



Household Structure
and Mobility Patterns of
Women in O-D Surveys:
Methods and Results
Based on the Case
Studies of Montreal
and Paris

Anne Bernard
Anne-Marie Seguin
Yves Bussiere

INRS, University of Quebec

Annarita Polacchini

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ABSTRACT

The importance of household structure on mobility patterns in urban areas has been revealed by many studies. However, data for this type of analysis are not always available even though the need for taking into account family structure may be extremely important in the explanation of differences in travel behavior, namely in the comparative analysis of different socioeconomic or cultural contexts. Furthermore, the interest of studying the mobility patterns in relationship to household structure may give important insights into structural patterns of mobility behavior useful for forecasting. It would also give useful results for gender analysis.

Telephone travel surveys are widely used because they are cheaper and often easier to realize but, due to the short duration of the interview, they usually do not contain direct information on family structure more easily obtained from longer at-home interviews. This paper is an attempt to validate and generalize a methodology presented elsewhere (Séguin and Bussière, forthcoming, 1996) for the Montreal region which reconstructed the variable of household structure from the telephone Origin-Destination (O-D) Travel Survey of 1987 which did not include questions on family ties between individuals living in the same household. We are presenting here the validation of the typology of household structure which was done on the basis of the Enquête Générale de Transport (EGT) 1991-92 survey of Paris and the 1993 O-D survey of Montreal and we present a few comparative results. Being confronted with the lack of the variable of the activity of the population in the survey of Montreal, we defined a working person as a person making at least one worktrip (or for business affairs) the day of the survey. We analyzed the differences in the relative distribution of family forms and the travel behaviors of individuals by sex, type of household, activity (working or not) with the help of a few global parameters (total mobility, mobility by mode).

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INTRODUCTION

The importance of household structure on mobility patterns in urban areas has been revealed by many studies. However, data for this type of analysis are not always available even though the need for taking into account family structure may be extremely important for the explanation of differences in travel behavior, namely in comparative analysis of different socioeconomic or cultural contexts. Furthermore, it may be an important explanatory factor in forecasting future demand.

Telephone travel surveys are widely used because they are cheaper and often easier to realize but, due to the short duration of the interview, they usually do not contain direct information on family structure, more easily obtained from longer at-home interviews. This paper is an attempt to validate and generalize a methodology presented elsewhere¹ for the Montreal Metropolitan Area (MMA), which reconstructed the variable of household structure from the telephone Origin-Destination (O-D) Travel Survey of 1987; the survey did not include questions on family ties between individuals living in the same household. This methodology seemed to give interesting and valuable a priori results but we felt the need of a more rigorous validation of the methodology. To do so, we needed to apply a similar methodology to a case study where transportation data including family forms were available. This appeared possible with the Paris region where such data exist. On the basis of the EGT of 1991-1992 (Enquête globale de transport) in the metropolitan region of Paris (Île-de-France) we will use the same methodology as the one applied in Montreal on the basis of a typology of eight types of households (and a residual category) and then compare the results with those obtained from the observed family ties of the EGT. For the comparison of work trips, we identified a working person as a person making at least one worktrip (or for business affairs) the day of the survey, this being used as a proxy. With the Paris data, we were able to compare the value of this proxy with the data on active population. The comparison will permit the validation of the methodologies which, we think, will open a wide field of comparative analysis of mobility by sex, activity and household structure in different geographical and cultural contexts.

We will first present some of the findings about women's travel patterns and household structure as seen in the literature, clearly showing the importance of family forms and gender in travel behavior. Secondly, we will describe the data we used for our study and the methodology. Thirdly, we will present the validation and a few comparative results between Paris and Montreal, the latter results being based on the O-D survey of 1993. We will highlight differences in the relative distribution of family forms and their respective travel behavior with the help of a few global parameters.

DATA

BACKGROUND: SOME FINDINGS ABOUT MOBILITY, WOMEN'S TRAVEL PATTERNS AND HOUSEHOLD STRUCTURE

Historically, the evolution of transportation modes had an important impact on societies in general and on the family in particular. Berger² examining the *impact of the car* on the American family during the first decades of the century, noted that

“...the car, more than any other transportation device before it, allowed individual members of the nuclear family, to have lives of their own, of which the particulars, and sometimes the entire experience, could remain private. No longer need the individual members of a family be dependent on each other for most of their recreational activities.”

The importance of the car in the constitution of the dynamics of families and their daily life was often underlined in studies. Rosenbloom³ examining America’s increasing reliance on the private car, looked at the various responsibilities which influence the travel patterns of working parents, in particular those of women, and at the way the needs of children are embedded in those patterns:

“two-worker and single-parent households, struggling to balance their daily activities and faced by continually decentralizing job opportunities, a dispersing urban infrastructure, and the lack of safe and responsive transportation options for children, have little choice—the car is the only practical option”.

Many studies revealed the *differences in travel patterns between men and women*. The results of these studies confirmed the existence of a division of tasks in the household on the basis of gender, with the men mainly responsible for going to work outside the home and the women for domestic tasks. Wachs⁴ distinguished four main differences by sex in mobility patterns: women make shorter work trips, greater use of public transit, more trips for the purpose of accompanying and serving another person’s travel needs, and drive fewer miles per year than men. He attributed these differences to the evolution of separate spheres that determine the social responsibilities of men and women.^{See also 5, 6; 7; 8; 9.}

As the *participation of women in the labor force* grew rapidly, many authors refined the analysis of mobility by sex by taking into account this dimension, and the presence of children in the household¹⁰. Hanson and Hanson¹¹ found that Swedish working women had a significantly different travel behavior compared to their spouses; these women were making more shopping and domestic trips, fewer social and leisure trips, and were using public transportation more often. Women with the most demanding home roles and household responsibilities (defined according to the marital status and the presence of young children) were found to spend the least amount of time travelling to work¹². The results of the investigation of Johnston-Anumonwo¹³ contributed to the general interpretation that household responsibilities lead women to have weak labor-force attachment and a preference for convenient work trips. Fagnani¹⁴, examining the impact of the presence of children on the worktrip length of female workers, found that the greater the number of children, the closer to home women worked^{see also 15}. The data and analysis presented by Rosenbloom¹⁶ showed that American women have significantly different travel patterns than comparably situated men because of their acceptance of responsibilities for the travel needs of their children. These responsibilities appear to be lighter as children grow older^{see also 8}. The author concluded:

“if women continue to bear a disproportionate share of the direct or emergency responsibility for their children, travel differences between the sexes will not disappear, regardless of other economic and occupational changes.”

Pickup¹⁷ distinguished three factors explaining the low mobility that occurs among women and these factors are a result of their *gender role*: the impact of family roles on patterns of women’s car availability, the impact of gender-related tasks on women’s access to opportunities and low mobility deriving from the conditions under which women travel (coping with children while travelling, coping with safety issues particularly in public transport). While the situation has been slowly changing with women

progressively having more access to the automobile, many studies showed that women use public transit more than men and that women are frequently car passengers. Even if there is not a consensus on that point, some authors related the fact that women live closer to their work to their more frequent use of public transit for work trips⁷.

The Great London Council survey¹⁸ revealed that women's use of private transport (car, taxi, mini-cabs and walking) was largely unaffected by the fact that they have care of a young child or not. The results also showed that women with young children were less likely, compared with women without young children, to travel to paid work, to go shopping for nonessential items or to go out for leisure; however, they were more likely to shop for essential items and to respond to others travel needs¹⁸. The National Travel Survey (NTS) of 1975-76 in the United States revealed that housewives' travel patterns distinguished them from the rest of the population because they made less than the average number of car journeys and a greater than average number of walk journeys (cited by Pickup¹⁹). It was also found that many housewives who lived in car owning households did not have access to the car during normal working hours and that most of the independent journeys by housewives were made during this period. In fact, a large proportion of journeys by housewives were short walk journeys¹⁹. In regard to the transportation mode, the study of Séguin and Bussière¹ showed that generally men are much more frequent car users than women and that the utilization rate of public transit is much higher for working women than for working men. Globally, the distances travelled to work by men were found to be higher than those of women; in fact, in all types of households, men travelled further than women. It was found that the rate of automobile ownership was extremely stable for working men (around 80%) and surprisingly high for working women who live alone (51%) and for those who are single parents (around 63%)¹.

Camstra²⁰ distinguished three reasons found in the literature to explain the *shorter commuting distances for women*: generally women have a weaker position in the labor market; they have a weaker position in the household and a limited access to the car; and, finally there is an overrepresentation of working women in central cities. He also added another reason, the lifestyles:

“A lifestyles dominated by labor aspirations will probably tolerate larger commuting distances, and still more men than women have a labor-dominated lifestyles.”²⁰

In the 1990 NTS, the data showed that in the U.S., women 16 to 64 years old, made more daily trips per person than men in urban as well as in rural areas (Rosenbloom²¹). It was also found that women made shorter trips. The 1990 NTS data suggested that:

“overall, traditional travel variables—household income, license-holding, employment—did more to explain the differences among women and among men than they did to explain the differences *between* comparable men and women.” (Rosenbloom²¹).

The results of the 1990 NTS showed that the worktrip distance from home was longer for low income people of both sexes in urban areas than it was for comparable people from wealthier households. It also showed that while the presence of children had an impact on travel patterns of both sexes, having children had a great impact on the trip rates of women and a far lesser impact on those of men:

“Married women made more person trips than all categories of married men, including those who are not parents; however, they travelled fewer person miles and made fewer vehicle trips than comparable men. Married women with children under six made more person trips, travelled fewer person miles, and made the same number of vehicle trips as single mothers with children under six. However, once their youngest children were school-age, single mothers made more trips, travelled fewer person miles, and made more vehicle trips than comparable married mothers. In a few categories, single women even made more trips than comparable married men.” (Rosenbloom²¹).

Furthermore, it appears that neither marital status nor household income explained the differences between women and men’s travel patterns^(Ibidem).

The *dimension of culture and race* was also taken into account in some studies. Focussing on racial differences in the commuting behavior of women, Johnston-Anumonwo²² examined travel behavior of non-mothers and mothers (women with dependent children at home) and found that European American women with long commuting distances are less likely to be mothers compared to African American women. Rosenbloom⁸ examining women’s travel patterns in the United States and in the Netherlands found that in the Dutch context, where non-car options are safer and more available compared with the American context: working mothers were still playing an important role in their children’s travel patterns, in particular due to their accompaniment role.

The results of the 1990 NTS permitted the description of the *relation between the household structure and travel behavior* (Al-Kazily, Barnes and Coontz,²¹):

“To evaluate ability to differentiate travel behavior, household structure was compared with household income, number of vehicles in the household, number of persons in the household, age of dependents, and travel mode (...). Both household structure and person role were found to be effective in differentiating values for travel variables. The number of vehicle owned by the household, number of persons in the household, and work status were the only conventional variables which are comparable to household structure and person role in this respect.”

Among the results, the analysis of travel behavior by household type revealed that trip frequency and travel distance per household were the highest for households with dependents, and tend to vary with household size; that trip lengths increased with the number of independents adults, but decreased with the presence of dependents (Al-Kazily, Barnes and Coontz²¹).

The results of the study of Séguin and Bussière¹ for Montreal showed that two factors clearly affect the pattern of mobility by household type for both working and nonworking adults: the smaller the number of adults in the household, the higher the mobility rate per person; and the presence of minor children in the household significantly increased the mobility rate of the adults as primary caretakers of the household. Looking at the mobility by purpose of the trips, the study revealed a greater number of trips for shopping for working women than for working men (with one exception: the households with female single parents with minor and major children) and equal rates of mobility for leisure purposes for working men and women.

It appears to us that the factors explaining gender differences in travel patterns are complex. The domestic and professional responsibilities are not automatically related to gender but rather to household and socioeconomic roles. Numerous studies insist on the presence of children in the household to explain differences in travel behavior. This factor is important but in many cases it has to be analyzed in

conjunction with the employment status. The complexity of factors at play invites more exploration. In this paper, we will focus on how to reconstitute the household structure when this variable is missing in the data base of a survey. The validation of the method will permit us to present elements for a comparative analysis of mobility in two different contexts: a North-American medium-size metropolitan urban area (Montreal, Canada: 3.2 million) and a large European metropolis (Paris, France: 11 million).

DESCRIPTION OF THE DATA

The 1993 Montreal O-D survey is a telephone home survey done for a large sample (59,942 households and a sampling rate of 4.6 %) during the autumn. The trips of the day before (a weekday) are counted for each member of the household aged 5 years and over. The person interviewed is usually one of the adults responsible for the household. In Paris, the 1991-92 EGT is a survey made at home by an interviewer. It is done between September and May on a sample of 11,000 households (sampling rate of 0.3%). This survey counts all the trips of the preceding day (weekday) done by all the members of the household aged 6 years and over. However, each person is interviewed personally except in certain cases for the very young.

The O-D survey of Montreal contains the essential information necessary to analyze transportation patterns. It describes all the trips made the day before the interview by each person of the household aged 5 years and over with some information on the household and on each trip. As for the *household*, the main variables are the following: total number of persons in the household, number of persons aged 5 years and over, age of each person, sex, possession of drivers' licence for those aged 15 and over, age and sex of the person interviewed, residential location, number of motorized vehicles. However, we have no information on the family ties between each member of the household. The information on *the trips* is very detailed: origin and destination of each trip made the day before, the purpose, the time of departure; the different modes of transportation used and their sequence; the lines of public transport used, driver or passenger for car use, mode of payment of parking, crossing of bridges, etc.

The variables in the 1991-92 EGT of Paris are much more detailed, the interview being made at home by an interviewer. For example, as to the household, we have the following information: age and occupational category of the household head (called the person of reference), location of the household, year of entry in the dwelling; type of dwelling and size, number of handicapped persons, number of adults, number of persons aged less than 6 years and 6 years and over, number of absent persons for a long period, number and type of vehicles in the household; parking facilities. For each *individual* in the household, we have similar information as in Montreal (age, sex, possession of driver's licence) which is complemented however with many other socioeconomic variables such as: economic activity, profession, social category, location of work or study, home-work distance, hours of work, main occupation, level of education, parking at work, professional status, ... We also have direct information on the family ties between each member of the household and the household head or person of reference. Finally the information on the *trips* and the travel modes contains the classic information (origin, destination, purpose, mode, transit line, etc., for each trip), which is complemented by much more detailed information such as: transportation of heavy objects or of animals, bridges, etc.

In Paris, the information on family ties is very detailed: visitor; person of reference; spouse; child, sister, brother, son-in-law and daughter-in-law, sister and brother-in-law; grandparents, parents-in-law, grandchildren; other parents; salaried servant lodged; other non parents'. This information on family ties between members of a household is absent in the telephone O-D survey of the MMA, we have reconstituted this variable and validated it with the Paris data which allows for comparative analyses between the two case studies.

METHODOLOGY

DESCRIPTION OF THE METHODOLOGY

The validation of the methodology (reconstitution of the variables relating to “household structure” and “activity”—working or not) was done with EGT data since they permitted a comparison between the constructed typology and the real data.

The household structures

The typology used here was derived from Séguin and Bussière¹. The 1993 O-D of the MMA was composed of a limited number of variables, as we have seen, and from which two were chosen to construct a typology which gives a good approximation of the types of households involved even though the telephone survey does not take family ties into account. Séguin and Bussière¹ first constructed a typology of the most familiar household structures and then refined them with the help of different criteria retained from a certain number of studies, particularly those of Hamel and others²². For each type of household, a series of conditions for which the different types would have to qualify in order to be assimilated into a type of household was constructed.

The construction of the typology which was done with a computer program was explained in detail in Séguin and Bussière¹ and we will just mention here the main characteristics of the model.

The two concepts constituting the basis of the typology are the couple and generational notions. The typology is presented in table 1 which defines the eight types of reconstructed household structures (+ a residual category). This typology was applied to the 1991-92 survey data in Paris, for validation, and to the 1993 O-D data in Montreal, for comparative analysis of travel behavior patterns in both case studies.

The working status of the individual

Furthermore, as we noted, many authors revealed the impact of working or not on travel patterns, and we retained this notion in our analysis of the mobility. As the variable existed in the EGT survey of Paris and did not in the O-D survey of Montreal, we had to define it in a way that would permit comparisons in the two contexts. We defined a working person as a person who made at least one worktrip (either home-to-work or for a professional purpose).

STEPS IN THE APPLICATION OF THE METHODOLOGY

Validation of the typology of household structures on EGT data

- (i)- Construction of the typology on the basis of real data from the EGT survey (computer program);
- (ii)- Construction of the typology using the concepts of age gap between members of the household and sex; computer program applied to EGT and O-D data survey;
- (iii)- Comparisons.

Proxy of the working population on EGT data

- (i)- Identification of the working population on the basis of real data from the EGT survey (computer program);

- (ii)- Identification of the working population with the proxy of one worktrip (or business trip) during the day; computer program applied to EGT and O-D data survey;
- (iii)- Comparisons.

Comparative analysis between MMA data and EGT data:

- (i)- Impact of household structure on women's mobility;
- (ii)- Impact of household structure on mode use.

RESULTS

VALIDATION OF THE TYPOLOGY OF HOUSEHOLD STRUCTURES AND THE DEFINITION OF THE WORKING POPULATION ON EGT DATA: ANALYSIS OF THE STRUCTURE OF POPULATION.

Validation of the typology of household structures

The first thing to note is the similarity of the structures of population in Paris whether we used the methodology of reconstitution of household structure based on the two notions of age gap and sex or the real data of the EGT survey (Table 2: columns 1 and 2). In the two cases, we find the same three categories of household constituting the majority of the population: couple with minor children (category 6) with about 27% of the population, couple (category 2) with 26%, and couple with minor and major or only major children (category 8) with about 20% (Table 2: columns 1 and 2). The fact that in the two contexts, the structures of the population by type of household are very similar means a *validation of our methodology of reconstruction of the variable*.

Proxy of the working population

With the one worktrip definition, the person who made at least one trip to go to work or for business affairs was defined as a working person. We applied this definition to the O-D survey in Montreal and the EGT in Paris, while the variable of working and nonworking existed in Paris.

Comparing EGT data with the results of the application of the one worktrip definition, we found an underestimation of the working population with the one worktrip definition in Paris among the population aged 6 and over (Table 3: columns 1 and 2). In fact, the people who were interviewed for the survey did not always declare a worktrip for the week day before even if they were really working people (teachers, part-time workers...). This appears especially for working women.

As expected, the proxy used underestimated the working population (of about 20%).

Table 1
Elements of Definition of the Household Typology

Type	Type of household	Nb. of persons/household	Nb. of adults/household	Of opposite sex	Nb. of children (≤17 years)	(2 generations) Gap>15 years between adults and children	(2 generations of adults) Gap>15 years between adults	(1st generation of adults - couple or not - of opposite sex - Gap 15 years)
1	Single person	1	1	1	0			
2	Male and female of same age	2	2	yes	0		no	
3	Several adults without children	>1	>1	no	0		no	
4	One adult with minor children	>1	1	no	≥1	yes		
5	Male and female with children	>2	2	yes	≥1	no	no	
6	One mature adult with children	≥2	≥2	no	≥1	yes	yes	no
7	Couple with minor and major children	>3	≥3	yes	≥1	yes	no	yes
8	Residual category	-	-	-	-	-	-	-

* Children is understood as referring to one or more children. Note: We define a minor child as a child less than 18 years old and an adult as a person of age of 15 years or less.

Source: Derived from Séguin and Bussière (1).

COMPARATIVE ANALYSIS OF THE TYPOLOGY OF HOUSEHOLD STRUCTURES AND THE DEFINITION OF THE WORKING POPULATION WITH THE O-D DATA, MONTREAL: ANALYSIS OF THE STRUCTURE OF POPULATION.

Typology of household structures

As we compare the two structures of population in Montreal and Paris by type of household, it is remarkable to notice a great similarity. The three most important categories in terms of percentage of population, are the couple with minor children (category 6; 30% in Montreal and 27% in Paris), the couple (category 2; 23% in Montreal and 26% in Paris) and the couple with minor and major or only major children (category 8; 21% in Montreal and Paris) (Table 2: columns 2 and 3).

Definition of the working population

The comparison of the structures of the population (proportion of working and nonworking population, by sex) reveals differences in the two contexts. The results show a majority of working people in Montreal (59% of the population) while the opposite situation is observed in Paris (nonworking: 58% of the population) (Table 3: columns 2 and 3). These results may be explained by the category of children among the nonworking population and should be clarified in another study.

As we noticed before, the proxy of one worktrip gives an underestimation of the working population. This means that the working population may represent more than 59% of the population in Montreal. While this underestimation plays a role in the two contexts, this reinforces the differences between the two structures.

The variable defining activity of the population is important since it is known to have an influence on mobility patterns. And we cannot reconstruct it easily when it is lacking; it is thus important to take it systematically into account in transport surveys.

Table 2
Structure of the Population (6 years +) by Type of Household

Data from the EGT 1991-92 (Paris) and Application of the methodology in Paris (1991-92) and Montreal (1993).

Description	Paris - EGT Data		Paris - Methodology		Montreal - Methodology	
	Volume	%	Volume	%	Volume	%
Single person	1 386 432	14	1 386 432	14	336 633	12
Couple	2 497 552	26	2 489 670	26	661 717	23
Adults without children	392 500	4	180 311	2	92 873	3
Adults with major children	335 414	3	373 252	4	125 514	4
Adult with minor children	277 173	3	291 208	3	116 798	4
Couple with minor children	2 701 507	28	2 640 486	27	874 418	30
Adult with minor & major children	102 466	1	189 550	1	15 478	1
Couple with minor & major or only major children	1 857 607	19	2 051 876	21	618 414	21
Residual	80 223	1	126 519	1	71 894	2
	9 630 874	100	9 630 874	100	2 913 757	100

EGT 1991-92, Paris; O-D 1993, Montreal; INRETS; INRS-urbanisation.

Table 3
Working and Non-working Population (6 Years and +)

1991-92 EGT Data (Paris) and Application of the one work-trip definition in Paris (1991-92) and Montreal (1993).

		Paris - EGT Data		Paris -1 Work-trip definition		Montreal -1 Work-trip definition	
		Volume	%	Volume	%	Volume	%
Working	Men	2 574 499	27	2 244 783	23	931 718	32
	Women	2 171 327	23	1 770 696	18	773 142	26
	Total	4 745 826	50	4 015 479	42	1 704 860	59
Non-working	Men	2 008 087	21	2 373 918	25	483 375	17
	Women	2 812 628	29	3 241 477	34	725 522	25
	Total	4 820 715	50	5 615 395	58	1 208 897	41
Total		9 566 541*	100	9 630 874	100	2 913 757	100

* The difference between the two totals (9 630 874 and 9 566 541) is explained by the existence of two variables ("sans objet" and "non renseigné") in the EGT.

Sources: EGT 1991-92, Paris; O-D 1993, Montreal; INRETS; INRS-urbanisation.

THE IMPACT OF HOUSEHOLD STRUCTURE ON WOMEN'S MOBILITY AND MODE USE

The study of mode use for working and nonworking adults reveals the importance of car-driving in Montreal and Paris, especially for men and especially in Montreal. Car-driving appears to be the most frequent mode used, except for the nonworking women in Paris (where walking is for them the first mode to be used). It also reveals the importance of urban transit and walking in Paris (Figure 1).

The mobility is defined as total daily trips per person. For the mode of *walking*, we can notice that the mobility of women is higher than the one of men, for working as nonworking persons, in Paris as in Montreal (Paris: Men= 0.73 and Women= 1.21 ; Montreal: Men= 0.21 and Women= 0.29). Compared to Montreal, more trips are made by walking in Paris; this may be associated with the urban form and the transport network (smaller distances to go from one place to another) which may also imply the greater use of car in the Montreal region (Figure 2).

For working women, the mobility by walking is the highest for women from households composed of adults without children (category 3; Paris: 1.31; Montreal: 0.47), adult with minor children (category 5; Paris: 1.09 ; Montreal: 0.39) and single person (category 1; Paris: 1.08; Montreal: 0.44). For nonworking women, the categories are 6 in Paris (couple with minor children: 2.05) and 5 in Montreal (adult with minor children: 0.75). For men, the presence of minor children do not appear to influence their mobility by walking, in Paris as in Montreal (Figure 2).

As expected, the mobility by *urban transit* is higher for women than for men, especially among the working population, in Paris as in Montreal (working population: Paris: Women= 1.04 and Men= 0.80; Montreal: Women= 0.77 and Men= 0.48). In Paris, the mobility by urban transit is especially high for working women who live alone (category 1: 1.33) or with others adults (category 3: 1.64). In Montreal, the working women making the most trips by urban transit are living with minor and major children (category 7: 1.25) or with adults without children (category 3: 1.12). For working men, we find the same categories in the two contexts but the level of mobility is lower (Figure 3).

For the mode of *car-driver*, the mobility of men (working or not) is a lot higher than that for women, in Paris as in Montreal (Paris: Men= 1.91 and Women= 1.23; Montreal: Men= 2.11 and Women= 1.37). However, working or not, men or women, in Paris as in Montreal, the persons who have the highest mobility rate as a car-driver are living with minor children (categories 5 and 6) except for nonworking men in Paris where the category 5 is replaced with the 2 (couple). This reflects the great influence of the presence of minor children on mobility by car in the two contexts (Figure 4).

As *car-passengers*, women are making more trips than men (Paris: Women=0.38 and Men=0.17; Montreal: Women= 0.48 and Men= 0.17). The fact they are working or not does not really influence the level of their mobility in the two contexts. Considering the household category, we can observe that mobility is the highest for women (working or not) living in a couple without children (category 2) (Figure 5).

The comparison of the use of *other modes* of transport (motorcycles, bicycles...) is less significant, the survey being made in the fall in Montreal when the usage of these modes drops. We may still note that for men these trips are more frequent (Paris: Men= 0.15 and Women= 0.04; Montreal: Men= 0.06 and Women= 0.03). However, the levels of mobility are still very low for those modes (Figure 6).

These results which clearly reveal the impact of the presence of minor children on individual mobility, especially for working women and for the car-driver, confirm the interest of taking into account the household structure in an analysis of mobility and the necessity of a methodology to reconstruct this variable when it is lacking in a survey.

CONCLUSION

We fully validated a methodology which uses the notions of age gap and sex of the members of the household to remediate a missing variable which plays an important role in the analysis of individual mobility: the household structure of the population.

Even though the proxy used to analyze working population trips underestimates the working population, the comparison of the results obtained from the proxy and the real data of working population revealed similar behavioral patterns.

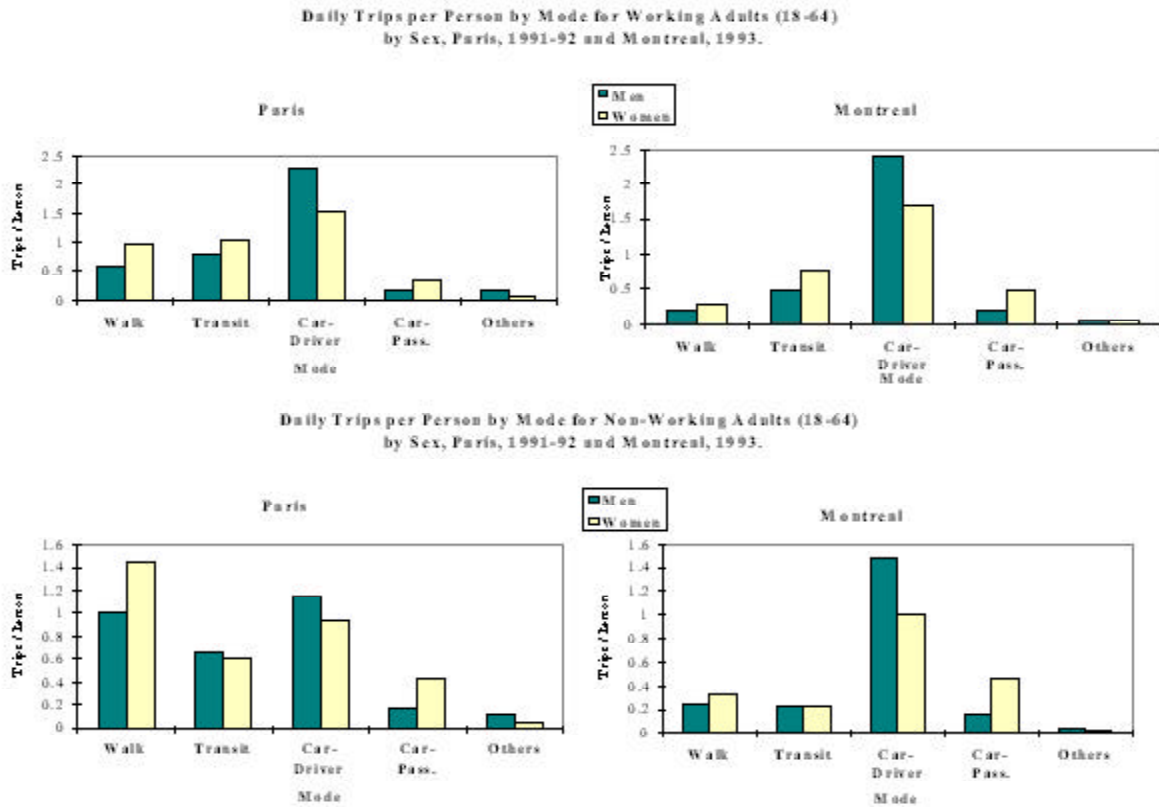
While comparing the impact of household structure on women's mobility and mode use in Paris and Montreal, the results showed the importance of the presence of minor children and the differences of mode use by sex and status of activity. As sociocultural differences may persist in the two contexts (family roles, mode use, occupation...), we revealed interesting similarities, especially for the mode of car-driver for working women with minor children.

The study of the mobility patterns in relationship to household structure may reveal extremely interesting results not only for describing present travel behavior but also for forecasting, especially in contexts where the family forms may change considerably with economic growth, as in developing countries.

Household Structure and Mobility Patterns

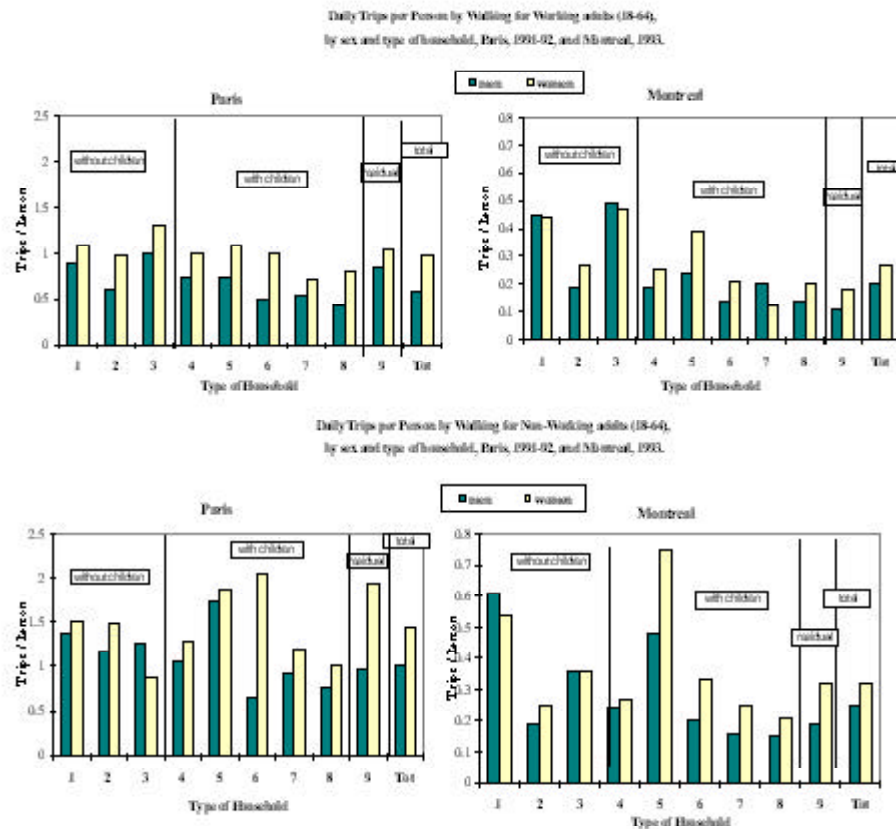
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Figure 1



Sources: EGT 1991-92, Paris; O-D 1993, Montreal; INRETS; INRS-Urbanisation.

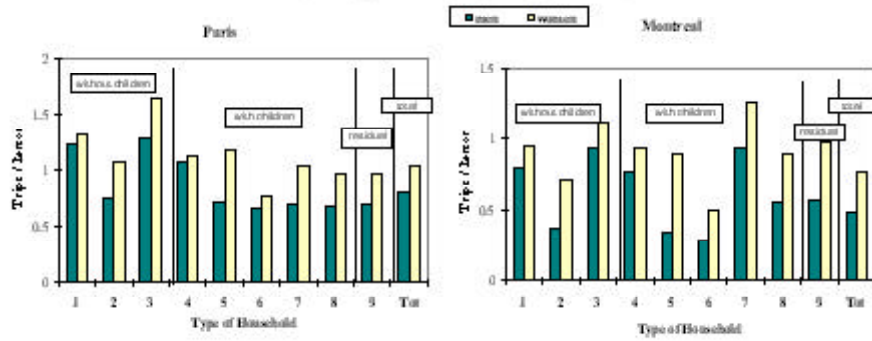
Figure 2



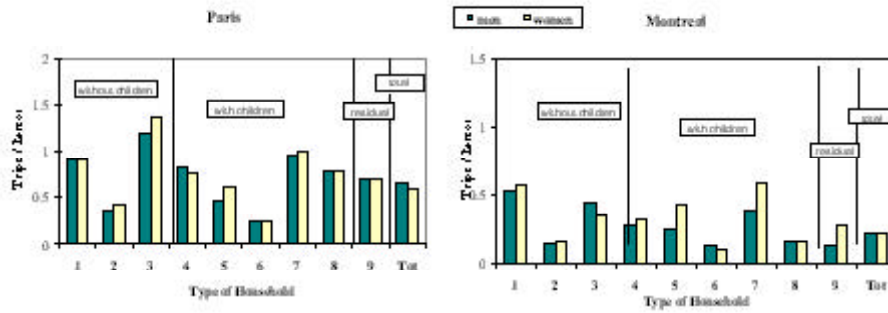
Sources: EGT 1991-92, Paris; O-D 1993, Montreal; INRETS; INRS-Urbanisation.

Figure 3

Daily Trips per Person by Urban Transit for Working adults (18-64),
by sex and type of household, Paris, 1991-92, and Montreal, 1993.



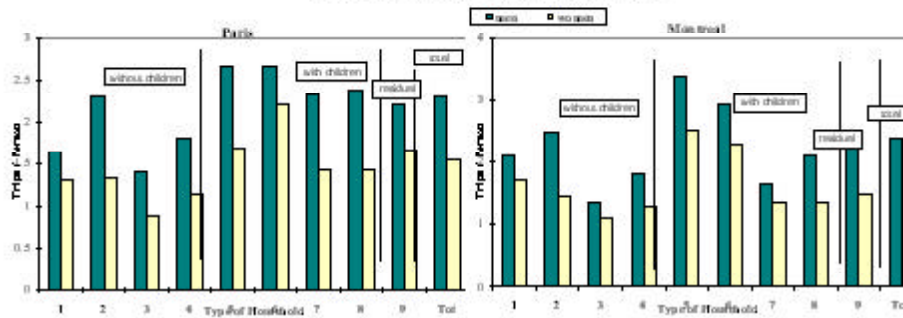
Daily Trips per Person by Urban Transit for Non-Working adults (18-64),
by sex and type of household, Paris, 1991-92, and Montreal, 1993.



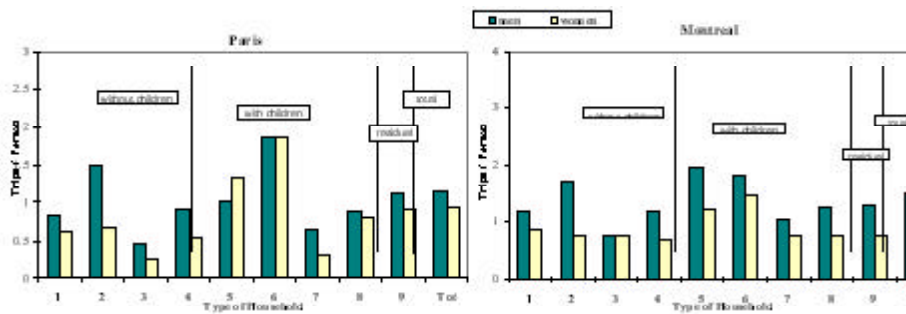
Sources: EGT 1991-92, Paris; O-D 1993, Montreal; INRETS; INRS-Urbainisation.

Figure 4

Daily Trips per Person by Car (Driver) for Working adults (18-64),
by sex and type of household, Paris, 1991-92, and Montreal, 1993.



Daily Trips per Person by Car (Driver) for Non-Working adults (18-64),
by sex and type of household, Paris, 1991-92, and Montreal, 1993.



Sources: EGT 1991-92, Paris; O-D 1993, Montreal; INRETS; INRS-Urbainisation.

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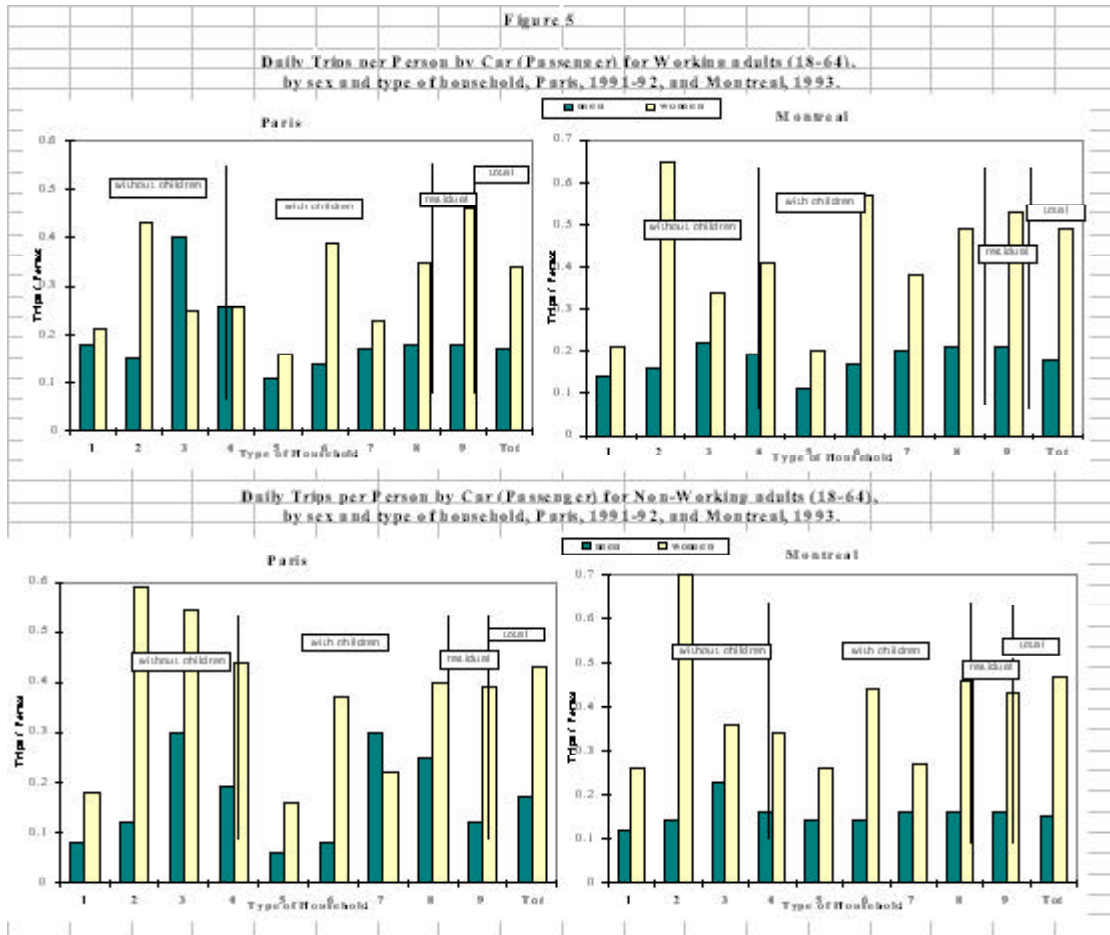
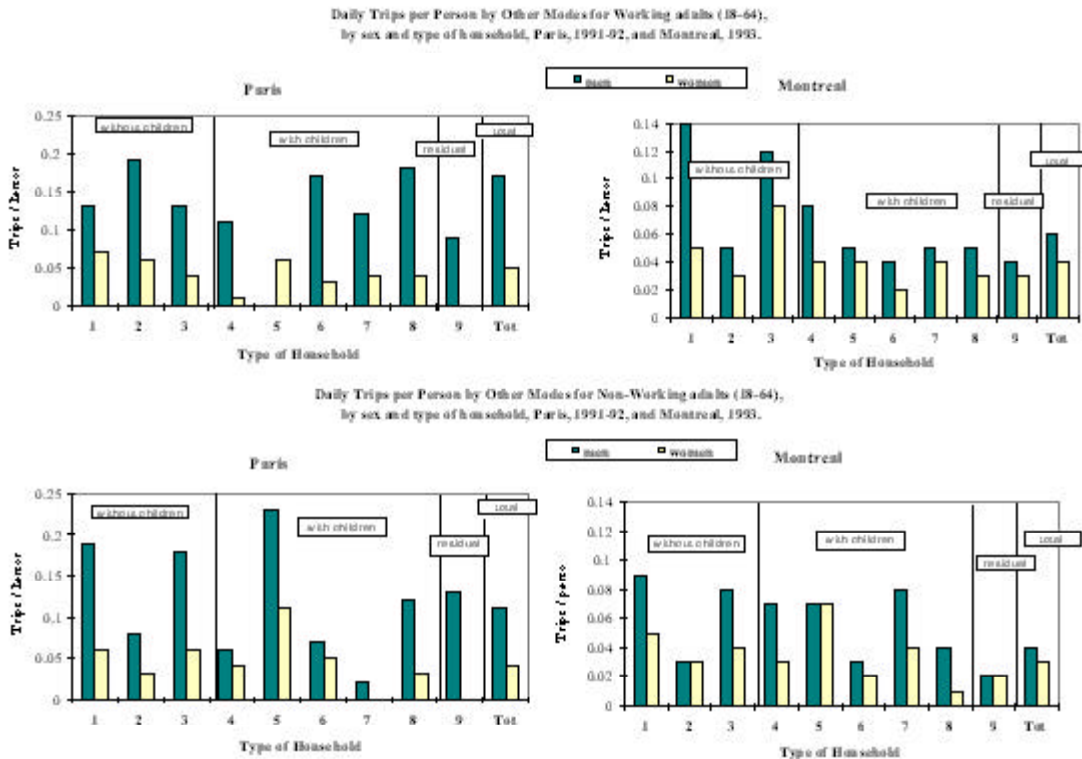


Figure 6



Sources: EGT 1991-92, Paris; O-D 1993, Montreal; INRETS; INRS-Urbanisation.

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