.

Sixth, the interaction or household allocation of the school chauffeuring task has two parts: assigning a gender to drive or they both drive separately. Finally, seventh, to take advantage of data available (concerning shift work and work from home) in the Portland travel diary, the study examines the association of having shift work and work from home and children chauffeuring to school.

The division of the number of chauffeurs into driving alone and share driving becomes important when factors in sub-questions above fail to explain the allocation of the chauffeuring duty. For those sharing, the study reveals the interaction by examining the strength of relationship between chauffeuring and work travel time and between the travel times of both adults in a household.
CHAPTER 4

RESEARCH QUESTIONS AND METHODOLOGY

The previous chapters showed a literature review of studies of interaction and the travel patterns of genders, as well as children chauffeuring travel patterns. This chapter presents research questions and methodologies. The first section addresses research questions. The second and third sections describe the study area and give Portland travel data. The fourth section presents methodologies and the variables used for the empirical study. Preparation of the Portland travel diary is in the appendix after Bibliography.

4.1 Background and research questions

The main research question is what the travel behavior of men and women regarding school chauffeuring are. The travel behavior question consists of two questions: who travels and how they travel? Responding to gender geography, a framework of study, I compare men’s and women’s chauffeuring travel behavior wherever possible. The main research question comprises seven sub-questions which are investigated in chapter 5. Next, attempts to explain travel behavior are in chapter
6. The section about who travels tells us what population groups are represented in our case studies. Travel behavior is explained both by gender roles and by household interactions.

To answer who travels, drivers are chosen by occupation, employment status and industry. Occupation was taken into account because Malecki & Bradbury (1992) found that egalitarian couples are in managerial / professional careers. To what degree does gender have a greater effect on school chauffeuring than occupations? If it does, there would be the greater number of women drivers than those of men in all types of occupations. I also expect to see many chauffeurs are in managerial / professional careers who are likely to be able to afford chauffeuring and perhaps drive their children to private schools. The Portland travel diary did not report types of schools so that I cannot study the relevance of chauffeuring trips to public versus private schools. Nonetheless, it is possible that some extreme cases who drive further for school chauffeuring may be involved in driving to a private school.

Regarding employment status, it was expected that men and women in full-time employment drive children to schools. Moreover, homemakers would be expected to be main chauffeurs. In addition, the research on activity travel behavior in space-time settings paid attention to women’s travel and non employment activity. I therefore would like to see the relevance of their employment status and chauffeuring travel decision.

For industry, I anticipated men and women in female-dominated industry would have similar travel behavior since jobs in the industry are evenly distributed and easier to be found in any neighborhood. However, Chapple & Weinberger (1996)
found that women have shorter work commutes than men in all types of industry. They concluded that gender has the greater impact on work commutes than industry types. Therefore, there is a chance that I would similarly find that the effect of gender is stronger than of industry type. Moreover, since occupation segmentation results in women’s short commutes, the segmentation would also affect chauffeuring travel behavior. I investigate whether gender-dominated division would differentiate gender’s travel pattern, in this study, children chauffeuring to school.

It is difficult to detach trip chaining from passenger-serving trips because they often tie together. For example, passenger-serving trips can be chained with other passenger-serving trips; shopping is linked with passenger-serving trips; work trips and passenger-serving trips are chained. The study investigates what activity trips are linked with school chauffeuring trips. Are there differences or similarities between men and women’s travel behavior?

Attempting to explain unique chauffeuring travel behavior of men and women, there are 7 sub-questions, as shown below:

If women drive children to school, rather than men, because of tradition, we may wonder about the extent of the dependency of children being driven to schools by women drivers (1). This reflects traditional / stereotypical households in the Portland metropolitan area. I expect to encounter typical households, with women adopting traditional values of being home makers, whilst men work, though there might be other variations of households showing traditional values.
Women of higher class have greater negotiating power and are more likely to share responsibilities with their spouses. Therefore, I examine the extent to which class has an impact on school driving habits (2). Class is defined in this study by high household income and women occupying managerial / professional positions.

The activity patterns may not solely depend on a driver’s characteristics and conditions. Drivers may take age of children to the consideration. Do adult chauffeurs prefer to drive for children at specific age range? (3). Rosenbloom (1987) and Rosenbloom (1993b) found that both women and men tended to drive more frequently for children less than 6 years old and also for teenagers. I divide children into age groups, similar to Rosenbloom’s work, and examine the association of the gender of the chauffeur to the ages of the children being chauffeured to school.

In the 1980s, various studies were performed on the activity travel patterns of households and household structure, or the family life cycle. These households were typically defined by the number of adults and children they contained, and additionally, in some studies, the ages of children. The next sub-question is whether there are chauffeuring travel behavior of men and women drivers by household structure? (4)

Does the number of earners in a household explain decisions on who drives children to school? (5) I would expect that single earner households may assign women to be in charge of chauffeuring while dual earner households agree upon sharing chauffeuring. Previous studies have found that child-serving travel time by women in dual-earner families was far greater than that of men (Rosenbloom 1987, 1993a), regardless of economic and occupational differences (Rosenbloom 1987). Children hardly affect men's travel patterns, regardless of their marital status, as
measured by person miles and trip rate (Rosenbloom 1995) and by distance
(Johnston-Anumonwo 1992). Husbands’ time use did not differ between one and
found that time use of husbands was stable until retirement. Moreover, husbands’
time use does not differ between one and two-earner households (Kooreman &
Kapteyn 1987).

It is traditional that men are breadwinners and women take care of household
duties and child-care, including chauffeuring children to school. Households may
assign a specific gender responsibility for driving children to schools, or both partners
may share. The assignment is done by the process of household interactions.

Household interactions can be revealed by relationships of travel time between
that of men and women in the same households: X-Y scatter plot of travel times and
correlations as well as regression equation. Moreover, I even hope to see the
significant relationship of work and chauffeuring travel time. For a reason, work
structure daily activities and activity trips so that work travel time is likely to partly
explain other travel time of any activity trips, especially chained trips. How do men
and women in the same households allocate children chauffeuring to schools? (6)

Data from the Portland travel diary provided additional information about shift
work and working from home. Deutsch (1999) found that men often help due to
having shift work. Moreover, a flexible work schedule, i.e. working from home, may
result in the more involvement in children-chauffeuring. Therefore, this study
investigates whether shift work and work from home is associated with the state of
being chauffeurs (7).
Mauch & Taylor (1997) found that gender determined child-serving and grocery shopping trips, more than ethnic, social, demographic or economic factors. This research examines whether there is the greater effect of gender over any other factors, occupation, employment status, industry and other variables. The effect of gender is explained by gender roles in the household. Consequently, I anticipate seeing unique patterns of men and women regarding children chauffeuring trips to school. The study is limited to households with children and whose mode of transport is private cars.

Overall, I may agree with previous studies which found gender is a robust variable to explain travel behavior. I would like to explain further that it is because of gender relations, specifically gender role. Gender role would show the greater proportion of women than of men chauffeuring children to school and therefore a high dependency of child mobility on women.

4.2 Study area

The study area, the 1996 Portland Metropolitan Statistical Area, consisted of 3 counties and 60 cities in Multnomah, Washington, and Clackamas counties in Oregon. I-84 is the main highway connecting downtown to the east, while US26 runs to the west. I-405 is the loop bordering the Portland CBD. I-205 on the east side connects to Portland International Airport. The main physical features influencing travel patterns include rivers. The Columbia River delineates a boundary between the two states. There are only two bridges crossing the Willamette River, which runs in a north-south direction through the study area.
Portland is famous for its land use planning and its multiple transportation services. There are buses, light rail (Metropolitan Area Express – MAX), the Portland streetcar, car sharing (Flexcar), Arial Trams and Amtrak. Moreover, the city supports urban bicycling and provides bicycle-friendly services. Transportation services are planned and provided by Metro (Portland Metropolitan Service District), appointed directly by regional government (Metro 2008). Metro also takes care of open space and parks, plans for land use, garbage disposal and recycling.

The study does not include teen drivers. In Oregon, fully licensed drivers are Oregon residents who are 18 years of age or over and have a valid permit in their possession. Teenage drivers who possess permits, but are 16-17 years old, must be accompanied by another adult driver, but may not be accompanied by another teenage driver seated in the front of their vehicles (Oregon.gov 2008). The rule results in chauffeurs in this study are aged over 20 who are legal to drive alone. The ability to drive alone is consistent with one answer of the Portland travel diary, school drive, which means drive to school alone.

4.3 Portland Travel Diary

The study analyzes the activity-travel diary obtained from the Household Activity and Travel Behavior Survey. The activity-travel diary survey was collected in 1994 and 1995 in Portland. The survey collected activity and travel information from 4,451 households and 10,048 persons throughout the Portland area. Data was collected from every household member, for two consecutive days. Household members answered what they did (activity choice), where (location choice), for how
long (activity duration) and with whom (activity participation). Estimates of travel / activity participation showed that travelers reported 122,348 activities and 67,891 trips. The survey was done by Cambridge Systematics, Inc. for the US Department of Transportation and the US Environmental Protection Agency.

Its purpose was to support the new generation of travel demand modeling, based upon an activity based approach. Objectives of the 1994 household activity and travel surveys were to respond to the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), the Clean Air Act Amendments of 1990, and Oregon’s Administrative Rule for Goal 12 of the State Land Use Laws. These, in part, required a reduction in Vehicle miles travelled (VMT) per capita, as part of a long-range plan. Moreover, it was to capture and to more fully understand the effects of changing demographics and household structures on travel behavior. In addition, the data collection concerned modeling trip chaining, which is closely associated with household structure.

The data collection had 3 objectives, according to Cambridge Systematics, Inc. (1996), at the back of cover page.

1) To increase the ability of existing travel forecasting procedures to respond to emerging issues including: environmental concerns, growth management, and lifestyle along with traditional transportation issues,

2) To redesign the travel forecasting process to reflect changes in behavior, to respond to greater information needs placed on the forecasting process and to take advantage of changes in data collection technology, and

3) To integrate the forecasting techniques into the decision making process, providing better understanding of the effects of transportation improvements and allowing decision makers in state governments, local governments, transit operators, metropolitan planning organizations and environmental agencies the capability of making improved transportation decisions.
According to Cambridge Systematics, Inc. (1996), the Portland travel diary collection is noted as an innovative and comprehensive form of data collection. First, the survey company recruited households from random samples taken from telephone exchanges. There was a two day seminar on data collection to brainstorm and streamline the data collection procedures. There was pilot testing, to minimize any abrupt termination of participation. The data collection procedures included: mailing survey material packets to participating households, reminder calls to participating households on the day before starting to record the travel diary and data retrieval by telephone interview, after two days of data collection.

Previous research partly, or fully, funded by the Institute of Transportation Studies, Center for Activity Systems Analysis, University of California, Irvine, has used data from the Portland travel diary. For example, McNally (1998) generated the Computational Process Model (CPM) to develop a better understanding of activity scheduling processes. The model can be used with GIS, the discrete choice model and microsimulation models. McNally (1997) investigated travel behavior characteristics, such as household activities, land use distribution, regional demographics, and transportation networks. He placed these in a framework which recognized the complex travel patterns resulting from space and time constraints, household interactions and transport accessibility. Recker & Golob (1997) analyzed and predicted the optimal path of household members, the result of the Household Activity Pattern Problem (HAPP). Recker (1997) generated an activity-based spatio-temporal measure of accessibility for transit and automobile modes.
Moreover, the diary was used for accessibility research, such as Kim and Kwan (2003) and to study individual accessibility, such as Weber (2001). Moreover, Buliung and Kanaroglou (2006a) studied the effect of urban de-centralization to daily activity travel patterns. De-centralization reduces activity space. However, the effect on non-work travel activity is unclear. Buliung and Kanaroglou (2006b) visualized household travel trajectories and showed standard deviation ellipses as exploratory analyses of household activity travel patterns in the GIS environment.

To obtain subjects for this study, men and women chauffeuring children to school, I first identify adults in the same households driving children to school. I find households with children (age <18) who have school drives greater than 0. Then, I extract the sample number or household id of these records and use it as a foreign key linking to all relations. Next, I search for people older than age 20 (who are also eligible for driving alone) and answer Q7 = 7 by personal car. The result is a set of records of chauffeurs who drive children to school.

The results found:

134 adult drivers: 48 men and 86 women
194 passengers (children)

45 of the children were aged less than 6 years old
104 of the children were aged between 6 and 12 years old
45 of the children were aged between 13 and 17 years old
Male drivers were the only chauffeurs in 17 households. Men were the sole adults in 5 households.

Women drivers were the only chauffeurs in 58 households. Women were the sole adults in 9 households.

Chauffeuring sharing took place in 36 households.

The total is 111 households.

The number of respondents in the Portland travel diary is 10,048 persons while those in this study are 134 persons. The details of the number of respondents are shown in Table 4.2.

<table>
<thead>
<tr>
<th>The number of responding</th>
<th>Travel diary data set</th>
<th>This study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons</td>
<td>10048</td>
<td>134</td>
</tr>
<tr>
<td>Households</td>
<td>4451</td>
<td>111</td>
</tr>
<tr>
<td>Gender</td>
<td>10048</td>
<td>134</td>
</tr>
<tr>
<td>Work from home</td>
<td>439</td>
<td>26</td>
</tr>
<tr>
<td>Shift work</td>
<td>1520</td>
<td>80</td>
</tr>
<tr>
<td>Employment status</td>
<td>8011</td>
<td>152</td>
</tr>
<tr>
<td>Occupation</td>
<td>5464</td>
<td>109</td>
</tr>
<tr>
<td>Industry</td>
<td>5464</td>
<td>117</td>
</tr>
<tr>
<td>Income</td>
<td>4451</td>
<td>111</td>
</tr>
<tr>
<td>Number of vehicles</td>
<td>4451</td>
<td>111</td>
</tr>
<tr>
<td>Age</td>
<td>10048</td>
<td>129</td>
</tr>
</tbody>
</table>

Table 4.1 The number of responding in the Portland travel diary and in this study
4,451 households, 10,048 records

Age < 18 and SchlDrive > 0

Find passengers

216 records with duplicated households

Find duplicates

216 passengers

Leave incomplete data

194 passengers

Study ‘age of children’

160 Unique households

Driver aged > 20, and
and Q7 = 7 (by private car)

Find drivers

Go to one by one case to find what gender drive or
Which household share driving

111 Households

One-adult households

Men and women,
driving alone and share driving

Figure 4.1 Tree diagram of case selection
It is noted that the number of respondents answering occupations, employment status and industry type are not equal because some respondents answer more than one category. It partly makes sense that some respondents are, for example, part-time employed and have 2 jobs so that they have 2 occupations and industry types. Some have both full-time and part-time jobs and thus have 2 occupations and employment status as well as industry type. Most of them do not fill out the repeated information, such as employment status and industry, every time it was asked. As a result, after searching by category the same persons with blank data are re-counted as it was considered as new information and thus new adding records. Another example is 26 respondents answer both shift work and work from home. Consequently, they have more than one employment status and industry.

<table>
<thead>
<tr>
<th>Dividing chauffeurs into</th>
<th>Men driving alone</th>
<th>Men share driving</th>
<th>Women driving alone</th>
<th>Women share driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of</td>
<td>12 (9%)</td>
<td>36 (27%)</td>
<td>50 (37%)</td>
<td>36 (27%)</td>
</tr>
<tr>
<td>Total</td>
<td>48 (36%)</td>
<td>86 (64%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>134 (100%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.2 The number and percentages of chauffeurs by driving alone and sharing

The allocation of children chauffeuring to school has 2 options: (1) driving alone or (2) share driving. Driving alone indicates separate trip. Share driving means adult drivers take turn to drive children to school. Share driving is separate trip since the case selection for this research chooses households with children answering school drive (driving alone to school) greater than zero. Moreover, they are separate activities since most households have more than one vehicle. Few households have only one vehicle. Share driving is not a joint activity that has resulted from a joint decision on travel together.

69
Sharing chauffeuring children to school dominates in this research (54%, men sharing + women sharing, see Table 4.2). The number of men and women chauffeurs who share driving are similar because they come from the same households. The data in this study are biased toward sharing; however since the proportion is almost equal gender role is still be the case.

4.4 Variables

The data used is from the Portland travel diary, which includes the following files: person, activity one and two, and household. Variables are Gender, Schdrive, Employed or Work status, Occupations, Industry, Shiftwork, Workhome, Income, Vehicles, Age and Gender. The meanings of the variables are described in Table 4.1, shown below.

Table 4.4 compares the responses in the entire Portland travel diary and the smaller number of responses of those who chauffeur children to school. School chauffeurs include a higher percentage of female drivers (64.18% to 52.02%) and therefore fewer male drivers. The occupations of school chauffeurs are more predominantly managerial / professional (65.14% vs 51.15%), with fewer operators / fabricators / laborers (1.83% vs. 6.98%). Relatively more school chauffeurs are employed part-time (16.00 % vs. 9.82%) and somewhat more are retired (21.33% vs. 16.63%). The industry in which respondents are employed are roughly similar, with the exception that more chauffeurs are in Industry 12, professional services (39.13% vs. 25.92%). The percentage of respondents who work from home are very similar, but more women among the school chauffeurs are employed in shift work (60.00% vs. 51.12%).

70
<table>
<thead>
<tr>
<th>Variables</th>
<th>Meaning / Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schdrive</td>
<td>The number of days driving alone to school last 5 days</td>
</tr>
<tr>
<td>Gender</td>
<td>Gender</td>
</tr>
<tr>
<td>Workhome</td>
<td>Categorical yes/no answer. Workers at homes answer 1.</td>
</tr>
<tr>
<td>Shiftwork</td>
<td>Categorical yes/no answer. Shift workers answer 1.</td>
</tr>
<tr>
<td>Employed</td>
<td>Employment or work status: employed full-time (1), employed part-time (2), self-employed full-time (3), self-employed part-time (4), unemployed but looking for work (5), retired (6), full-time homemaker (7), not employed (8), DK/RF (9)</td>
</tr>
<tr>
<td>Shiftwork</td>
<td></td>
</tr>
<tr>
<td>Occupat</td>
<td>Occupations: managerial / professional (1), technical / sales / administrative support (2), service (3), farming / forestry / fishing (4), precision production / craft / repair (5), operators / fabricators / laborers (6), military (7), homemaker (8), DK/RF (9)</td>
</tr>
<tr>
<td>Industry</td>
<td>Industry: construction (1), mining (2), agriculture (4), manufacturing (4), transportation / communication / public relations, personal services (5), wholesale (6), retail trade (7), finance / insurance (8), business and repair service (9), personal services (10), entertainment (11), professional (12), and public administration (13), military (14), DK/RF (15)</td>
</tr>
<tr>
<td>Income</td>
<td>Income ranges: 0-4,999 (1), 5,000-9,999 (2), 10,000-14,999 (3), 15,000-19,999 (4), 20,000-24,999 (5), 25,000-29,999 (6), 30,000-34,999 (7), 35,000-39,999 (8), 40,000-44,999 (9), 45,000-49,999 (10), 50,000-54,999 (11), 55,000-59,999 (12), 60,000 or more (13), and DK/RF (14)</td>
</tr>
<tr>
<td>Vehicles</td>
<td>Number of vehicles owned. They might be either person owned or household owned. This variable is in household table so that it is likely to be household owned.</td>
</tr>
<tr>
<td>Age</td>
<td>Age</td>
</tr>
<tr>
<td>Q29AMPM</td>
<td>Time of activity trip, 1 = AM, 2 = PM</td>
</tr>
<tr>
<td>Q29AHour</td>
<td>Trip duration, hours</td>
</tr>
<tr>
<td>Q29AMin</td>
<td>Trip duration, minutes</td>
</tr>
<tr>
<td>Sample No</td>
<td>Sample Number in Household table, equivalent to household id</td>
</tr>
<tr>
<td>Person No</td>
<td>Person number</td>
</tr>
</tbody>
</table>

Table 4.3 Variables from the Portland travel diary used in the study
<table>
<thead>
<tr>
<th>Responding</th>
<th>Full study</th>
<th>This study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age of driver (&gt;20)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persons</td>
<td>%</td>
<td>Persons</td>
</tr>
<tr>
<td>Gender = 1 (men)</td>
<td>3625</td>
<td>47.98</td>
</tr>
<tr>
<td>Gender = 2 (women)</td>
<td>3931</td>
<td>52.02</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td>5275</td>
<td>109</td>
</tr>
<tr>
<td>1</td>
<td>2698</td>
<td>51.15</td>
</tr>
<tr>
<td>2</td>
<td>973</td>
<td>18.45</td>
</tr>
<tr>
<td>3</td>
<td>953</td>
<td>18.07</td>
</tr>
<tr>
<td>4</td>
<td>49</td>
<td>0.93</td>
</tr>
<tr>
<td>5</td>
<td>209</td>
<td>3.96</td>
</tr>
<tr>
<td>6</td>
<td>368</td>
<td>6.98</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>0.15</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>0.28</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
<td>8011</td>
<td>150</td>
</tr>
<tr>
<td>Employed full-time</td>
<td>4119</td>
<td>51.42</td>
</tr>
<tr>
<td>Employed part-time</td>
<td>787</td>
<td>9.82</td>
</tr>
<tr>
<td>Self-employed full-time</td>
<td>430</td>
<td>5.37</td>
</tr>
<tr>
<td>Self-employed part-time</td>
<td>128</td>
<td>1.60</td>
</tr>
<tr>
<td>Unemployed but looking for work</td>
<td>239</td>
<td>2.98</td>
</tr>
<tr>
<td>Retired</td>
<td>1332</td>
<td>16.63</td>
</tr>
<tr>
<td>Full-time homemaker</td>
<td>476</td>
<td>5.94</td>
</tr>
<tr>
<td>Not employed</td>
<td>278</td>
<td>3.47</td>
</tr>
<tr>
<td>DK/RF</td>
<td>222</td>
<td>2.77</td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td>5464</td>
<td>161</td>
</tr>
<tr>
<td>1</td>
<td>278</td>
<td>5.09</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>0.16</td>
</tr>
<tr>
<td>3</td>
<td>83</td>
<td>1.52</td>
</tr>
<tr>
<td>4</td>
<td>347</td>
<td>6.35</td>
</tr>
<tr>
<td>5</td>
<td>470</td>
<td>8.60</td>
</tr>
<tr>
<td>6</td>
<td>138</td>
<td>2.53</td>
</tr>
<tr>
<td>7</td>
<td>456</td>
<td>8.35</td>
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<tr>
<td>8</td>
<td>263</td>
<td>4.81</td>
</tr>
<tr>
<td>9</td>
<td>342</td>
<td>6.26</td>
</tr>
<tr>
<td>10</td>
<td>479</td>
<td>8.77</td>
</tr>
<tr>
<td>11</td>
<td>505</td>
<td>9.24</td>
</tr>
<tr>
<td>12</td>
<td>1416</td>
<td>25.92</td>
</tr>
<tr>
<td>13</td>
<td>214</td>
<td>3.92</td>
</tr>
<tr>
<td>14</td>
<td>62</td>
<td>1.13</td>
</tr>
<tr>
<td>15</td>
<td>402</td>
<td>7.36</td>
</tr>
<tr>
<td><strong>Work home</strong></td>
<td>439</td>
<td>14</td>
</tr>
<tr>
<td>men</td>
<td>259</td>
<td>59.00</td>
</tr>
<tr>
<td>women</td>
<td>180</td>
<td>41.00</td>
</tr>
<tr>
<td><strong>Shift work</strong></td>
<td>1520</td>
<td>40</td>
</tr>
<tr>
<td>men</td>
<td>743</td>
<td>48.88</td>
</tr>
<tr>
<td>women</td>
<td>777</td>
<td>51.12</td>
</tr>
</tbody>
</table>

Table 4.4 The number and percentages of responding persons

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Table 4.5 compares the responses of the two groups for income and number of vehicles. The respondents who chauffeur children to school have higher incomes: 33.33% are in the highest income category, $60,000 or more, compared with 16.87% for the entire data set. As we would expect, the households with school chauffeurs also own more vehicles. No households report no vehicles, although 7.33% of households in the full study have no vehicle. Fewer school chauffeuring households have one or two vehicles, but more have three vehicles (30.00% vs 12.71%), and a larger percentage have 4 or more vehicles (8.99% vs 4.25%). We can conclude that the households which chauffeur children to school are wealthier, employed in managerial or professional occupations, and have more vehicles available for driving than households in Portland more generally.
4.5 Methodology

The research process starts with finding households chauffeuring children on trips to school. Then, we identify the chauffeurs of those households. There are two keys: household id and personal id. There are four groups of chauffeurs: (1) men who chauffeur alone, (2) women who chauffeur alone, (3) men who share chauffeuring, (4) women who share chauffeuring with men in (3). The two keys of household id and person id differentiate men and women chauffeurs in the same households (meaning (3) and (4)).

I seek the socio-demographic aspects of chauffeurs, including occupation, employment status and industry. The effects of gender role on decisions on children-chauffeuring trips to school are examined. Gender roles partly explain the travel behavior of chauffeuring children to school. The other major factor is shared driving. Scatter plots show the relationship between chauffeuring travel time (Y) and work travel time (X). Furthermore, correlations are done to see the strength of the relationship. Finally, a regression equation is used to explain household interactions regarding school chauffeuring when men’s travel time can explain the changes of women’s travel time or vice versa. The equation: Y = a + bX, where Y is chauffeuring travel time of men drivers, and X is work travel time of women drivers in the same household.

The dependency of children on women for mobility to schools is clearly shown. The preference regarding children in specific age ranges is also examined. Travel patterns of genders as related to household structure, defined by the number of
adults and children in a household, are also investigated. Important factors to consider are the number of earners in a household and the effect of class. Next, the effects of shift work and working from home are examined.

4.6 Conclusion

This study of travel behavior investigates the allocation of responsibility for chauffeuring children to school between men and women in the same households, raising the questions of ‘who’ and ‘how’. In chapter 5, the effects of gender roles on decisions on children chauffeuring to school are examined in terms of occupation, employment status, and industry. Gender roles partly explain behavioral patterns regarding chauffeuring children to school. Chauffeuring is found to be more of a women’s travel behavior, as well as being linked to short work travel time and trip chaining, for women.

Chapter 6 reveals the dependency of children on being chauffeured mainly by female adults in household, rather than by men. The study evaluates the preferences of men and women chauffeurs regarding the travel arrangements for children at specific age ranges. Travel patterns of genders by household structure, defined by the number of adults and children in a household, are also investigated. Important factors to consider are the number of earners in households. Work travel time is also always used in the study of women’s commuting. In this study, work travel time is expected to explain the travel time of chauffeuring children to school. Then, the effect of class is also investigated. Literature on women’s travel patterns includes class as one
factor. This study observes the effect of class on decision making regarding school chauffeuring. Class is defined here by a woman’s occupation and household income. In addition, the effects of shift work and working from home are examined.
CHAPTER 5

TRAVEL BEHAVIOR: WHO TRAVELS AND HOW DO THEY TRAVEL?

The previous chapter looked at research questions and methodologies. This chapter examines the decisions and negotiations made between men and women over chauffeuring children to school. First, I observed the degree to which gender affected the decision regarding chauffeuring children to school. I accomplished this by comparing male and female chauffeurs of various occupations, employment statuses, and industries. Next, I investigated how men and women deal with chauffeuring trips. Consequently, there is a section on trip chaining. Finally, at the end of the chapter, I include a summary of the findings and transition to chapter 6.
5.1 Occupation

The majority, 59% of men (30 of 51) and 71% of women drivers (41 of 58) are in managerial / professional occupations. They tend to drive children to school more frequently than men and women in other occupations. These findings correspond with Malecki and Bradbury (1992), who observed that households which shared this responsibility equally are those of couples in managerial / professional careers. Since, not for all occupations, women drivers are in greater number than do men, gender role has moderate degree of effects on school driving.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of men drivers</td>
<td>30</td>
<td>9</td>
<td>7</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td><strong>51</strong></td>
</tr>
<tr>
<td>The number of women drivers</td>
<td>41</td>
<td>8</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td><strong>58</strong></td>
</tr>
</tbody>
</table>

Table 5.1 Male and female drivers by occupation

Key: Occupation

1 = Managerial/professional

2 = Technical/sales/ administrative support

3 = Service

4 = Farming/forestry/fishing

5 = Precision production/craft/repair

6 = Operators/fabricators/laborers

7 = Military

8 = Homemaker

9 = DK/RF

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The total number of women chauffeurs answering occupation and of women in this study are noticeably not equal. The total number of women chauffeurs is 86. It differs from 58, the number of women drivers who answer occupations. That is, 33% did not provide their occupations. Explanation of this occurrence is shown in the following section, 5.2 Employment status.

It should be noted that though for occupation, 8 = homemaker and also for employment status, in the following section, 8 = full-time homemaker, the two categories are not identical. Female chauffeurs may consider themselves full-time homemakers (employment status) but not homemakers (occupation). They don’t think of homemaking as a job or an occupation, but the category of “full time homemaker” accurately describes the way they spend their time, at the time of this study.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of women chauffeurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sole adult (adult who fills in travel diary)</td>
<td>8</td>
</tr>
<tr>
<td>Married</td>
<td>Data not available. (There is no marital status in the person table.)</td>
</tr>
<tr>
<td>Working (Employed full-time or part-time)</td>
<td>51</td>
</tr>
<tr>
<td>Working from home</td>
<td>8</td>
</tr>
<tr>
<td>Full-time homemaker</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 5.2 The number of women chauffeurs in specified categories
5.2 Employment status

The employment status of drivers differs between men and women. Male chauffeurs are nearly all in full-time employment. There are a greater number of male drivers who are employed full-time than female drivers, employed full-time. Women drivers are either in full-time, part-time employment or are retired. It is right not to limit this study only to full-time employed workers, though, because other groups of women drivers are employed either part-time, or are retired. Retirees driving children to school was not expected. I anticipated homemaker drivers which happen to be a few. One third of women drivers are retirees. This explains ‘blank’ occupations of women drivers answering occupations in section 5.1.

There is a shift of school chauffeuring duty to women retirees in the same households. Although they are retired from work they are not retired from being women and thus are still taking care of children. Women drivers who are retirees take high percentages of sharing driving duty. Gender role continues to take effect on women retirees.

Gender role has impact on women’s school chauffeuring travel behavior, regardless of employment status. The percentages of women, employed full-time and part-time, who drive alone and share driving are similar.

Men who are full-time employed are most likely to be in charge of taking children to school, perhaps, because they have to go to work anyway so that they chain chauffeuring with work trips. This statement is supported in the trip chaining section, where we see a large number of men chauffeuring chain chauffeuring to work trips.
<table>
<thead>
<tr>
<th>Employment status</th>
<th>The number of men chauffeurs</th>
<th>The number of women chauffeurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed full-time</td>
<td>39</td>
<td>29</td>
</tr>
<tr>
<td>Employed part-time</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>Self-employed full-time</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Self-employed part-time</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Unemployed but looking for work</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Unemployed</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Retired</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>Full-time homemaker</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55</strong></td>
<td><strong>97</strong></td>
</tr>
</tbody>
</table>

Table 5.3 Men and women chauffeurs by employment status

When there is only one female adult in a household, it is out of necessity that women take care of children and child chauffeuring to schools, not as a result of gender roles. It is likely that a one-woman-adult household is a single-mother household. These drivers have to chauffeur children to school and, as a result, often have long activity trips. 58 of the households included women who chauffeured alone. Out of these households, just 8 contained one adult female. This group of women could not have been identified if this study researched only women who picked up and dropped off passengers.

In addition, the number of men and women drivers exceeds the total number of chauffeurs shown in chapter 4, 134 adult drivers: 48 men and 86 women, because some respondents answer more than one employment status.
5.3 Industry

The number of workers in the travel diary is used to classify the industry type, i.e. ‘Male-dominated’, ‘Female-dominated’, or ‘Neutral’. Table 5.4 shows the total number of men and women in the workforce and the result of the division. The differences, the number of men minus that of women, point out whether the industry is male-dominated or female-dominated. The greater the difference indicates male-dominated whereas the less the negative value points out female-dominated. The rest is ‘Neutral’ type. In addition, in ‘Professional’ industries, there were more women than men, so this category was identified as including female dominated industries. However, these findings might have been specific to the Portland travel diary itself.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of men</th>
<th>Number of women</th>
<th>Difference</th>
<th>Industry type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>245</td>
<td>33</td>
<td>212</td>
<td>Male-dominated</td>
</tr>
<tr>
<td>Mining</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>Not defined</td>
</tr>
<tr>
<td>Agriculture</td>
<td>59</td>
<td>24</td>
<td>35</td>
<td>Neutral</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>252</td>
<td>95</td>
<td>157</td>
<td>Male-dominated</td>
</tr>
<tr>
<td>Transportation/communication/public relations</td>
<td>331</td>
<td>139</td>
<td>192</td>
<td>Male-dominated</td>
</tr>
<tr>
<td>Wholesale</td>
<td>88</td>
<td>50</td>
<td>38</td>
<td>Neutral</td>
</tr>
<tr>
<td>Retail trade</td>
<td>208</td>
<td>248</td>
<td>-40</td>
<td>Neutral</td>
</tr>
<tr>
<td>Finance/insurance</td>
<td>117</td>
<td>146</td>
<td>-29</td>
<td>Neutral</td>
</tr>
<tr>
<td>Business and repair service</td>
<td>184</td>
<td>158</td>
<td>26</td>
<td>Neutral</td>
</tr>
<tr>
<td>Personal services</td>
<td>197</td>
<td>282</td>
<td>-85</td>
<td>Female-dominated</td>
</tr>
<tr>
<td>Entertainment</td>
<td>258</td>
<td>247</td>
<td>11</td>
<td>Neutral</td>
</tr>
<tr>
<td>Professional</td>
<td>647</td>
<td>769</td>
<td>-122</td>
<td>Female-dominated</td>
</tr>
<tr>
<td>Public administration</td>
<td>80</td>
<td>134</td>
<td>-54</td>
<td>Neutral</td>
</tr>
<tr>
<td>Military</td>
<td>37</td>
<td>25</td>
<td>12</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

Table 5.4 ‘Male-dominated’, ‘Female-dominated’ and ‘Neutral’ industry types
<table>
<thead>
<tr>
<th>Industry</th>
<th>Men chauffeurs</th>
<th>Women chauffeurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male-dominated</td>
<td>22 (26%)</td>
<td>6 (8%)</td>
</tr>
<tr>
<td>Female-dominated</td>
<td>29 (35%)</td>
<td>48 (62%)</td>
</tr>
<tr>
<td>Neutral</td>
<td>33 (39%)</td>
<td>23 (30%)</td>
</tr>
<tr>
<td>Total, by gender</td>
<td>84 (100%)</td>
<td>77 (100%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>161</td>
</tr>
</tbody>
</table>

Table 5.5 The number of chauffeurs by industry types

Note: The number of drivers shown in Table 5.5 is a small sub-set of the total number of workers studied, as not all workers are responsible for school chauffeuring.

There should be some similarities in the activity and travel patterns of men and women in the same industry type. In the case of female-dominated industries it was found that places of work are often conveniently located. It is believed that working closer to home allowed women to take care of chores and children more effectively, a reason why women would seek these positions. This will have a similarly beneficial effect, I argue, for men in female-dominated businesses and these men also tend to have similar travel patterns to women. In contrast, these men should have different travel patterns from men in male-dominated industry.

The statement that women work close in the neighborhood may be true since there is a greater percentage of women chauffeurs in female-dominated industry. However, it is not for men chauffeurs. The number of men drivers is somewhat similar, regardless of industry type. Working in female-dominated industry does not make men tend to be chauffeurs.
Using paired t-test statistic, there is no significant difference between men and women, regarding industry type. Working in male- or female-dominated industry does not significantly bring any differences between the number of men and women drivers.

5.4 Trip chaining

What do workers do to cope with work and children chauffeuring to school? In short, they simply chain school trips to work trips and other trips, wherever possible. Men (the left-hand, blue bar in Figure 5.1) or women (the right-hand, green bar) take care of a few children chauffeuring to school in the mornings, and their counterparts are assigned to serve more school driving trips in the afternoons. Men often have meal trips, right after school driving trips. Women sometimes chain chauffeuring trips with general shopping duties and household maintenance. In the morning, the first activity is often to drop children off, before heading to work.

In the morning, chauffeuring is often chained to driving to work. Besides work in the morning and meals in the afternoon, men and women have different chained activities. Regardless of the time period, household maintenance is handled by women, indicating a following of traditional gender role. Serving passengers in the morning is mostly the responsibility of women, as opposed to men. Similarly chaining with general shopping is performed more by women than by men.
Figure 5.1 Bar charts compare the number of men’s and women’s morning activity travel, chaining children chauffeuring to school.

Figure 5.2 Bar charts compare the number of men and women by activity travel purposes chained to Children chauffeuring to school trips, in the afternoon.
By comparison, in the afternoons after work, there are less time constraints. At this time there is an increase in the frequency of various activities, both at home and out-of-home, such as resting, relaxation, amusement, making visits and performing hobbies. The destinations of rest and relaxation were not identified in the Portland travel diary. The frequency and distribution of most activities in the afternoon are similar between men and women. Additionally, in the afternoon women chain chauffeuring to meals, household maintenance, shopping and general trips. Rarely are children chauffeuring to school single-purpose trips and they are usually made by non full-time workers. Table 5.6 below shows the number of activity trips chained to chauffeuring trips. In general, there are a greater number of women chaining trips to chauffeuring trips, than those of men in most activity journeys. The result is consistent with other findings, one of women’s travel behavior is trip chaining.

5.5 Summary

In this 1994/1995 data set from Portland, drivers who chauffeur children to schools answered questions about their managerial / professional occupations. About half of women chauffeurs did not list any occupations. Regarding employment status, most male chauffeurs were in full-time employment while female chauffeurs were dispersed among full-time, part-time employment, and being retired. That gives the clue that women retirees tend to answer ‘blank’ to occupation. The study found there is no difference in the decision on chauffeuring children between men and women in male-dominated, female-dominated and neutral industries.
<table>
<thead>
<tr>
<th>Types of activity trips</th>
<th>AM or Chain before work</th>
<th>PM or Chain after work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>women</td>
</tr>
<tr>
<td>Rest and relaxation</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Work</td>
<td>22</td>
<td>19</td>
</tr>
<tr>
<td>Meal</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Serving passengers</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>Household or personal business</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Household obligations</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Household maintenance</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Work-related</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Visiting</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Exercise/Athletics</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Hobbies</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Incidental trips</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Shopping, major</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Shopping, general</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Amusement at home</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Amusement out of home</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5.6 The number of activity trips chained to chauffeuring trips by men and women chauffeurs and by in the morning and afternoon
Men and women chauffeurs similarly link chauffeuring with work trips in the morning and to meal trips in the afternoon. There are more variations of chained trip purposes for women than for men. Women’s activities are also dispersed into serving as passenger and household maintenance in the morning, while in the afternoon; the chained activity trips generally include household maintenance and shopping.
CHAPTER 6

EXPLAINING TRAVEL BEHAVIOR

What does the decision of children chauffeuring relate to? At first, I proposed to link it with gender, specifically with female gender roles. If this were the case, there should be a greater number of women chauffeurs than men. This was the case, except for the category of male drivers, employed full-time. Next, this chapter includes the effect of children’s ages on the household decision. Then, the study addresses the influence of household structure on chauffeuring duty and investigates trip patterns of single earner versus dual earner households. Furthermore, I examine the effects of class on school driving habits. Finally, I try to answer whether having shift work and work from home is associated with the state of being a chauffeur of children to school.
6.1 The dependency of child mobility on women

There are more number of women chauffeurs than men by occupation and employment status (Table 6.1). However, there is no significant difference between the number of men and women chauffeurs overall, using the paired t-test. The dependency of children mobility on women is not endorsed statistically. It is because case studies in this research are overwhelmed by chauffeurs who share driving, as shown in chapter 4 (Table 4.3). Moreover, one third of women drivers are retiree and therefore do not answer occupation and industry.

<table>
<thead>
<tr>
<th>MOccup</th>
<th>WOccup</th>
<th>MEmploy</th>
<th>WEmploy</th>
<th>MIndustry</th>
<th>WIndustry</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>41</td>
<td>39</td>
<td>29</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>2</td>
<td>22</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>32</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>.</td>
<td>.</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>22</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>51</td>
<td>58</td>
<td>55</td>
<td>97</td>
<td>84</td>
<td>77</td>
</tr>
</tbody>
</table>

Table 6.1 The number of men and women chauffeurs
6.2 Upper-middle class

The nature of the interactions over chauffeuring children to school may partly be explained by class. Class is defined here by women’s occupations and household income. Further, class is associated with sharing the responsibility of driving between men and women in the same households. In addition, if only one vehicle is owned per household, then this necessitates car sharing and chauffeuring (n=1).

The majority of cases in this study share chauffeuring duties (Table 4.3) and are households that are upper-middle class. In this study, upper-middle class households are defined as households with professional or managerial-career women (occupation = 1) and high household incomes, not less than 6, $25,000-$29,999. The number of upper-middle class households totals 37 while the number of lower middle class is three. The number of households by class is not greater than the number of households in which women answer occupation as managerial / professional career. Consequently, the results of the study represent households of that group and hence results may not be applied to any other groups of households.

16 households out of 37 share chauffeuring (43%). Of the rest, 21 households (57%) have women chauffeurs. There is not a case of men chauffeuring alone. Class partly explains sharing chauffeuring children to school, while gender roles will explain the trend for women to be chauffeurs.
6.3 Age of children

I have divided children into 3 groups, similar to the studies performed by Rosenbloom (1987; 1993b). These are: under 6, 6-12 and 13-17 years old. Women and men drive children aged 6 to 12 more frequently than children of other ages (Table 6.2). In fact, twice the number of trips is made for this age group. A major difference between this research and Rosenbloom’s work is the consideration of destination. Rosenbloom did not specify the destination of passenger-serving trips. The destinations in this study are schools.

<table>
<thead>
<tr>
<th>The number of children</th>
<th>Less than 6</th>
<th>6-12</th>
<th>13-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men drive</td>
<td>12</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>Women drive</td>
<td>26</td>
<td>55</td>
<td>22</td>
</tr>
<tr>
<td>Data not available</td>
<td>7</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Total, by age of children</td>
<td>45</td>
<td>104</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>194</td>
</tr>
</tbody>
</table>

Table 6.2 The number of men and women drivers, by age of children: less than 6, 6-12 and 13-17
From the graph (Figure 6.1), there are more women chauffeurs than men for all ranges of age of children. However, there is no significant difference between the genders of chauffeurs, by age of children. They chauffeur children to school similarly regardless of age of children. Moreover, there is no significant difference in age of children corresponding to the number of chauffeurs. There is no preference for driving any specific range of children, for chauffeurs.
6.4 Household structure

The number and age of children and the number of adults in a household are used to define household structure and a family’s life cycle. Household types are:

(1) Two adult households with 1 child
(2) Two adult households with 2 children
(3) Two adult households with 3 children
(4) Two adult households with more than 3 children
(5) More-than-two-adult households with children.

To display complementary interactions toward child chauffeuring duties between men and women in the same household, the study focused on the travel patterns of two-adult households and households with more than two adults.
Table 6.3 The number of men and women chauffeurs by household type

<table>
<thead>
<tr>
<th>Types of households /chauffeuring</th>
<th>2 adult households with 1 child</th>
<th>2 adult households with 2 children</th>
<th>2 adult households with 3 children</th>
<th>2 adult households with more than 3 children</th>
<th>Households with more than 2 adults with children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men chauffeuring alone</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Women chauffeuring alone</td>
<td>9</td>
<td>20</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Sharing</td>
<td>6</td>
<td>16</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Regardless of the age of children, men and women mostly take turns to chauffeur children. There are a greater number of solo female chauffeurs than solo male chauffeurs, regardless of the household type. Women chauffeured alone for children of all age groups. Men chauffeured alone for older children aged (6-12) and for teenagers aged (13-17) and for household of 2 adults with 2 children. In 2 adult households with three children under 13 years old, men chauffeured alone (n=2) and with three children aged under 6, the chauffeuring was shared (n=2).

Next, I investigated the relationship between work and chauffeuring travel time, by family life cycle. The travel time of couples in the same household is plotted and Pearson’s r and slopes of regression are calculated (Table 6.4 and Figure 6.2). These statistical measures explain the chauffeuring travel behavior of genders chaining work trips.
\[ Y = 2.012 + .643 \, X \]

Where \( Y \) = chauffeuring travel time of men drivers in 2 adult household with 1 child

\( X \) = work travel time of women drivers in the same household

<table>
<thead>
<tr>
<th>Type of household</th>
<th>X - Y</th>
<th>R</th>
<th>( R^2 )</th>
<th>Sig. F</th>
<th>Slope</th>
<th>Sig. t</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 adult household</td>
<td>WWkTt - MChfTt</td>
<td>.769</td>
<td>.592</td>
<td>.000</td>
<td>.643</td>
<td>.000</td>
</tr>
<tr>
<td>with 1 child</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 adult household</td>
<td>MWkTt - WWkTt</td>
<td>.335</td>
<td>.113</td>
<td>.037</td>
<td>.347</td>
<td>.037</td>
</tr>
<tr>
<td>with 2 children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6.4 Statistical relationships and values by household types

Figure 6.2 X-Y scatter plot of women’s work travel time (WWkTt) and men’s chauffeuring travel time (MChfTt), in 2-adult households with 1 child
In 2-adult households with 1 child, the chauffeuring travel times of men (MChfTt) can be explained by the work travel time of women (WWkTt) in the same household, more or less 60%. This is because the greater work travel time women have, the greater chauffeuring travel time men have. If women drove to work, men in the same household tended to chauffeur children.

There is no graph of relationship of work travel time because the study is limited to explaining of chauffeuring travel time. Nonetheless, findings about work travel time are mentioned because work commutes structure daily activity trips.

It should be noted that there are respondents who record zero work and chauffeuring travel time, perhaps because they work from home. I keep these respondents because I would like to study interactions of men and women in the same households in which one’s adult’s decision on activity trips affects the other’s decision on activity trips. Moreover, though some women have no work trips, men in the same household who work full-time chauffeur children. It is counter to how I have thus far defined gender roles and it is worth to keep these couples in the dataset to show all possible outcomes.
6.5 Dual earners vs. single earners

This study found that not only household structures have an effect on children chauffeuring to school, but also the number of earners in a household. The following discussion investigates the complementary relationship or interaction between men and women in the same household over child chauffeuring duties. What gender is the breadwinner? What gender tends to be the children’s chauffeur? In cases where men chauffeured alone, women in the same household drove further to work than their male counterparts (n=3), 3%, or men did not have any work trips (n=2), 2%, and thus were responsible for child escorting.

There are some men who have both work trips and child escort trips, while women in the same household have none of these trips (n=4), 4.6%. They are in single earner households. In contrast, there are women who have both trips, while men in the same households have no trips (n=2), 2%. Two households had couples without work trips. One was a woman chauffeuring children (n=1), while, in the other, a man chauffeured children (n=1), 1%.

Some men are breadwinners and women in the same household do not have to make work trips. These women are, therefore, fully responsible for children chauffeuring to school (n=25), 29%. These households have women chauffeuring alone. These are examples of traditional gender roles and, moreover, they can be seen in all types of household.
In contrast, in single earner households which have a women breadwinner, there were men who chauffeured alone (n=2), 2%. Men sharing chauffeuring were measured at (n=1), 1%, and women chauffeuring alone (n=2), 2%. This occurrence is counter to gender roles. Men adjust themselves to take care of out-of-home household burdens, in this case chauffeuring children to school. Female breadwinners are still responsible for child-related duties, which is similar to male breadwinners who have out-of-home trips and thus chauffeur children to school. It is suggested that further research be conducted and primary data collected regarding this group, in order to compare male breadwinners and single earner households.

Both men and women workers in the same household shared children chauffeuring duties at a rate of (n=24), 26%. They were in dual earner households. In single earner households, male workers shared chauffeuring, while women in the same household also had chauffeuring trips (n=9), 10%. This trend, however, can be seen in all types of households. No couples had work trips and they shared children chauffeuring to school at a rate of (n=2), 2%. None of couples had work trips and child chauffeuring trips were assigned to a woman at a rate of (n=1), 1%.

In dual earner households, both genders had work trips, but only the women were in charge of children chauffeuring to school (n=8), 9%. In contrast, a woman did not have chauffeuring trips, while their male counterparts did (n=1), 1%. The total number of households analyzed was 87.

To conclude, the majority of those surveyed were dual earner couples, sharing the duty of chauffeuring children to school. Also significant were single earner men who allocated children chauffeuring to school to women. Gender roles persisted here and there were also men sharing chauffeuring.
There is no significant relationship between the chauffeuring times of both genders in the same household. However, in single earner households, men’s work travel times could explain the 15% changes in women’s work travel times. The work travel times of women had a significant and negative relationship on the work travel times of men. The significance level was measured at .05. If men traveled far to work, women in the same households were likely to have shorter work trips.

### 6.6 Household interactions

Household interactions mean allocation of tasks among family members. This study limits family members to drivers and task is chauffeuring children to school. Allocation of chauffeuring can be two genders share driving or an arrangement for a gender fully responsible for chauffeuring.
6.6.1 Share driving

Sharing chauffeuring between men and women can be explained statistically. This section presents an association between driving and the travel characteristics of genders (number of chauffeuring trips, travel time of children chauffeuring to school, number of work trips and work travel time). There are 2 groups:

(1) men in shared-driving group
(2) women in shared-driving group

In addition, a few households show sharing between women in the same households. They fall into women in shared-driving group.

To help remember the meaning of made variables, the following abbreviations are as used:

No : Number
Trip : Trip
M : Men
W : Women
Wk : Work
Chf : Chauffeuring
Tt : travel time
i : sharing (to differentiate sharing from driving alone)
Table 6.6 Made variables used in the analysis

Correlations of travel time of genders are not significant, except for a negative correlation ($r = -.436$, sig. t-tailed = .018) of chauffeuring and work travel time of men who share driving (Table 6.5). For men who share driving, the greater work travel time the less chauffeuring travel time. They may allocate the duty to women in the same households. The work travel time of men who shared driving helps to explain variations up to 20% in chauffeuring travel times ($R^2 = .19$, Figure 6.3).
Figure 6.3 Linear relationship of men’s chauffeuring and work travel time

Figure 6.3 shows a regression line and equation where $Y$ is men’s chauffeuring travel time while $X$ is men’s work travel time. Men in this graph share driving ($n=36$). Their chauffeuring travel time can be explained by their work travel time. The relationship between these two travel times is negative. That means the greater work travel time the less chauffeuring travel time.

Some men workers help with chauffeuring, although women are mainly responsible for school driving trips. It is not surprising therefore to find that the number of school trips made by women is greater than that of men in the same household ($n=6$). Women have more passenger trips than do men. Moreover, the number of daily activity trips of most men is less than that of the majority of women.
In this study of children chauffeuring to school, women tend to work closer to home and are mainly responsible for household duties, while men work further from homes and chauffeur children to school (n=8). There are households where women have more work trips than men (n=6). It is noted that women who are full time homemakers also share chauffeuring duties with working men (n=10).

Women, who share chauffeuring and do not have work trips, take up to 40 minutes to drive their children to school. The most frequent time range is from 5 to 25 minutes. Both men and women workers keep chauffeuring times short, certainly no greater than 20 minutes. They also bear work travel times of between 10 and 40 minutes. Women, similar to men, have a longer work travel time and keep chauffeuring travel time short. It makes sense that those who do not have work trips bear greater chauffeuring travel times, of anywhere up to 55 minutes. This phenomenon is not limited to a specific gender.

6.6.2 Driving alone

Men driving alone have a greater work travel time and less chauffeuring time, when compared to men who share chauffeuring. There is no relationship of work and chauffeuring travel time of men driving alone but there is a significant relationship between these variables for men sharing driving. There are a few extreme cases: a man driving alone has a 35 minute work travel time and about 5 minutes chauffeuring travel time. Also a man sharing chauffeuring duties, chauffeurs for 40 minutes and has a short work trip, of just 10 minutes.
Paired t-tests indicate that there was a difference in the chauffeuring travel times, between men driving alone and men who shared driving (Sig. 2 tailed .078 at the level of .10). This divides men into two groups. Women, however, could be consolidated into one main group. For a reason, there were no significant differences in chauffeuring travel times, between women driving alone and those who shared driving (Sig. 2 tailed .882). This may indicate that gender role has a greater impact on women and their travel behavior on children chauffeuring to school.

There are more women driving alone, who have no work trips to complete. A few of these women have greater chauffeuring travel times, of between 40 and 55 minutes. Most women in these two groups chauffeured children for between 1 to 20 minutes. Work trip travel times varied for both groups, and ranged from 0 to 45 minutes.

In a similar manner, men and women who are fully responsible for chauffeuring children keep school driving travel time short, not more than 20 minutes (see Figure 6.4 and 6.5). They choose to stay in the neighborhood, perhaps, because they want their children go to good schools around and thus they keep chauffeuring travel time short. Men and women, driving alone similarly bear longer work travel time (10 to 30 minutes) while chauffeuring travel time does not exceed 20 minutes. If genders chauffeur alone, their chauffeuring and work travel time are comparatively similar.

Women have a few extreme cases of short work commutes and lengthy work commutes while for men, extreme cases bear long chauffeuring and keep work commute short. Extreme cases have travel time greater than 20 minutes and even
reach 55 minutes. These extreme cases are recommended in further study for an in-depth interview. Their school destinations may be private school or school for specialty group such as hearing impaired.

Figure 6.4 The distribution of men’s chauffeuring and work travel time of those driving alone

In Figure 6.4, men’s work travel time tell little about men’s chauffeuring travel time as shown by low $r^2$, .139 and moreover correlation coefficient is not significant (sig. 2-tailed = .259) at .05. There is weak relationship between men’s travel times of those who drive alone. The greater work travel time the less chauffeuring travel time.
Similarly, there is weak relationship between women’s chauffeuring travel time and women’s work travel time of those who drive alone (Figure 6.5). Most of them keep school chauffeuring short. Except is those who have zero work travel time (Figure 6.5). They are retiree or they work from home. They are therefore full responsible for school chauffeuring and a few of them are extreme cases to drive longest for children to school.

Noticeably, the direction of relationship differs. Men’s are negative whereas women’s are positive. For men, the greater work travel time the less chauffeuring travel time. For women, it is opposite. Women have to handle with both work and chauffeuring duty. Gender role prevails.
6.7 The effects of shift work and work from home on chauffeuring

The number of workers from home is 14 and that of shift workers are 40 (Table 6.7). I further divide workers into driving alone and share driving (Table 6.8). Men shift workers share driving (94%). The result of study supports Deutsch (1999) which conducted primary data collection and stated that men helped because of having shift work. Work from home equates men and women to be chauffeurs since the number of chauffeurs are similar.

<table>
<thead>
<tr>
<th>Shift workers</th>
<th>men</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>women</td>
<td>24</td>
</tr>
<tr>
<td>Workers from home</td>
<td>men</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>women</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 6.7 The number of chauffeurs who are shift workers and those who work from home by gender

<table>
<thead>
<tr>
<th>The number of chauffeurs</th>
<th>shift work</th>
<th>work home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving alone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>men</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>women</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Share driving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>men</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>women</td>
<td>10</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 6.8 The number of chauffeurs who are shift workers and those who work from home by gender and by driving alone and share driving

In contrast, shift work is associated with women driving and sharing. Moreover, there are the greater number of women shift workers who drive alone than do those share driving. For women shift workers, gender role has the greater impact than having shift work. More women drive anyway, giving the same condition of having shift work and work from home.
Chapter 6 attempts to explain travel behavior, asking the question, what are the stakes of the decision about chauffeuring children? The dependency of children’s mobility on women was investigated first. The effects of class on school driving habits of women and men were also observed. Children’s age does not affect the decision about driving. There is an influence of household structure on patterns of chauffeuring children to school. The number of earners in a household also explains decisions on who drives children to school. Shift work men chauffeurs tend to share chauffeuring. The effect of work from home equates the tendency of both genders to be chauffeurs. Household interactions and gender roles predominantly explain the children-chauffeuring travel behavior of genders.

The study provides empirical evidence of the travel behavior of men’s and women’s children chauffeuring to school, using data from the 1996 Portland travel diary. Women with children and their male counterparts cope with children chauffeuring to school by chaining trips to other trips, mostly work and meal trips. Women delegate children chauffeuring to school to men in the same households, since they both have to work. Managerial and professional careers are most associated with children chauffeuring to school. Male-dominated and female-dominated industries come about as a result of occupation segregation, which is a cause of spatial mismatch and containment but this does not significantly differentiates the number of chauffeurs. Most men and women keep children chauffeuring to school short and have longer work trips. Upper-middle class,
women’s professional / managerial career and high household income, account for chauffeur respondents. Studies of travel behavior should not be limited to those of women with children, but should also include men with children, because chained trips before work are children chauffeuring to school for both men and women.
CHAPTER 7

CONCLUSION

This empirical research of school chauffeuring applies to the US context. Travel behavior of chauffeuring children to school is two-fold. First: who drives? And second: how they drive? Most male chauffeurs are full-time employed. Most female chauffeurs are full or part-time employees, or are retirees. The majority of chauffeurs, who filled in occupation, are in managerial / professional careers. It is noted that almost half of women drivers do not answer questions about occupations because they do not currently earn, e.g. the retirees. Moreover, the chauffeurs disperse across both male and female dominated industries and also in neutral industries. Participation in male- and female dominated industries does not significantly differentiate the number of chauffeurs.

Genders handle children chauffeuring to school and time constraints before work similarly, by chaining these trips to work trips. The finding is similar to McGuckin et al. (2005). Moreover, women also chain these trips to other errands that involve serving passengers and household maintenance. Comparatively, in the
afternoon, women and men chain chauffeuring to meal trips. Women have diversified activity trip chains. Women often chain chauffeuring trips to household maintenance and general shopping.

There is a moderate degree of gender role influence. Gender should be taken into account for transport modeling. For a reason, the number of sole women drivers is much greater than that of sole men chauffeurs. However, the tendency of women driving is not statistically supported, similar to McLafferty & Preston (1991), when controlling for occupation and industry. It may be because about a half of case studies in this research are adult drivers, who share driving. A similar number of chauffeurs resulting from gender roles and sharing indicates the same extent of the effects of gender roles (women chauffeur children, regardless of having work trips) and chauffeuring sharing.

There is no preference for men and women chauffeurs regarding children’s age. Regardless of children’s age, women are the main chauffeurs. Both men and women mostly chauffeur children, aged between 6 and 12. However, the number of chauffeurs by children’s age is not significantly different. There is no tendency or preference on any specific age range that adults will drive to school for children.

Regardless of household type, there are far more women chauffeuring alone compared to men. In two-adult households with 1 child, the chauffeuring travel times time of men (MChfTt) highly relates to the work travel time of women (WWkTt) in the same household, by approximately 60%. This shows household interactions in which one member’s decision affects the other’s decision on activity trips.
Men chauffeuring alone tend to be in single earner households while women in the same household do not have work trips. Men chauffeuring alone are in households in which women have greater work travel time, ones where or men do not have work trips.

The number of earners in households provides a logical sense of who are chauffeurs. Men chauffeuring alone are in single earner households. Dual earner households have shared driving. In addition, class, the occupation of women in managerial or professional positions, and high household incomes induce school driving sharing. Moreover, shift work facilitates men to help sharing school chauffeuring. Work from home equates genders to have school chauffeuring.

Concepts of gender relations fit intra-household interaction studies, especially family interactions on child chauffeuring trips. This study sheds light onto transport research and gender relations. The study differs from other intra-household interaction research by not relying on household members, but on genders in households instead. Sharing out-of-home child-care is found and thus there is a shared division of labor in such households.

School trips are the fourth most popular trips, after household-related, work and shopping trips. Similar to work commutes, school activity travel is fixed in space and fixed in time. Driving mode allows men and women to similarly chain work and meal trips to chauffeuring children to school. Class should continue to be put into studies of activity travel patterns and gender relations. There should still be gender-related research in transportation, because gender roles can partly explain similarities and differences between male and female activity travel patterns.
This study’s results may be applied for demand forecasting models. The findings add knowledge to the pool of gender geography and time geography, the framework of this dissertation. The study sheds light on travel patterns of children being chauffeured to school, a pattern which often involved chained work trips for both men and women in the same households, and which tends to rely on automobiles.

**Suggestions for future research**

Several suggestions can be made for further study. First, the study of role change and trip chaining change could compare travel behavior of genders in three periods of time, e.g. using (1) the early 1960s (2) 1985 (3) 1994 & 1995 data collection in the Portland metropolitan area. Second, research should include school commuting patterns use alternative modes, e.g. biking, walking in the suburb vs. inner city. Third, research is needed on school chauffeuring travel behavior in suburbs vs. those in central city. This research could use methods such as GIS, S-T path, and prism. Fourth, studies of extreme cases would be helpful (although this would need primary data collection), e.g. the greatest chauffeuring travel time, and household interactions of those extreme cases, and try to answer why do they have such patterns? Fifth, there should be studies of chauffeuring variations by ethnic groups and area or region. Sixth, automobile dependency should be studied in other metropolitan areas. Finally, seventh, the study of travel behavior of men with children is also interesting because in the morning there are many men who drive children to school and chain school trips with work trips. They, similar to women, are constrained by time.
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In Microsoft Access, the key attributes are Sample no and person no in the Person table. There is no key in activity one table which contains the activity and travel information, because that allows repetition of activity and travel. Sample no is a foreign key which links all tables.

In MS Access, in the design view, right click at the graphic pane. This opens the query properties box. Change ‘unique record’ to ‘yes’. This step shows unique records of non-repeated individual, identified by household number and person number; otherwise the results are millions of trips, which a computer and SPSS cannot handle. Alternatively, click sql view and add ‘distinctrow’ after the word ‘select’, for example SELECT DISTINCTROW per.SCHDRIVE, per.OCCUPAT, per.SAMPNO, per.PERSNO, per.GENDER. Then, copy all records and paste them in MS Excel. Choose the first row and click Data, Filter and Autofilter. Click on the drop down list to create subtables of selected values, such as choosing the schdrive value 5. Counts number of records having schdrive value 5. Having the same result of table of counts, we might use crosstab in SPSS under Analyze and Descriptive statistics. Search and selection by for instance: gender, occupation and Sample No is done in MS Access, Design view.
Households with children going to school are identified by driving mode. Sample No, Person No, Age, Gender and Schdrive are needed. The age of children is less than 18 years old. They go to school by driving mode; therefore, Schdrive is greater than 0. It is assumed that household members drive them to school. Sample no is used as a key to link to drivers. The age of driver is greater than 20. School chauffeurs are adults (age >20) who answer Q1 = 22, pick up / drop off and Q7 = 7, personal car.

Q29AHOUR and Q29AMIN thus equals to children chauffeuring to school travel time. In a similar manner, Q1=12 indicates work, thus the work travel time can be found through Q29AMIN.