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Women's Travel Issues:

Research Needs and Priorities

Conference Proceedings and Papers

U.S. DEPARTMENT OF TRANSPORTATION
Research and Special Programs Administration

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Preface

The Conference on Women's Travel Issues sponsored by the Office of University Research, U.S. Department of Transportation and the Committee on Transportation of the National Research Council, was held at the National Academy of Sciences in Washington, D.C., September 17-20, 1978.

The Steering Committee structured the Conference over a six month period. They also evaluated the papers and reviewed and commented on this document. The members of the Conference Steering Committee are:

Karen L. Borlaug, then Office of University Research, currently Office of Transportation Regulation, Office of the Secretary.

K. Patricia Burnett, Northwestern University.

Douglas B. Gurin, Office of Policy Development, Urban Mass Transportation Administration.

John Havens, Boston College.

Ann Muzyka, Transportation Systems Center, Research and Special Programs Administration.

Katherine L. O'Leary, Director, Product Dissemination and Transfer Division, U.S. Department of Housing and Urban Development.

Wanda Reyna, Office of Civil Rights, Office of the Secretary.

Sandra Rosenbloom, on leave to the Office of University Research from the University of Texas at Austin, Steering Committee Chair.

David Rubin, Transportation Systems Center, Research and Special Programs Administration.

Louise E. Skinner, Urban Planning Division, Federal Highway Administration.

Mary Lynn Tischer, Urban Planning Division, Federal Highway Administration.

Helen L. Whitfield, Office of University Research, Research and Special Programs Administration.

Editor's Acknowlegments

This Conference would not have been possible without the active support and guidance of a number of people. Every member of the Steering Committee contributed significantly to the quality of the papers presented and to this document, one of the final products of the Conference.

Robert J. Ravera, Director of the Office of University Research, and the entire OUR staff were instrumental in initiating the Conference and providing support and assistance to the Conference Committee.

John J. Fearnsides, Deputy Under Secretary of Transportation, was an unwavering source of support. His confidence in the Conference was crucial to its success.

Ellen B. Feingold, Director of the Office of Civil Rights, U. S. Department of Transportation and her staff were early and constant supporters of this Conference.

Gratitude is also due to those people who assumed the difficult job of chairing Conference Sessions: David Gendell, Jack Goodman, John Havens, Steven Lerman, David Rubin, and Martin Wachs.

It would be impossible to overestimate the contributions of the authors of the papers presented and discussed at the Conference. Each paper offered a rich set of issues and findings for participants to discuss and debate; these issues and Conference discussion about them form the basis of the synthesis I prepared which appears in Part I and of the

Research Recommendations appearing in Part IV. I am particularly indebted to the authors of the four Conference commissioned papers for their contributions to my understanding of the complex issues in this area:

Janice Fanning Madden and Michelle J. White;

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Lydia Kostyniuk and Donald Cleveland; and

K. Patricia Burnett.

I am also indebted to Lydia Kostyniuk, David Hartgen, Larry Richards, Karen Borlaug, Louise Skinner, and Mary Lynn Tischer for their perceptive and constructive criticism of the drafts of my work.

Sandra Rosenbloom

Chair, Conference Steering Committee

Editor, Conference Procedings

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WOMEN'S TRAVEL ISSUES: THE RESEARCH AND POLICY ENVIRONMENT

Sandra Rosenbloom
University of Texas

I. Background and Emphasis of the Conference

The papers and speeches appearing in this volume were delivered at the Conference on Women's Travel Issues, sponsored by the U.S. Department of Transportation and held at the National Academy of Sciences in September 1978. The Conference was organized in response to two different yet intertwined planning and research issues. The first issue was a concern over the way current and future transportation programs and facilities do and will affect women and their needs. The second issue was the need to predict travel behavior and to better our methods of predicting which individual differences in and among groups of people lead to differences in travel behavior. Both issues were rooted in empirical findings that the current travel patterns and attitudes of women were noticeably different from those of men. Both issues also grew from the need to understand the impact of governmental transportation programs on various groups in society and to evaluate those programs in terms of effectiveness and equity.

The Conference was designed as a research Conference; to analyze the extent and value of current research on women's travel issues and to propose additional research where warranted. Therefore, a strong attempt was made to focus the Conference on the second issue, the prediction of travel behavior: to consider how the growing involvement of women in the

paid labor force and the increasing number of female headed families would impact the complex relationship of employment opportunities, residential location choice, and travel behavior. Most of the women's concerns that could be raised as equity issues were deliberately excluded because they were so often linked with demands for political action rather than for additional research.

A. Can Equity Issues Be Separated from Research Questions?

The distinction between the two issues, and indeed between "political" topics and "research" topics is often easier to make intellectually than in practice. Questions about current services and facilities overlap and complement concerns about the future travel behavior of women since future urban travel may well be a response to current options.

Planners have long recognized the fundamental chicken and egg question inherent in transportation patterns; building transportation facilities today may well generate tomorrow's demand. Thus, prediction of the future can become a self-fulfilling prophecy. Traditional planning tools and models used to predict various aspects of travel behavior cast political and policy shadows. Models in common use assume that some variables, like income and car ownership, are important in predicting travel behavior and that other variables, like the household division of responsibilities and allocation of transportation resources, are not. To make such assumptions without recognizing the important demographic trends in society is: 1) to risk being seriously wrong in future predictions (as most long-run predictions of vehicle miles travelled [VMT] and car

ownership have been), or 2) to "freeze in time" the relationships observed in the 1950s and 1960s when basic data was gathered and perhaps "create" the future.

There also tends to be a symbiotic relationship between "political" issues, or demands for governmental actions, and the answers to research questions about household behavior and travel patterns. In fact, some opposition to the Conference was based on the view that "legitimate" research questions about women's travel behavior could not be kept separate from normative concerns and demands for political action. Others, however, were in opposition to the "narrow" focus on research; advocates felt such research was simply a way to delay or deter legitimate demands for governmental reform.

Because much of this report focuses on very research-oriented women's travel issues, it might be useful to note briefly the value of such research for those who are policy advocates. Political demands are often generated because women are seen as inadequately served by existing highway and transit facilities. Such demands are based on two unvalidated assumptions: 1) that many women will always be different from the travelling public at large or at least from most men (that is, not in the paid labor force, not travelling at peak period, etc.), and 2) that they will always be different in exactly the same way they are today. The research addressed by this Conference will allow advocates to be sure that their demands address the right problem, in the right way, and in a manner that does not preclude further response in the future.

B. Which Travel Behavior Questions are Women's Issues?

It is not clear which urban travel questions are "women's issues." Since the Conference, a number of scholars have begun to study the comparative impact of the changing home and work roles of women. Research articles and books have recently appeared discussing the importance of individual household characteristics such as employment status or changes in the presence of children. Therefore, many people find it less necessary to insist that such individual concerns are or must be defined as women's issues. The original stance of the Conference, however, was a response to current empirical evidence which shows that women exhibit the most drastic changes in travel behavior as a response to the striking demographic changes occurring in society. Much of the research presented at the Conference (and discussed below) validates approaching many travel questions as women's issues.

The concerned reader who does not consider the behavioral or disaggregate travel demand questions raised here to be women's issues will find only the title of the Conference to reflect that view. Each and every article, and indeed most of the speeches, address larger travel issues in a scholarly and complementary way.

C. The Value of Segmenting the Needs and Behavior of Women

In the world of declining governmental resources, every government investment decision responds to some interests and needs over others. Governmental decisions represent choices between and among interests in conflict; thus the important element for policymakers is informed choice

between various alternatives.

Very real planning questions are addressed by segmenting the needs of women or subgroups of women from those of the more general public. It is necessary to know what interests are and are not affected by proposed governmental programs and how programs designed to advance certain goals could do so in ways that provide the most benefits to the greatest number of people. Alternatively policymakers need to know the dysfunctional or undesirable impacts on certain groups of otherwise meritorious programs so that they can act to mitigate those negative consequences. Identifying the special transportation needs of women serves these purposes without in any way implying that women's needs are to take precedence over other needs. That is clearly a political decision.

The purpose of this Conference and the research it presented was to provide decision makers with the kind of information that will allow them to decide what projects will serve the "greatest public good" at the same time they learn what the impact and implications of proposed projects will be for women in different situations. The Conference was not designed to prove that women have different needs that will always be associated with their sex, or even if they did, that such needs necessarily called forth governmental response. While some Conference participants, and some conference opponents, have their own opinions on those points, the Conference was designed to elucidate the key travel behavior issues underlying the striking demographic changes taking place in society and to provide useful and important information to government policymakers.

Six major topics were addressed in the papers and discussed at the Conference. The next few pages will discuss how these six topics relate to the major focus of the Conference -- the prediction of travel behavior. This discussion will set the stage for a point by point analysis of the six major substantive topics around which the Conference was formally structured.

II. Predicting the Impact of Women's Changing Activities on Travel Behavior

A. Are Sex or Sex-Linked Variables Related to Travel Behavior?

There are demographic, economic and social changes taking place in our society which clearly impact women's activity patterns and utimately their travel behavior. Most observers agree that there are notable differences in the current travel patterns of men and women. There is significant controversy, however, as to whether such differences are explained by sex and whether those differences will continue into the future given societal changes.

Some observers feel that current travel differences are related to economic factors such as low income and occupational status, factors which are only historically linked to sex. These observers argue that as more women enter the full-time paid labor force and their income and occupational status rise, their behavior will be the same as comparably situated men. Women's assumption of traditional household and childcare responsibilities, they argue , will decrease as they enter the paid labor force and as the sexes more equitably divide those

roles between working spouses. Thus, the use of sex as an explanatory or predictive variable would not be warranted.

Other observers, however, feel that sex will continue to correlate highly with certain household roles even for women in the paid labor force. These responsibilities will create very different activity patterns and travel needs for comparably situated men and women. This group contends that culturally defined sex-linked roles give every indication of being a stronger force than pure economic variables. Thus, they argue that a married woman living with her spouse and two children and employed outside the home will behave very differently than a married man living with his spouse and two children and employed outside the home even if both have the very same individual and/or household income.

Some observers have attempted to temper this debate by noting that the predictive variable in the example given above is not sex but household role; they have questioned whether it is not possible to focus on how households allocate their activities and their resources among various members. Several researchers are currently investigating travel behavior from this perspective. The argument, however, is made less forceful by current empirical observations (some presented in this volume) that women, across socio-economic groupings, are overwhelmingly the spouse carrying out domestic and childcare responsibilities in two worker households. Obviously this has normative implications for some advocates but it has practical planning considerations as well: sex is a relatively easy bit of data to collect while more sophisticated concepts of household allocations of resources and responsibilities are not. If, in fact, sex highly correlates with certain roles, now or in the future, it is

far simpler to use sex as the predictive variable. The current and successful use of sex by planners to delineate a transit market segment may illustrate this.

Future correlations between sex and household roles are still open to intense debate. However, it is not necessary to resolve the question of whether sex is a predictive variable to accept the need to study the impact of rapid societal changes on household and individual travel behavior. Even if sex were not to be a predictive variable, an argument far from settled, it is clear that changing societal norms and pressures may have rendered obsolete traditional indicators and predictors of travel behavior. It cannot be both ways; if society is becoming more egalitarian and social roles are being modified so that men take on more childcare and domestic responsibilities, and women take on greater income producing activities, then an examination of historical travel patterns can no longer be used to predict either men's or women's trip patterns. If society is not becoming more egalitarian, then the travel behavior of women cannot be predicted by examining either the current or historical travel patterns of comparable men.

The need to study changing activity patterns does not imply that we know all about the current travel behavior of women. In fact, this is not so; we only know about the travel behavior of women who resemble most men -- those in the full time paid labor force travelling to work at traditional hours in a vehicle of some type. Much less is known about the other travellers: suburban housewives, elderly women, female heads of households and welfare mothers. We know little about off-peak travel, little

about the travel patterns of those who walk or bike to work or any other destination, and little about the part-time, late night, or seasonal worker. We also know little about differences between subgroups of people although racial and ethnic distinctions may account for significant differences in travel needs and preferences. For example, there is sociological evidence from a number of studies that ethnicity and even race may affect the travel behavior of women; elderly Chicana women travel far less than comparably situated Black women.

B. Individual and Household Behavior: A Women's Issue?

Individuals behave as household members, and a number of intrahousehold variables may define and constrain the activities and the travel behavior of the various members. Role and sex may define the activities in which certain individuals engage and they may also determine how household resources, such as available cars, are allocated among the household's members. Traditional models have not recognized these variables. For example, they have used only household income to predict auto ownership and have consistently underestimated actual auto ownership. The failure to predict accurately this variable is easy to understand when it is remembered that a household with two outside working spouses with a total income of $15,000 is expected to behave by these models in the same manner as a one outside worker household with an identical total income.

Further, traditional transportation models have used only a few variables, notably household income, household composition (usually size), and auto

ownership, to predict future travel demand and modal choice. Trip generation rates, for example, are commonly based on just two variables, income and auto ownership. Prediction of modal split is usually based on income and sometimes employment. The data on which such predictions are made are not collected or analyzed at the individual or household level but rather at an aggregate level at some preordained geographic area or zone.

It is not surprising, then, that traditional models have not been successful in predicting the effect of given policies on particular groups, or in predicting response to different governmental policies, or in predicting the impact of demographic and societal changes on the travel behavior of women or men. The information on individual travel behavior sought by this Conference could address many of these deficiencies in current planning technologies.

Modifications are underway in the development of travel behavior theories which allow the corporation of social-psychological concepts into traditional planning methodologies. These changes in behavioral theories and the models built upon them are the result of the need to improve predictability, a need which can be met by focusing on individual differences. The research addressed and proposed at this Conference fits into these larger developments in the field of travel behavior.

Of course, a move to incorporate individual, behavioral variables into transportation methodologies does not focus specifically on women's behavior. So this change in the planning field does not end automatically the debate over whether women's travel patterns will be different from

comparably situtated men. It does, however, validate the need to examine the behavioral questions central to this Conference; does or will transportation behavior differ by sex, by role, or by some other dimension? Eventually such research would in fact address the underlying causes of current travel differences between the sexes and might suggest whether sex is a predictive variable for the future. It might also suggest whether sex can be used as a surrogate for important behavioral variables such as household role.

It does not matter whether the demographic changes discussed above are "women's issues". If the patterns of either or both men and women are changing, our planning tools and models must be calibrated to respond. To do so, we must know what current patterns are and how they are changing, the magnitude and direction of any changes, and the implications for future urban development and transportation patterns. We do not have to agree on whether significant demographic changes in society are accompanied by changes in culturally defined sex roles to agree that the impact of any such cultural changes must be studied.

C. What an Examination of Travel Differences Can and Cannot Do

The research suggested by the Conference can supply crucial information to deal with a major question that policy makers must ask; are there differences in travel behavior between men and women attributable to sex, or other variables, such as role, which are closely associated with sex in our society? An equally important question that cannot be answered by researchers but only can be addressed in the political arena; do differences in travel behavior between the sexes, regardless of cause,

suggest appropriate governmental responses or changes in transportation systems?

The materials presented in this volume are a clear testimony to the legitimacy of studying women's travel issues in a rigorous and scholarly way. Such substantive research can and will serve policy makers attempting to make major transportation decisions about the investment of funds and governmental programs to be pursued. But policy response to the research presented or proposed at the Conference will not be clear and unambiguous. It is not realistic to expect research on women's travel patterns to resolve the many legitimate political disputes over the allocation of scarce resources among competing interests in our society.

The proposed research should serve to highlight such conflicts, however, to provide policy makers with better information on the potential impacts of a number of considered options, and to give both advocates and proponents of particular programs a better insight into the effects of differing policies. For most observers, the Conference resolved in large measure the debate over whether women's travel behavior can be a legitimate research issue, even if only as part of a larger investigation of household travel behavior. It did not and could not resolve the far more intractable political questions that surround such research.

III. Major Substantive Issues Addressed by the Conference

The Conference papers and presentations were organized around six major substantive themes which addressed the central issue of the Conference -- the prediction of travel behavior. These six themes were: 1) the intra-

household implications of the involvement of women in the paid labor force, 2) the residential and locational implications of changes in labor for participation, 3) comparative attitudes and preferences of men and women travellers, 4) personal security, 5) human factors and reactions to vehicle environments, and 6) methodological and planning implications.

The major research concerns within each of these six major themes will be briefly presented below and will be followed by the papers themselves. These discussions are based in large part on the material and analyses appearing in the Conference papers, particularly those papers commissioned expressly for the Conference. In addition, the following sections represent the Conference discussion of key issues by participants and paper authors and post-Conference comments by members of the Steering Committee.

A. Intrahousehold Implications of the Involvement of Women in the Paid Labor Force

In 1890, less than 20 percent of the labor force were women and less than 20 percent of all women worked. More strikingly, in 1890 less than 5 percent of all married women were in the labor force. Today women account for between 42 percent and 46 percent of the paid labor force and 48 percent of those women are married and living with their spouse. The

really striking change is the rapid increase in the number of married women with children in the paid labor force since the Second World War. In 1947, 20 percent of married women were in the paid labor force; in 1978, almost half of all married women were. In 1977, one-third of all women with children under the age of six worked outside the home, although less than 24 percent did in 1965. A recent study by The Urban Institute conducted for the U. S. Department of Labor predicted that by 1990, 55 percent of the female population, 16 and over will be employed outside the home; the greatest percentage of that increased employment will be among married women between 25 and 54, and there will be a very large increase in the number of working mothers with children under six.

Other demographic changes are striking. There are a growing number of households headed by women; in 1977 there were 7.7 million such households, and 56 percent of those female heads were in the labor force. In addition, there has been a significant increase in the total number of part-time workers; of the 4 percent annual increase in the part-time work force, over two-thirds are women.

What are the implications of such complex and significant societal changes? The first section of this document presents several papers designed to investigate one major aspect of those demographic changes; the impact of the employment of women on their tripmaking and their household's tripmaking behavior. The papers presented are specifically concerned with how households allocate their childcare and domestic responsibilities among the various members -- as revealed by their travel behavior, and how these allocations are changed or altered when the

female spouse obtains outside employment.

Obviously, this set of questions is only one concern of many that arise from an examination of demographic trends. The papers presented in this first section largely focus on the number and kind of trips taken by both men and women in a household. In addition, however, we would like to know how changes in the employment status of women in a household affect their modal choice and the way they structure or link the trips they make. For example, the need to pick up children at a childcare center or to shop on the way home from work may affect either worker's ability to use mass transit or ride-sharing modes.

The growing number of female heads of households also raises important and interesting questions. For example, how does this growing number of households affect auto ownership rates, residential location choices, and tripmaking behavior? In general, those female heads of household who are in the work force are unlike any other group on which we have existing information; there are not many male heads of household without spouse. Just as interestingly the income and employment status of this group of women is changing as their numbers increase; many middle-class women are becoming heads of households as the divorce rate among all groups increases.

The information presented in the papers in the first section of this document lays the groundwork for an analysis of the many other key topics discussed in Section I above. An understanding of the travel behavior of all members of the increasing number of households with two

working spouses is critical to our ability to predict and respond to future travel demands. We must also have a comparable understanding of households with only one adult where that person is also in the paid work force. We must know the numbers and kinds of trips taken by all members of the household, modal choice by trip type and the kind of trip tours taken (that is, complex grouping of more than one activity into one trip from the house). Data on the changes in those patterns over time as the income of one or both workers increases and/or as the children grow up is also critical.

B. Residential and Locational Implications of Changes in Labor Force Participation

Another important set of concerns arises out of the changing demographics of the population: how the employment of women effects or is affected by their residential location decisions and their accessibility to relevant employment concentrations. Such questions clearly build on the demographic information presented in the previous section.

Several disciplines have devoted significant thought to the complicated relationships between urban development and transportation systems. However, focusing on women brings a new set of questions. How will the increasing employment of women, their rising incomes and their continuing or changing family responsibilities affect how either two worker families or female headed families choose their home and their work places? The central concern of transportation planners is the transportation implications of household location and employment decisions.

However, these questions can be framed in reverse causal order; how do transportation services and facilities effect residential and employment choices?

Traditional household choice models maintain that households locate in relationship to the employment opportunities available to the chief worker leaving the "secondary" worker to fend for, historically, herself. In these models, household rent and space are traded off against travel costs. Traditional labor market economists, however, maintain that travel is a cost of employment and that workers act to maximize their net income, i.e., their gross salary less their travel costs (in both time and money). Either model can be used to explain why women tend to work closer to home, have lower travel costs (measured in both time and money) and use mass transit more than men.

What impact will the increasing involvement of women in the labor force have on household decisions? Will households act to maximize total household income or minimize total household travel expenditures? If they choose to compromise between either the employment choices or the travel costs incurred by or available to both workers, what are the implications for urban form and by definition for both household and total travel choices? What are or will be the housing and employment choices of households headed by women? What impact will a woman's new activities have on the decision to move within an area from an existing residence?

Most of the traditional models make a number of assumptions that may not be valid for women workers whose personal mobility may be limited by family responsibilities or the inability to obtain mortgages. Unmarried heads of households have been found to prefer multi-family housing even as income rises. This raises a number of questions. Is there in fact a substantial choice difference between female heads of household and male headed households who prefer low density, single family housing? Are female heads at any income level able to obtain mortgage loans to purchase low density suburban housing?

Female workers with or without spouse present may calculate the value of their domestic responsibilities and the time spent engaged in those activities differently than similarly situated males. If so, will this create different calculations of the time they are willing to spend in travel, the mode they are willing to use, or the places thay are willing to live?

C. Comparative Attitudes and Preferences of Men and Women Travellers

A number of cognitive processes are involved in any individual's judgements about particular transportation services and in that person's decision to use a certain mode. What is important in people's modal choice decision is how they perceive certain system attributes and how they use those perceptions to form their preferences for a certain mode or service. This personal preference, constrained by environmental characteristics, guides travel choice behavior.

Not all people perceive system characteristics in the same way; some people may find rail transit to be noisy or crowded, while that may not be others' perception. Not all people prefer the same features whether or not their perceptions are the same. Retired people may not care whether mass transit is reliable although employed people may be very concerned about this feature. Important cognitive factors such as perceptions, attitudes, and preferences intervene between the actual characteristics of a transportation system and a person's choice of that system when travelling.

Researchers have spent considerable time investigating how people form their perceptions and how (and if) those perceptions affect their travel behavior. Such research has been used for example to identify features of existing systems that ought to be altered to attract more riders, as well as to predict ridership on new facilities and services. By differentiating groups with similar cognitive processes, or attitudes, the prediction of response to new systems or services may be possible. Transit marketing agencies use such information to do market segmentation, grouping people with similar decision-making processes. They can then predict each group's response to both existing and proposed transportation system attributes and make those systems more responsive to people's concerns.

The papers presented and the Conference discussions highlight the importance of attitudinal and preference variables in comparing and predicting the travel behavior of women and men. Men and women have been found to have different attitudes and preferences toward components of

transportation systems. Women are more, often significantly more, pro-transit and anti-car than men. Attitudinal research therefore is not directly a woman's issue but women can often be defined as a distinct market segment with attitudes and decision processes internally similar but different from men.

These differences in attitude, however, may be caused by variables which could change along with the demographic changes in society; this would seriously detract from the use of current attitudes as behavioral predictors. It is known that people's experience with a mode or service affects their attitudes toward modal choice. Women currently use transit far more than men and it is difficult to isolate differences in their experiences from sex-based differences in preference or reactions toward certain system attributes. Reported intentions to use transit, which are far higher among women in the research presented, may simply reflect an adaptive response to a situational constraint. Knowing that they have no alternative transportation option, some women may report a favorable intention to use transit. Indeed they may see it in a more favorable light.

All of the researchers who presented papers recognized these difficulties and attempted to control for both experiential and situational constraints. Because these issues are so complex and interwoven, some doubt still remains.

For example, one Conference paper controlled for auto avialability by using a measure derived by dividing the number of cars available to a

house by the number of licensed drivers in the household. This tacitly assumes that all drivers have equal access to household vehicle(s). It can be argued, as the authors noted in their oral discussion, that access to available transportation resources within a household may not be equal. It is possible that women in households with one car may only have the same modal options (for certain trips at least) as women in households without any car. There is reason for both sets of women to report favorable perceptions of transit since they both have roughly equivalent situational constraints. Thus we still cannot know if women really have more favorable attitudes toward mass transit independent of situational constraints.

There are other problems with basing behavioral predictions on stated attitudes and preference. Perceptions are a result of experience and conditioning to actual system characteristics. Therefore, it is possible to change system attributes significantly without changing people's perceptions; if so, there will be no change in their travel behavior. For example, it is possible to make commuter trains run on schedule or make a transit station safer without changing people's perceptions that the station is unsafe or that the train is always late.

Just as significantly, transportation researchers in general have not been very successful in using stated preferences or intentions to predict behavior. Some of this may be due to what has been called the discount factor; the closer people are to actually making a decision and the more they know about that choice, the more likely they are to give an accurate

description of what they will do. In fact some argue that there must be a situation where a stated attitude can influence behavior for such questions to be valid. For example, attitudes or stated intentions toward non-existent but planned rapid rail systems may be meaningless.

At the present time research consistently shows real and significant differences in the attitudes of men and women toward many transportation options. It is important to know if there are long-term differences in men's and women's evaluation of transportation improvements based perhaps on personal preference, or whether such differences are now the result of situational constraints and varied experience. Such information would allow the prediction of the transportation behavior of women even as their employment and household responsibilities change.

D. Personal Security

Both the frequency of use of public transportation and spatial and temporal use patterns are influenced by an individual's perceptions of personal security. Most people feel personal security in transportation to be largely a woman's issue. However, the papers presented on this topic indicate that personal security has relevance for men's travel choices as well. Of course, security questions involve all the modes. For example, many women may fear both parking garages and the walks to and from their parked cars.

Women may make a number of activity and travel choices based on their perceptions of their safety; some Conference participants argued that women

actually make major decisions such as employment choices based on such perceptions. Women who work at late-night occupations and those who depend on public transit are especially vulnerable, but those who have low incomes as well may have fewer transportation or employment choices available.

There are a number of perceptual problems in this area. People may feel safe when they are not, and not feel safe when they are. Those who work in rape prevention have found that women perceive an area to be secure because they are unaware of recent rapes at that location. Efforts to increase security, or to lower crime rates, must then be two-pronged: they must actually make the area more secure and they must convince the people involved that such is actually the case. This raises the interesting, and disturbing question of whether people's perceptions of safety can be changed without actually making an area more secure. Research presented in this volume shows this to be entirely possible. Women, in particular, can be convinced that a transit station is safer when the crime rate has actually not changed!

As a corollary, there is a need to develop a method to decide which areas, stations, parking lost, etc. ought to be made more secure. Many crimes, particularly rape and personal harassment, are significantly under-reported and so analysts are hard pressed to know where the problem is the worst and under what conditions. Since citizens may not actually know themselves where real crime rates are high, responding to citizen complaints may cause an inefficient deployment of resources.

There is evidence that men and women have different concerns about personal security and some indication that they have different responses to crime countermeasures. It is necessary, therefore, to determine if differential countermeasures are necessary and if those differential measures have different short and long term impacts on crime.

Major transit properties are extremely worried about declining ridership among women which management attributes to their fears for personal safety. Since so many current transit riders are women, this is a particularly significant problem. It is not surprising that the transit industry is involved in several major studies of personal security. One of the Conference papers that addresses this issues is derived from such a study.

E. Human Factors and Reactions to Vehicle Environment

Women have different reactions to and attitudes toward certain aspects of vehicle design. And, obviously, there are physiological and anatomical differences between the sexes. Therefore, questions arise about women's differential responses to specific components of vehicle design and how those responses affect their decision-making. These issues have significance for a number of reasons. Such information may be used to predict the response of different subgroups in the population to existing or proposed safety devices, or to down-sizing in vehicles to meet environmental and energy constraints. There is some evidence that women may be willing to make different trade-offs than men among safety, environmental protection and energy conservation. It is important to

have a firm understanding of those decision processes to be able to predict the response to a wide variety of governmental environmental and energy measures.

Current transportation systems are also concerned about consumer response to ride quality. Are there differences in male and female perceptions of that attribute and do any such differences in perception affect mode choice?

Human factors research, suprisingly, has not been particularly concerned with sex differences in the past. A paper in this volume reports on the dearth of practical treatments of gender of sex differences in the human factors literature, citing a review of articles appearing in two major human factors journals over an eleven year period. The researchers found that half of the studies reported on used only male subjects, another third failed to mention who their subjects were, and only one-third of the remaining studies which had data by sex, analyzed for sex differences. It is striking that of those studies that did analyze along the dimension of sex, 73 percent found significant performance differences due to sex.

In particular, the literature dealing with the reaction to vibration in vehicles and to the motion of vehicles has simply ignored sex from the beginning, perhaps because many such experiments originated with the military. However, recent research seems to indicate both differences in the perceptions and responses of men and women to certain vehicle environments and also an inclination to act differently on those

perceptions.

It is interesting to note that in an area where most professionals admit the need for research along the lines of sex, so little work has been done. Only one paper presented at the Conference discussed such issues. Work is needed to identify how reactions to different vehicle components and vehicle attributes affect mode choice and related travel decisions for both men and women. Such information would allow prediction of car buying by sex, response to safety or environmental modifications to vehicles, and changes in mode choice in response to undesirable ride quality.

F. Methodological and Planning Implications

Planning may be thought of as a technical process in which sophisticated tools and methods are brought to bear on public problems. When planning is viewed in this light it can be addressed neatly within the primary focus of the Conference, the prediction of travel behavior, and it can eschew discussions of equity. Yet it is difficult to analyze the planning process, in transportation or any field, without recognizing that planning decisions involve choices between competing interests and values. Even if planning methods and tools were value-free, an assumption seriously challenged by the Conference, it is clear that choices between interests in conflict raise equity issues. At the very least planners must explain to decision-makers what are the interests in conflict and determine upon which groups in society the burden of a given decision will fall.

The federal government has ordered and structured the transportation planning process so that many interests and affected groups can speak out about their concerns. There is a tacit assumption in the requirements for citizen participation and public hearings that many groups understand and explain best their own interests and the impact on their interests of government policies. There is also a recognition that some groups are disadvantaged in the planning process either by their inability to "speak for themselves" or by economic and social forces in general. Recent federal legislation mandates special attention to the needs of such groups. These concerns and the process as it has evolved has carried planning far beyond a set of technical procedures which admit of no known value judgements or subjective appraisals.

Ultimately the choice between competing interests is a political one, but the proper presentation of those interests is a planning concern. A finding that women, or any group, have special interests or are affected differently by proposed programs does not, of course, require that planners or decision-makers change their proposals. There are few governmental decisions that affect everyone in the same way or distribute their burden equally. Both proponents and advocates of studying women's travel issues must recognize that there is a clear difference between a mandate that women's needs must be understood and recognized in the planning process, and a mandate that those needs take precedence over other concerns and interests. However, an informed planning process may eventually find ways to accommodate a larger number of

interests and concerns within governmental programs or to mitigate the negative consequences of those programs for certain groups.

There were three major prediction issues that arose in discussing planning methodologies and women's travel issues. Each will be described and discussed briefly below.

1. Planning Methodologies; Do They Work and Are They Value-Free?

A whole range of planning and predictive models have been developed in the last 20 years on which a number of transportation decisions in major metropolitan areas have been based. There is considerable debate within the transportation planning community on specific attributes of those models or the data sets on which they are based.

There are serious technical questions about the ability of many models to predict individual response to a variety of potential transportation policies. The models in use in most metropolitan areas have been widely criticized for their inability to predict the implications of certain policies for the travel behavior of any subgroup in the population including women. Because current metropolitan planning transportation models are based on aggregate observations they cannot be used to focus on individual groups or to predict the impact of various policies on those groups. Most models in use are insensitive to the behavioral causes of travel so they cannot be used to predict people's responses to innovative transportation services, to different policies such as gasoline rationing, or to different products such as electric cars.

Because current models are not based on behavioral relationships they may fail to correctly predict the impact of demographic and societal changes on the travel behavior of women or men. In short, existing models are relatively ineffective in key policy areas because they do not recognize or measure the individual differences between and among members of a household. Such an understanding is a prerequisite to formulating effective transportation, energy, and environmental policies.

For many planners the availability of technical tools allows them to view the planning function as objective and value-free; they feel strongly that their use of such tools removes the planning process from the political realm. The increasing use of such models has strengthened this view and furthered a strong technological orientation in current transportation planning. Recent criticism has charged that neither the models themselves nor their ultimate use in the planning process are neutral and objective.

A model is a set of relationships between variables portrayed in mathematical terms. Not all real world relationships can be represented or, at least, the model becomes so unwieldy as to be useless. The choice of which relationships and which variables to include and which to exclude is far from an objective one. It is based on analysts' views of which variables are linked to travel behavior and which kinds of travel behavior are important. Most existing models are filled with assumptions that reveal value judgements: modal-split models assume that all travellers are the same and make their travel decisions based on time and

cost considerations alone, not on household responsibilities or even personal preference. Women's changing employment or income status, or their different attitudes about public transit, are not included in most models because of a decision that those variables are not relevant or need not be distinguished from mens'.

Most commonly used models focus largely or solely on work trips, based on the implicit judgement that society is only interested in measuring the activity of people in the paid labor force. Most models deal only with vehicular travel, implicitily assuming that walking, biking and other modes are not or will not be significant policy concerns. In so limiting their data collection and analysis efforts, such models cannot produce information on the trip behavior of retired people, women or bikers, if policymakers should seek such data.

In addition, many models include relationships based on empirical observations of key variables. When such relationships are used to predict future travel demand they tend to "freeze in time" cultural and even economic patterns that may no longer exist (e.g. traditional divisions of household responsibilities) or that we do not automatically wish to perpetuate (e.g. black ghettos or low density suburban development).

In addition to criticism of existing travel demand models, there has also been criticism of the presumably objective measures used to evaluate the costs and benefits of proposed transportation services and facilities. Critics have noted that most "objective" analyses initially make

a number of value judgements; for example, that increased access and decreased traffic congestion are always desirable. Alternatives are often evaluated not only in terms of one another but in terms of some idealized or valued alternative, an ideal not always apparent to observers.

Like most of the travel demand models, many cost-effectiveness analyses focus solely on work trips. A commonly used evaluation criterion is travel times savings on the journey to work; this figure usually represents the total or aggregate of all individual time savings that might occur because of some transportation alternative. In quantitative evaluations such measures tend to weigh the time of a male working outside the home higher than that of an unsalaried housewife working at home and often to weigh a professional's time higher than a low income person's. In addition, the use of aggregate figures obscures significant differences that each transportation alternative may have for different groups of people, even for those in the paid labor force.

The models and analyses discussed above are given strength and legitimacy by their use in an increasingly formally prescribed planning process. This process involves regulations, prohibitions, and mandates from several levels of government. This evolving process has been changed in response to the demands and criticisms of a number of groups in the past.

Some Conference speakers felt that the way to change deficient technical tools (as well as the objectives of the planning process) was through attention to the structuring of that planning process. In their view, changes in unsatisfactory technical procedures would come through

demand for changes in the objectives and requirements of the planning process. Should the process be required from its onset to specifically take into account the needs of women or the impact of proposed policies on women, the models and the data collection procedures could and would be changed accordingly. It is not possible for a model that does not take into account women's changing employment and household responsibilities, or for a planning study that did not gather data on women's non-work trips, to suddenly take those factors into account. If the process itself is not changed, a concern with women's issues would simply be added to the end of a technical process which did not include a sophisticated analysis of those issues at all.

2. Transportation Planning and Equity

Planning issues lead to decisions about the allocation of scarce resources among competing interests in society. Two related concerns captured the attention of Conference participants; how resources should be allocated among competing interests, and how fairly such resources had been allocated in the past.

A crucial issue underlying both questions was a concern with what Conference participants tended to call equity, although they often meant different things at different times. To some, equity meant equality, that men and women in general should have equal amounts of transportation resources. For some the mere fact that men and women were found to have different travel patterns was an indication that inequities existed. But it should be clear that all inequalities in behavior are

not indicative of inequities nor of the need for additional transportation services. Such a definition of equity is a difficult one because it assumes that everyone, men and women, workers and non-workers, etc. have the same needs and desires for travel. Obviously, this is not so.

Equity was also used to mean a concern with disadvantaged groups in society -- the poor, the elderly, the handicapped, and increasingly, women. This definition of equity is also a difficult one. It gives very little idea of how resources could or should be allocated to these groups or among the various groups and interests in society. Any group may be disadvantaged without having travel patterns significantly different from the average. And any differences in travel behavior between and among groups are not necessarily indicative of deficiencies in transportation services nor of the need for governmental redress.

What most participants seemed to mean when they expressed their concern for equity was that transportation services ought to be provided to those individuals and groups that needed them whether their demand was greater or lesser than the average. Moreover, many Conference participants felt that government in general and transportation planners in particular ought to take an active role in determining the needs of certain groups, including women, and actively work to meet those needs.

The identification of needs, however, is not an easy task. Even once identified, the decision that a transportation need is deserving of attention by governmental planners and ultimately policymakers is very much a political and value judgement.

Thus, there are two basic issues facing transportation planners; first, how to identify whether a group, such as the elderly or suburban women, have unmet or poorly met transportation needs. Secondly, how to evaluate the importance of those needs or even rank them so that in a world of scarce resources those who are most "needy" will be identified and possibly served first.

a. How to Identify "Needs"

The problem of identifying whether any group of women currently has or will have unmet travel needs is obscured by the perceptual aspect of need assessment. People may say they are in need when in fact they are not. Or, just as important, people may say they have no unmet needs. The latter response may come from people so limited by their existing travel constraints that they do not formulate desires that they know they cannot fulfill.

This raises a clear dilemma for planners. One option is to assert that there are some objectively observed travel needs which are not being met and to respond to those needs whether they are perceived or not. This option makes sense if we are concerned about system attributes such as safety or comfort. However, this option is problematic if we are concerned about increasing access to sites where planners think the needy ought to go, even in the absence of any expressed desire on their part to do so.

b. How to Evaluate Unmet Needs

In at least a conceptual sense, it is possible to attempt to evaluate unmet transportation needs by how vital they are to the health and welfare of the people involved. Unfortunately, such an approach can call forth a great deal of rhetoric without giving significant guidance to planners caught in the middle of a number of conflicting needs. On one value-system, for example, a male worker's trip to work would be ranked higher than the shopping trips of his housewife spouse because his travel is more vital to the well-being of the entire household. This value in fact pervades most of the government sponsored highway construction of the last twenty years. Moreover, that same value judgement may be made routinely by all members within a family about the allocation of a single car. Does that consensual decision make a "stranded" suburban housewife less needy?

Inherent in some definition of need is the concept of merit; that different groups of people may have genuine unmet needs but one group is more deserving than the others. This is another way of ranking conflicting needs but it goes further; it implies that the important question is how much people deserve assistance. One need not support this view to recognize that the concept of the "deserving needy" is at least an implicit equity criterion in many planning decisions. This concept raises some interesting problems for those concerned with meeting women's travel needs. At the Conference a number of participants questioned whether the transportation problems of middle-class suburban housewives were as deserving of attention as those of black inner-city heads of

households. This question at least tacitly assumed that those who were in a better financial position were less deserving of assistance no matter how genuine their need.

Allied to this concern with the merit of any need was a question of whether governmental response or equity concern was appropriate where the transportation need was created by some conscious decision of the people involved. A number of Conference participants questioned whether the government should be concerned with the transportation problems of suburban housewives, for example, who had chosen to move to low density suburbs where they knew there would be no public transit service. Was the government required to intervene because women allowed their salaried spouse to take the only household car? Some participants argued that to provide expensive transit services to low density suburbs was in fact to encourage households to keep making the same dysfunctional locational and inequitable household allocations.

There were no easy answers to the equity questions about identifying and ranking transportation needs. Many participants felt that these conflicts and tensions could only be resolved in the political arena.

3. Transportation and Urban Support Systems

A major concern facing transportation planners is how interrelated all transportation questions are with all urban development and service delivery questions. Some participants questioned whether transportation planners were finding it necessary to address deficiencies or inequities in the way metropolitan housing markets operated and the method by which social

and human networks delivered services.

A number of groups in society are demanding that transportation services and systems redress the inadequacies in other service delivery systems. It is clear that planners must question whether a need for a service on the part of women or any group in society (however identified or ranked) is really a transportation need or whether such a need is created by a failure in the delivery mechanisms of other support systems. Transportation resources are not unlimited and all the problems created by deficiencies in other societal systems cannot be addressed by transportation facilities. Moreover, unless there is a recognition of the true source of a problem, imperfections in other societal systems may never be addressed.

It is also clear that transportation planners cannot develop transportation plans independently of other urban development plans. Many at the Conference questioned whether transportation planners are asking the right questions when they attempt to predict future transportation patterns. Which are the dependent and which the independent variables in the complex relationship between developing residential and industrial land use patterns and transportation system components?

4. Summary

The research presented at the Conference pointed out the need for transportation planners to respond to the issues raised by this Conference and to incorporate findings from current and future research efforts into their tools and plans. But the very issues this Conference addresses have caused conflict in the transportation

planning community. For the transportation planning profession to accept the ideas suggested by the Conference requires that planners acknowledge the subjective nature of many of their activities. Planners must accept that the planning process itself is a subject for political debate and that the technical procedures so highly developed over the years might require changes so that they can better inform policymakers and respond to new political objectives.

III. Organization of This Volume

The individual papers dealing with the six major themes discussed above will follow this section. Some papers presented at the Conference appear in this document in abridged form only; these abridgements follow the presentation of the full papers. Following those are the speeches presented by the distinguished speakers who addressed the Conference.

The findings and research recommendations prepared by Conference participants on the last day of the Conference close this volume.

II. CONFERENCE PAPERS

A. INTRA-HOUSEHOLD IMPLICATIONS OF THE INVOLVEMENT OF WOMEN IN THE PAID LABOR FORCE

INTRA-HOUSEHOLD IMPLICATIONS OF THE INVOLVEMENT OF WOMEN IN THE PAID LABOR FORCE

The first paper in this section describes current demographic trends in American society. The remaining four papers deal with one crucial aspect of those demographic changes -- how households respond to the salaried employment of women. These four papers consider how household responsibilities are allocated among the members and the consequences of that allocation for the kind, number, and distribution of trips made by individual members of the household.

Ralph Smith's paper on demographic trends is the first chapter in a recently-published Urban Institute report undertaken for the U.S. Department of Labor. It is a detailed examination of the increasing involvement of women, particularly married women, in the paid labor force. Smith analyzes historic trends, and, cautioning that labor market economists have been notably unsuccessful in predicting the participation of women, makes projections to 1990. In a brief analysis, he concludes that there are demographic, economic, and sociological explanations of the large increase in labor force participation, especially of married women with children. Smith's paper lays the ground work not only for the papers that follow his in this section but for many of those in subsequent sections.

Richard McGinnis' paper is based on a sub-sample of the 1968 Washington, D.C. Home Interview Survey; he considers how trips were distributed among members of a household rather than focusing on total household travel. He investigates changes in the travel behavior of a wife when she chooses to seek a paid job, the impact of children on the travel behavior of the wife entering the paid labor force and the travel differences between married men

and women. He finds that in most cases the husband's trip-making behavior stayed the same or increased slightly when his wife sought salaried employment; the wife's non-work travel decreased to more nearly resemble that of her spouse. McGinnis concludes that it is employment and not the presence or absence of children which creates these shifts in travel.

The Skinner-Borlaug paper also uses a sub-set of the 1968 Washington, D.C. Home Interview Survey, along with a small survey taken in Edinburgh in 1971. A cross-cultural analysis is performed of the shopping travel patterns between women and men in the Washington data as compared to patterns demonstrated in the Edinburgh data. The authors find that as women are employed in the paid labor force to an increasing degree, their number of shopping trips decreases. These women do, however, appear to retain the primary shopping responsibility.

The Hanson and Hanson paper describes a study designed to ascertain how the time constraints imposed by employment affect the travel behavior of women and to investigate how a wife's full-time employment affects the travel patterns of her husband. The study was undertaken in Uppsala, Sweden in the Spring of 1971. The authors found that women's non-work trips were reduced considerably when they entered the paid work force, but that there was little or no impact on the trip behavior of their husbands. Moreover, the authors found that there was a significant shifting of non-work trips such as shopping by the wife to weekends; in contrast to American research they found that trip-linkages or chaining decreased for employed women.

It should be noted that while the Edinburgh data set used in the Skinner-Borlaug paper and the Uppsala data analyzed by Hanson and Hanson include weekend travel, comparable weekend trip data are not contained in the

often used 1968 Washington, D.C. Home Interview set. Thus, the degree to which shopping was shifted to the weekend but still maintained by the wife cannot be determined.

David Damm's paper analyzes travel behavior from the perspective of activity schedules, that is, how people order their activities and trips over time. Using data collected in Minneapolis-St. Paul in 1970, he examines whether sex alone is a predictive variable in explaing both activity schedules and resultant travel behavior. He concludes that it is also necessary to focus on other socioeconomic variables describing a household and the number of people available to carry out household responsibilities; studying the activity schedules divided solely by gender is inefficient.

THE MOVEMENT OF WOMEN INTO THE LABOR FORCE*

Ralph E. Smith
National Commission for Employment Policy

A major transformation in American society has been taking place, one that affects virtually all of our social and economic arrangements. An increasing proportion of women are either working outside the home or looking for work. The workplace is no longer a man's world. The family with a working husband supporting a wife who stays home to mind the children still exists, but it is getting harder to find and it is certainly no longer typical.

At the turn of the century, only 5 million of the 28 million Americans in the labor force were female. One-quarter of these women were teenagers and only a handful were married. As recently as 1947, fewer than 17 million of the 59 million labor force participants were women. But over the past thirty years, six out of ten additions to the workplace have been female. During this short period in our history, it has become widely acceptable for married women to seek work outside the home. Almost half are now doing so, including over one-third of mothers of young children.

The movement of women into the paid labor market has often been called a revolution. It certainly is a revolution in the sense that it is

*This paper was the draft of a work which became the first Chapter of a 1979 Urban Institute publication The Subtle Revolution: Women at Work. It is published with permission.

bringing about a fundamental change in social and economic conditions. The division of labor between the sexes in which men work outside the home for pay while women engage in unpaid housework is breaking down. And, as more women work outside the home, the fight for equal treatment in the job market and equal responsibilities for unpaid domestic work is intensified. Indeed, female-male relationships in every aspect of society are being questioned and are changing. The movement of women into the labor force is part of this larger social revolution, both as a cause and as an effect. The economic power that is provided by paid employment enhances the bargaining power of an individual in the marketplace, the political arena, and the home.

But the revolution associated with women's movement into the paid labor force is, in many ways, a subtle revolution. It is subtle in that it has been gradual, not traceable to any abrupt change. Decade after decade the percentage of the female population in the labor force (that is, their participation rate) has been increasing. In the years since 1947, when statistics began to be collected on a regular basis, the participation rate of women increased in all but four years, but never by more than 1.5 percentage points in any one year.

The revolution is subtle in that its origins are difficult to understand. Students of female labor force behavior have many explanations and disagree about which are the most important. Many economists point to the increasing attractiveness of the paid labor market to women, as real wages have risen and opportunities (particularly in white collar jobs) have expanded. Many sociologists point to changes

in sex role attitudes, rising divorce rates, and falling birth rates as important factors. Other explanations offered at one time or another include the invention of labor-saving devices for the home, rising education levels, inflation, unemployment, the movement away from rural areas, and so forth. Probably all have been important in various periods.

It is subtle in that its course has been difficult to predict. Time after time, projections of the size of the female labor force have seriously underestimated future growth. Official government forecasts repeatedly have called for a tapering off of past growth rates and repeatedly have been wrong.

It is subtle in that many of its consequences are enigmatic. No one really knows what the American economy and society would be like today had the women stayed home. No one knows what the future effects of their continued labor force growth will be. The consequences of the past growth in the female labor force and the anticipated consequences of continued growth are far-reaching.

This book is about some of the consequences. It is intended to provide a basis for anticipating and reacting to challenges caused by this growth. These challenges include transition problems, as individuals and institutions adjust to women's changing role, and new opportunities, as more women become available for paid work outside the home.

Each of the chapters that follows focuses on aspects of society that have been or will be affected by the continuing increase in the size

of the female workforce. The implications of anticipated growth over the next dècade for the labor market itself, the home, and other social institutions are examined. The authors have as their objectives: to describe and analyze the changes that are likely to occur because of women's increased labor force activity; to isolate issues likely to arise because of these changes, expecially those that may be the subject of public policy; and to identify alternative ways of resolving these issues and to present a conceptual and factual basis for choice.

This chapter presents the context within which the changes are occurring. The growth of the female labor force since the turn of the century and the reasons for it are reviewed. Next, a picture of today's female workforce--who they are and what they are doing--is presented. Forecasts of the growth of women in the labor force through the end of the next decade are offered; the projections for 1990 will be used as a frame of reference by the other authors. The final sections of this chapter discuss several of the issues arising from women's movement into the labor force and provide a summary of the remainder of the volume.

The Growth of the Female Labor Force*

Although stereotypes are often based on fact, they are seldom revised as quickly as the facts change. Stereotypes about the roles of men and women and the structures of families provide an excellent example of

*The discussion of the determinants of past labor force growth and the projection of future growth and based on research conducted under Grant No. 21-11-77-09 from the Employment and Training Administration, U.S. Department of Labor.

this phenomenon. In 1890, the first year for which labor force information remotely comparable to current tabulations appeared, few women worked outside the home. That year's census revealed that 3.7 million women were in the labor force. They accounted for only 17 percent of all workers and 18 percent of the female population, age 14 and over. All but a million of these working women were single. Only 4.5 percent of married women were in the labor force at that time.

Expansion of the female labor force since that era has been due both to population growth and to the dramatic increase in the proportion of women who have chosen (or been required) to seek paid work. Meanwhile, the male labor force has grown much less rapidly. Although the male population expanded at about the same rate as the female population, the proportion of the male population in the labor force actually fell. Between 1890 and 1977 the female labor force participation rate grew from 18 percent to 48 percent while that of males declined from 84 percent to 78 percent. The decrease for men is mostly attributable to longer education, earlier retirement and longer lifespans.

Most of the increase for women is associated with a profound change in the activities of married women. Throughout the entire period, most adult women have married and their participation has significantly increased. By 1977 nearly half of all married women who lived with their husbands were in the labor force. The increases in the participation rates among women who had never married or who were in other marital categories (separated, divorced, and widowed) were much less pronounced, because a substantial percentage of them have always had

to work. In 1890, 37 percent of women who had never married were in the labor force, compared with 59 percent in 1977 and the rate for women no longer married increased from 29 percent to 42 percent.

The sharpest sustained increases in the participation rates of women, including married women, have occurred in the past few decades. Between 1947 and 1977, the participation rate of women increased by 17 percentage points. To appreciate the magnitude of this change, consider how many women are in the labor force now who would not be there if no change had occurred. In 1977, 40 million women were in the labor force, 48.5 percent of the female population age 16 and over. If, instead, the percentage in the labor force had remained as it was in 1947 (31.8 percent), only 26 million women would have been in the labor force. In other words, there are 14 million women now in the labor market who would not be there if a revolution in women's roles had not occurred.

The post-War participation rate increase is primarily a result of the more than doubling of the participation rate of married women. Between 1947 and 1977, their rate increased from 20.0 percent to 46.6 percent. Thirteen million of the 14 million added to the labor force as a result of participation rate increases were married. The question, then, is: why is a so much larger fraction of the female population, especially of married women, now seeking work?

Many attempts have been made by economists and sociologists to answer this question. From their theoretical and empirical studies, it is possible to identify the factors that are likely to have played

significant parts, without trying to isolate the relative sizes of their contributions. The theory of decision-making developed in micro-economics provides one conceptual framework. An individual decides whether to participate in the labor force based on the perceived rewards to seeking paid employment relative to the rewards of spending this time outside the labor force. The latter may include a multitude of activities such as going to school fulltime, homemaking, volunteer work, convalescence, or simply leisure.

For healthy men who have completed their education and are younger than normal retirement age, the decision to seek work is hardly a conscious one. Ninety-five percent of all men between the ages of 25 and 54 report that they are either working or looking for work. Economic necessity and social conformity together serve to make the cost of neither working nor looking for work unacceptably high for most central-age men.

Other demographic groups include large numbers of individuals who do have a choice. As we have seen, an increasing proportion of women have opted to participate. This suggests that the perceived benefits of being in the labor force have been increasing, the benefits of not participating have been decreasing, or both. What has changed?

Most economists who have investigated this subject rely heavily on economic explanations. As the economy has expanded throughout most of this century, real wages (adjusted for inflation) available to women have increased manyfold. There has been no corresponding increase in the rewards to working within the home. Therefore, more women have

shifted part of their work activity into the marketplace. The "opportunity cost" of staying at home all day has become too great for an increasing proportion of women.

The economic model on which this conclusion is based takes into account two opposing forces set in motion by rising wages. The first is the positive relationship between participation in the labor force and the wage rate discussed above. As wages rise, paid labor is substituted for unpaid activities outside the labor market. The opposing force is an income effect, through which the rising income within a family associated with higher wages is translated into less economic pressure to work and greater financial means to enjoy leisure pursuits, go to school, and so forth.

For married women with husbands present there is a preponderance of evidence that the substitution effect has outweighed the income effect. Even though the increase in husbands' earnings throughout most of the century has permitted improvement in living standards without their entering the labor force, many wives have chosen to do so. The economic explanation for this phenomenon is that these women were facing a three-way choice, rather than the simple labor vs. leisure choice originally presumed in the theory. For them, the third option is unpaid work within the home. An increase in family income permits reduction in unpaid work, through the purchase of labor-saving devices, restaurant meals, domestic service, and the like. Thus, increases in real wages over time may cause more participation in the labor force for

married women, as has occurred throughout this century (Mincer, 1962; Cain, 1966).

Additional economic explanations for the long-term increase include the tremendous growth in the kinds of jobs that are thought to be most appealing to married women or for which employers are most willing to hire women. These include the growth in the service sector, office employment, and jobs that permit part-time schedules. Also, the importance of physical strength in many industrial sector jobs has diminished. In addition, women are acquiring increasing amounts of education, enabling them to qualify for jobs that are both better-paying and more interesting.

These explanations are closely related to the wage explanation in that they help to account for the continual rise in women's wages, even as so many women enter the market. Had demand not increased, it would have been likely that their wages, relative to men, would have fallen. In fact, the ratio of median female to male wage rates has been remarkably stable, remaining near six-tenths of the male wage throughout the century. Nonetheless, some independent effects of the shifts in the mix of job opportunities and in educational advancement should be expected since both affect the non-monetary benefits of paid employment as well.

Other economic factors that may affect the decision of a married woman to participate include her likelihood of finding a job, her husband's employment status, and inflation. Changes in these variables cause temporary changes in either the expected rewards to being in the labor

market or in income levels. Each may account for the pace of labor force growth in particular periods of unemployment fluctuations or inflation, but not for the long-term growth.

Sociologists have identified another set of influences that have reinforced these economic factors. These include demographic and attitudinal changes. Later marriages, rising divorce rates, declining birth rates, and other demographic trends certainly have been responsible for some of the participation rate growth, especially in recent years. Women who have never married are much more likely to participate in the labor force than married women of the same age. Women who are divorced or separated are more likely to participate than women with husbands present. The decline in the proportion of women who are in intact marriages has moved more women into the labor force-prone categories. It is actually somewhat more complicated than this, since causation goes in both directions; that is, increasing labor force participation of women may have helped to bring about later marriage and marital disruption.

Similarly, among women in otherwise comparable situations those with no children have the highest likelihood of being in the labor force; those with school-age children have the next highest; and those with very young children are least likely. Hence, the decline in the birth rate since the mid-1960's has contributed to recent labor force growth. The same qualification about causation applies. Women who are otherwise committed to the labor force may want fewer children.

Finally, increasing acceptance of non-traditional, and especially non-familial, roles for women has been credited with contributing to the rapid rise in the female participation rate in recent years. For example, in 1964 54 percent of women surveyed agreed that a mother who worked could establish a close relationship with her children (Mason, et al., 1976). Within only six years, the percentage of women with this view increased to 73 percent. This is a far cry from the attitudes prevailing in the 1930's, when only 18 percent of women in a national opinion survey answered with an unconditional yes to the question, "Do you believe that married women should have a full-time job outside the home?" and 41 percent said no (Oppenheimer, 1970). Sociologists have assembled convincing evidence that an increasing proportion of women believe that work outside the home is compatible with their other roles and that this increase is related to the growth in their labor force (Waite, 1978). Once again, causation is difficult to disentangle. For example, attitudes may have changed largely in response to the economic factors cited. Nonetheless, it seems likely that whatever the original reason the result will be to either increase the perceived benefit of being in the labor force or decrease the perceived benefit of staying at home.

In sum, during most of the period since World War II, all three sets of factors discussed here--improvement in job market opportunities, demographic change, and liberalization in attitudes--have contributed to the expansion of the female labor force. The next section provides a picture of what this workforce looks like. Then, the changes in the

size and composition of the female labor force that should be anticipated and the consequences of these changes are examined.

The Female Labor Force Today

Who are the women in the job market today? Why are they there? What are they doing? These kinds of questions are often answered with reference to the "typical" or average woman in the labor force. She is married, living with her husband, and working in a clerical job to increase her family's standard of living. This kind of a word picture provides the illusion of contributing to one's understanding of the female labor force. In fact, it contributes to the widespread misunderstanding of women's present role in the labor market.

With over 40 million women in the labor force--almost half of all women age 16 and over--it is nearly as misleading to attempt to describe them with a few averages as it would be to do so for men in the labor force. The distinguishing feature of the female work force is its diversity. Some indication of this can be seen by examining frequency distributions of their characteristics, rather than averages. A few will serve to demonstrate that the phenomenon of women working outside the home is not restricted to any particular group.

The review of the factors that have been responsible for the rapid growth of the female labor force do suggest certain characteristics or conditions which tend to increase the chances that a woman will be working or looking for work: Women who are in particular need of money--those with no husbands or with husbands who are not working or have low earnings--are more likely than women in high-income families to be in

the labor force. Women with few competing responsibilities outside the labor market are more likely to seek work. For example, women who are child-free or whose youngest child is already in school are more likely to participate. Finally, women with especially good job prospects are attracted to the labor market. Educational attainment is one indicator of this. Nonetheless millions of women who are married to husbands with above-average earnings or who have pre-school age children or who are not able to find particularly good jobs are also in the labor force.

Statistics on the marital and family characteristics of the women in the labor force illustrate the extent to which the composition of the female labor force is affected by some of these factors (U.S. Department of Labor, 1978). In March 1977, the most recent month for which detailed tabulations are available, there were 39.4 million women in the labor force, of whom 33.9 million were under age 55. Among the labor force participants under age 55, 57 percent were married and living with their husbands; 16 percent were divorced, separated, and widowed; and the remaining 27 percent had not married (Table 1).

The labor force participation rates shown in this table reveal that, even though the majority of the working women under age 55 are married and among the married ones the majority have young children, marriage and child-rearing do inhibit participation. Notice that 54 percent of women living with their husbands were in the labor force, compared with 61 percent of women who had never married and 71 percent of women who had been married. Notice, too, that within each marital group, women

Table 1

Labor Force Status of Women Ages 16-54, March 1977

	Population (thousands)	Labor Force (thousands)	Participation Rate (percent)
Never-married	14,756	9,028	61.2
Married, spouse present	36,095	19,484	54.0
No children under 18	11,527	7,527	65.3
Children 6-17 only	13,277	7,519	56.6
Children under 6	11,291	4,438	39.3
Other ever-married	7,641	5,415	70.9
No children under 18	3,218	2,473	76.8
Children 6-17 only	2,905	2,108	72.6
Children under 6	1,518	834	54.9
Total, 16-54	58,492	33,927	58.0

with no children under age 18 are more likely to participate than those with children between the ages of 6 and 17 and these women are more likely to participate than those with children under age 6. Analysis of more detailed data revealed similar patterns for most age groups.

What are all of these women doing in the labor force? Here again, there is considerable diversity. Three-quarters of them are working at least 35 hours per week (that is, full time) or are looking for such work. But one in four seeks part time jobs. The latter group includes a disproportionate number of teenagers and women over age 54. Female workers can be found in all kinds of jobs under all kinds of conditions and with a wide range of wages.

However, despite the heterogeneity of the female work force, most women are engaged in a rather narrow range of activities. The occupational and industrial concentration in a few "women's" jobs is the biggest problem facing women in the labor market today. One-third of all female workers are concentrated in clerical occupations. The fields of health care (not including physicians), education (not including post-high school), domestic service, and food service employ another percent of the female work force. The extreme form of occupational segregation in which women remained at home ended years ago. But the majority are still doing "women's work."

In large part due to the limited range of jobs held by women, the earnings of women tend to be very low. The occupations within which women are concentrated tend to have below-average pay scales and offer

limited opportunities for advancement. In addition, women often earn less than men within the same occupation. Largely as a result, the median annual earnings of women working full time, year round, are only sixty percent of those of men.

Notwithstanding the relatively low wages received by most women, their earnings are often a critical component of total family income. This is especially the case for the nearly eight million families which are headed by women. In 1976 in 35 percent of these families the only worker was the woman who headed it and their median family income was $7,300. In another 24 percent her earnings were supplemented by other family members, bringing the average up to $12,300. But if there were no earners (the situation for 27 percent of these families), the median income fell to only $3,800.

Even in intact marriages, the wife's earnings should not be dismissed as pin money. In March 1976 there were nearly 24 million marriages in which the wife worked. On average, the wife's earnings accounted for 26 percent of total 1975 family income. In the 10 million families in which the wife worked year round, full time, nearly 40 percent of total family income was from the wife's earnings. Again, averages obscure important distributions. On average, the U.S. population is not poor; but this does not comfort those who are. Similarly, among these 24 million families in which the wife worked were over one million in which the wife was the only earner in the family, families in which total family income was still below the poverty line and families in which total family income was below $15,000.

The Future Growth of the Female Labor Force

We have seen that the female labor force has grown rapidly during this century, particularly since World War II. Women from backgrounds as varied as the female population itself are now participating. We have also seen that the work they are doing is still largely confined to occupations that have come to be known as "women's work." What about the future? Will the size of the female labor force continue to grow? How rapidly? With what consequences?

The authors of the chapters that follow each proceed on the assumption that the labor force participation rate of the female population will continue to increase at a fairly rapid pace at least through the end of the next decade. The effects of this increase, especially as it has implications for current policies, are then examined in several critical areas. This section presents the labor force projections on which their analyses are based.

By 1990 about 55 percent of the female population ages 16 and over will be in the labor force, compared with 48 percent in 1977. Together with population growth, this will result in 52 million women working or looking for work, 12 million more than in 1977. Most of the net additions to the labor force will be between the ages of 25 and 54; most will be married; and many will have young children.

These projections are based on an extensive analysis of the determinants of future labor force growth, described in a separate report (Smith, 1978). Estimating the future size of the labor force involves projecting the size of the female population and projecting the percentage

of this population who will be in the labor force. The former is known with a fair degree of accuracy for women in 1990 who will be at least age 16, since they have all been born already. The Census Bureau provides projections by sex and detailed age categories. But projecting the percentage of women within each age group who will be in the labor force is much more tenuous. The track record of past labor force participation rate projections for women is not an enviable one.

The procedure we have followed is based on the observation that the percentage of women in the labor force differs considerably among population groups delineated by age, marital status, and presence of young children. As illustrated in the preceding table, the presence of a husband and/or young children reduces the chances of a woman being in the labor force. Also, there are differences between age groups; for example, women who are over age 54 are much less likely to be in the labor force than younger women. The overall percentage of women in the labor force has grown both because the participation rates within many of the specific age-marital-family status groups have increased and because the demographic composition of the female population has shifted toward groups that are more likely to be in the labor force, specifically women without husbands or young children. To project the future size of the female labor force we first projected the demographic composition of the female population and then projected the participation rates for 35 separate age-marital-family status groups.

The projections reported here were based on the assumption that, within each age group, the marital and family composition of the female

population will remain approximately as it was in 1977. The resulting marital and family composition is similar to the central projection made by the Census Bureau, but is still subject to error. The labor force projections are not very sensitive to a wide range of alternative assumptions regarding marital status, but are sensitive to the fertility assumption. In particular, if there is a baby boom before the year 1990, the labor force projection in general will be too high, but the projection of the number of working mothers would probably be too low (assuming no other errors). This uncertainty is further discussed below.

The next step--projecting participation rates within each group--is by far the most difficult. The participation rates of most female groups under age 55 have risen sharply in recent years. Will these increases continue? The answer depends on the future course of the large number of factors that influence the participation decision and the size of their impacts. Will role attitudes continue to change? Will job opportunities and wages continue to grow? Will the relative position of women in the labor market improve? To what extent will these and other factors continue to affect labor force decisions?

We concluded that most of the economic, social and demographic factors that have contributed to the rapid growth in the female labor force in recent years will continue to propel women into the labor market and encourage them to remain. The one important exception is that the sharp drop in the birth rate that occurred in the 1960's and 70's is unlikely to continue; by disaggregating the population by presence of young children and holding the composition of each age group's population

constant, we have implicitly removed changes in the fertility rate as a source of future labor force growth.

Why should it be expected that the labor force participation rate of women will continue to increase over the next decade? The reasons go back to most of the economic and attitudinal ones used to account for the increases that occurred since World War II. As long as married women continue to be attracted to the labor force by improved labor market opportunities, anticipated growth in the economy over the next decade should be an important positive factor. Will women continue to share in the job opportunities that are created by economic growth? There are several reasons to expect that they will. First, the job outlook in the white collar and service sector occupations (except for teachers) looks particularly good. Second, continued enforcement of equal opportunity laws should open up opportunities in other fields, such as the skilled trades, that have long been male preserves. Third, the educational level of the adult female population is expected to continue to increase, including in fields such as law and medicine in which the rewards for being in the workforce are particularly large. Fourth, women are developing increased work experience which, by itself, may pay off in higher wages, promotion opportunities, and seniority rights.

In addition to the economic reasons, the role of attitudinal change should not be ignored. The women who will be between the ages of 20 and 64 in the year 1990 are now between the ages of 8 and 52. There is considerable evidence that younger women's attitudes toward the role

of women in the labor market are more liberal than those of older women. Even if no individual woman's attitude changed any further, just the replacement of the less liberal older women with the younger ones over time (that is, the aging of the cohorts) will, itself result in a working-age population that is more oriented toward the labor market.

Another factor that may be decisive for many women is the momentum that has built up as more and more women participate in the labor force. As women who do not work outside the home become a minority, keeping up with the Joneses will increasingly require that Ms. Smith enter the labor force. A family's place in the income distribution used to depend almost exclusively on the earnings of the husband. Now, even if the husband has above-average wages, the family could have below-average income if the wife stays home. Also, the full time homemaker finds that her occupation is becoming the atypical one.

The labor force projections reported here are based on the simple assumption that the increase in each age-marital-family group's participation rate over the next thirteen years will be similar to its trend from the preceding thirteen-year period. These produce rates for each age group that are slightly lower than those that would result from fitting trends directly to the age groups, since the latter would reflect the past decline in birth rates. The complete report contains several alternative projections, based on different estimation periods and behavioral assumptions.

A summary of the projections for 1990, along with the comparable numbers for 1977, is reported in Table 2. Notice that, even with the substantial increases in the participation rates of women with young children that are projected, the presence of children is still expected to deter labor force participation, although not by as much as it does today. Among married women under age 55, for example, it is projected that about 74 percent of the women with no minor children will be in the labor force; 70 percent of those with children between the ages of 6 and 17 only will participate; and 55 percent of those with children under age 6 will be in the labor force. Similarly, women without husbands will still be more likely to be in the labor force than married women, even though the projected growth in the former's participation rates is much smaller.

In other words, these projections do not reflect a sharp break with recent history. Nonetheless, when added to the changes in labor force patterns that have occurred during the last few decades, they depict a dramatic departure from many people's picture of what American women are doing. If these projections are accurate, by the end of the next decade, two-thirds of all married women under the age of 55 would be in the labor force, including more than half of the mothers of young children. Even though the number of married women in this age group is expected to increase from 36.1 million in 1977 to 44.4 million in 1990, the number staying home with children under age 18 is not expected to grow. The stereotype of a wife staying at home to look after her children would fit only one quarter of the 44.4 million

Table 2

Summary of Main Projections of Female Labor in 1990[a]

	Population (thousands)			Labor Force (thousands)			Participation Rate (percent)		
	Actual 1977 (March)	Projected 1990	Projected Change	Actual 1977 (March)	Projected 1990	Projected Change	Actual 1977 (March)	Projected 1990	Projected Change
Total, 16 and over	82,209	94,690	12,481	39,359	51,890	12,531	47.9	54.8	6.9
16-24	18,106	15,535	-2,571	10,324	10,420	96	57.0	67.1	10.1
25-54	40,386	52,023	11,637	23,603	35,706	12,103	58.4	68.6	10.2
55 and over	23,717	27,132	3,415	5,432	5,764	332	22.9	21.2	-1.7
Total, 16-54	58,492	67,558	9,066	33,927	46,126	12,199	58.0	68.3	10.3
Never-married	14,756	13,757	-999	9,028	9,464	436	61.2	68.8	7.6
Married, s.p.	36,095	44,390	8,295	19,484	29,600	10,116	54.0	66.7	12.7
No Children Under 18	11,527	12,942	1,415	7,527	9,561	2,034	65.3	73.9	8.6
Children 6-17 Only	13,277	17,859	4,582	7,519	12,520	5,001	56.6	70.1	13.5
Children Under 6	11,291	13,589	2,298	4,438	7,519	3,081	39.3	55.3	16.0
Other Ever-Married	7,641	9,410	1,769	5,415	7,062	1,647	70.9	75.0	4.1
No Children Under 18	3,218	3,740	522	2,473	3,063	590	76.8	81.9	5.1
Children 6-17 Only	2,905	3,882	977	2,108	2,865	757	72.6	73.8	1.2
Children Under 6	1,518	1,788	270	834	1,134	300	54.9	63.4	8.5
Total 16-54	58,492	67,558	9,066	33,927	46,126	12,199	58.0	68.3	10.3

a. Smith (1978).

women under the age of 55 who are expected to be married and living with their husbands in 1990.

Several patterns deserve discussion. First, all but 600,000 of the projected labor force increase is in the age group that is most likely to be able to compete successfully in the labor market, ages 25 through 54. This pattern is mainly due to the aging of the post-war baby generation. They will be in their prime years for being in the labor force by 1990. Fifty-five percent of the female population age 16 and over will be in this age group, compared with 49 percent in 1977. The absolute number of women in the 16-24 age group will fall; even with a projected 11-point increase in their participation rate, the number of young women in the labor force will be virtually the same as in 1977.

Married women are expected to account for a larger proportion of both the female population and the female labor force than they did in 1977. The former will occur because of the change in the age distribution; the latter, for the same reason plus the projected continued growth in their participation rate.

Finally--and most important--a very large increase in the number of working mothers with children under age 6 is projected. An increase of 3.4 million mothers in the labor force with young children is projected, a 65 percent increase over the 1977 level. An additional increase of 5.8 million working mothers with children between 6 and 17 (and none under age 6) is projected, a 60 percent increase. Increases of this magnitude, especially for the mothers of younger children, could have

tremendous consequences for child care policy, work schedules, and other issues that affect a person's ability to juggle the demands of a job with the demands of a child.

How likely is it that there really will be a substantial increase in working mothers with young children? Although the specific number is sensitive to the assumptions built into the projections, there seems little room for doubt that there will be a large increase and, with it, a large increase in the number of young children with working mothers. Three factors contribute to the expected increase. First, the number of women in their central childbearing years will continue to increase until the middle of the next decade. In 1976 there were 30.1 million women in the 18-34 age group; in 1985 there will be 33.9 million; and in 1990 the number will fall slightly to 33.1 million women. Second, most demographers anticipate a leveling off of fertility rates or an increase; there is no basis for expecting a further decline. The fertility rate projection used here may be conservative. Third, the participation rates of women with young children have risen more rapidly than that of any other group. Part of this has been due to the increasing acceptability of combining motherhood and work outside the home. The women who will be bearing children in the 1980's were mostly in their teens and early twenties in the 1970's and are likely to hold the newer views; also, they will have had more role models who combined child-rearing and labor market activities. Thus, the participation rate increases that occurred in recent years are likely to continue.

INFLUENCE OF EMPLOYMENT AND CHILDREN ON INTRA-HOUSEHOLD TRAVEL BEHAVIOR

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The role of the woman in the American household is changing. More and more women are entering the labor force because of personal or economic reasons. Time devoted to the work activity decreases the amount of discretionary time available to the woman. Household activities traditionally carried out by the housewife are sometimes reassigned to the husband, other members of the household, or to hired help. Changes in these activity patterns are usually accompanied by changes in travel patterns.

In this study a model of travel behavior is hypothesized. The model describes the relationships between individuals' travel patterns, their household's characteristics, and the various components of social structure. The overall objective of this study is to investigate the mechanism responsible for allocating trips among the individual members of a household.

More specifically this research explores some of the changes in travel behavior that occur when the wife in a household is employed. The study also examines the influence of children on the travel behavior of employed and unemployed women. Finally, the travel behavior of married women is compared with the travel behavior of married men.

The Functional Role of Travel

Aside from a small amount of travel categorized as "pleasure driving," travel is undertaken by an individual in order to engage in an activity

that is spatially separated from the site of his previous activity. Thus, travel is not a final good; it is an intermediate good that must be consumed before the final good, the desired activity, can be realized. Therefore, it follows that if one is to understand travel behavior, it is necessary to examine the causal structure of human activity participation decisions.

People engage in activities as a means of satisfying their human needs and wants. Certain of these activities such as securing food, shelter and medical attention are common to all persons; although the specific location, quality, and frequency of the activity may vary from individual to individual. Other activities depend more on an individual's socio-psychological make-up and place or role within the social structure. A decision to engage in a particular activity is based upon an individual's desire or need to participate in the activity and his willingness and ability to pay the cost of the activity.

A Model of Travel Behavior

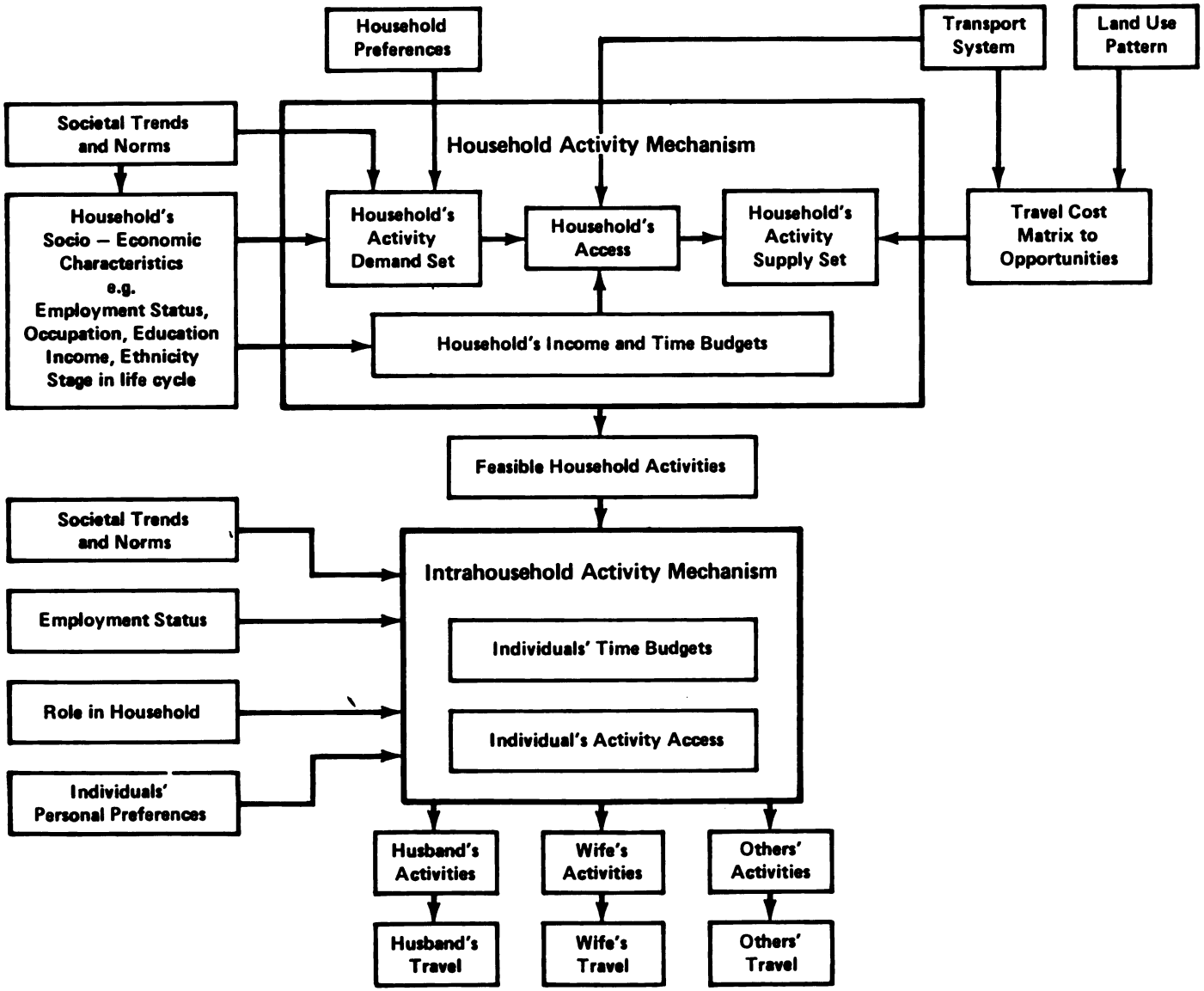
The model in Figure 1 hypothesizes how individuals' travel patterns are related to the various components of social structure.

Activity Supply Set

On the supply side of the model, the transportation system and land use pattern combine to produce a matrix of travel costs to all opportunities in the area. Not all of the opportunities included in the travel cost matrix are available to any one household. The set of activity opportunities available to a household is limited by the household's access to the transport system and to the activities themselves.

Figure 1

A Model of Household and Intrahousehold Travel Behavior



A household's accessibility to the transport system is determined primarily by its ownership of automobiles and secondarily by its access to public transit. A household's decision on automobile ownership is a travel behavioral decision. This choice is based upon many factors including the household's desire to travel, its ability to purchase and operate automobiles and the availability of alternative means of travel.

An individual's access to the transport system is dependent on the household's allocation of its automobile(s) to the various members of the household. Other factors such as age, physical handicaps, and lack of income can further restrict one's ability to use the transport system. An individual's accessibility to an activity depends upon the person's knowledge of the activity's existence and his ability to meet the admission requirements for age, sex, education, income, and socail status.

Activity Demand Set

The household's activity demand set is made up of the activities needed to keep the household in operation as well as the discretionary activities desired by the household. The obligatory activities are in large part determined by the household's stage-in-the-life cycle. Discretionary activities are determined in part by the household's personal preferences, but they are also influenced by societal norms which suggest certain types of activities based upon the household's social status and other socio-economic characteristics.

An individual's activity demand set is composed of the individual's share of the household's obligatory activities and his own personal

discretionary activities among the various members of the household is discussed later in the paper.

Individual Activity Patterns

The outcome of the market clearing process of matching an individual's activity demand set with his activity supply set is the individual's activity pattern. The activity pattern represents an equilibrium that has been established as a result of the selection of an activity bundle that satisfies the individual's and household's desires as best as can be done given the household's income budget and the individual's time budget.

An activity pattern is a complete description of the individual's actions over some predetermined period of time. It tells what types of things the person does as well as when, where, and with whom they are done. An individual's travel pattern is a tracing of his activity pattern over space and time. It describes all of the individual's spatial movements required by the activity pattern.

Intra-Household Activity Allocation Mechanism

Certain activities must be performed in order to maintain smooth operation of a household. These, so called, obligatory activities include shopping for food and clothing, working to generate income, and driving the kids to school on a rainy day.

The allocation of the obligatory activities to the various members of the household is influenced by several factors. First, each member in the household has a particular role to fulfill. The norms of society have established certain "traditional" roles for males and females within a household. Individuals within a household may or

may not choose to assume the "traditional" role depending upon their personal preferences.

Another factor affecting the activity allocation is time. Each individual in the household has certain demands for his time. The individuals' uncommited time is thus an important factor in determining the allocation of the obligatory activities. Finally, the individuals' ability to carry out the activities must be considered.

Time Budgets and Human Activity Behavior

In many instances, time is the most important constraint in determining an individual's activity (and travel) behavior. All people begin with the same time budget of 24 hours per day. Because time cannot be saved, all 24 hours must be consumed each day.

Becker has proposed a theory of the allocation of time that is a modification of classical utility theory (1). Becker, concerned with a lack of attention by economists to the cost of time in non-work activity decisions, developed a utility formulation which includes the cost of time on the same footing as the cost of market goods.

In his model, Becker sees households as both "producing units" and "utility maximizers" in that they combine time and market goods to produce "basic commodities," and they select the best bundle of these "basic commodities" to maximize their utility function. An example of a basic commodity is sleeping which requires a bed, house, and time.

Becker combines time and income to produce a single resource constraint. This combination is possible since time can be converted into goods by using less time in consumption and more time in work.

Hägerstrand, a Swedish geographer, has taken a different approach in his "time-geography"* model of society. He sees a world in which "every individual or household is surrounded by an environmental structure or a pattern of resource and activity alternatives that are necessary to satisfy needs and wants and which are unevenly distributed in time and space." (2, p. 37) In his model, Hägerstrand attempts to show how an individual's decision to participate in a particular activity (and to travel to the activity) is influenced by time constraints as well as by other constraints.

According to Hägerstrand, an individual's freedom to move from station to station or activity to activity is limited by three types of constraints: capability, coupling, and authority constraints. "Capability constraints limit the activities of the individual through both his own biological make-up and the tools he can command." (2, p. 39) An individual's daily life is confined to an island whose size is dependent upon how far he can journey and still have time to return to home to sleep.

Coupling constraints "define where, when and for how long, the individual has to join other individuals, tools, and materials, in order to produce, consume and transact" and depend upon the characteristics

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* In the discussion of Hagerstrand's model, single quotes, '', refer to Hägerstrand's words and double quotes, "", refer to the words of Pred, the author of the article from which this information was obtained.

of the activities. "Authority constraints spring from the basic characteristics of what Hägerstrand terms 'domain.' A domain is defined as a 'time-space entity within which things and events are under the control of a given individual or a given group.' . . . In time space, domains appear as cylinders the insides of which are either not accessible at all or are accessible only upon invitation or after some kind of payment, ceremony, or struggle." (2, p. 42)

General Activity Behavior

Some researchers have tried to gain insight into human activity decision making by empirically examining how people allocate their time to different activities. The investigations have generally been referred to as time-budget studies and have evolved from the time and motion studies used in industrial management research.* The approach of these studies is similar to the household's monetary allocation and income budget studies found in economic research. The majority of these studies have been concerned with studying the variations in the amount of time allocated to different activities by an individual as a function of the individual's socio-economic characteristics.

Human Time Allocation

One such study was conducted by Chapin and Hammer in Metropolitan Washington, D. C., in 1968 (3). In this study, 1756 individuals were interviewed in their homes and asked to describe in detail their activities of the previous weekday and one preassigned previous

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* For a detailed description of the evolution of these studies, see Alexander Szalai, "Trends in Comparative Time-Budget Research" in The American Behaviorial Scientist, Vol. IX, No. 9, May, 1966, pp. 3-8.

weekend day. Data on the socio-economic characteristics of the individual and the household were collected. The activity data were classified into 12 obligatory and 26 discretionary activity categories for analysis. The time for travel and the time for each actual activity were recorded separately, although they were combined in the analysis.

In relation to the amount of and allocation of discretionary time, Hammer and Chapin found that race, sex, employment status, and stage in the life cycle were important factors. Due to lower employment rates, females were found to have a higher weekday mean time for discretionary time than men; however, females employed full-time were found to have lower means than full-time employed males.

As one would expect, full-time employed persons had less discretionary time during the week than those who were not employed full-time. Discretionary time on Sunday was also lower for full-time employees--probably because they had to do chores on Sundays that the others did during the week. An interesting finding was that despite the smaller amounts of total discretionary time, full-time employees never spent less discretionary time away from home than did their counterparts.

Life cycle proved to be an important factor. Young, childless persons were found to spend the least amount of discretionary time at home and the most out of the home. Older persons without dependent children were at the other end of the scale with the most time in the home and the least out. In the middle fell the persons with dependent children.

The differences in the recreational and social interests, as well as the physical stamina of the different age groups, were reflected by these patterns.

Life Cycle and Human Activity Behavior

Age and stage in life cycle are known to be influencers of consumer behavior. The purchasing patterns of households have been shown to change as the households pass through the various stages of life (4). Chapin and Hammer in their human time allocation study discussed above showed that the stage in life affected the use of discretionary time. Travel researchers have used indicators of life cycle and age to explain travel behavior (5,6). While there seems to be a general agreement that life cycle and age affect behavior, there is not any consensus on how one should categorize age and the life cycle for analyses.

Wells and Guber point out that the specification of the life cycle groups or age groups in a study can easily affect the results of the study. Inappropriately selected groups can merge populations with very different behavioral patterns so that averages over the group may produce patterns that are not representative of any of the populations within the group. Wells and Guber also suggest that for many types of consumer analysis, life cycle ought to be a more sensitive explainer than age. They cite several examples of studies in which analysis by age group tended to conceal information that would have been exposed by life cycle analysis (4).

As far as what categories to use in life cycle analysis, Wells and Guber propose the following as the stage through which most households pass (4, p. 355).

1. The bachelor stage; young, single people.
2. Newly married couples; young, no children.
3. The full nest I; young married couples with dependent children.
    a. youngest child under six,
    b. youngest child over six.
4. The full nest II; older married couples with dependent children.
5. The empty nest; older married couples with no children living with them.
    a. head in labor force,
    b. head retired.
6. The solitary survivor; older single people.
    a. in labor force,
    b. retired.

Testing the Travel Behavioral Model

Travel data from the 1968 home interview study conducted by the National Capital Region Transportation Planning Board is used in the analysis. A sub-sample of 2320 households (approximately 10% of the total survey) was selected so as to be geographically representative of the Washington, D. C. metropolitan area. Care was taken to get a sample of each weekday during the three seasons (spring, summer, and fall) that interviews were conducted. Weekend travel data was

not collected and thus could not be included in the study.

Households were grouped using cluster analysis techniques*. Twenty-two variables describing household characteristics were condensed by cluster analysis into four dimensions defined by 12 of the original household variables. These four household dimensions were then used to assign individual households to eight groupings of households as shown in Table 1.

The eight household groupings represent a mixing of employment statuses and stage in the life cycle measures. Stage in the life cycle is brought out by the presence or absence of children, the presence or absence of both husband and wife, and the age group and sex of household head. The employment statuses of the households are represented by the employment status of the head (employed, unemployed, or retired), and the employment status of the female spouse (employed, or unemployed).

Comparisons of travel behavior were made between groups 2 (childless couples - wife not employed) and 3 (childless couples - wife employed), groups 4 (families - wife not employed) and 5 (families - wife employed), groups 2 and 4, and groups 3 and 5. Average trip generation rates by trip purpose were computed for each day of the week and for the average week day. Households were stratified by race and automobile ownership to control for influences of these factors. Travel rates

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* For a complete description of the analysis techniques see McGinnis, Richard G., "Social Structure and Urban Travel Behavior." California University Institute of Transportation and Traffic Engineering Dissertation Series, June, 1975.

Table 1

Descriptions of the Eight Types of Households

Type	Characteristics of Group	Overall Homogeneity
1 Bachelors (445 members)	Household size – 1 or 2 persons; generally no children present; husband and wife not both present; head of household generally female; head of household employed	.87
2 Childless couples Wife not employed (404 members)	Household size – generally 2 persons; children not present; husband and wife may be present; unrelated bachelors may be present; head of household male; head of household employed; wife not employad	.96
3 Childless couples Wife employed (300 members)	Household size – generally 2 persons; children not present; husband and wife present; head of household usually employed; wife employed	.97
4 Families Wife not employed (327 members)	Household size – at least 3 persons; age of head, 35-54 years; school age children present; husband and wife both present; head employed; wife not employed	.97
5 Families Wife employed (318 members)	Household size – at least 3 persons; children present; generally school age children present; husband and wife both present; head employed; wife employed	.93
6 Younger and older families Wife not employed (296 members)	Household size – at least 3 persons; age of head, generally under 35 or 45-64; children present; husband and wife present; head employed; wife not employed	.97
7 Retired couples (107 members)	Household size – at least 2 persons; age of head, generally 55 or older; children may be present; children 6-17 not present; husband and wife generally present; head retired	.80
8 Unemployed older singles (89 members)	Household size – at least 2 persons; age of head, 55 or older, children may be present; husband and wife not both present; head is generally female; head is unemployed; head is generally retired	.86

were computed for the husband and wife together, husband only, wife only, total household, and the household less the husband and wife. Walk trips were not available and thus were not included.

Sample sizes and distributions of the households by automobile ownership and race are shown in Table 2. Households were eliminated from the original data set if there were not both a husband and wife present in the household.

Results

Table 3 gives the average trips per weekday for each of the four household categories by purpose of trip. From these gross household figures it can be seen that families with children travel about twice as much during the week as families without children, reflecting in part the differences in household size. But are the extra trips in the larger households made primarily by the children or distributed in some way among all members of the household?

Few studies have bothered to examine the intrahousehold distribution of trips. In this study travel by the husband and wife were analyzed to see the way in which employment status and children affected their individual travel behavior. Tables 4, 5,and 6 give the average weekday travel rates for the husband and wife together, the wife only, and the husband only, respectively. These travel rates are shown separately by trip purpose and automobile ownership.

Automobile Ownership

In the model hypothesized in this study, automobile ownership is

Table 2

Distribution of Households Used in the Analysis by Automobile Ownership and Race

Automobile Ownership	Childless Couples						Families with Children					
	Wife Not Employed			Wife Employed			Wife Not Employed			Wife Employed		
	No.	% All	% Black	No.	% All	% Black	No.	% All	% Black	No.	% All	% Black
0	14	4	79	21	7	62	7	2	86	19	6	68
1	225	62	12	142	48	23	121	38	12	114	36	36
2	115	32	2	119	41	16	173	55	2	131	41	18
3+	8	2	13	11	4	18	17	5	0	53	17	9
Total	362	100	11	293	100	23	318	100	8	317	100	26

Table 3

Average Trips per Weekday
Total Household

	Type of Household			
	Childless Couples		Families with Children	
Trip Purpose	Wife Not Employed	Wife Employed	Wife Not Employed	Wife Employed
Total	4.99	5.91	10.07	9.98
Total Non-Work	1.87	1.65	4.73	3.29
Work	1.01	1.76	1.06	2.01
Shopping	0.71	0.47	1.30	0.83
Social-Recreational	0.34	0.48	1.15	0.82
Serve Passenger	0.12	0.09	.50	0.32
Other*	0.70	0.61	1.78	1.32

*Other Trips Include All Trips Not Specifically Mentioned Above Except for "Return Home" Trips

Table 4

Average Trips per Weekday Made by Husband and Wife
(the standard error of the mean is given in parentheses)

Trip Purpose/ Auto Ownership	Childless Couples: Wife Not Employed	Childless Couples: Wife Employed	Families with Children: Wife Not Employed	Families with Children: Wife Employed
Total Trips				
0 Auto	2.03 (.36)	3.09 (.37)	*	3.00 (.37)
1 Auto	4.58 (.22)	5.47 (.23)	4.80 (.32)	5.54 (.33)
2 Autos	5.36 (.33)	6.22 (.30)	6.55 (.31)	6.46 (.30)
3+ Autos	*	*	7.63 (.75)	6.08 (.47)
Total Non-Work Trips**				
0 Auto	.69 (.26)	.35 (.24)	*	.14 (.25)
1 Auto	1.64 (.18)	1.35 (.19)	1.84 (.29)	1.49 (.28)
2 Autos	2.09 (.28)	1.90 (.24)	2.81 (.28)	1.94 (.25)
3+ Autos	*	*	3.32 (.65)	1.55 (.38)
Work Trips				
0 Auto	.62 (.13)	1.40 (.15)	*	1.40 (.15)
1 Auto	.98 (.03)	1.72 (.05)	.88 (.05)	1.69 (.07)
2 Autos	1.02 (.04)	1.76 (.08)	1.02 (.04)	1.69 (.07)
3+ Autos	*	*	1.13 (.13)	1.69 (.12)
Shopping Trips				
0 Auto	.10 (.07)	.07 (.07)	*	.07 (.07)
1 Auto	.72 (.09)	.37 (.07)	.66 (.10)	.54 (.09)
2 Autos	.69 (.11)	.57 (.09)	1.11 (.11)	.73 (.10)
3+ Autos	*	*	1.66 (.27)	.52 (.12)
Social-Recreation				
0 Auto	.27 (.15)	.13 (.10)	*	.07 (.07)
1 Auto	.28 (.05)	.46 (.08)	.28 (.07)	.26 (.07)
2 Autos	.44 (.08)	.43 (.09)	.37 (.06)	.37 (.06)
3+ Autos	*	*	.51 (.22)	.28 (.09)
Serve Passenger				
0 Auto	.00 (.00)	.00 (.00)	*	.00 (.00)
1 Auto	.11 (.03)	.14 (.04)	.36 (.08)	.27 (.06)
2 Autos	.14 (.04)	.05 (.02)	.42 (.07)	.27 (.05)
3+ Autos	*	*	.25 (.14)	.33 (.09)
Other Trips**				
0 Auto	.32 (.16)	.15 (.15)	*	.00 (.00)
1 Auto	.53 (.07)	.38 (.07)	.54 (.10)	.42 (.10)
2 Autos	.82 (.14)	.85 (.15)	.91 (.11)	.57 (.11)
3+ Autos	*	*	.90 (.33)	.42 (.10)

*Less than 12 Households in Category.
**Excluding "Return Home" Trips.

Table 5

Average Trips per Weekday by Wife Only
(the standard error of the mean is given in parentheses)

Trip Purpose/ Auto Ownership	Childless Couples		Families with Children	
	Wife Not Employed	Wife Employed	Wife Not Employed	Wife Employed
Total Trips				
0 Auto	.73 (.29)	1.30 (.26)	*	1.57 (.26)
1 Auto	1.51 (.14)	2.69 (.13)	1.66 (.21)	2.48 (.17)
2 Autos	2.35 (.23)	2.82 (.16)	3.22 (.23)	3.22 (.19)
3+ Autos	*	*	3.80 (.59)	3.00 (.31)
Total Non-Work Trips**				
0 Auto	.52 (.26)	.13 (.18)	*	.06 (.18)
1 Auto	.90 (.13)	.62 (.11)	.94 (.15)	.63 (.15)
2 Autos	1.37 (.21)	.76 (.13)	1.87 (.16)	.97 (.16)
3+ Autos	*	*	2.24 (.54)	.94 (.24)
Work Trips				
0 Auto	.00 (.00)	.68 (.11)	*	.70 (.11)
1 Auto	.00 (.00)	.89 (.03)	.00 (.00)	.82 (.04)
2 Autos	.00 (.00)	.84 (.05)	.00 (.00)	.79 (.05)
3+ Autos	*	*	.00 (.00)	.68 (.09)
Shopping Trips				
0 Auto	.10 (.07)	.04 (.05)	*	.03 (.05)
1 Auto	.44 (.06)	.21 (.04)	.42 (.07)	.28 (.06)
2 Autos	.57 (.10)	.29 (.06)	.88 (.09)	.41 (.06)
3+ Autos	*	*	1.24 (.24)	.38 (.10)
Social-Recreational				
0 Auto	.20 (.14)	.00 (.00)	*	.03 (.05)
1 Auto	.16 (.03)	.22 (.04)	.12 (.04)	.14 (.04)
2 Autos	.32 (.06)	.21 (.05)	.23 (.04)	.19 (.04)
3+ Autos	*	*	.23 (.11)	.17 (.06)
Serve Passenger				
0 Auto	.00 (.00)	.00 (.00)	*	.00 (00)
1 Auto	.07 (.02)	.05 (.02)	.22 (.06)	.08 (.04)
2 Autos	.11 (.04)	.02 (.01)	.36 (.07)	.16 (.04)
3+ Autos	*	*	.25 (.14)	.21 (.07)
Other Trips**				
0 Auto	.22 (.11)	.09 (.14)	*	.00 (.00)
1 Auto	.23 (.04)	.14 (.04)	.18 (.04)	.13 (.04)
2 Autos	.37 (.07)	.24 (.06)	.40 (.06)	.21 (.06)
3+ Autos	*	*	.52 (.26)	.18 (.07)

*Less than 12 Households in Category.
**Excluding "Return Home" Trips.

Table 6

Average Trips per Weekday by Husband Only
(the standard error of the mean is given in parentheses)

Trip Purpose/ Auto Ownership	Childless Couples: Wife Not Employed	Childless Couples: Wife Employed	Families with Children: Wife Not Employed	Families with Children: Wife Employed
Total Trips				
0 Auto	1.30 (.25)	1.79 (.22)	*	1.43 (.26)
1 Auto	3.07 (.12)	2.78 (.14)	3.13 (.19)	3.06 (.23)
2 Autos	3.01 (.16)	3.39 (.21)	3.33 (.16)	3.24 (.17)
3+ Autos	*	*	3.83 (.47)	3.08 (.24)
Total Non-Work Trips**				
0 Auto	.17 (.16)	.23 (.14)	*	.06 (.18)
1 Auto	.74 (.10)	.74 (.11)	.88 (.16)	.85 (.21)
2 Autos	.73 (.13)	1.13 (.18)	.95 (.14)	.96 (.15)
3+ Autos	*	*	1.08 (.37)	.60 (.18)
Work Trips				
0 Auto	.62 (.13)	.72 (.10)	*	.70 (.11)
1 Auto	.98 (.03)	.83 (.04)	.88 (.05)	.87 (.04)
2 Autos	1.02 (.04)	.93 (.05)	1.02 (.04)	.90 (.05)
3+ Autos	*	*	1.13 (.13)	1.00 (.08)
Shopping Trips				
0 Auto	.00 (.00)	.03 (.05)	*	.03 (.05)
1 Auto	.28 (.04)	.16 (.03)	.23 (.05)	.26 (.06)
2 Autos	.13 (.03)	.28 (.05)	.23 (.05)	.32 (.05)
3+ Autos	*	*	.42 (.15)	.14 (.07)
Social-Recreational				
0 Auto	.07 (.07)	.13 (.10)	*	.03 (.05)
1 Auto	.12 (.03)	.25 (.05)	.15 (.04)	.11 (.04)
2 Autos	.12 (.03)	.22 (.05)	.14 (.03)	.18 (.04)
3+ Autos	*	*	.28 (.15)	.11 (.04)
Serve Passenger				
0 Auto	.00 (.00)	.00 (.00)	*	.00 (.00)
1 Auto	.04 (.02)	.09 (.03)	.14 (.05)	.19 (.05)
2 Autos	.03 (.02)	.03 (.02)	.07 (.02)	.11 (.03)
3+ Autos	*	*	.00 (.00)	.11 (.05)
Other Trips**				
0 Auto	.10 (.07)	.07 (.05)	*	.00 (.00)
1 Auto	.30 (.04)	.24 (.05)	.36 (.08)	.29 (.09)
2 Autos	.45 (.10)	.60 (.12)	.51 (.09)	.35 (.09)
3+ Autos	*	*	.38 (.14)	.24 (.06)

*Less than 12 Households in Category.
**Excluding "Return Home" Trips

seen as an element of travel behavior. A causal link between travel and automobile ownership exists because automobile ownership is determined (in part) by the household's desire to travel. Households that have large demands for travel and who can afford the travel will purchase more automobiles than those who have less demand for travel. As a result, travel rates of households would be expected to increase with automobile ownership. The findings of this study tend to support this hypothesis.

The impact of automobile ownership on individual household members' travel is not uniform, however. The allocation of the first car appears to be to the husband and the second car to the wife. With the exception of the childless households with the wife employed, there is no significant increase in the husband's non-work travel when the household automobile ownership increases from one to two. On the other hand, the wife's non-work travel increases significantly when a second car is present for each group of households except childless households with the wife employed. This increase ranges from 23% for "childless-wife employed" households (not significant at $p = .05$) to 99% for "families-wife not employed" households.

Effect of Wife's Employment

An employed person has less weekday discretionary time than an unemployed person. When the wife in a household becomes employed the total household budget of discretionary time is decreased. Thus, the number of discretionary activities performed during the week by the household

would be expected to drop, particularly for the wife. The activities eliminated could either be postponed until the weekend, reassigned to another member of the household, or merely forgone.

The available data do not allow for a clear distinction between trips made for discretionary purposes and those made for non-discretionary purposes. For instance, some shopping trips are essential to household operations while others are not. However, even shopping trips for essential items can be considered somewhat discretionary in this study because, in most cases the weekday trip can be postponed until the weekend when the shopper has more time. Thus, the shopper uses discretion in deciding when to make the trip.

The shopping trips have been grouped together with social-recreational, serve passenger, and "other" trips into a category called "non-work" trips. The "non-work" category includes all of the discretionary trips. However, within the "non-work" trip category there may also be a few non-discretionary trips.

The effects of the wife's employment on intrahousehold travel are shown in Table 7. For all levels of automobile ownership, there is a significant decrease in non-work travel for an employed wife. This decrease is approximately one-third for one-auto households and nearly one-half for two-auto households, regardless of whether or not there are children in the household.

The decrease in employed women's travel occurred primarily in shopping trips (approximately 50% reduction), serve passenger trips (approximately 60% reduction), and "other" trips (approximately 40% reduction).

Table 7

The Effect of Wife's Employment on Intrahousehold Travel

Percent increase (decrease) in non-work travel due to wife's employment

Automobile Ownership / Household Member	Childless Couples 0	Childless Couples 1	Childless Couples 2	Families with Children 1	Families with Children 2	Families with Children 3+
Wife only	(75)	(31)	(45)	(33)	(48)	(58)
Husband only	35	0	55	(3)	(1)	(44)
Wife and Husband	(49)	(18)	(9)	(19)	(31)	(53)
Household except wife and husband				5	(36)	(54)

(See Table 5.) Social-recreational trips actually increased for employed wives in one-auto households.

The combined non-work travel of the husband and wife also decreased for all levels of automobile ownership when the wife was employed. The size of this reduction was less than for the wife alone because the husband's travel did not decrease much at all. In fact, for childless households with two-autos husband's travel increased 55%.

From the analysis two trends are evident. When the wife in a household is employed, the household's weekday discretionary activities decrease and a transfer of certain activities are made from the wife to the husband. The magnitude of the shift of these activities to the husband is shown in Table 8.

Table 8 shows the proportion of non-work trips that are made by the wife in each of the four types of households. When the wife is not employed, she is responsible for the majority of the shopping and serve passenger trips. However, for households where the wife is employed, the shopping trips are shared almost equally between the husband and the wife and much of the serve passenger travel is transferred to the husband.

The employed woman has approximately the same amount of social-recreational travel as her husband. The shifting of social-recreational trips between husband and wife is less meaningful than for other non-work trips because of the personal nature of recreation. Social-

Table 8

Distribution of Non-work Trips between Husband and Wife

Percentage of Trips Made by Wife

Trip Purpose/ Auto Ownership	Childless Couples		Families with Children	
	Wife Not Employed	Wife Employed	Wife Not Employed	Wife Employed
Shopping Trips				
0 Auto	100	57	*	43
1 Auto	61	57	64	52
2 Autos	83	51	79	56
3+ Autos	*	*	75	73
Social Recreational				
0 Auto	74	0	*	43
1 Auto	57	48	43	54
2 Autos	73	49	62	51
3+ Autos	*	*	45	61
Serve Passenger				
0 Auto	–	–	*	–
1 Auto	64	36	61	30
2 Autos	79	40	86	59
3+ Autos	*	*	100	64
Other Trips				
0 Auto	69	60	*	–
1 Auto	43	37	33	31
2 Autos	45	35	44	37
3+ Autos	*	*	58	43
Total Non-Work Trips				
0 Auto	75	37	*	43
1 Auto	55	46	51	42
2 Autos	66	40	67	50
3+ Autos	*	*	67	61

*Less than 12 Households in Category.

recreational activities (trips) probably are decided upon more often at the individual level than at the household level.

In conclusion, it can be said that an employed wife assumes a smaller proportion of the household's activities than does an unemployed wife. Furthermore, the travel behavior of an employed wife closely approximates the travel behavior of an employed husband. This phenomenon is not true for unemployed women.

Effect of Children

In terms of gross household travel, households with children travel approximately twice as much as households without children (see Table 3). Analysis of the intrahousehold distribution of travel indicates that most of the increased travel of households with children is due to the children themselves.

In Table 9 the combined travel of husband and wife for families with children is compared against husband and wife's travel in households without children. These comparisons are shown both for employed wives and not employed wives. The additional travel untaken by the children in the households is also shown.

In households where the wife is employed, there is no significant change in the total trips or total non-work trips made by the husband and wife when children are present. The primary difference in husband and wife's travel in these households is a significant increase (93% to 440%) in the "serve passenger" trips for households with children. Shopping trips are also higher (28% to 46%) in households

Table 9

Effect of Children on Intrahousehold Travel

Average Trips per Weekday

Trip Purpose/ Auto Ownership	Wife Not Employed			Wife Employed		
	Childless Couples	Familes with Children		Childless Couples	Families with Children	
	(Hus&Wife)	(Hus&Wife)	(Children)	(Hus&Wife)	(Hus&Wife)	(Children)
Total Trips						
0 Auto	2.03	*	*	3.09	3.00	.47
1 Auto	4.58	4.80	2.73	5.47	5.54	2.98
2 Autos	5.36	6.55	4.80	6.22	6.46	3.43
3+ Autos	*	7.63	10.55		6.08	6.83
Total Non-Work Trips						
0 Auto	.69	*	*	.35	.14	.13
1 Auto	1.64	1.84	1.48	1.35	1.49	1.55
2 Autos	2.09	2.81	2.64	1.90	1.94	1.70
3+ Autos	*	3.32	5.97	*	1.55	2.74

*Less than 12 Households in Category.

with children; however, the increase is not statistically significant.

By far, the largest difference between the travel behavior of households with and without children is the extra travel attributed to the children. For households in which the wife is employed, the non-work travel by the children is nearly equivalent to the combined husband and wife travel.

The impact of children on the travel behavior of households in which the wife is not employed is slightly different from that found for households with employed wives. When the not-employed wife has an automobile available (2 autos), the combined travel of the husband and wife increases significantly when children are present (22% for total trips and 34% for non-work trips). Again, the increased travel in households with children was due primarily to increases in shopping (61%) and serve passenger (200%) trips.

If only one automobile is available, then no sigificant difference exists between the combined non-work travel of husbands and wives in families with children from that of households without children. Serve passenger trips do increase significantly (273%), but shopping trips actually decrease slightly.

In summary, the results indicate that the presence of children has little effect on the travel of the husband and wife in the household. The travel by the children, however, significantly increases total household travel.

Conclusions

From the results of the study, it is evident that employment status is a much stronger influencer of women's travel behavior than is the presence of children. Employed women participate in fewer non-work activities during the week than do not-employed women. Unfortunately, a comparison of weekend travel was not possible, so it is unknown to what extent working women postpone their non-work activities to the weekend.

When children are present in a household, serve passenger trips and shopping trips generally increase. However, these increases are small in comparison to the extra travel undertaken by the children themselves. Thus, little change occurs in the total behavior of married women due to the presence of children.

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SHOPPING TRIPS: WHO MAKES THEM AND WHEN

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I. Introduction

Shopping travel constitutes a significant proportion of the trips made by the traveling public. Shopping travel associated with household maintenance purchases is traditionally defined to be part of the female role. This persists despite the increasing proportion of women joining and remaining in the paid work force. Little has been done to date to empirically document those who make these trips by gender, working status, and/or family status. A more thorough assessment of who shops and under what constraints they shop would aid transportation policy makers and planners in designing transportation systems to meet these needs.

This paper addresses the question of who makes the household shopping trips and under what general constraints these shopping trips are made.

The two hypotheses tested in this paper are defined thus:

1. That women make the majority of shopping trips, independent of working status (full-time employment, part-time employment, or not employed) and family status (single, married, or retired, with or without dependents under age 16).
2. That this finding is stable across cultures, at the minimum, those of the United States and the United Kingdom.

To test these hypotheses, data from two studies, collected in different cultures at approximately the same time are analyzed. The first data base is a 10 percent random sample (with trips made by travelers under age 20 removed), drawn from the 1968 Washington (D.C.) Council of Governments origin-destination survey. The second is a 1971 sample of shopping trips made by the residents of a council area in Edinburgh, Scotland. Linked trips by the 177 sample members are recorded for analysis.

II. Data Description

The Washington, D. C., Council of Governments (WASHCOG) data base analyzed in this paper consists of 11,374 trip links with the socio-demographic variables of the trip maker and the trip maker's household attached to the description of the trip link used. These 11,374 trip links represent a 10 percent random sample of all trips contained in the 1968 WASHCOG data set, with those trips made by travelers below age 20 deleted from the 10 percent sample. The trip purposes recorded by the travelers are collapsed into three categories, shop, home, and other. "Other" includes work, social-recreation, serve passenger, school, work business, personal business, medical-dental, sightseeing, and change mode. Each trip link has a beginning purpose and an ending purpose, which are the basic variables used in this analysis.

The Edinburgh, Scotland, sample is much smaller than the WASHCOG one. It reflects the different assumptions under which it has been collected, the primary difference being that the trips are defined to include shopping as a primary purpose. The households in the sample chose the person in that household who does the majority of the shopping (who is, in 174 of

177 cases, female), and that person reports her shopping trip patterns for one, and for a majority of travelers, two linked shopping tours. Between two and four links are possible on each shopping tour, and two to four are reported. The location from which the data came is a council area on the perimeter of the city of Edinburgh. The sample members are thus defined to be working class. Further, these travelers have no cars available to them for their shopping trips since very few households own cars, and fewer of the women in the sample hold valid driver's licences. This is a further constraint on their shopping travel which is not present in the WASHCOG data set.

The two data bases are subjected to identical analysis procedures. The WASHCOG data are split into two subsets on the basis of gender. This is not possible for the Edinburgh data, which is defined as female. As primary descriptions of these data bases, they were further divided by family status (married, single, retired) and by occupational status (full-time, part-time, and non-work). The distributions of these data by sex, family status, and occupational status are given in Tables 1 and 2 for the WASHCOG data and in Table 3 for the Edinburgh data. The family status data from all three analysis sets are roughly proportional. The occupational status data are not proportional across data sets, reflecting societal and cultural differences by sex and location.

Based on these preliminary descriptions of the data, the next stages of the analysis are to test the primary hypotheses, that shopping trips are made by women without regard to family and occupational status, and that these findings are true for both the American and Scottish cultures.

TABLE 1

OCCUPATIONAL AND FAMILY STATUS
FEMALE TRAVELERS
WASHINGTON, D.C. 1968

Occupational Status	Family Composition									
	Single	Couple	Single, Child <5	Couple, Child <5	Single, Child 5-16	Couple, Child 5-16	Single, Child >16	Couple, Child >16	Retired	Row Total
Full-Time	481	538	40	158	188	671	119	232	32	2459 46.5%
Part-Time	37	52	7	38	26	229	13	28	10	440 8.3%
Non-Work	78	291	16	320	85	1287	50	157	106	2390 45.2%
Column Total	596 11.3%	881 16.7%	63 1.2%	516 9.8%	299 5.7%	2187 41.3%	182 3.4%	417 7.9%	148 2.8%	5289 100.0%

TABLE 2

OCCUPATIONAL AND FAMILY STATUS
MALE TRAVELERS
WASHINGTON, D.C., 1968

Occupational Status	Family Compostion									
	Single	Couple	Single, Child <5	Couple, Child <5	Single, Child 5-16	Couple, Child 5-16	Single, Child >16	Couple, Child >16	Retired	Row Total
Full-Time	512	974	12	756	59	2222	112	430	53	5130 87.8%
Part-Time	53	42	2	57	5	122	8	25	9	323 5.5%
Non-Work	93	67	2	11	4	50	14	47	99	387 6.6%
Total Column	658 11.3%	1083 18.5%	16 0.3%	824 14.1%	68 1.2%	2394 41.0%	134 2.3%	502 8.6%	161 2.8%	5840 100.0%

TABLE 3

OCCUPATIONAL AND FAMILY STATUS
FEMALE SHOPPING TRAVELERS
EDINBURGH, SCOTLAND, 1971

Family Composition \ Occupational Status	Full-Time	Part-Time	Non-Work	Row Total
Old Age Pensioner	0	0	10	10 6%
Single, No Child	0	0	2	2 1%
Couple, No Child	8	10	13	31 18%
Couple, Child >15	13	27	20	60 34%
Single, Child >15	0	1	5	6 3%
Couple, Child 5-15	11	15	19	45 25%
Single, Child 5-15	2	0	2	4 2%
Couple, Child <5	0	4	13	17 10%
Single, Child <5	0	0	2	2 1%
Column Total	34 19%	57 32%	86 49%	177 100%

In order to perform these tests, the beginning and ending purposes of each trip link are cross-tabulated, holding gender, marital status, and occupational status constant (for the WASHCOG) data or holding gender and either marital status or occupational status constant (for the Edinburgh data). The results of these cross-tabulations are shown in Tables 4 through 14. The discussion of these findings follows.

Tables 4 through 9 document all trips included in the Washington data broken down by occupational and marital status as well as beginning and ending trip purposes. As is obvious from the tables, women make the majority of shopping trips (67% or 922 of 1380 of all trips with shopping as the beginning or ending purpose). Occupational status has little impact on this, with the exception of full-time working women whose shopping patterns are roughly equivalent to their male counterparts. The disparity between male and female full-time working travelers is more pronounced in single persons. Single full-time working women make a third more shopping trips than single full-time working men (79 trips of 9% of all trips vs. 42 trips or 6%) while single men tend to make more trips for other purposes. Married full-time workers make trips in roughly the same proportions, with women still making more of the shopping trips.

The tendency for women to make a greater number of shopping trips is more evident with part-time workers. Travel patterns between married and single women are roughly similar, with beginning and ending trip purposes proportions reversed in the shopping category. Married men, however, tend to make slightly more than half as many shopping trips as single men (10 or 4% vs. 5 or 7%, respectively). Between women and men, both married and

TABLE 4

TRIP PURPOSES

SINGLE, FULL-TIME WORKERS

WASHINGTON, D.C.

Female

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	10	57	10	77 9.3%
Home	48	0	322	370 44.7%
Other	22	274	85	381 46.0%
Column Total	80 9.7%	331 40.0%	417 50.4%	828 100.0%

Male

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	1	27	10	38 5.5%
Home	34	0	295	329 47.3%
Other	10	241	77	328 47.2%
Column Total	45 6.5%	268 38.6%	328 55.0%	695 100.0%

TABLE 5

TRIP PURPOSES

MARRIED, FULL-TIME WORKERS

WASHINGTON, D.C.

Female

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	24	133	19	176 11.0%
Home	85	0	608	693 43.3%
Other	47	571	112	730 45.7%
Column Total	156 9.8%	704 44.0%	739 46.2%	1599 100.0%

Male

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	51	271	42	364 8.3%
Home	223	0	1690	1913 43.7%
Other	80	1603	422	2105 48.0%
Column Total	354 8.1%	1874 42.8%	2154 49.2%	4382 100.0%

TABLE 6

TRIP PURPOSES

SINGLE, PART-TIME WORKERS

WASHINGTON, D.C.

Female

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	4	5	2	11 13.3%
Home	3	0	28	31 37.3%
Other	6	30	5	41 49.4%
Column Total	13 15.7%	35 42.2%	35 42.2%	83 100.0%

Male

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	1	4	1	6 8.8%
Home	3	0	27	30 44.1%
Other	1	18	13	32 47.1%
Column Total	5 7.4%	22 32.4%	41 60.3%	68 100.0%

TABLE 7

TRIP PURPOSES

MARRIED, PART-TIME WORKERS

WASHINGTON, D.C.

Female

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	4	45	6	55 15.9%
Home	29	0	116	145 41.8%
Other	15	110	22	147 42.4%
Column Total	48 13.8%	155 44.7%	144 41.5%	347 100.0%

Male

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	2	8	1	11 4.5%
Home	6	0	82	88 35.8%
Other	3	110	34	47 59.8%
Column Total	11 4.5%	118 48.0%	117 47.6%	246 100.0%

TABLE 8

TRIP PURPOSES

SINGLE, NON-WORKERS

WASHINGTON, D.C.

Female

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	15	37	6	58 25.3%
Home	32	0	67	99 43.2%
Other	10	49	13	72 31.4%
Column Total	57 24.9%	86 37.6%	86 37.6%	229 100.0%

Male

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	2	7	1	10 8.8%
Home	6	0	50	56 49.6%
Other	5	34	8	47 41.6%
Column Total	13 11.5%	41 36.3%	59 52.2%	113 100.0%

TABLE 9

TRIP PURPOSES

MARRIED, NON-WORKERS

WASHINGTON, D.C.

Female

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	105	391	49	545 26.5%
Home	402	0	494	896 43.6%
Other	61	461	92	614 29.9%
Column Total	568 27.6%	852 41.5%	635 30.9%	2055 100.0%

Male

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	3	24	1	28 16.0%
Home	22	0	54	76 43.4%
Other	6	56	9	71 40.6%
Column Total	31 17.7%	80 45.7%	64 36.6%	175 100.0%

TABLE 10

TRIP PURPOSES

SINGLE WOMEN

EDINBURGH, SCOTLAND

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	2	12	3	17 19%
Home	66	0	3	69 77%
Other	1	3	0	4 4%
Column Total	69 77%	15 17%	6 6%	90 100%

TABLE 11

TRIP PURPOSES

MARRIED WOMEN

EDINBURGH, SCOTLAND

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	19	151	32	202 43%
Home	205	0	14	219 47%
Other	13	28	3	44 9%
Column Total	237 51%	179 38%	49 11%	465 100%

TABLE 12

TRIP PURPOSES

FULL-TIME WORKING WOMEN

EDINBURGH, SCOTLAND

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	2	26	12	40 37%
Home	54	0	4	58 53%
Other	1	0	10	11 10%
Column Total	57 52%	26 24%	26 24%	109 100%

TABLE 13

TRIP PURPOSES

PART-TIME WORKING WOMEN

EDINBURGH, SCOTLAND

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	10	59	8	77 40%
Home	90	0	8	98 51%
Other	8	7	1	16 9%
Column Total	108 56%	66 36%	17 9%	191 100%

TABLE 14

TRIP PURPOSES

NON-WORKING WOMEN

EDINBURGH, SCOTLAND

Beginning Purpose \ End Purpose	Shop	Home	Other	Row Total
Shop	10	86	16	112 74%
Home	16	0	2	18 12%
Other	5	15	2	22 14%
Column Total	31 20%	101 66%	20 13%	152 100%

single, women make considerably more shopping trips than their male counterparts. Taken together, part-time working women make 9% more shopping trips than part-time working men (60 or 14% vs. 15 or 5%).

Finally, among non-workers, women make 11% more shopping trips than men (554 or 24% vs. 39 or 13%). As with part-time workers, the married and single women make roughly the same number of shopping trips. With the men, however, the situation reverses from that of part-time workers; married men now making nearly double the number os shopping trips of single men (11 or 16% vs. 28 or 9%).

These tables show that women make more shopping trips than men, regardless of the occupational status; the discrepancy in the amount of shopping travel is more evident between part-time and non-working men and women.

Women's shopping travel patterns are approximately equal in Washington and Edinburgh. This documented in Tables 10 through 14. There are, however, percentage differences noticeable between the two samples. These are primarily due to the socio-economic characteristics of the council area where the Edinburgh data were collected as well as the constraints of the set. The primary purposes of the travel recorded is defined to be shopping, resulting in a larger proportion of shopping trips in that data.

Occupational status and marital status have little effect on shopping travel patterns in the Edinburgh data. Single women travel somewhat more than married women (42 trips or 47% vs. 210 trips or 45%) while part-time working women tend to travel the most of the three occupational status cate-

gories sampled (83 trips or 46% vs. 48 trips or 44% for full-time workers and 67 or 44% for non-workers). As in the Washington data, full-time working women make the fewest shopping trips. Nonetheless, women of varying occupational and family types in Edinburgh, as in Washington, make the shopping trips necessary to maintain their households. This finding is, if anything, even more pronounced in Edinburgh, since the data reflect the household's definition of the primary shopper.

III. Conclusions and Implications

The analysis presented in this paper supports both primary hypotheses posited in the Introduction. The hypothesis that women make the preponderant share of shopping trips, independent of working status and family status, is proven. In the WASHCOG data set, women make approximately double the proportion of shopping trips as made by men of the same marital status. One hundred forty-eight or 13% of the trips made by single women are shopping trips, while 59 or 7% of single men's trips are shopping trips; the equivalent numbers of married women and men are 774 or 19% and 400 or 8%. In another comparison, between the proportion of shopping trips made by women and made by men of the separate working status categories, the findings are also conclusive. For full-time working women, 245 or 10% of their total trips are for shopping, while full-time working men made 400 or 8% of their trips for shopping. Part-time working women spend 64 or 15% of their trips for shopping while part-time working men shop in 17 or 5% of their trips. Non-working women shop in 614 or 27% of their, trips, compared to 41 or 14% of the non-working men's trips being for shopping purposes.

The hypothesis that this phenomenon is stable across the cultures of the United States and United Kingdom is also substantiated. The fact that the Edinburgh data set is overwhelmingly composed of women, chosen as the household's shopping traveler substantiates part of the general hypothesis that women do the shopping. The finding that the shopping patterns of the women in the Edinburgh sample are approximately the same, given the different assumptions under which the data have been collected, as those of women in the WASHCOG sample, further supports this.

Household maintenance shopping is a frequent activity with standardized goods available in many locations. Other shopping is a fairly infrequent activity, with high per item purchase cost, affected by somewhat unique goods availability in more centralized locations. In order to differentiate between the shopping travel generated by these two general types of shopping, it is necessary to split the purpose "shopping" into two distinct types. The travel patterns associated with each type of shopping are different, with different impacts on the transportation system. Additional information on when and how frequently these shopping trips are made, by time of day, day of week, and by general type of shopping, would aid policy makers and planners in their understanding of shopping travel patterns and their impact on the transportation system. The impact of trip tour formation on mode choices must also be studied. Shopping trips require package space and schedule flexibility. Both of these requirements adversely impact the choice of high occupancy vehicles if shopping is part of a complex tour.

This paper documents with empirical procedures, the hypothesis that gender

remains the main, overriding descriptive variable in determining shopping trip makers. The implications of this finding on planning procedures are unknown, but need to be subjected to further scrutiny.

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THE IMPACT OF WOMEN'S EMPLOYMENT ON HOUSEHOLD TRAVEL PATTERNS: A SWEDISH EXAMPLE

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I. INTRODUCTION

The increasing proportion of married women in the paid labor force has generated considerable interest in the impact of women's employment on traditional sex roles and family structure. One way of assessing this impact is to observe the daily travel behavior of a sample of urban residents to document how the employment of women affects the way in which household members carry out daily out-of-home activities. In the course of carrying out daily activities the urban resident participates in four major role complexes: the household/family role, the work/career role, the interpersonal/social role, and the leisure/recreation role (10). The specialization of land uses in the contemporary industrialized urban area and the concomitant spatial separation of activity sites mean that a person must undertake travel in order to carry out these roles. As a result, participation in these roles can be translated into the standard trip-purpose categories of (1) shopping and (2) personal business (both of which are related to the household/family role), (3) work, (4) social, and (5) recreation. The priority or weighting an individual accords each of these roles, (or reasons for travel) is important in determining how much time is allocated to each, how frequently the activity is undertaken, and how far one is willing to travel to engage in the activity.

There are many factors that affect the relative weighting the individual attaches to each role, but one important factor stimulating recent changes in role priorities in post World War II, industrialized countries has been the dramatic increase in the number of women, especially married women, who have joined the paid labor force. The question addressed in this paper is how the employment of women has affected the relative importance accorded to the various roles as revealed through the observed daily travel behavior of urban residents. In particular the paper examines the impact of women's employment on:

(1) the travel patterns of women (by comparing the travel behavior of full-time employed women with the behavior of part-time employed women and women who are not in the labor force) and

(2) the travel patterns of full-time employed husbands (by comparing the travel behavior of men whose wives work full-time outside the home with the travel behavior of men whose wives do not work outside the home).

The study examines the daily out-of-home activity patterns of individuals to see to what extent observed travel patterns reflect the role priorities traditionally assigned by gender and reflect shifts in role priorities generated by the employment of women.

The study makes use of data collected in the Uppsala (Sweden) Household Travel Survey, the only currently available data base that provides detailed spatial and temporal longitudinal informa-

tion on individuals' intraurban travel. In addition to forming the basis for the descriptive portion of this study, the Swedish data base provides a springboard for a brief discussion of policies that the Swedish Government has recently either promulgated or proposed to reduce the degree of sex-role stereotyping that is present in Swedish society. The stated goal of these policies is to build a society in which each individual participates fully in each of the four roles outlined above. This goal raises normative questions concerning how the shape of such a society might be reflected in the travel behavior of individuals.

II. BACKGROUND

Interest in time-space budgets as windows on people's daily lives is not new (see, for example, Refs. 5, 25, 28, 1). Until recently, however, the focus of such studies of individuals' daily activity patterns has been almost exclusively on how people spend their time; explicit consideration of the spatial component of urban activity patterns has been either non-existent (e.g. Refs. 2,23,25) or at best rudimentary (5). Time-budget studies have been concerned with such questions as the amount of time spent in discretionary as opposed to obligatory activities in order to ascertain the "quality of life" of different population groups.

From the perspective of the geographer or the transportation planner, such questions, while admittedly interesting, do not adequately grapple with the "quality of life" concept, for to ignore the spatial aspect of activity patterns is to deny the fact that

contemporary urbanized space, with different activities allocated to different, discrete locations, places a premium on mobility. If we are to understand the impact of women's employment on the daily lives of individuals, then clearly we must consider how different groups of people (e. g. full-time employed women or part-time employed women) make use of the same urban environment. Hence, the focus of this paper is on people's involvement in out-of-home activities, and consequently the terms "travel patterns" and "activity patterns" are used synonymously.

Studies of individuals' time allocations (5,25) have employed the same conceptual framework as many studies of urban travel behavior, namely that observed behavior is a function of the individual's choices made within constraints (12,18,28,17). The constraints of sex roles and employment were early recognized as important determinants of observed time allocation patterns, and study after study has documented that of all the population groups observed, women who hold full-time jobs outside the home have the least amount of time to allocate to discretionary activities such as social visits or recreation (2,6,7,31). One extensive study that examined the time budgets of individuals from twelve countries concluded:

> All told then, the time-budget data form a rather compelling document suggesting that problems faced by the working women have not been adequately solved in any of the countries surveyed, and substantial inequities in the division of labor by sex remain everywhere (23, p. 121).

As indicated by Robinson, Converse and Szalai (23), these earlier

studies have shown that for women the additional responsibilities of paid employment are not usually accompanied by a reduction in the household responsibilities that have traditionally been assumed to be the woman's. Although there are those who claim that when a wife goes to work there are appropriate shifts in the division of labor and power within the household (3,32), the empirical evidence is overwhelmingly to the contrary. Whether she works outside the home or not, the woman is expected to retain primary (and often exclusive) responsibility for the rearing of children, the provision of meals, and the maintainence of order in the household (8, 24, 11, 9). Furthermore, the lack of an equitable sharing of household responsibilities between working men and working women is exacerbated by women's reduced access to the private transportation available to the household (13). While time budget studies have invariably considered the impact of employment on the woman's allocation of time to various activities, only one (22) to our knowledge has examined the effect of a wife's employment on the husband's activity pattern.

In order to assess the impact of women's employment on family structure, it is necessary to examine not only how women's travel patterns vary as a function of employment status, but also how the husband's travel pattern is affected by his wife's working outside the home. Given the findings of the time budget studies, we expect to find significant differences in the travel patterns of the three groups of women examined. If indeed, women's employment were to lead to a

more equitable division of labor within the household, we would expect to find that the travel of men with working wives differs from that of men with non-working wives; for example, the men with working wives might shop more frequently or spend less time in recreation. However, we expect a wife's employment to have little impact on the travel pattern of the husband. The data used to test these notions were collected in the Uppsala Household Travel Survey; this data set is the only one currently available that contains disaggregate longitudinal information on the travel behavior of urban residents.

III. THE DATA

The Uppsala Household Travel Survey was conducted in Uppsala, Sweden in the Spring of 1971 (21). For a five-week period each adult member of the approximately 300 sample households kept detailed records of all activities undertaken outside the residence. Each time the individual left home he or she was viewed as embarking on a trip, a series of movements between specific locations where travel was interrupted so that one or more activities could be undertaken. A trip, then, is considered as beginning and ending at the residence; its length varies with the number of stops that transpire between leaving and returning home.

The Uppsala study made use of a self-administered travel diary in which the respondent recorded, for each stop made on each trip, information about the time of arrival at and departure from the stop, the means of transportation used to get to the stop, the

location (street address) of the stop, the type of location visited (e.g., drug store, friend's house), the activities pursued, and the amount (if any) of expenditure made at the stop. All out-of-home travel was recorded, including that done on foot or by bicycle. All origins and destinations have been geocoded to points corresponding to street addresses. In addition to the travel data, information was collected on the socioeconomic characteristics of the household and the individual.

The Swedish Population Registér enabled the selection of a sample stratified by stage in the life-cycle. The Register contains a complete enumeration of all households in Sweden and includes the name, age, and sex and address for members of the household. The Uppsala population register was divided into six well-defined life-cycle groups on the basis of variables considered influential in shaping people's activity patterns, and the sample households were selected randomly from the list of households within each group. For a description of the life-cycle groups see Table 1.

The analysis of travel is carried out on a number of sub-groups taken from the total sample. The following groups were defined:

- Women who work full-time (35 hours per week) outside the home
- Women who work part-time (1-34 hours per week) outside the home
- Women who do not work outside the home
- Full-time employed men whose wives work full-time
- Full-time employed men whose wives do not work outside the home

Only those individuals with complete travel records and complete socio-economic data were included. Elderly (Group 1) people were

Table 1: A Description of the Six Life-Cycle Groups in the Sample Uppsala, Sweden, 1971

Group Number	Characteristics	Number of House-Holds in Sample	Number of Individuals in Sample
1	Head of household 67 or older	47	68
2	Head of household between 50 and 66; no children living at home	51	80
3	Head of household between 18 and 49; single persons only	26	27
4	Head of household between 18 and 49; two person household with no children	51	99
5	Head of household between 18 and 49; at least one adult and at least one child over seven years of age: no pre-school children	62	141
6	Head of household between 18 and 49; at least one adult and at least one child less than seven years of age	59	116
Totals		296	531

Source: Field surveys conducted in Uppsala, Sweden, 1971.

excluded from the analysis because all but a few were retired.

Tables 2 and 3 give the breakdown of employment status (number of hours worked per week) by life-cycle group for women (Table 2) and for men (Table 3). These two tables hold few surprises but several points of interest. First, it is abundantly clear that in this sample of Swedish households, men retain the "breadwinner" role: when elderly, retired individuals (Group 1) are excluded, 84% of men work full-time as compared to only 33% of the women. Second, while most women are not in the paid labor force, part-time employment is far more prevalent among women than among men; in fact, about as many women are employed part-time as full-time. Third, the pattern of employment among women is familiar (9). Those women who are least likely to work are those with pre-school children (Group 6), while those who are most likely to work are single (Group 3) or are women without any children at home (Groups 2 and 4). Part-time work is an option frequently taken by women with school-aged children (Group 5).

The similarity between the U.S. and Sweden in patterns of employment among women is striking. Given Swedish child care facilities and the generous maternity leave policies, this similarity comes as something of a surprise. However, since 1971 (when these data were collected) child care facilities have been substantially expanded and so has the proportion of working mothers with young children. By 1975, 60% of mothers with small children had joined the labor force (either in part or full-time work) as compared to 37% in 1965 (27). In the

Table 2: Employment* Among Women at Different Stages of the Life-Cycle - Uppsala, Sweden 1971

Group†	Number of hours worked per week outside the home			
	0	1-34	≥ 35	Row Total
1	31 (79.5)	6 (15.4)	2 (5.1)	39
2	12 (27.9)	15 (34.9)	16 (37.2)	43
3	2 (14.3)	3 (21.4)	9 (64.3)	14
4	8 (17.4)	13 (28.3)	25 (54.3)	46
5	26 (35.6)	27 (37.0)	20 (27.4)	73
6	35 (64.8)	12 (22.2)	7 (13.0)	54
Column Totals	114 (42.4)	76 (28.3)	79 (29.3)	269

* Figures in parentheses are row percentages.

† See Table 1 for explanation of groups.

Source: Field surveys conducted in Uppsala, Sweden, 1971.

Table 3: Employment* Among Men at Different Stages of the Life-Cycle - Uppsala, Sweden, 1971

Group	Number of hours worked per week			
	0	1-34	≥ 35	Row Total
1	19 (86.4)	2 (9.1)	1 (4.5)	22
2	5 (16.1)	3 (9.7)	23 (74.2)	31
3	0 (0.0)	2 (18.2)	9 (81.8)	11
4	6 (12.2)	3 (6.1)	40 (81.6)	49
5	6 (11.1)	1 (1.9)	47 (87.0)	54
6	2 (3.8)	3 (5.7)	48 (90.5)	53
Column Totals	38 (17.3)	14 (6.4)	168 (76.3)	220

* Figures in parentheses are row percentages.

† See Table 1 for explanation of groups.

Source: Field surveys conducted in Uppsala, Sweden, 1971.

U.S. in 1975 some 43% of women were employed outside the home.

The point to be made here is simply that the fact that the analysis is based upon Swedish data should not be considered a drawback. On the contrary, because on the one hand Sweden is in many ways similar to the U.S. (see, for example, Ref. 26) and because on the other hand Sweden's social policy is considerably more advanced than that of the U.S., many insights transferrable to the U.S. situation, present and future, can be gleaned from the analysis of these Swedish data. An important similarity for the purposes of this study is the fact that there is a close resemblance between the U.S. now and Sweden in 1971 in the patterns of female employment at different stages of the life cycle.

IV. ANALYSIS

The analysis uses the 35-day travel diary data to compare the observed travel behavior of the population sub-groups under study. The comparisons are based on a number of travel measures, generated for each individual, that describe the frequency of travel for different purposes, the amount of time spent in and distances travelled to different types of activities, patterns of mode use, and the level of variety present in the individual's travel over the 35-day recording period. The purpose of the analysis is two-fold: 1) to ascertain how the time constraints imposed by employment affect the travel behavior of women, and 2) to investigate how a wife's full-time employment affects the travel pattern of the husband. Clearly many of the tasks associated with the household/family role

can be carried out by either adult member of the household. What types of shifts occur in the role priorities of the adult members of the household when a wife works full-time outside the home? To what extent do gender-associated roles persist within the household after the woman goes to work?

Before the travel behavior of women and of men is investigated, we need to examine the relative location of the groups of individuals whose travel is to be compared. We need to determine, for example, whether or not the two groups of men, for example, are located similarly vis a vis activity sites in Uppsala. Suppose one group were found to be located closer, on the average, to the Central Business District (CBD), then any differences observed in the travel behavior of the two groups could be attributed to locational differences rather than to behavioral ones. Therfore, locational analysis is carried out before the travel behavior of each of the different sets of groups is compared.

A. The Relative Location of Groups of Women

In order to determine whether the three groups of women are located similarly with respect to key locations in the urban area, three simple measures were computed, where applicable, for each individual. In 1971 Uppsala was still very much a single-center city with hardly and suburbanization of retail establishments. Therefore, the distance from home to the CBD was used as a rough measure of the density of activity sites in the vicinity of the home, and also as an index of the individual's accessibility to the major center of retail and service activity in Uppsala. For the two groups of employed women, the

distance from home to the workplace and the distance from work to the CBD provide accessibility measures improtant to the individual because of the repetitive nature of the journey to work. If the workplaces of one group were located closer to the CBD, we might expect the members of that group to shop more frequently in connection with the work trip.

For each of these measures the mean was computed (see Table 4), and the inter-group means were compared via the Student's t-test. In no instance was there a significant difference between the means. The conclusion is, therefore, that the three groups of women are located essentially similarly; any differences observed among the groups' travel behavior cannot be attributed to divergent locational patterns.

B. The Travel Behavior of the Three Groups of Women

From the 35-day travel diaries a number of measures were computed for each individual, with each measure summarizing for that person a certain aspect of travel over the five-week period. For each of the three groups of women the mean and variance for each measure was computed so that inter-group comparisons could be evaluated using the Student's t-test. The measures encompass travel frequency, distances travelled, time spent in various activities, mode use, and indication of the amount of variety (or lack thereof) in the person's travel over the observation period.

Some measures of travel frequency are displayed in Table 5. While there is little inter-group distinction in total trip frequency, the total number of stops made increases with the number of hours worked per week. Full-time employed women made more stops than either

Table 4

MEASURES OF THE RELATIVE LOCATION OF THE THREE GROUPS OF WOMEN- UPPSALA, SWEDEN, 1971

	Full-time employed women	Part-time employed women	Unemployed women
Average Distance[a] from Home to CBD	1.89 (1.71)	1.93 (0.89)[b]	2.17 (1.45)
Average Distance from Home to Work	4.45 (12.56)	4.24 (11.08)	NA
Average Distance from Work to CBD	4.04 (12.66)	3.98 (11.67)	NA

[a] Airline distance in Kilometers

[b] Figures in parentheses are standard deviations

Source: Field surveys conducted in Uppsala, Sweden, 1971.

Table 5

Frequency of Travel [a] for the Three Groups of Women - Uppsala, Sweden, 1971

	Full-time employed women	Part-time employed women	Unemployed
Total number of trips	42.2	41.9	38.4
Total number of stops	122.1†	120.5	107.2*
Number of 1-Stop trips	22.4	23.2	23.0
Number of 2-Stop trips	11.6	11.0	10.3
Number of 3-Stop trips	3.3	3.4	3.2
Number of 4-Stop trips	2.6	2.6	2.1

[a] Measured in average number of stops per person over the 35-day recording period

* Significantly different ($p \leq .10$) from part-time employed women

† Significantly different ($p \leq .10$) from unemployed

Source: Field surveys conductod in Uppsala, Sweden, 1971.

Table 5

Frequency of Travel[a] for the Three Groups of Women - Uppsala, Sweden, 1971 (Continued)

	Full-time employed women	Part-time employed women	Unemployed
Number of 5†-Stop trips	2.4	2.2	2.4
Percent of work trips that were single purpose	54.9*	40.4	NA
Number of trips on week days	32.7	32.3	32.2
Number of trips on week ends	9.6*	8.4	8.8
Number of stops on week days	97.6	97.5	94.8
Number of stops on week ends	25.0*	21.3	22.8

[a] Measured in average number of stops per person over the 35-day recording period

*Significantly different ($p \leq .10$) from part-time employed women

†Significantly different ($p \leq .10$) from unemployed

Source: Field surveys conducted in Uppsala, Sweden, 1971.

part-time employed or unempolyed women. Although there are no significant differences among the groups in the number of single purpose (1-stop) trips or multiple-stop trips of various stop lengths taken, working women made more multi-stop trips (trips with 2 or more stops) than did non-working women; full-time employed women were far more likely to make single purpose work trips than were part-time employed women. This suggests that with the reduced time constraints imposed by part-time employment, part-time workers are better able to undertake travel for non-work purposes in conjunction with the journey to or from work. Weekend travel also distinguishes full from part-time workers, with full-time employed women making significantly more weekend trips and stops than part-time workers. The indication is that full-time working women defer some non-work travel to the weekend when time constraints are not as severe as they are during the week.

In order to determine the frequency of travel for different purposes, a detailed activity code was collapsed into five rather standard trip purpose categories (see Table 6). The travel frequencies for each of these purposes, given in Table 7, demonstrate that the higher level of weekend trip-making on the part of women working full-time is most assuredly not for the purpose of leisure or recreation. In fact, the pattern contained in this table is unmistakable: full-time working women make fewer stops for all non-work purposes than do part-time workers, who, in turn, make fewer non-work stops than women who are not in the labor force. Note that not all of these differences are statistically significant at the

Table 6: Specific Activities Included in General Categories
Uppsala, Sweden, 1971

1. Social

talking in person with family member
talking in person with friend or neighbor
visiting home of relative
visiting home of friend
club meeting
eat meal with others
drinking with others
accompany someone shopping without spending money

2. Personal Business

making a telephone call
sending a telegram
mail letter or package
banking
paying a bill
make an appointment
professional consultation (eg. with doctor, lawyer)
eat meal alone
attend church
walk dog
do laundry
attend educational course

Table 6: Specific Activities Included in General Categories Uppsala, Sweden, 1971 (Continued)

3. Shopping

purchase goods or services; make an expenditure
pricing or window shopping
fitting
exchange goods
order a good without payment
pick up a good without making an expenditure

4. Work

work
work related activity
seeking employment
work without pay (such as helping a friend paint house)

5. Recreation

indoor audience event (eg. concert, play, movie)
sports observer indoor
sports participant indoor
sports observer outdoor
sports participant outdoor
walking for pleasure
driving for pleasure
look after child at playground
sitting for pleasure

Table 7

Frequency of Travel [a] for Different Purposes By the Three Groups of Women - Uppsala, Sweden, 1971

	Full-time employed women	Part-time employed women	Unemployed women
Number of stops for social activities	9.8	10.6	12.0
Number of stops for personal business	8.3†	10.1	15.1*
Number of stops for shopping	27.8†	30.5	33.7
Number of stops for work	23.3*	16.7	NA
Number of stops for recreation	5.5†	6.2	7.7*

[a] Measured in average number of stops per person over tho 35-day period.

*Significantly different ($p \leq .10$) from part-time employed woman.

†Significantly different ($p \leq .10$) from unemployed woman.

Source: Field surveys conducted in Uppsala, Swoden, 1971.

p = .10 level, but many are, and the pattern is worth recognizing.

The pattern persists, by and large, in Table 8, which shows distances travelled for the various trip purposes and Table 9, which gives the time spent in different activities. Although full-time employed women clearly travel greater distance overall and spend more total time away from home, these facts can be entirely explained by this group's travel to work. Full-time working women travelled less distance for non-work purposes than either of the other groups, and spent significantly less time than non-working women in all non-work activities. Corroborating the time-budget studies (2,5,22,23), full-time women workers spend remarkably less time in recreation than do either part-time or unemployed women. These data indicate that employment for women generates clear shifts in travel behavior; as more time and travel are devoted to work, less time is available and less travel is undertaken for other activities. Travel for personal business seems to be particularly sensitive to the employment status of the woman traveller.

In any study of travel patterns there is one question of great interest that is seldom even asked and never addressed because empirical evidence requires detailed longitudinal travel data that generally are not available. The question concerns the amount of variety (or, alternatively, the degree of stereotyping) observed in the individual's travel pattern over some extended period of time. Because the Uppsala data are longitudinal, this question can be considered here. Four measures were generated as indexes of the variety present in a person's travel over the 35-day study period:

Table 8

Distance Travelled[a] to Different Activities By the Three Groups of Women - Uppsala, Sweden, 1971

	Full-time employed women	Part-time employed women	Unemployed women
Total distance travelled	148.0†	158.4	122.7*
Distance travelled for social activities	22.4	24.5	30.3
Distance travelled for personal business	11.2†*	15.5	23.3*
Distance travelled for shopping	36.3†	43.1	50.5
Distance travelled for work	45.3*	34.1	NA
Distance travelled for recreation	16.4	22.3	20.8

[a] Average per person airline distance in kilometers.

*Significantly different ($p \leq .10$) from part-time employed women.

†Significantly different ($p \leq .10$) from unemployed women.

Source: Field surveys conducted in Uppsala, Sweden, 1971.

Table 9

Time Spent[a] in Different Activities By the Three Groups of Women - Uppsala, Sweden, 1971

	Full-time employed women	Part-time employed women	Unemployed women
Total time spent outside the home	182.8*†	130.4	79.2*
Time spent in social activities	17.3†	19.0	22.0
Time spent in personal business	7.6†	7.4	24.2*
Time spent shopping	8.9†	9.8	10.6
Time spent working	150.1*	79.6	NA
Time spent in recreation	9.4*†	14.6	12.9

[a]Average number of hours spent per person over 35-day recording period.

*Significantly different ($p \leq .10$) from part-time employed women.

†Significantly different ($p \leq .10$) from unemployed women.

Source: Field surveys conducted in Uppsala, Sweden, 1971.

the number of different locations (street addresses) visited, the number of different land use types* visited, the number of different activities+ engaged in, and the number of different food stores visited (see Table 10).

The time constraints of full-time employment are evident in the data; unemployed women visit significantly more unique locations, land use types, and food stores than do full-time working women. The fact that full-time workers visit fewer different food stores than do the members of the other two groups means that they do less "shopping around" and are more likely to confine their food shopping to a few, repetitively visited, stores. In sum, while the women in the three groups participated in about the same number of different activities, the repertoire of places contacted was more restricted for full-time workers than for non-working women.

Given that the travel of full-time employed women differs in many ways from that of the other women, the question of whether the three groups of women differ in their access to the various travel modes needs to be addressed. Perhaps the more restricted non-work travel of working women reflects their reduced access to a car. Table 11 showing patterns of modal use by the three groups indicates,

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*The land use code used in the Uppsala study recognized 99 different land use categories (e.g. bank, barber shop, park, liquor store.

+The activity code used in the Uppsala study recognized 70 different activities (e.g. make a purchase; see a movie).

Table 10: Some Measures of the Variety[a] in the Travel Patterns of the Three Groups of Women - Uppsala, Sweden, 1971

	Full-time employed women	Part-time employed women	Unemployod women
Average number of different locations visited	30.4†	32.4	34.7
Average number of different land use types visited	20.3†*	24.0	23.2
Average number of different activities engaged in	14.5	15.3	15.7
Average number of different food stores visitod	4.3†*	5.4	5.1

[a] Observed over the 35-day recording period.

*Significantly different ($p \leq .10$) from part-time employed women.

†Significantly different ($p \leq .10$) from unemployed women.

Source: Fieid surveys conducted in Uppsaia, Sweden, 1971.

Table 11
Proportion of Individual's Stops Made By Each Mode: Average for Each Group of Women Uppsala, Sweden 1971

	Full-time employed women	Part-time employed women	Unemployed women
Walk	.43†	.43	.55*
Bicycle	.13†	.12	.05*
Bus	.14	.15	.14
Car Driver	.11	.12	.11
Car Passenger	.16	.19	.13*

*Significantly different ($p \leq .10$) from part-time employed women.

†Significantly different ($p \leq .10$) from unemployed women.

Source: Field surveys conducted in Uppsala, Sweden, 1971.

however, that the travel differences reported above cannot be attributed to differential mode use. In fact, of the three groups, the unemployed women appear to be the most "disadvantaged" with respect to use of the various travel modes. Unemployed women make more stops on foot and fewer by bike than do either of the other groups. The higher incidence of bicycle travel among the working women is entirely in accord with earlier findings that in Uppsala the bicycle is frequently used for the journey to work (14,15). While use of the bus and the car as driver are essentially the same for all three groups, unemployed women are car passengers less often than are part-time working women. In short, none of the groups makes extensive use of the automobile, and all women make more stops on foot than by any other mode.

This comparison of the travel patterns of the three groups of women has demonstrated that employment clearly has an impact on the daily activity patterns of women. The time constraints imposed by full-time employment mean that full-time working women are not as free as part-time workers to make additional stops on their work trips; the same time constraints lead full-time workers to shift some essential non-work travel to the weekends and to reduce the frequency of travel, the distance travelled and the time spent for all non-work purposes. To add to this picture of generally more restricted non-work travel among full-time employed women, the members of this group distribute their travel over a smaller set of destinations than do unemployed women. And finally, despite the more binding time constraints, the full-time working woman does

not undertake a larger proportion of her travel by automobile than do women in the other two groups. In sum, the time and effort accorded to travel associated with all the non-work roles is reduced as the time and effort associated with the working role is increased for fully employed women.

These findings lead inevitably to the question of whether the husbands of full-time employed women "take up the slack" created by their wives' employment. Do the husbands of such women increase their own participation in the household/family role as their wives' participation in this role as revealed in out-of-home activity patterns necessarily decreases?

To address this question we compared the activity patterns of men with full-time employed wives with the patterns of men with unemployed wives; only full-time working men were included. Throughout the analysis, the same measures are used for both women and men.

C. The Relative Location of the Two Groups of Men

As before, the relative location of the groups under study is checked before the travel behavior of the groups is compared. Table 12 shows that there is no difference between the two groups of men in terms of their relative location.

D. The Travel Patterns of the Two Groups of Men

The analysis of the travel patterns of the two groups of men is parrallel to that conducted for the women. If indeed a wife's employment generates shifts in household responsibilities (as suggested by Chafe, Ref. 3), then we would expect to find men with working

Table 12

Measures of the Relative Location of the Two Groups of Men - Uppsala, Sweden, 1971

	Men with full-time working wives	Men with unemployed wives
Average distance[a] from home to CBD	1.9 (1.2)[b]	2.2 (1.4)
Average distance from home to work	8.4 (19.1)	7.2 (16.8)
Average distance from work to CBD	8.1 (19.3)	6.6 (17.0)

[a]Airline distance in kilometers

[b]Figures in parentheses are standard deviations

Source: Field surveys conducted in Uppsala, Sweden, 1971.

wives engaging more often than men with non-working wives in shopping and personal business activities and perhaps curtailing their recreational travel. The results, however, do not support the notion that a wife's employment generates major shifts in the travel pattern of her husband.

In Tables 13 and 14, showing frequency of travel, the only significant difference between the two groups is in the frequency of multi-purpose travel; husbands of full-time working wives make more multi-stop trips (trips with two or more stops) and more 3-stop trips than do husbands of unemployed women. However, Table 14 demonstrates that this propensity for multistop travel is not in the line of house-hold duty: men whose wives work full-time do not make significantly more stops than the other group for any non-work activity. The only considerable difference ($p = .11$) is in the frequency of social travel. In fact, the most startling difference comes from a comparison of Tables 7 and 14; full-time employed women make substantially more shopping stops and substantially fewer recreation and social stops than do their husbands.

Similarly, while Table 15 shows the only significant difference between the distances travelled by the two groups of men lies in the distance travelled to work, a comparison of Tables 15 and 8 shows men with working wives travelling further than their wives for social and recreational activities and less for shopping. In Table 16, the two groups of men are seen to have essentially similar patterns of time allocation with the exception that men whose wives work full-time

Table 13: Frequency of Travel[a] for the Two Groups of Men - Uppsala, Sweden, 1971

	Men with full-time employed wives	Men with unemployed wives
Total number of trips	48.3	51.4
Total number of stops	133.0	133.4
Number of 1-Stop trips	28.8	31.3
Number of 2-Stop trips	12.0	11.9
Number of 3-Stop trips	4.3*	3.2
Number of 4-Stop trips	2.4	1.8
Number of 5†-Stop trips	2.2	1.4

[a] Measured in average number of stops per person over the 35-day recording period.

* Significant difference between the means ($p \leq .10$).

Table 13: Frequency of Travel[a] for the Two Groups of Men - Uppsala, Sweden, 1971 (Continued)

	Men with full-time employed wives	Men with unemployed wives
Percent of work trips that were single purpose	47.8	47.0
Number of trips on week days	37.9	37.8
Number of trips on week ends	11.8	11.7
Number of stops on week days	107.8	100.0
Number of stops on week ends	30.5	29.8

[a] Measured in average number of stops per person over the 35-day recording period.

* Significant difference between the means ($p \leq .10$).

Table 14

Frequency of Travel[a] for Different Purposes By the Two Groups of Men - Uppsala, Sweden, 1971

	Men with full-time working wives	Men with unemployed wives
Number of stops for sociai activities	12.3	9.1
Number of stops for personal business	10.1	10.6
Number of stops for shopping	21.8	19.6
Number of stops for work	24.7	25.5
Number of stops for recreation	9.3	7.3

[a]Measured in average number of stops per person over the 35-day period.

Source: Field surveys conducted in Uppsala, Sweden, 1971.

Table 15: Distance Travelled [a] ***to Different Activities By the Two Groups of Men - Uppsala, Sweden, 1971***

	Men with full-time employed wives	Men with unemployed wives
Total distance travelled	191.4	228.5
Distance travelled for social activities	32.3	25.4
Distance travelled for personal business	14.0	15.1
Distance travelled for shopping	31.2	35.9
Distance travelled for work	43.7*	59.9
Distance travelled for recreation	32.9	24.3

[a] Average per person airline distance in kilometers.

*Significant difference between the means ($p \leq 10.$).

Source: Field surveys conducted in Uppsaia, Sweden, 1971.

Table 16: Time Spent [a] in Different Activities By the Two Groups of Men - Uppsala, Sweden, 1971

	Men with full-time employed wives	Men with unemployed wives
Total time spent outside the home	179.3	182.2
Time spent in social activities	20.2	17.4
Time spent in personal business	11.2	7.0
Time spent shopping	5.2	5.9
Time spent working	146.2	145.0
Time spent in recreation	17.4*	12.5

[a]Average number of hours spent per person over 35-day recording period.

*Significant difference between the means ($p \leq .10$).

Source: Field surveys conducted in Uppsala, Sweden, 1971.

spend more time in recreation than do men whose wives do not work; in fact, they spend almost twice as much time in recreation as do their full-time working wives. Table 17 reveals no distinction between the two groups of men in the level of variety present in their travel, (note, however, that men visit fewer food stores than do women), and the only difference in mode use (Table 18) is in the use of the bicycle.

Perhaps the most remarkable differences uncovered by this study lie in a comparison of mode use by men and women (Tables 18 and 11). Women rely upon walking nearly twice as often as do men; they use the bus and car passenger modes significantly more than the men do, and use the car as driver with only a fraction of the frequency that men do. Women, then, are far more reliant on the more time-consuming and less independent modes of transportation (walk, bus, car passenger), while the men make extensive use of the automobile.

This comparison of the travel patterns of the two groups of men indicates that a woman's full-time participation in the labor force does not generate many substantial shifts in the daily activity pattern of her husband; in fact, a man's travel is relatively unaffected by the employment status of his wife. The most significant impact seems to be that men with working wives spend more time in leisure pursuits than men with unemployed wives, a curious finding that has also been reported in time-budget studies (22). Ironically, the real distinction lies not in a comparison of the behavior patterns of the two groups of men, but in a comparison of full-time working women and full-time working men (see Ref. 13).

Table 17

Some Measures of the Variety [a] in the Travel Patterns of the Three Groups of Men - Uppsala, Sweden, 1971

	Men with full-time working wives	Men with unemployed wives
Average number of different locations visited	31.3	30.5
Average number of different land use types visited	18.3	19.3
Average number of different activities engaged in	15.6	15.2
Average number of different food stores visited	3.3	2.7

[a]Observed over the 35-day recording period.

Source: Field surveys conducted in Uppsala, Sweden, 1971.

Table 18

Proportion of Individual's Stops Made By Each Mode: Average for Each Group of Men Uppsala, Sweden, 1971

	Men with full-time working wives	Men with unemployed wives
Walk	.20	.25
Bicycle	.10*	.18
Bus	.09	.05
Car driver	.48	.41
Car passenger	.07	.10

*Significant difference between the means ($p \leq .10$).

Source: Field surveys conducted in Uppsala, Sweden, 1971.

Although the full-time employed woman engages in far less non-work travel than the unemployed woman, she still does more shopping than her husband. In other words, a woman's full-time employment is not accompanied by a major reduction in the importance of her household/family role within the household. She must work and retain primary responsibility for the smooth running of the household; what must give is her participation in social and recreation activities which is lower than that for any other group. The findings here for out-of-home travel, therefore, substantiate those of time-budget studies that have emphasized in-home activities.

Given that the husbands of working wives do not appreciably share in travel related to the household/family role, we must ask how working women, with their reduced participation (vis a vis unemployed women) in travel for shopping and personal business, manage to maintain their households. The answer may lie in an observation made by Vanek after she recognized the same pattern in time-budget data on time spent in housework by employed and unemployed women (30). She observed that full-time employed women spent less time in housework than did non-working women, even on the weekend when presumably both groups had similar time constraints. Vanek concludes that for unemployed women there is something of Parkinson's law at work here and that full-time employed women get the housework done more quickly and efficiently because they must. A similar explanation has been offered by Chapin and Logan (7) and Michelson (22).

It is clear from the many time-budget studies that have been conducted that the activity patterns of men and women revealed in this study

are widespread throughout the industrialized world. They reflect the tenacity of traditional sex roles that place employed women in a double bind. Is it possible to change behavior patterns of such long standing? The Swedish Government is aggressively trying to do so. The last portion of this paper briefly discusses some Swedish policies aimed at creating greater equality between the sexes.

V. CONCLUDING THOUGHTS: NEW DIRECTIONS IN SWEDEN

Government policy in Sweden is actively supporting the emergence of two equal adults in a normative family pattern that would have men and women sharing equally in the four roles (family, social, work, recreation) outlined at the outset of this paper (19). The government believes that since they are trying to build a society based upon the norm of two income-earners per family, and since they are promoting the viewpoint that neither the traditional male role nor the traditional female role is worth striving for absolutely, government should pursue policies that enable all adults (and parents in particular) to combine work and family life. Clearly in the kind of society that is envisioned, an analysis of activity patterns like the one reported in this paper would reveal no significant differences in the travel behavior of working men and women.

There are a number of policies either currently in effect or under consideration that could result in greater similarity in the travel patterns of men and women. The three of greatest interest here are policies relating to child care facilities, parenthood leave, and the length of the working day. Before 1975, free public education was

not available for children under 7 years of age; in 1975, Parliament, recognizing the severe shortage of pre-school places, adopted a 5-year plan to provide 100,000 new places in day care centers and 50,000 new places in after-school centers to care for the school-age children of working parents (27). This plan will increase three-fold the number of day care places available in publicly supported centers and should remove one barrier to the employment of women with small children.

A second policy, aimed specifically at promoting the increased involvement of fathers in family life, was the 1974 replacement of maternity leave with parenthood leave, by which either parent can take all or share any part of the 7-month leave from work (at 90 percent pay) available to workers upon the birth of a child. Either working parent is also entitled to up to 18 days' leave per year to stay home with a sick child (27). The thrust of these two programs embodies one of the basic principles espoused by the Swedish government in their attempt to loosen people's rigid adherence to traditional sex roles; instead of dwelling on the working woman's inevitable conflicts between home and work, the Swedes have asked what prevents fathers from fuller participation in the household/family role (19).

Finally, the Advisory Council to the Prime Minister on Equality between Men and Women is demanding that for parents of children under three, the workday should be cut to 6 hours. They would like to see the six-hour workday eventually extended to everyone as a means to promote greater contact between parents and children and greater sharing of household responsibilities (16). The Swedish

trade unions, however, are pushing for an alternative mechanism for reducing working hours by advocating the four-day work week. The matter of exactly how reduced working hours will be spread throughout the week is clearly an issue critical to how the future daily activity patterns of men and women will take shape.

There are additional government programs in Sweden designed to bring about greater equality between the sexes, but they do not bear directly on transportation issues. The point to be gleaned from this glimpse at Swedish policy is disarmingly simple, but could have profound repercussions. Observing the same type of inequalities between the sexes that were reflected in our analysis of urban activity patterns, the Swedish government has decided to take an active role in attempting to effect social change. It is still too early to know whether or not such an attempt will succeed.

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ANALYSIS OF ACTIVITY SCHEDULES ALONG THE DIMENSION OF GENDER

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Introduction

Virtually all transportation policies and planning to date have treated target populations as if expressed or observed needs to travel and participate in activities were identical for men and women. With the growing number of women in the labor force, the rising number of dual career marriages and the increase in general consciousness of "women's issues," this approach to planning and policy making has been called into serious question. For transportation researchers, it is no longer sufficient to leave these issues untouched. As a result, we must establish the extent to which the transportation-related behavior of women is different enough from that of men to merit special attention by analysts and policy-makers. Unfortunately, there is no clearcut method available for doing this.

If we separate a population by gender, we are usually still confronted by quite a heterogeneous group. In order to clarify the topic "women and transportation," three fundamental decisions were made in this study. First, the phenomenon to be observed is activity schedules. Since most transportation demand is in fact derived from demand to participate in activities at the end of a trip, it seems more appropriate to concentrate on the more basic need expressed by trip making. In this context we can begin to understand how providing for "activity needs" may not always require providing transportation and how changing the nature of the activities (e.g. location, opening hours) can affect travel behavior. Observing when (during a day) people participate in activities and for how long.

Although the present analysis includes only out-of-home activities which were visited by a motorized vehicle, future studies could easily extend this work to encompass home activities as well as those visited on foot.

Second, working people will be discussed. Prior research (Stevens, 1976) has shown that the activity-related behavior on nonworkers is highly complex and subject to considerable unexplained variation. It seemed, therefore, reasonable to begin with a subset of the population whose behavior on working days is, because of the large block of time committed to a job, more predictable.

Third, an exploratory analysis of the factors associated with working women's activity behavior will be included. It is not at all clear how conclusions about "women's travel" in general can be of use to policy-makers. Should policies be applied equally to all women, regardless of income, age, or familial responsibilities? One of the major points to be made in this paper is that analysis of women's travel and activity behavior should result in better understanding of the full range of variables which interact with "gender."

Outline of the Paper

After a discussion of prior research related to activity schedules, a conceptual framework for an analysis of activity schedules will be presented. Using this framework as a point of departure, attention will then be turned toward the set of basic variables on which an analysis of activity schedules can be based. Following that will be a brief section on exploratory research which points toward further analysis, particularly of the multivariate variety. The paper will conclude with discussion of: (1) Currently

available data and modeling techniques, (2) planning of activity and travel-related facilities, and (3) needed research in this area.

Prior Research

The relevant literature can be usefully divided in four categories. Beyond several excellent review articles which outline most of the major findings in the field (cf. references 3, 7, and 12), the first category is represented by a number of authors who lay solid theoretical foundations for empirical analysis of activity schedules. The second category contains economic studies whereas the third category deals with simulative studies which have been conducted on entire populations without particular reference to gender-specific differences. Last, are those sources which shed light on the issues of activity systems analyzed with respect to gender.

The discussion in this section will be limited to those researchers who have made significant contributions to our knowledge of differences of activity time allocation along the dimension of gender. For the more general sources related to the first three categories the reader is referred to references cf. 1, 2, 4, 5, 6, 9, 10, 13, 14, and 16. Although all of them have remained in the realm of exploratory analyses, each gives us valuable insights into some of the factors which seem to be important in explaining gender-specific behavioral differences. Particularly for the specification of the models discussed in this paper, these insights would play an important role.

Palm and Pred, for example, explored alternative situations in which working women were constrained by children and/or household responsibilities or lack of automobile (15). Drawing heavily on the framework developed

by Hägerstrand, they outlined the way in which various constraints might limit the "action space" within which such women make decisions about allocating their time. Two other sources give credence to the belief that an undifferentiated analysis of "women" across all activities leads at best, to marginally useful knowledge. Chapin in his study of activity patterns in Washington, D.C., calculated the mean number of hours of weekday "discretionary" time (i.e. devoted to activities in which participation is chosen) for working men and working women (4). His results showed no significant difference between the means of each group. However, when he broke each group into the components "presence of a child under thirteen years old" or "no presence," he found an increase in the difference of means between the men and the women whose households had a child under thirteen. This seems to imply that, at least in Chapin's sample, the presence of younger children reduces women's disposable time more than men's. Such differences appear even more crass when samples are split along lines of occupational status or class. In a 1973 study reported by the Office of Management and Budget, the average time spent on personal and family care was computed for men and women within the classes blue and white collar. In both classes, females spent a considerably larger share of time than males (white collar: 6.1 vs. 3.8 hours; blue collar: 7.1 vs. 4.1 hours). Again, even those women holding full time jobs seem to carry a greater share of the household responsibilities than their male counterparts (19).

Hanson and Hanson demonstrated the need also to differentiate activities in which people participate (8). Using longitudinal household survey data from Uppsala, Sweden, they examined four indices of "daily activity-

travel behavior." Their analysis of the frequency of participation in different activities, for example, showed that individual responsibilities within the family are not equally shared. "While fully employed men use 'more time' for their own leisure pursuits, fully employed women are occupied with individual household duties." (8, p. 220)

Clearly, the available literature points toward the need for further investigation not only of the factors which relate to household responsibilities, but also of the interaction of these factors with other socio-economic variables. The following sections of this paper will be geared to such an investigation.

Conceptual Framework

An activity schedule is simply the set of activities in time and space in which a person chooses to participate. Choice of an activity schedule cannot, however, be viewed in isolation from other activity-related decisions. In order to understand the context in which a schedule is chosen it is instructive first to consider the choice hierarchy shown in Figure 1. This hierarchy shows a sketch of the general context in which temporal and spatial decisions are made. The first group contains decisions which are usually made infrequently and require a considerable amount of forethought, e.g. moving one's home to a new location, purchasing and automobile or beginning a job. Conditional on this set of longer term decisions are a group of choices which can, for the most part, be made in a relatively short time, with much less preplanning. Scheduling activities is such a choice.

FIGURE 1

GENERAL CHOICE HIERARCHY FOR TIME-SPACE DECISIONS

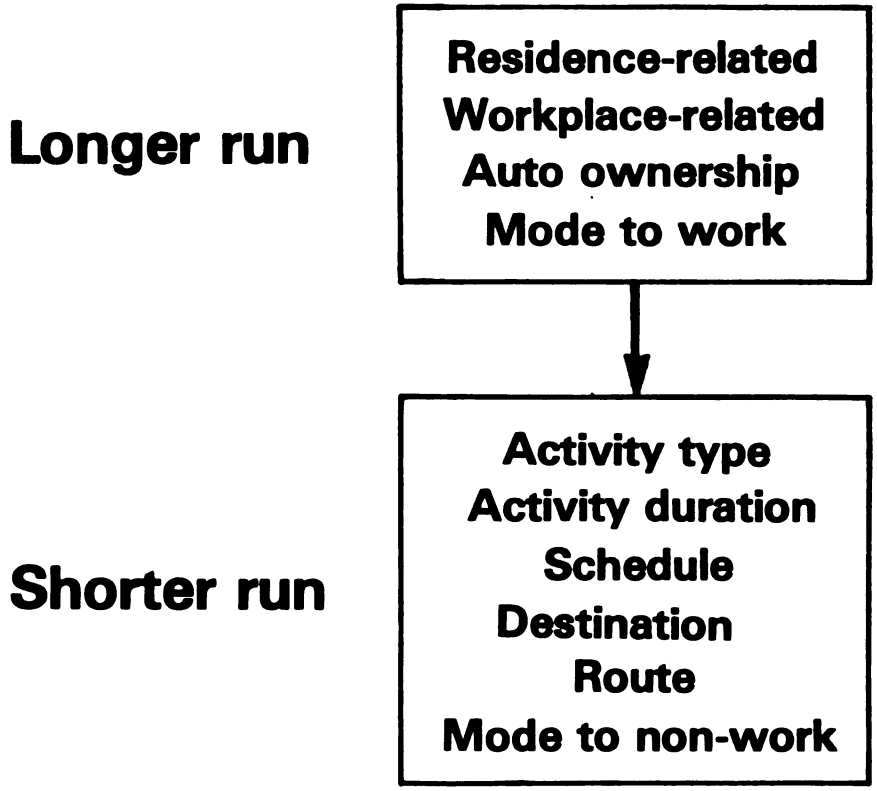
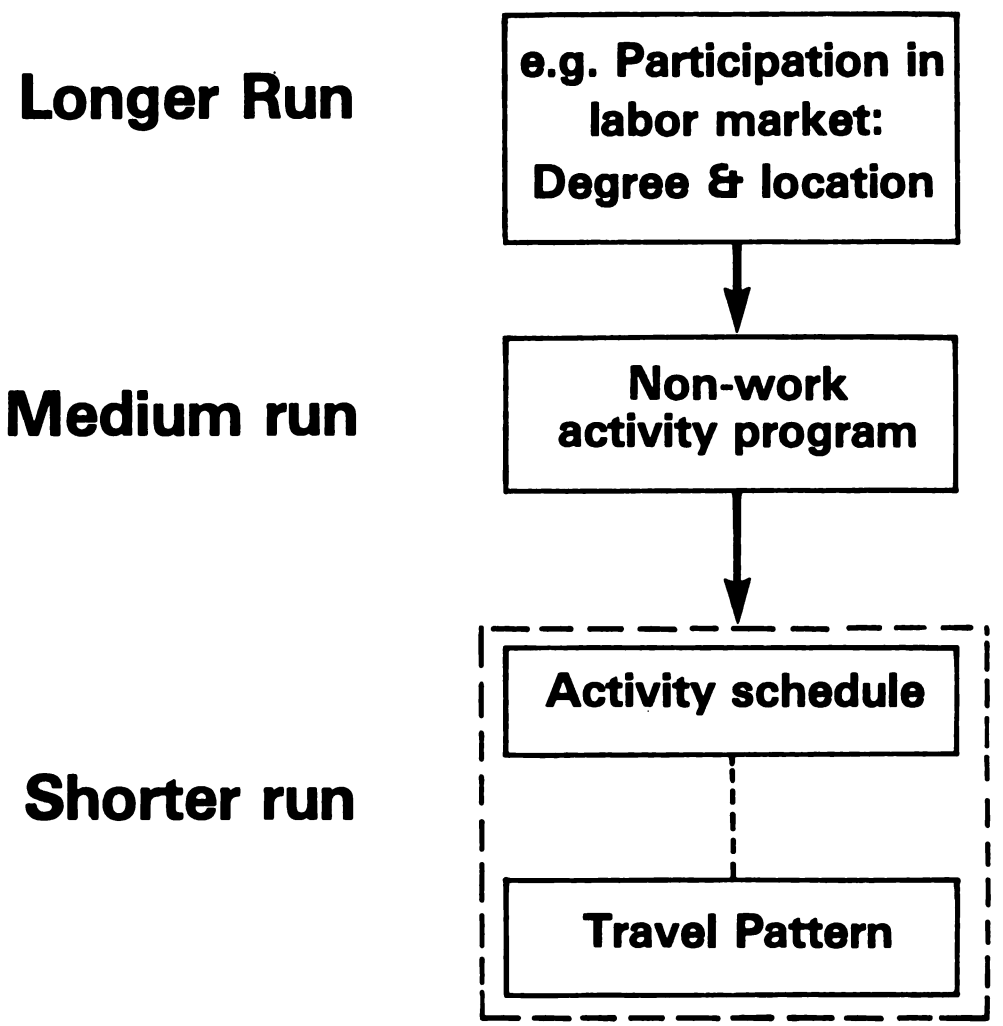


Figure 2 highlights the position of this decision within the general context. The outcome of the longer term decision of to what extent and where to participate in the labor market exerts a powerful influence on most people's temporal and spatial behavior. Given this, one then decides to allocate the remaining (out of home) time to various non-work activities, i.e. create an activity program (11). Once the time has been portioned to various types of activities, it is hypothesized that decisions are made to schedule the program within specific slots in a time interval (e.g. a day or week). That is, one selects (in the Lund researchers' terms) a "path" in time and space along which to perform a program. Carrying out the schedule also requires simultaneous decisions about travel mode, route and destination, resulting in a travel pattern. At this time, we will exclude route and destination choice and will deal with mode (drive alone and shared ride) as an explanatory variable. Hence, we will be able to focus on participation in and scheduling of activities.

For the present study, we will consider the set of activities for individuals who work more than 15 hours per week. In 1970 most of these people undoubtedly had no choice about whether or not to participate at a specific time in a work activity on the day sampled. We can, therefore, speak of an activity's degree of fixity in time and space, work being most fixed of all the non-home activities. With respect to some individuals (e.g. working mothers) a case could be made for treating other daily activities (e.g. trips to a day care) as "fixed." Unfortunately, since there is very little consensus about how to measure degree of fixity of activities outside of work and home (shopping, recreation, etc.),

FIGURE 2

CHOICE HIERARCHY FOR PARTICIPATION IN OUT-OF-HOME ACTIVITIES



we will assume here that most working people choose whether or not to participate in such activities during a given day's time period. The end result of a person's decisions to participate constitutes then, his or her activity schedule.

Since most home-related activities (eating, sleeping, etc.) can also be considered pegs around which an activity schedule is chosen, these together with the work activity will be taken as the fixed reference points for the present analysis. That is, for any given working person, five distinct time periods can be defined:

1. prior to leaving for work from home
2. on the way to work
3. during the work activity
4. on the way home
5. after arriving home from work

Within each of these periods decisions are made as to whether or not to add activities to the basic and, for our purposes, obligatory schedule "home-work-home." It is at this juncture that the present study departs from conventional wisdom on the most effective analytical approach. Many previous analyses have been based on Markovian assumptions, implying that a person's decision in one time period would have no relation to decisions made during other periods. It should be obvious, for example, that going shopping for groceries during work reduces the likelihood that someone will repeat that "decision to participate" later in the day.

At the same time, not all characteristics of the time periods are identical. Research which focuses on the frequency of nonwork trips without differentiating the time of day consequently produces misleading results. Many nonwork/nonhome activities have restricted opening hours which preclude participation in certain time periods. Of equal importance is the fact that the level of spatial accessibility (i.e. how many activities can be reached within a given time) varies from period to period. Although a person may experience a low accessibility level at home, at work the reverse may be true. Using a general home-based accessibility measure as an explanatory variable for all daily trips being taken would, therefore, bias our results. Finally, a person will experience different degrees of dependence on other people's schedules during different time periods and for different activity types.

In the next sections we will explore the decisions made in each of the five time periods and point toward a set of interrelated models with which one can explain and eventually predict the impact of alternative policies on the activity schedules of working people. Segmentation of the sample along the dimension of gender will allow us to isolate the variables which seem to play a more important part in the activity schedules of working women.

Variables to be Used in an Analysis

Based on the results of prior exploratory analyses and the theoretical frameworks developed around the concepts of choice and constraint, a basic set of critical variables becomes apparent. Since including a

variable implies an hypothesis about why people behave as they do, it is useful to consider this set in detail. As one can see in Figure 3, the explanatory variables should be grouped into seven categories. While there is some degree of overlap between groups, the categories provide a framework with which to understand the constraints which operate in the lives of working people. In the present study it also provides a means of indicating the extent to which particular variables within a group appear to be important in influencing the choices working women make about their daily activity schedules. Naturally, this list of candidate variables is not exhaustive; there are many unobserved factors at home and at work which perhaps limit the choice set from which people pick and certainly affect the observed schedule. However, since we would like to be able to discuss the implications of the results for policy-making and hence, eventually predict the impact on women's (or men's) activity schedules of alternative public policies, our set of variable is limited to those which can be directly observed.

The first group of variables--temporal--is represented primarily by the time when an individual began and finished work for the day. In both cases dummy variables can be created as to whether the person began work after 9:00 a.m. or finished after 6:00 p.m., between which time many activities (especially retail and commerical) would be opened. (Although some activities surely maintain other opening hours, the present specification should be a solid basis from which to refine our understanding of temporal constraints.)

FIGURE 3

BASIC VARIABLES TO BE INCLUDED IN AN ANALYSIS

DEPENDENT VARIABLE: DURATION OF A DEVIATION

EXPLANATORY VARIABLES:

1. Temporal

- Opening hours of retail and commercial activities
- Work schedule (e.g. time of shift)

2. Spatial

- Total employment density
- Retail employment density
- Population density

3. Socio-economic: Person level

a. Demographic

- Age
- Sex

b. Work Responsibilities - related

- Duration of work
- Type of employment
- Number of air trips in last 12 months

FIGURE 3 (CONT'D)

4. Socio-Economic: Household level

a. Status-oriented

- Income
- Number of automobiles
- Housing type
- Number of licensed drivers

b. Household Responsibilities - related

- Size
- Stage in life cycle
- Number of workers
- Work status of spouse
- Number of non-working adults (excluding spouse)
- Number of children 5-15 years old
- Total number of trips made by other members

5. Transportation - related

- Mode
- Number of riders in car
- Use of freeway during trip
- Carpool during trip
- Travel time (in-plus out-of vehicle)
- Travel cost

Parallel to the temporal group is the set of spatial variables representing the location of activities which may be available, or in Hägerstrand's terms reachable. (cf. references 6, 13) Since people's places of work and home are not all equally located with respect to a city's activities, it is necessary to include different measures depending on the locations of the origin and destination of the tours. As a result, three measures of accessibility would be calculated: home-based, work-based and home-work combined. "Home-based" would be used in models two and four. For the "home-work" accessibilities, travel times and costs would be those which went beyond what someone would have experienced without a deviation, i.e. the marginal values.

Third, there are socio-economic variables at the person level. Besides usual demographic variables like age, a set of less well explored variables related to responsibilities at work should be included. Duration of work, for example, gives some indication of the extent to which disposable time for non-home/non-work activities is available. A person who stays at work for twelve hours is not as likely to add activities to his/her schedule as the person staying six hours. Expecially since "working people" can be defined as those employed for over 15 hours per week, it is critical to determine the point at which time spent at work makes a substantial difference in schedules chosen. The other two variables listed can be used as proxies with which to measure the level of responsibilities which are associated with various jobs.

Fourth, at the household level there are also socio-economic variables which may affect an individual's choice of activity schedule. The first subset reflects the status of the household. Ability to take part in

activities is to some extent limited or facilitated by financial resources (income) and by the physical means with which to travel (licensed drivers and number of automobiles). At the same time, a particular "market segment" is delineated by housing type and perhaps also by number of automobiles and income. The second subset relates to responsibilities which exist in households. For the analysis of working women's activity schedules, these variables are among the most interesting. "Stage in life cycle" indicates the age of the head of household and age of the youngest child (if any exists). As Chapin has shown, the amount of "free time" available to an adult as well as how that time is spent changes markedly from one stage to the next. (Ref. 4, pp. 112-118.) Using information on the number of children from five to fifteen as well as on the first life cycle group (youngest child less than five) one can presumably gauge the extent of responsibilities associated with having children. Consequently, data on the number of workers and nonworking adults gives us some insight into the availability of people in the household to take care of such responsibilities.

These variables could indicate the extent to which the person observed is dependent on the schedules of other household members. Information on whether a spouse also works provides a way of exploring the implications of dual career marriages on the activity schedules of each. Finally, the total number of trips made by other household members serves as a proxy measure of the likelihood that household responsibilities will be performed by individuals other than the working person(s) observed. For example, a relatively high number of trips made on the

interview day might point toward the fact that a nonworking adult (e.g. retired parent) may be carrying out duties which would otherwise fall to the working person (e.g. shopping).

The last group of variables, transportation-related, are straightforward the first four relate to the ease with which a person could deviate from home-work schedule. Mode (auto driver, auto passenger), carpool (yes or no) and number of riders all give us information on the degree to which a person is dependent on others when traveling to an activity. One presumes that the higher the dependence on others' schedules, the less likely a person will be to participate in additional activities.

Data Analysis

Analyses were performed on data from the Home Interview Survey (HIS) of Minneapolis--St. Paul from 1970. Included in the HIS was information on over 6,000 households, 15,000 persons and 4:00 a.m. to 4:00 a.m. trip diaries (i.e. one day) for each person older than five years. Even though there are obvious deficiencies associated with this dataset (e.g. no data on the degree of flexibility of working hours, no walk trips), it was nevertheless possible to generate sufficient information with which to conduct a preliminary analysis of daily activity schedules. At the present time and for the purposes at hand, no available American dataset seemed more useful than that from Minneapolis/St. Paul.

The sample for the present analysis was delimited by several parameters. First, only those workers who either drove alone or shared a ride in an automobile during the entire day of the survey were included. Prior research indicates that persons who travel by public transit have a

very low probability of adding activities to the "home-work-home" schedule (13); further, the percentage of trips by transit in Minneapolis/St. Paul was relatively low overall (about 6%). Second, individuals whose trip destination lay outside the survey region or did not begin and end their activity schedules at home were eliminated from the sample. Finally, for those persons who made more than one stop in a time period, a primary activity was designated as the one whose duration was longest.

The hypotheses generated with these analyses suggest that future research into gender-specific travel/activity behavior ought to augment such a sample with data not usually a part of traditional home interview surveys. Consider Table 1, for each of the five time periods, the distribution of trips by purposes is given. Tables 2, 3 and 4 show the proportion of these trips within activity purpose group made by women.* In the context of prior findings these results seem counter-intuitive, since women appear to make proportionally fewer shopping and social-recreation trips and about an equal number of serve passenger trips as men. A number of factors seem to be at play here. First, we believe that the temporal choice set from which decisions of when to participate in activities are made is not adequately represented by one day's observation. Particularly for working people, the weekends are often a more convenient time to make major shopping excursions. Moreover, for women with many household duties, postponing outside activities until the weekend may be the only feasible solution. Therefore, even including pre- and post-work,

*There were 210 women and 1799 men in the sample.

TABLE 1

DISTRIBUTION OF ACTIVITY PURPOSES

(% by time period)

Time Period \ Purpose	SHOP	SCH	MED	OREC	OSR	PB	SP
1 (before work trip) H-O-H	40 (13%)	2 (29%)	4 (22%)	2 (3%)	16 (5%)	32 (9%)	25 (7%)
2 (to work) H-O-W	9 (3%)	1 (14%)	1 (6%)	1 (1%)	17 (5%)	36 (10%)	149 (43%)
3 (during work) W-O-W	10 (3%)	0	2 (11%)	2 (3%)	35 (10%)	81 (22%)	4 (1%)
4 (to home) W-O-H	59 (19%)	1 (14%)	5 (28%)	15 (20%)	57 (17%)	91 (25%)	113 (32%)
5 (after home trip) H-O-H	191 (62%)	3 (43%)	6 (33%)	55 (73%)	215 (63%)	126 (34%)	59 (17%)
all periods	309	7	18	75	340	366	350

TABLE 2

PROPORTION OF TRIPS BY WOMEN

SHOPPING

PERIOD 1 (H-O-H)	0.5
PERIOD 2 (H-O-W)	0
PERIOD 3 (W-O-W)	1.0
PERIOD 4 (W-O-H)	1.6
PERIOD 5 (H-O-H)	0.7
ALL DAY	0.7

TABLE 3

PROPORTION OF TRIPS BY WOMEN

OTHER SOCIAL RECREATION

PERIOD 1 (H-O-H)	1.0
PERIOD 2 (H-O-W)	.5
PERIOD 3 (W-O-W)	0
PERIOD 4 (W-O-H)	1.7
PERIOD 5 (H-O-H)	1.6
ALL DAY	1.3

TABLE 4

PROPORTION OF TRIPS BY WOMEN

SERVE PASSENGER

PERIOD 1 (H-O-H)	0.5
PERIOD 2 (H-O-W)	1.0
PERIOD 3 (W-O-W)	2.0
PERIOD 4 (W-O-H)	1.5
PERIOD 5 (H-O-H)	0.3
ALL DAY	1.0

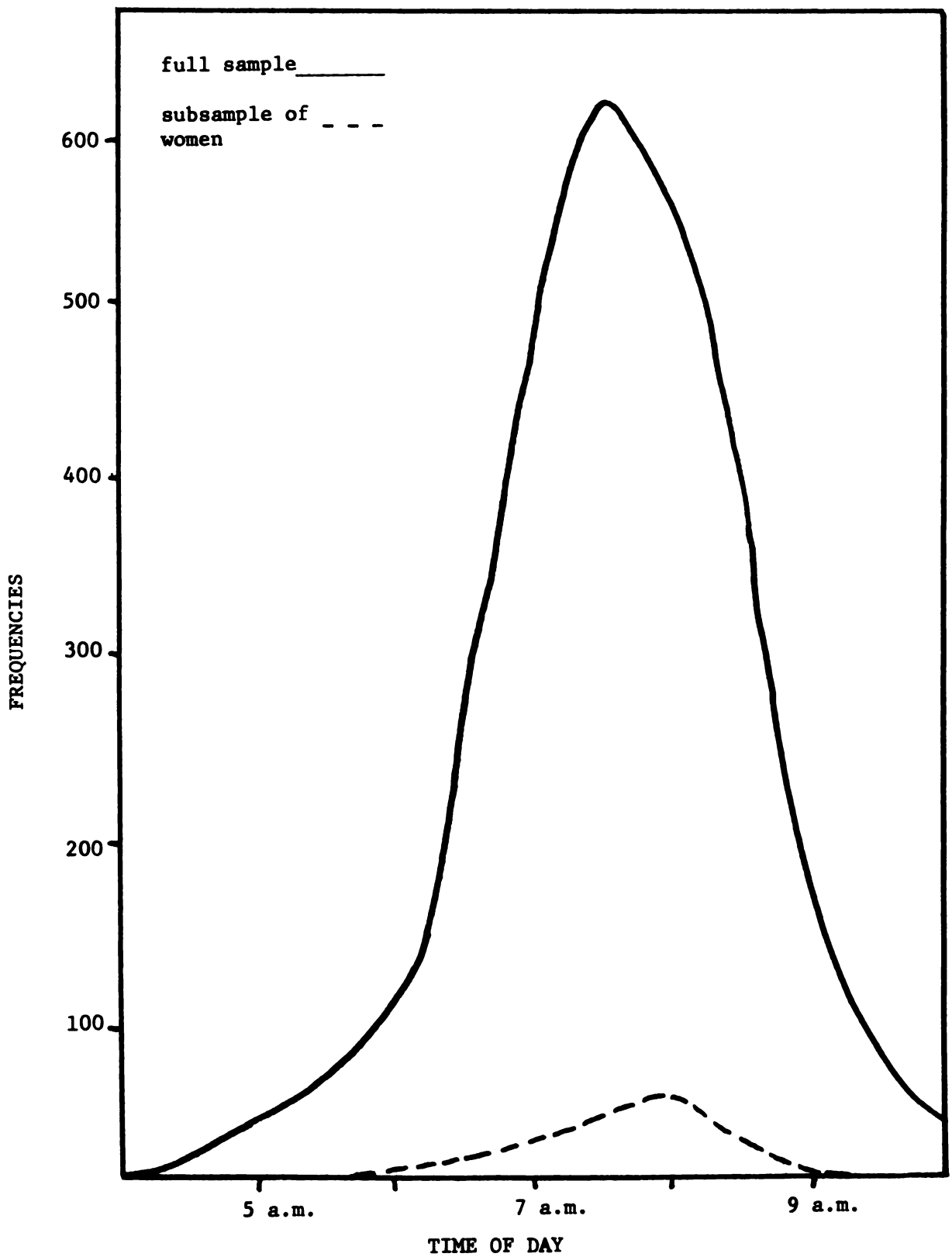
home-based deviations does not represent the full time span for many decisions. Third, many women's responsibilities are within the home; while a working husband may be responsible for vehicular-related duties, his female counterpart is probably tied more closely to the home, requiring less or no travel. This hypothesis is further suggested by Figure 4 which shows the distribution of ending times for the entire sample and for the subsample of women. That the peak for women is later than for the whole sample implies that women are, by staying home longer, involved in more household-related activities.

Next, statistics associated with the full and subsample indicate several factors which may also account for the apparently counter-intuitive results discussed above. For the full sample there is a mean of 1.4 workers per household whereas for subsample 1.6. Similarly, the average number of "other workers" is 0.7 versus 1.0. Both these numbers seem to reflect the fact that working women tend much more than men to have a working spouse or another working adult in their households--who may take over out-of-home related duties. Of considerable interest is the fact that in the total sample the average worker has twice as many children between the ages of 5 and 15 as in the subsample. At the same time, the women are slightly more likely to be single than persons in the full sample (20%) more). Finally, women are in cars with two or more passengers when they go to work 10% more than all persons in the sample.

In terms of correlation between variables, particularly duration of a deviation and the set of explanatory variables listed in Figure 3, there is little information with which to draw conclusions about factors

FIGURE 4

DISTRIBUTION OF ENDING TIMES: WORK TRIP



which are more important for women than for men. Indeed, while the correlation coefficients themselves are not high, they are very similar for both sets of data. Duration of work and duration of deviations in period three, for example, are -0.08 and -0.11; those for the dummy variable for arriving at work after nine in the morning and duration of deviations in period two are 0.18 and 0.15.*

Conclusions

Despite the tentative nature of the results, several perspectives can be developed. First, it is not clear whether analyzing the activity schedules of women per se is useful. While comparably situated men and women may have different activity schedules, all women do not have the same activity schedules. It seems more appropriate then to focus on other socioeconomic variables which tend to describe the responsibilities of a household and the number of people able to carry them out. For example, working class women will have considerably fewer financial resources than their manager level counterparts to pay for housecleaning and child care. Also, a single or married woman will naturally have fewer household duties when she has no children.

Second, there are a number of variables which will be explored. The day of the week on which a person was interviewed should be examined to see whether temporal proximity to the weekend significantly affects the outcome of decisions; additionally, opening hours for various activities may be different depending on the day of the week. Next, accessibility

*Since people with no deviation and hence, a duration of length zero are considered together with all nonzero durations, these coefficients are necessarily biased. Unbiased models using such variables can be constructed using the formulation suggested by Tobin (1958).

measures with respect to the person's home, work and home-work combined should be calculated and used as indicators of the extent of opportunities the person experiences at various times of the day. The more opportunities, presumably the greater the likelihood of making a stop. Further, the interaction of decisions to stop in different time periods should be taken into account. As discussed in the section on prior research, current evidence shows that the assumption of independence between time periods of a day (as used in most analyses to date) is erroneous.

Finally, it is appropriate to consider developing multivariate models with which to explain and eventually predict activity schedules. On this basis, it will be possible to establish more conclusively, (1) the variables which appear to be critical in choosing a schedule, and (2) whether schedules of specific groups within the class "women" merit special attention by policy-makers as well as researchers.

Acknowledgements

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B. RESIDENTIAL AND LOCATIONAL IMPLICATIONS OF CHANGES IN LABOR FORCE PARTICIPATION

RESIDENTIAL AND LOCATIONAL IMPLICATIONS OF CHANGES IN LABOR FORCE PARTICIPATION

Transportation planners, geographers, and urban economists have long considered the relationships between employment choices, residential locational decisions, and transportation patterns. The three papers in this section treat defferent facets of those relationships from the perspective of women entering or continuing in the paid labor force.

Madden and White argue in their paper that women's work trips are currently different from men's because their employment and housing choices are different. They find that different disciplines look at these choices, and their impact on travel behavior, in very different ways. These approaches determine in part the answer to the central question: as women's labor force participation grows more similar to men's, will their work trip patterns become more similar? In reviewing the diverse literature of both labor market economists and residential location analysts, Madden and White find more questions than answers. They argue, however, that most work shows that future urban form and travel patterns cannot be independently projected because they are causally linked. Therefore, the transportation as well as public service planner must have a better understanding of the causes and effects of women's travel behavior in order to make accurate projections of women's longer term residential and travel choices.

Betak and Harmon's paper examines one aspect of the trade-off between residential location cost and transportation; the importance of accessibility in the initial and secondary house purchase within a community. The authors report on a series of studies conducted in Hamilton, Ontario beginning in 1970. They find that access to work acted as a negative constraint on

choice rather than a stated determinant of preference; people were willing to incur some loss of accessibility if this involved a perceived improvement in the price, dwelling size or lot size of the house in question. While some of the literature postulated that men and women would have different concerns about aspects of housing, most of the concepts used by men and women were similar. Indeed, Betak and Harmon found that in the case of couples the housing choice was relatively egalitarian and represented a consensus on important concerns. This suggests that housing choices in the future, as more women enter the paid labor force, may represent a compromise between the needs of both workers rather than dominance by one worker, as suggested by the literature.

Hock's paper looks specifically at the residential location of working women in Baltimore and finds that black married women are more likely to be located near the city periphery than near the suburbs. Hock questions whether this pattern is a direct reflection of work trip origins, housing choices or discrimination in the employment or housing markets. She suggests that current data sources are not tabulated in a manner conducive to responding to these questions.

WOMEN'S WORK TRIPS: AN EMPIRICAL AND THEORETICAL OVERVIEW

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I. Introduction

Research findings on women's work trip behavior are scattered across diverse studies of transportation networks, of urban land use, of wages and occupations, of local labor markets, of residential location and housing demand, and of consumer expenditure patterns. While some basic empirical relationships provide common grounds for this rather vast and dichotomous literature, the explanations for these relationships are quite diverse. In this section, we explore the empirical underpinnings for studies of women's work trip behavior, focusing on three sets of "stylized facts" which describe women's work trips, women's jobs, and residential constraints imposed by women's household roles. We refer to these data as "stylized facts" because they reflect simple correlations which may disguise a more complex set of behavioral relationships.

A. Women's Work Trips

There are several important "facts" about sex differences in work trips:

(1) Women's work trips are shorter than men's. Fuchs, using the 1960 U.S. Census, finds that women are twice as likely as men to earn their

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wages at home or within walking distance of their homes. (12) Taaffe, et al, using the Chicago Area Transportation Study, find that 62.6 percent of women and 40.0 percent of men with suburban jobs have commuting journeys of less than three miles. (45) The London Transport Executive observes that women using public transportation spent an average of 38 minutes in travelling to work while men spent 44 minutes. (25) Pratt, using (1911) data on workers in Lower Manhattan, finds 47 percent of men and 60 percent of women spend an hour or less commuting to work. (38) Madden, using 1971 and 1972 panels of the older male and female cohorts from the National Longitudnal Survey, finds that married men spend 33 percent more time commuting to work each day than do married women. (28) Wheeler, using the Pittsburg Area Transportation Study, finds employed women travel an average of 3.06 miles to their jobs, compared to 3.43 miles for all workers. (50) Wolforth, using travel data in Vancouver, finds women commute an average of 3.0 miles while men commute 4.2 miles. (55) Hecht, using data from firms in Worcester, Massachusetts, finds that women commute an average of 1.1 miles less than men do. (17)

(2) Women are more likely to use public transportation in their work trips. While sex differences in the use of public transportation are not large, Wheeler indicates that women use more mass transit in Pittsburgh. (50) Morgan reports that 7.6 percent of the employed wives in the Panel Survey of Income Dynamics used public transportation in 1976 while only 6.3 percent of husbands and female heads of households used public transportation. (31) Similar results have been found in the National Longitudinal Survey, where 6.3 percent of men aged 50 to 64 in 1971 used public transportation, compared to 7.3 percent of women aged 35 to 49 in 1972.

Taaffee, et al, find that 76.5 percent of women with jobs in the Chicago central business district use public transport to get to work, compared with 58.1 percent of men with jobs in the same area. (45) Among workers with suburban jobs, 19.1 percent of women use public transport but only 6.3 percent of men did so. The London Transport Executive finds that 55 percent of men and 64 percent of women use public transport to commute to work. (25) Interestingly, Strober, using the Michigan Survey Research Center 1967-1970 Survey of Consumer Finances, finds that other things being equal, households with employed wives both own more automobiles and spend more on automobiles than one earner households. (44)

However, work trips are not generated in vacuums, but are the outcome of choices made about both residential location and job location. Women's work trips are different than men's because their housing and job choices are made differently.

B. Women's Jobs

Women's experiences in the labor force are significantly different from that of men in the labor force:

(1) Women earn less. In 1977, their earnings were 42.3 percent of men's. Those employed full time, full year earned 54.8 percent of their male counterparts. (46)

(2) Women work at different jobs. Over half the female labor force is employed as clerical workers or service workers, compared with 14 percent of the male labor force. (47, Table A-21) Most women workers are still employed in female occupations. The industries in which women work are

(1) Employed women are less likely to be married. As indicated in Table I, 68.9 percent of employed men are married compared with 56.7 percent of employed women. This large differential is primarily the result of significantly lower labor force participation rates among married women, although the longer life expectancy of women increases the proportions of widowed, divorced and separated women. Schafer reports that married couples' housing demand is different from that of the unmarried. (42) Specifically he finds that 30 to 60-year-old-households with children are much more likely to select single family housing (which is more likely to be suburban), than other types of households and they are less affected by workplace location in choosing their residential locations. Since employed women are less likely to be married, they, on the average, should reside in denser housing than employed men do.

(2) Employed women are more likely to have an employed spouse. Even though employed men are much more likely to be married, sex differences in labor force participation rates result in a substantially larger proportion of employed women having employed spouses, as indicated in Table I. Even if households treated husbands' and wives' work locations symmetrically in determining their residential location, employed women are more likely to be constrained by a spouse's work location in making their own location decision, women are even further constrained.

(3) Unmarried employed women are more likely to reside with dependents. Over 11 percent of women in the labor force are single, widowed, divorced, or separated and also head families. These women are substantially different in their housing and location needs from married men and married

also substantially different. Although men are 70 percent of the workforce for all manufacturing firms, women are 81 percent of the workforce for the manufacture of apparel and other textile products. Women comprise 56 percent of both the finance, insurance, and real estate workforce and the service industry workforce. (47, Table B-3)

(3) Women work shorter hours. While 10 percent of employed males work part-time, 28 percent of employed females do.

Since women earn less than men, work in different occupations and in different industries, and work fewer hours than men, and since work trips are known to vary by earnings, occupation, industry and hours worked, differences in women's work trip behavior could be the result of what goes on at the workplace.

C. Residential Constraints on Women

Employed women select different residential locations within the city. Kaniss and Robbins find that 44 percent of women workers and 37 percent of men workers in Philadelphia lived within the City boundaries in 1970. (21) Kain, in his study of Detroit in 1953, found very different residential distributions by sex of worker, holding the workplace constant. (20) Women's residences were more tightly clustered around their workplaces. For workers with jobs in the CBD, 33 percent of the men, but only 17 percent of the women, lived in the far suburbs. For workers with jobs in the nearer suburbs (Kain's "ring 3"), 51 percent of the men, but only 43 percent of the women lived further out than their jobs. These varying residential distributions reflect sex differences in housing demand. These differences are not surprising if one considers the fact that employed women live in different types of households than employed men.

TABLE I

Household Composition of the Employed, by Sex: March 1978.

	Number (in thousands)	Percent of Total
Men	53,865	100.0
Married, spouse present	37,118	68.9
with another family member employed	21,677	40.2
With no other family member employed	15,441	28.7
Single (never married)	12,186	22.6
Other ever married (includes divorced, widowed, separated)	4,561	8.5
Women	38,099	100.0
Married, spouse present	21,614	56.7
with another family member employed	19,582	51.4
with no other family member employed 2,032	5.3	
Single (never married)	9,092	23.9
Other ever married	7,393	19.4
Unmarried head of household	4,289	11.3

Source: U.S. Department of Labor, "Household and Family Characteristics of the Labor Force", News Release, July 24, 1978, Table 3; Employment and Earnings (April 1978), Table 66.

women (since they are usually the only adult in their families). In fact Schafer finds these households are more likely to reside in multi-family housing as their income increases, while married households choose single family housing as their income rises. (42) These households are also different from the 8.5 percent of the male labor force who are divorced, separated, or widowed and have no families living with them.

The central question for researchers who seek to explain women's work trip behavior or define their labor market opportunities, for planners who seek to structure the urban landscape so as to maximize the welfare of employed women as well as other groups, for transportation analysts who seek to predict future travel demand, is: Why are women's work trips different? In particular, as women's level of participation in the labor force grows more similar to men's, will their work trip patterns become more similar? Or, on the other hand, will their work trip patterns remain unchanged, significantly shifting the characteristics of the total work trip distribution in cities? The answers to these questions depend on whether women's work trip patterns are the result of their labor market roles, their household roles or some nebulous sex difference in travel preferences.

Because there have been two rather diverse literatures which have developed with respect to explaining worktrips--that of urban analysts which has focused on residential location and that of labor market analysts which has focused on worker mobility between jobs--and because we seek to sort out those explanations of work trip differences based on household

characteristics from those based on labor force characteristics, we review these two literatures in separate sections.

In the final section of this paper, we review the policy relevance of the research issues outlined in Sections I and III.

II. Labor Market-Oriented Explanations of Work Trip Behavior

A. A General Analysis of the Relationship Between Journey-to-Work and Labor Market Status

Labor market analysts have traditionally treated the journey-to-work as a cost of employment. Assuming that residential locations is fixed, the labor market analyst views workers of either sex as selecting a job, and therefore a journey-to-work, so as to maximize net earnings. (Net earnings are the wages paid by employers minus costs of employment such as travel, taxes, union dues, etc.) Other things being equal, near jobs are clearly preferred to far jobs. Therefore, employers more distant from residential locations are expected to pay higher wages than those who draw their employees from their own neighborhoods. Moses lays the basis for a theory of wage differentials based on travel costs, but no comprehensive theory, has followed his work. (32) The lack of a comprehensive theory, which fully accounts for spatial factors affecting the demand for and supply of labor and also considers the supply of and demand for urban land, plagues empirical research on work trip behavior. Because an urban model which simultaneously clears land and labor markets has not been developed, the empirical researcher has not been able to isolate wage effects and housing costs effects of different commuting patterns.

To determine the actual extent to which observed wage differentials are the result of observed commuting differentials is quite complex. In order to make such an assessment, it is necessary to know the cost of the commute to the worker and the price the employers are willing to pay to expand their labor markets.

(1) The value of travel time. In order to measure the extent to which employers compensate commuting costs, one must sum out-of-pocket costs of commuting plus time costs. The time use literature has generally valued travel time using the wage rate net of taxes, arguing that the net wage rate must represent the marginal value of time, since if time were worth less (more), workers could make themselves better off by taking jobs with more (less) hours at the same net wage. This assumes that workers can choose either their hours or their jobs.

The empirical literature has generally found travel time to be valued at substantially less than the after-tax wage rate. Becker found travel time to be equivalent to 40 percent of workers' hourly earnings in Seattle. (3) Lisco estimated a value of 51 to 53 percent of earnings for workers commuting from Skokie to the Chicago Loop. (24) Rees and Schultz found values ranging from insignificant up to 60 percent of earnings across various occupations. (40) Beesley estimated a value between 30 and 50 percent of hourly wages in London, finding that higher income individuals tended to value commuting time at a higher proportion of their wages then did lower income individuals. (5) Beesley also found that most of the observations which were inconsistent with his value of time estimation were women. He argues that women

tend to appear at the extremes (i.e., extraordinarily low or high value of travel time) because, on the one hand, they are more likely than men to be low earners and low earners value their commuting time at a lower percent of their hourly wages and, on the other hand, many employed women are part of a two-earner household and, consequently, have a higher value of time because of their high household income and because of their family responsibilities outside the labor market.

The overall difference between value of travel time and net wages for both sexes could indicate that workers desire to work more hours, or that commuting is a significantly more enjoyable activity than working. The latter explanation may be more often the case for lower income workers who, therefore, value travel time at a lower proportion of their wage rate. Since the empirical literature finds women's values of work trip time to be both higher and lower than men's values, this is clearly an area needing more research.

(2) The nature of spatial wage gradients. To demonstrate that employees receive compensation for their commuting costs, it is necessary to show that: (a) there may be incentives for employers to pay for commuting; and (b) that systematic spatial variation in wages exists. The former requires consideration of employee tastes for commuting and of spatial variability in production in technology, in the price of non-labor inputs, and in demand for the final product; that is, the explanation requires a general equlibrium model of intraurban firm location. This analysis is the subject of Section III. The latter is an empirical question about the nature of labor markets. Before reviewing empirical

studies of wage gradients, the reader should be cautioned that these studies empirically describe wage gradients exist and why they differ across occupations.

There has been relatively little empirical study of spatial wage gradients in general, or by occupation or by industry. Segal finds manufacturing wages in the counties surrounding New York City to be generally higher than those in New York City, although wages in the garment industry, a predominantly female industry, are higher in the city. (43) However, he found a converging trend over time. Rees and Schultz, in their study of the Chicago labor market, find evidence of systematic spatial wage gradients. (39,40) For blue collar workers, they find a regional wage gradient which peaks in the southeast and falls off toward the northwest section of the city. Labor markets for the two primarily female clerical occupations studied-- keypunch operators and typists-- were found to be of smaller geographic size. In fact, they were immediate neighborhood markets. Employers actually expressed preferences that female employees live nearby and some even had rigid hiring standards related to distance for females. * As a result, women experienced very little return from increased commuting.

Evans reports a wage gradient for stenographers in Boston which dips at the Jordan Marsh Department Store. (8) Although he implies that young females value their proximity to Jordan's, a more objective conclusion is that they value accessibility of the job to the transit system. In actuality, his empirical findings do not support his conclusion that wages systematically increase as the firm's distance from Jordon

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* The data were collected in June 1963, prior to the Civil Rights Act of 1964 which invalidated such procedures.

Marsh increases.

Rather than measuring a spatial wage gradient, Kasper attempts to measure directly the extent to which employers bear commuting costs. (23) Kasper uses wage and commuting data collected from households who were randomly assigned to public housing in Glasgow in 1974. Since the Glasgow housing market was extremely tight and this housing was subsidized, Kasper argues that commuting costs are not systematically compensated by higher quality or lower cost housing.

Kasper finds some evidence that, controlling for skill differentials, workers with longer journeys to work received compensating increases in wages. However, these results are generally not statistically significant and are much more ambiguous for women than for men. While finding a tendency for women to be employed in their immediate neighborhoods, Kasper, in contrast to Rees and Schultz, (40) finds that a 1 percent increase in the journey to work increases women's weekly salaries by 7.2 percent-- 10 times greater than the return for men. This would imply steeper wage gradients for women than for men and is a variance with the rest of the wage gradient literature.

B. Why Women Commute Less: Alternative Explanations and Empirical Findings

From the above analyses of the connections between the journey-to-work and labor market outcomes, there are two central hypotheses which emerge to explain the shorter commuting journeys of women workers: (a) they choose to commute less in order to accommodate their household duties and, as a result, receive lower wages; and (b) they are only

hired in those categories of jobs which have no spatial wage gradients and, therefore, commute less because there is no return to commuting greater distance. The issue, simply, is: do women's commuting decisions result in lower labor market status or are women's commuting patterns the result of their lack of labor market opportunity? In the following two subsections, each of these hypotheses and the relevant empirical research is discussed in more detail.

(1) Commuting constraints affect labor market status. There are actually three different mechanisms by which an exogenous restriction on commuting can lower wages.

The first, and simplest, is that women who are short distance commuters receive net earnings equivalent to longer distance commuters, so that the differences in gross wages reflect only the costs incurred in longer commutes. Women who commute less are, therefore, not disadvantaged by their mobility restrictions. Fuchs (1971) argues in favor of this point in using commuting distance as a correcting factor to determine the "real" male/female wage differential.

The second mechanism, developed in more detail by Gordon and Morton, (13) and Madden, (29) argues that the restrictions on commuting imposed by women's greater share of household responsibility results in women having a lower wage elasticity of labor supply to the firm than men have. When two separable labor pools have differing wage elasticities of labor supply, profit-maximizing employers pay higher wages to the group with the more elastic labor supply. Therefore, women who commute less receive lower net (as well as gross) wages than those individuals who are willing

to commute longer distances. Intuitively, the argument is that the relative geographical immobility of women increases employer's market power in setting wages for women, resulting in wage exploitation of the geographically captive female labor market.

The third mechanism is more aspatial. Workers who commute less are likely to have restricted their job search to a narrower geographical labor market which includes a smaller number of potential employers than is the case for those who have searched a wider area. Since the probability of maximizing one's wages is positively related to the extent of job search, those who search less do not find as high paying a job as those who search more. Women commute less, search less, and, as a result, find less rewarding jobs than men.

It is difficult empirically to separate these three hypothetical mechanisms by which shorter work trips could be connected to lower wages. All three predict higher wages for those who make lengthier work trips. Because of the difficulties in measuring actual commuting costs as described above, it is impossible to test these hypotheses directly. Instead, only the empirical implications of the hypotheses can be tested.

Fuchs measures the wage differential associated with differences in the trip to work in the 1960 U.S. Census. (12) He finds that persons who walk to work or work at home earned 26 percent less than those who travelled to their jobs, other things being equal. Women are almost twice as likely as men to walk to work or work at home and are 56 percent less likely to commute to a different county or city to work. He then

uses these differences in travel characteristics to adjust the male/female wage differential, implicitly assuming that wage differentials associated with commuting differentials must be compensating for commuting costs. Fuchs does not statistically demonstrate any basis for this assumption, however. He merely correlates low earnings with shorter journey-to-work, without demonstrating any cause and effect relationship.

Others have explored the connection between wages and intraurban geographical mobility by establishing that women are less mobile than men, that they are less sensitive to spatial wage differentials, and that, therefore, the profit maximizing behavior by employers described by Madden (27, 29) and Gordon and Morton (13), would generate larger wage differentials than is warranted by commuting costs.

Madden using the actual wage and commuting experiences of a national survey of U.S. women age 35 to 49 in 1972 and men age 45 to 59 in 1971 and controlling for differences in skills, city size, region and race, finds that married women have a lower spatial wage elasticity than married men, although the result is not statistically significant for the entire data set. (28) She also finds that increasing the number of children or increasing the spouse's income significantly increases the journey to work for men and decreases it for women, indicating that differing household roles by sex affect work location choices. Similarly, Erickson attributes variations in women's work trips to the number and age of their children. (7) Andrews surveys a sample of married women in five urban areas in U.K. in 1968 to ascertain their willingness to commute additional distances for jobs paying varying

salaries. (2) He finds that wives' willingness to stay in the labor force as the journey-to-work increases is positively correlated with their own earnings and their overall contribution to household income, but is not clearly correlated with husbands' earnings. Andrews does not survey any men for comparisons, however. Similarly, Offner finds women in New York City ghetto neighborhoods in 1960 to be twice as likely as men to withdraw from the labor force as they become geographically more removed from job locations. (35) Wabe finds women in areas of London having more jobs have higher labor force participation rates. (49) Niemi finds unemployed women much less interested than unemployed men in accepting a job or training in a more distant location. (34)

While all these studies indicate that women are less responsive than men to spatial differences in the labor market, they do not indicate the extent to which employers exploit these differences. The contribution of women's work trip differences to their lower status in the labor market has still not been satisfactorily established.

(2) Labor market constraints result in restricted commuting. As explained above, women may commute less because some exogeneous factor, such as the household division of labor, results in a decision to bear the labor market costs of geographical immobility. Alternatively, women may make no choices about their own commuting, but, rather, find that the only jobs open to them are those which are nearby and/or those for which flat wage gradients result in no financial returns for commuting. Several studies discussed in this section of the paper and in Section III support the notion that women are employed in jobs which have flat spatial wage gradients and which, therefore, offer little return to commuting.

If women's work trip behavior is the result of their restricted labor market opportunities, then the interesting research questions are: what explains occupational differences in wage gradients; and what explains the occupational segregation of women?

The former question must be answered by researchers who study firm location decisions and is discussed in more detail in the urban analysis subsection. The latter question is a complex one which has not yet been satisfactorily answered. Although occupational differences by sex are the result of some combination of differences in preferences and in skills and of job discrimination, the relative significance of each of these factors is not clear. (26)

III. Urban Economic Explanations of Work Trip Behavior

A. A General Analysis of the Relationship Between Journey-to-Work and Residential Location.

In contrast to the labor market approach, the urban approach concentrates on residential location as the main determinant of women's work trip behavior. The basic analysis is premised on the urban models used by Muth and Mills to generate urban land values and land uses. (33, 30) Their work, stated in its simplest form, makes the following assumptions: (1) All jobs are located in the center of the city. (2) All households are alike; that is, they have identical utility functions (tastes), incomes, and demographic structure, and each has one worker. (3) Travel costs, including actual outlay and time costs, are constant per mile; that is, no congestion exists. (4) Households are assumed to have no innate preference for living in particular locations except as their prices differ. (5) All travel is for commuting to work.

In this model, households determine their residential locations by maximizing utility which is a function of their consumption of housing and a composite good, subject to a budget constraint which restricts total expenditures on housing, the composite good and commuting to the household's income. This maximization solution determines the household's demand for housing at different locations. Since all jobs are located in the city center, the further the household is from the center, the greater are its commuting costs. The household will choose to locate further from the center only if it is compensated for increased commuting costs by decreased housing costs. Therefore, the household's spatial demand for housing is defined by a price gradient for housing (i.e., a rent gradient) which declines at a decreasing rate with distance from the center.

Note that this concept of spatial equilibrium is very different from the views of labor analysts on commuting, as described above. Labor market studies analyze commuting as a cost of employment for which workers must be compensated by a higher wage. Urban researchers, however, analyze commuting as a cost of housing for which households are compensated by a lower land price.

Obviously, in this simple model where all jobs are in the center, all workers are alike, and all households are alike, no sex differences in work trips are possible. However, this simple model can be extended to accommodate several of the differences in the household status of employed men and women which were described above. In particular, the residential location effects of employed women earning less than men and living in households with different demographic characteristics are analyzed and the implications for sex differences in work trip behavior are discussed below.

(1) Differentiating households by earnings. Higher earnings have two effects on the household's willingness-to-pay for housing. First, higher income raises demand for housing at any given location, which tends to flatten the slope of the rent gradient. (Higher income households find the low price of land at suburban locations relatively more attractive than low income households do, since they buy more housing.) Second, higher earnings raise travel costs by increasing the value to time spent commuting. This results in a steeper bid rent gradient. For American households it is generally thought that the first effect outweighs the second and, therefore, that higher earnings lead to a net flattening of the bid rent gradient. This leads to rent gradients which increase in steepness as household earnings decreases, so that low earning households outbid higher earning households for centrally located land. (See Ref. 30)

Since female-headed households and unmarried women who live alone have lower earnings than similarly situated males, this extension of the urban model predicts that female-headed households will reside closer to the city center and commute shorter distances than male-headed households. Although these residential location and work trip differences would appear statistically correlated with sex, in fact it is earnings differentials and not sex which cause the location and travel patterns we observe.

Two further points should be noted. First, many scholars in the urban field have suggested that household location behavior can be seen as an attempt simply to minimize commuting costs or distance. The urban model suggests that this is not the case. Households trade off accessibility to their jobs against their demand for housing. Second, higher income

households generally have longer commuting journeys because they demand more housing than lower income households. Although some researchers have attempted to explain work trip length by occupational status, (51) the urban economic model suggests that the positive effect of rising income on housing demand is a simpler explanation.

(2) Differences in household demographic structure. As described above, women "work-tripmakers" come from substantially different categories of households then men "work-tripmakers." Households with different demographic structures are likely to have different tastes for accessibility to the city center and for housing space, and these taste differences result in residential location and work trip differences.

Larger families are likely to prefer more spacious housing-- thus at given income levels they tend to have higher demand for housing than smaller families. Since housing is cheaper in the suburbs, they are more likely to live in the suburbs than smaller families. Employed men live in larger families than employed women. Therefore, family size, rather than sex of tripmaker, explains why some employed women live closer to the center than some employed men.

Similarly, the needs or tastes of female-headed families may be quite different from those of husband-wife households where only the husband is employed. The theory so far would predict that a husband-employed-wife-and-two-children household would exhibit the same locational behavior as a household headed by an employed female and consisting of herself, her aged mother, and two children, assuming that both had the same income and job locations. However, if the female-head-of-household has more childcare

responsibilities than the employed husband with a non-employed wife, then the former may incur greater disutility from commuting and may choose to live closer to her job. Furthermore, households headed by unmarried workers (who, as shown in Table 1, are disproportionately female) may prefer central city locations even if they work in the suburbs, since the ancillary services devoted to their interests-- day care centers, restaurants and entertainment catering to the interests of unmarried people-- are located there.

The basic urban model assumes that households each have a single worker. The rapidly rising labor force participation rates of married women make this assumption less and less accurate. An urban model of the behavior of two-earner households is clearly needed. However, constructing such a theory raises difficult issues. In sections below we describe two separate approaches to such a theory.

(a) Traditional decision-making. Kain postulated that for two-earner households, the usual causal relationship between job and residential location might be reversed. (20) Rather than viewing their job location as fixed and deciding on a utility-maximizing residential location, married women workers would view their residential locations as fixed and decide on a utility-maximizing job location. This theory implies a two-stage decision-making process for the two-earner household. First, its residential location is determined with respect to the husband's fixed job location and, second, the wife's job location is determined with respect to the household's fixed residential location. *

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* Madden points out, however, that the more limited spatial area of job search by women than men workers results in employers having greater monopsony power over them and paying lower wages. (28) See discussion in Section II.

In making the first stage decision, the household would anticipate the wife's work pattern and her expected earnings, so that the household would choose its residential location by trading off accessibility and demand for space relative to the husband's job location only, but assuming that its income level is the sum of expected earnings by both husband and wife.

This theory leads to the testable hypothesis that single and two-earner households having the same overall household income levels will exhibit the same housing consumption behavior and will choose the same length commuting journey for their male workers if they have the same job locations. Duker has tested the first prediction and finds that employed wife households consistently consume less housing than fulltime housewife households having the same total income levels. (6) He finds that the former are less likely to own their own homes, that if they own, their homes are of lower value and that if they rent, their apartments have lower rent levels. The finding concerning lower value homes owned by employed wife households could reflect high discounting by banks and other mortgage lenders of wives' expected earnings, but this does not explain the lower rent levels paid by employed wife households. Duker postulates that since wives spend only half of their adult lives in the labor force, * wives' income represents transitory rather than permanent income for the household. Since housing consumption depends on permanent income, he

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* Heckman and Willis dispute this statement, arguing that, in fact, half of wives spend all their time in the labor force and half spend none of their time in the labor force. (18)

concludes that employed wife households should be expected to consume less housing.

An alternative explanation of Duker's findings is that employed wife households make different residential location choices than housewife households of the same income level and therefore their housing consumption patterns differ. We turn to such a theory in the next section.

(b) Non-traditional household decision making. The traditional decision-making theory sketched above is schizophrenic in that it assumes the household acts in one way with respect to the husband's job and in another way with respect to the wife's job. A more general theory would assume that the household acts symmetrically with respect to both husband and wife. White has developed a theory, building on the work of Beckmann, (4) in which the household maximizes a utility function which includes the leisure time of both the husband and the wife as arguments. (54) * Utility is maximized subject to the household budget constraint and time constraint for both the husband and wife. Suppose both the husband and the wife have fixed job locations: the husband works at the center of the city and the wife at some location in the suburbs. (The basic approach would be unchanged if the assumed job locations were varied or interchanged.) Then the household bid rent function can be derived. The maximization of utility in this model indicates that two-earner households are likely to locate in a ring around the job locations of their suburban worker,

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* Also see Ref. 36 for a more general treatment of the same problem which does not assume a specific form of the utility function and treats the households time budget in greater detail, allowing the household to determine an optimal labor supply schedule as well as an optimal residential location.

while single-earner households will locate both closer in and further out. Thus a model of rational decision-making by households, treating both workers symmetrically, leads to the prediction that married women workers will have shorter commuting journeys than men workers, single or married, and that married women workers are more likely to have non-radial commuting trips. These predictions are consistent with the data discussed above. Unfortunately, they do not enable us to differentiate between the worktrip predictions of the traditional and the non-traditional models of household decision-making.

On the housing market side, however, the two theories do yield different predictions. The traditional theory predicts that single and two-earner households having the same total income will exhibit the same housing consumption patterns, as long as the husband has a similar job location in both cases. The non-traditional theory predicts that single and two-earner households will exhibit very different housing consumption patterns, with the two-earner households' location and housing consumption level depending on the location of the wife's job as well as on the location and income of the husband's job.

The model can also be modified to take account of part-time work by married women, high valuation of women's relative to men's commuting time by two-earner households' or alternative job location patterns. Note finally that the non-traditional theory predicts that if two earner households have two centrally located jobs, then these households will locate more centrally than single earner households even if they have the same total income level. This is because two earner households

face higher marginal commuting costs than single earner households for each extra mile they move outward-- since two people must travel. This suggests an explanation for the recent influx of younger, childless households into older central city neighborhoods: the "gentrification" movement.

(3) Job suburbanization. The previous discussion assumed that all jobs were located at the center of the city. However, employers have an incentive to suburbanize in order to lower costs of production. Wage costs, in particular, are minimized if employers who suburbanize: (a) reduce their wages by the full amount of commuting costs saved by workers; and (b) hire only workers who live further away from the center of the city than the firm. If these two conditions hold, then households' bid rent functions for residential land are unaffected by the existence of suburbanized employment.

This approach to the problem of job suburbanization leads to a theory of spatial wage gradients. In particular wages offered by employers for equivalent jobs at different locations will vary by the amount of commuting costs saved by workers, assuming that no workers out-commute. But since the cost of commuting includes both time costs and actual outlay, and since the value of time is related to the wage rate, the spatial wage gradient will tend to be flatter for low wage occupations and steeper for high wage occupations. This provides a theoretical justification for the empirical literature cited above which tends to find that women workers face flatter wage gradients than men workers. This finding can be explained simply by the fact that women workers tend to be concentrated in low wage occupations. Further, the theory predicts that suburbanization

is most attractive for firms whose workers already live in the suburbs. * This is most likely to be the case for firms having a large percentage of high-income workers (since high income workers are likely to live in the suburbs) and for firms hiring predominantly women workers (since married women workers are likely to live in the suburbs). Firms hiring a predominantly low income, male labor force may actually have positive wage gradients, since they may not be able to hire enough workers in the suburbs without hiring out-commuters.

B. Empirical Studies of the Relationship Between the Journey to Work and Residential Location

(1) Introduction. A difficulty in reviewing the theoretical and empirical work in urban economics-- regardless of topic-- is that the two have developed separately, with theorists often making no attempt to test their theories and empiricists testing ad hoc theories of their own. In many areas of urban economics, the empirical work predates the theory. Relatively few clear, testable implications have been generated by urban economic theories. In many cases simple testable hypotheses are often difficult to generate from theoretical work because many variables are present in urban economic models and it is not clear which to hold constant and which to vary. For example, households

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* See Ref. 52 for a discussion of the conditions under which job suburbanization does cause households' bid rent functions to shift and thus suburban employment subcenters to form. In particular, this may be caused by firms moving so far out (perhaps to be near a circumferencial highway) that they face a shortage of workers available in yet further-out locations and are forced to hire workers who must out-commute.

decide on both their job locations and their residential locations. Depending on whether the model assumes that households have fixed job locations and vary their residential locations to maximize utility or have fixed residential locations and vary their job locations to maximize utility, different predictions result.

On the empirical side, the ideal set of data to test models of urban worktrip behavior would include the following types of information for a sample of households:

(a) Residential location.

(b) Job location for all working members of the household.

(c) Mode of travel for journey to work.

(d) Information concerning the jobs of all household members, including hours worked, wage/income, occupation.

(e) Information concerning the household structure, including number of working/non-working members, age, education, non-earned income.

(f) Information concerning changes over time in residences and previous jobs.

It will come as no surprise that such detailed data is difficult to obtain. The problem is that the theory of urban travel behavior combines elements of both labor economics and urban (or travel demand) economics. Thus while labor economists have collected detailed data on household characteristics, they have generally been uninterested in job or residential location and commuting behavior. For example, millions of dollars have been spent to collect detailed labor force and commuting data on over 20,000 individuals in the National Longitudinal Survey (37), but there is no information on their job or residential locations.

Similarly, while transportation economists have collected detailed data on travel behavior in origin-destination surveys, they have not collected information on earnings, household structure, or job characteristics. Their data, for example, do not usually differentiate worktrips by men in two-worker households from worktrips by men in single worker households.

(2) Studies using workplace data. In this section we discuss studies of commuting behavior based on data gathered from workplace records. These data are among the best available for studies of work trip behavior, since a sample of workers having the same workplace can be viewed as having a fixed job location and vairable residential location. Unfortunately, there are few studies using this approach. One exception is Hecht who gathered data from ten firms in Worcester, Massachusetts that moved out of the Worcester central business district due to urban renewal. (17) Hecht regressed commuting distance on such household variables as income, marital status, sex and age of the worker and on number of dependents. Unfortunately, Hecht combined all workers in the same regression, thereby not considering the possibility that workers in single or two-earners households might decide on residential locations according to a different model. Hecht found that married workers, female workers and older workers had longer commuting journeys, but none of these effects was statistically significant. (17)

Workplace data presents some interesting possibilities for testing urban models. For example, the propensity of households to change residential locations while retaining the same job and the type of adjustment made could be studied. One study which attempts to do this (Ref. 41) is

Roseman, who collected employee records for workers at the John Deere Harvester Works in East Moline, Illinois. His data included previous work location (before John Deere) and all residential locations from time of hiring. Thus both the effects of changes in workplace location and in residential locations could studied, each for its feedback effect on the other. Unfortunately, Roseman studied only male employees of the plant. Similar studies including female would be of interest.

(3) Studies using transportation survey data. Another group of studies attempts to explain length of worktrip, using data from transportation (origin-destination) surveys rather than from employers' records, The most famous of these studies is the paper by Kain using 1953 data from the Detroit Area Traffic Study. (20) Kain's work is particularly interesting in that many of the hypotheses he tested can be derived directly or indirectly from utban economic models, even though many of these models were developed after Kain did his work. For example, Kain found that workers with CBD job locations have longer worktrips than workers with suburban job locations. He also found that higher income workers and workers with larger families live further out.

Kain examined comparative work-residence patterns for men and women workers and found women workers with centrally located jobs to live closer to their jobs than men workers. Also more women lived within a short commuting journey from their jobs than men workers, regardless of whether the job was centrally located or in the suburbs. Kain suggested that this may be due to the operation of the "traditional model" of household decision-making, i.e. employed wives selecting jobs near their homes. However, these results are also consistent with the "non-tradi-

tional" model of household decision-making in cases where the wife works in the suburbs and the husband at the center.

Sociologists and geographers have also attempted to explain the length of commuting journeys using origin-destination survey data. A typical study is by Wheeler, who uses the Pittsburgh Area Transportation Study (no date given) to argue that worktrip length is explained by occupational status. (51) Wheeler's data show that while worktrip length generally increases with occupational status for workers in general, it seems to have no relationship to status for women workers. Rather the data for women show fairly constant worktrip length regardless of occupation, except that women clerical workers commute longer distances than other women workers. The data are consistent with several of the hypotheses discussed above. Household decision-making may be asymmetrical with respect to men and women workers, i.e. men get their income from their jobs and choose their residential location on the basis of their incomes, while women get most of their income and choose their residential locations on the basis of their husbands' jobs. Alternately, if households act rationally with respect to both earners in choosing locations, but women have lower incomes, then women workers could again have shorter commuting journeys than men.

Several other studies using travel surveys have turned up interesting data on women's trips. For example, Wolforth's analysis of travel behavior in Vancouver in the early 1960's confirms the hypothesis that married women workers have shorter commuting journeys: he finds an average trip length of 2.5 miles for women with working husbands, com-

pared with 3.0 miles for all women, 5.7 miles for men with working wives and 4.2 miles for all men. (55) The shorter commuting trip by women with employed husbands is consistent with the hypotheses of both the traditional and non-traditional models of household decision-making. Similarly, the longer worktrip by men with employed wives than by all men commuters could support either theory. The longer journey is consistent with the non-traditional theory on the assumption that symmetrically considering the job locations of both spouses implies a systematically different worktrip length for men with working wives. But it is also consistent with the traditional theory since we expect men with working wives to have higher housing demand and to locate further from the center of the city. Thus the travel survey data does not enable us to distinguish between theories.

Another study is Taaffe, et al, which uses data from the Chicago Area Transportation Survey to study commuting patterns of workers with suburban jobs. (45) Taaffe finds women workers much less likely than men to commute to work by car, regardless of whether they work in the CBD (4.7% by car versus 36.9%) or in the suburbs (26.6% versus 77.4%). He also finds that women hold a greater percent of CBD jobs (32%) than suburban jobs (23%). Women have shorter commuting journeys than men if they work in the suburbs (62.6% of women live within 3 miles of the job versus 40.9% of men). However, this differential is much less for CBD workers (40.9% of women live within 6 miles of the job versus 38.2% of men). Also women suburban workers are less likely than men suburban workers to outcommute (38.0% versus 53.2%). This last result is difficult to inter-

pret without further information on race and household status of men and women commuters, since the urban model suggests that outcommuting is irrational for all but two-earner households. (Other households can simultaneously reduce their commuting cost and housing cost by relocating outward.) Blacks and low income households, however, may not be able to find suburban housing.

Another study using travel survey data is by Hathaway, who attempts to determine whether trip-distribution models should be calibrated separately for men and women and/or married and single workers. (16) Hathaway uses data on worktrips from a subset of contiguous districts within the London Transport Survey area. Only public transport worktrips starting and ending in the subset are considered. The average worktrip length for men workers is 52.1 minutes, while for single women it is 50.9 minutes and for married women 47.9 minutes.

Hathaway estimates a gravity model for all workers and the same model separately for nine categories of sex/age/marital status. Using a chi-squared test, he finds that the samples are significantly different. However, the added explanatory power gained by disaggregating the trip-distribution model is marginal and not worth the added cost. Thus he argues that travel behavior by commuters can be modeled without disaggregating by sex or marital status.

However, Hathaway's results seem not surprising given the severe restrictions on his sample. Much of the difference between women's and men's commuting behavior may be due to differences in their respective propen-

sities to take public transportation or by their different propensities to commute long distances. The fact that commuting journeys by public transportation within a subarea of London do not differ more by sex or marital status probably only shows that travel studies should not restrict their purview to so narrow a sample.

(4) Studies using census data. The U.S. and British Censuses give data on commuting behavior by men and women workers by city subdivisions. The data give the number of residents of a subdivision who work in the central city versus the suburbs, classified by residential location. Thus inferences concerning trip length and direction can be made by looking at the proportion of workers in particular residential areas who cross the central city-suburb boundary. Census travel data were first used by Foster and Beesley in a famous study estimating the benefits of constructing a new underground rail line in London (the Victoria Line, since completed). (9) Foster and Beesley explained the proportion of workers in different boroughs who travelled to central London using multiple regression analysis. The explanatory variables were journey time, social class composition of the borough and total borough population. The estimated equation was then used to simulate the traffic generation effect of the reduction in journey time resulting from the new line.* More recently, Wabe has estimated a similar model using 1951 and 1961 data explaining the proportion of workers of each sex living in various London boroughs that travel to

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* This data was only used to estimate the traffic generation effect of the Victoria Line. Diversion of traffic from other rail lines and other transit modes was estimated using origin-destination data.

jobs in central London. (49) The most important independent variables are: (a) average journey time to central London, (b) average price per trip, (c) the number of jobs in the borough filled by males (females) per 1,000 male (female) workers living in the borough, (d) the social character of the borough (perhaps a proxy for household income data which is not collected in Britain).

The comparison of Wabe's results for men and women workers is interesting. He finds that the social character of the borough is much more important in explaining travel behavior by men than women: an increase in the number of households in the top two social classes in the borough implies an increase in the number of male workers commuting to central London nearly three times as large as the increase for women. Wabe also finds that women workers are more sensitive than men to the price of the journey, but have approximately the same pattern of sensitivity to time costs. The higher price elasticity and relatively lower time elasticity of women relative to men workers probably results from the fact that women's wages are lower than men's, therefore their time is worth less.

Studies of this type pose difficult interpretational problems. Since census data is neither workplace- nor residence-specific, it is difficult to interpret his results. Thus, for example, some workers have fixed residential locations and are therefore sensitive to the time and fare cost of travel and the wage levels of jobs in Central London versus nearby. Other workers have fixed job locations and are therefore sensitive to the trade off between travel costs and relative housing prices near versus far

locations. Thus the negative relation between high fare and time cost of travel to the center and number of workers travelling could result from either central area workers relocating out of high cost boroughs to more accessible locations of from firms moving to these boroughs and providing employment locally.

It should be clear from this survey of the literature that the urban economic models and related empirical work add an extra set of dimensions to the study of women's work trips. We have suggested that households do not attempt to choose residential locations to minimize the length of their commuting trips, that job locations themselves are variable and may move to where workers are located, and that the housing market capitalizes into the price of housing differences in accessibility to jobs. Further, employed women face a different set of decisions relating to their worktrips than men because they often live in households that include employed men and because they have higher family incomes than they could earn through their own employment alone. Thus, for example, employed women are often not as free as employed men to vary their residential locations when they find an attractive job at an unattractive location.

IV. Policy Implications of Alternative Explanations of Women's Work Trip Behavior

The basic research questions on women's travel behavior outlined above are of more than academic interest, as the resolution of these issues suggest different alternatives to policymakers in such areas as transportation, employment, public housing, and public services.

(1) Transportation. In order to perform cost-benefit analyses of trans-

portation projects, it is necessary to value the travel time savings of those affected by the project. Since roughly one-half of all trips are worktrips and since women account for up to 40 percent of those worktrips (and this proportion is steadily growing), techniques for predicting women's future travel demands and for valuing their travel time are necessary to any accurate assessment of the costs and benefits of travel projects. The two crucial research issues for cost-benefit analysis are: (a) will women's changing labor force participation change their work trip behavior and, therefore, significantly alter total trip distribution; and (b) what methodologies are appropriate for monetizing women's travel time.

(2) Employment. In order to assess the efficiency with which the labor market matches women workers to jobs, it is necessary to determine the jobs for which individual women are, in fact, available. The essential research question which must be answered for employment policymakers is: how geographically mobile is the female labor force? Knowledge of the spatial responsiveness of women to job opportunities is necessary to assess the following categories of employment policies:
(a) the effect of various intraurban locations for government-sponsored employment and training programs--such as those of the Comprehensive Education and Training Act (CETA)--on the number of women who can be assisted by the programs. As indicated by numerous studies described in this paper, women are more sensitive than men to distance and, therefore, their labor force participation decisions are much more strongly influenced by the geographic location of employment and training opportunities.

(b) the appropriate geographical labor market boundaries for which affirmative action numerical goals and timetables can be defined. Frank has argued that the relative geographic immobility of women workers places an unfair burden on geographically isolated employers who are expected to meet affirmative action hiring guidelines based on sex-ratios for the entire occupation or industry. (10, 11) Of course, the other side of the coin is that, if Frank is right, affirmative action hiring guidelines would be too lenient for employers in denser labor markets.

(3) Subsidized housing and employment relocation. In the late 1960's there was a debate over the emerging toward employment suburbanization and whether the government could best help ghetto blacks obtain jobs by subsidizing employers who moved jobs to central cities or by subsidizing suburban housing for blacks which would enable blacks to locate closer to jobs. (19, 14) The basic point was that in order for blacks to obtain jobs, either the black workers had to move closer to the jobs or the jobs had to move closer to the black workers, i.e. potential commuting journeys had to be cut down.

The general lines of this debate are clearly applicable to women workers as well as blacks. It is clear that many government programs affect the spatial relationship between jobs and housing and thus the length of commuting trips. Local governments often provide subsidies for firms to move into their jurisdictions. The federal government provides subsidies for new low-income housing. The locations of both jobs and housing can be affected by government programs in order to further a variety of goals.

The research on women's work trip behavior suggests that these housing and job related programs must be coordinated with new and existing transportation facilities if they are to be as effective for women as they are for men.

(4) Public services. Many of the services provided by government require large physical plants which are costly to move. Schools, hospitals, subway and rail commuting systems, water and sewer systems, and power plants are essential to the provision of public services. The lifetime of these physical plants spans several decades and, therefore, the decision of planning boards as to the size and location of these facilities requires long term projection of the future residential location patterns of the population. Alonso, in noting several of the demographic and labor force changes discussed in Section I of this paper, has argued that the changes in the labor force attachment of women ultimately will increase demand for denser housing closer to the CBD relative to demand for more suburban housing. (1) This forecast is premised on notions of changing travel demand by employed women and their households. Future urban form and travel patterns cannot be independently projected since they are causally linked. The urban public services planner, therefore, requires accurate projections of women's longer term residential and travel decisions. Such projections must be based on an understanding of the causes and effects of women's travel behavior.

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INDIVIDUAL SPATIAL CHOICE BEHAVIOR

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I. Introduction

The interplay between urban land use patterns and transportation systems has been a theme in modern transportation and land use research. Explicit assumptions are found in the early transportation studies in the 1950's and 1960's (46), models of land use development proposed for use in the land use in the land use and transportation studies of the 1960's (40, 21), various mathematical theories relating transportation and land use (see, for example, Refs. 1, 4, 31, 44), and various studies of residential choice behavior (for example, Refs. 6, 17, 37). Clearly, one of the results of a choice of residence within an urban area is the pattern of travel which will occur between the residence and other points or places in the city. Thus, transportation researchers, planners, and policy makers need to give careful attention to the theoretical, empirical, and policy implications of the factors which effect residential choices within urban areas.

Residential selection within an urban area may be considered to be comprised of two sets of choices; (1) those occurring for the first time, i.e., new immigrants to an urban area, and (2) those occurring for the second, third, and so on time, i.e., relocation choices. While this distinction is not made in the land use theory literature, it is one which has been commonly held in the residential choice literature (see, for example, Refs. 30, 35, 45). This distinction is retained in the following comments and the focus is on intra-urban relocation decisions and choices. A major assumption

underlying much of the land use and transportation modeling literature is the determinant role of "accessibility" in housing choice (see, for example, Refs. 1, 5, 29). While accessibility is assumed to be important in these models, many of them are mute on any differences which might be expected in the determinancy of accessibility for males and females. Of the models assume that households with male and female partners have different male and female needs which are, in turn, influenced by traditional role-related activities. Burnett (9) discusses such assumptions in some urban models.

One major belief is that site choice is a function of access to work for one household member, while the other completes shopping activities at retail centers located in residential areas. This obviously requires the traditional division of labor with males working outside the home and females as full-time housewives and mothers. Questionnaire research on housing choice also contains such assumptions. For example, Hempel (17) assumes that "access to the husband's place of work" is relevant in choice, but allows no consideration for the influence of access to the wife's place of work. Other studies carry role-stereotype further. Beshers (6) postulates that the sexes have different needs and responsibilities in the decision regarding residential choice. Males are presumed to focus on job accessibility and finance and females on the dwelling and neighborhood.

Researchers tend to adopt different positions in the conduct of survey research on site choice when it comes to the selection of respondents. Thus, studies such as Ermuth's (14) rely solely on males, while Windley (43) surveyed only females. In both cases, it is explicitly or implicitly assumed that any differences in the needs or preferences of

the sexes are negligible. Only a small number of studies are based on responses from both partners and even fewer studies control for sex-related variance in the housing choice process. For example, Butler, et al., (10) interviewed both partners, but do not report the results by sex. Hempel (17) and Michelson (28) also report studies based on both partners. An additional contradiction exists in that access to work has been central to research using normative and aggregative frameworks (for example, the work of Alonso), while being simultaneously declared unimportant by empirical researchers using survey procedures (39).

Evidently, much transportation and land use theory accepts as a fundamental assumption the importance of accessibility, particularly the journey-to-work, in residential choice behavior. Furthermore, a number of contradictory assumptions underlie both existing theory and the approach taken in much empirical research. This situation suggests a need for both improved empirical research and perhaps alternative theoretical framework.

II. Some Canadian Evidence

Beginning in 1970 a series of studies on intra-urban relocation was conducted in Hamilton, Ontario. At the time of the studies, Hamilton was a predominantly industrial city with a population of approximately 300,000. The intent of the studies was to more closely investigate some of the issues previously described. The first study (3) was an attempt to test the primacy of the journey-to-work in residential choice. The study attempted to satisfy the assumptions contained in classical spatial equilibrium models such as Alonso (1) and Wingo (44). The respondents were 127 males employed at a major manufacturing company. The employment site was situated such that housing was available in the immediately surrounding area as well as with increasing distance from the plant.

Furthermore, the test site was proximate to high speed transportation routes which provided a relatively uniform accessibility surface. In short, the study came as close as possible to satisfying the assumptions of the classical spatial equilibrium models. Presumptively, this would provide the "best" case for obtaining evidence to support the primacy of the journey-to-work in residential choice.

Basically, the results were negative. For every personal characteristic tested (perceived socio-economic status, income, education, occupation, and total unweighted socio-economic status), the factors of neighborhood site (physical characteristics of the neighborhood, public services, neighborhood amenities, and social environment) and of residential point-location site (the individual site, the layout of the dwelling itself, and financial considerations -- unquestionably the most important single residential location factor) were invariably ranked most important. The factors of nearness to public transportation, nearness to religious institutions, and discrimination were always of little importance in the choice of a residential location. The situational characteristics of nearness to transportation routes, nearness to shopping, nearness to the place of work, and nearness to recreational facilities were variously ranked with seemingly no predictability in the directionality of this variance with regard to the personal characteristics. However, within the situational characteristics the journey-to-work exerted the greatest effect upon relative ranking. Thus, the results of this first study did not augur well for the assumed determinancy of the journey-to-work and accessibility in residential choice.

In a second study (7) the focus was on determining factors which were important in intra-urban migration for recent movers in terms of their family life cycle and socio-economic status. Sixty-nine interviews were

completed in a suburban community of the Hamilton area. The respondents were equally split between males and females. Approximately half of the respondents had moved in the previous six months, while almost 93 percent of the respondents had moved in the previous nine months. Using a Q-sort methodology, the respondents ranked thirty residential location factors in terms of their importance with respect to their recent move. These thirty factors are listed Table 1. Using the two most important factors in each of the general groupings, as Table 2 indicates, dwelling characteristics were clearly the most important factor in the choice of residence for recent movers. Financial considerations and physical neighborhood appearance followed this first ranked factor, while accessibility ranked fourth out of the five general factors. As Table 3 indicates, none of the accessibility factors were ranked within the five most important individual factors for all respondents. Rather, dwelling characteristics ranked first and third, financial considerations ranked second and fourth and the physical neighborhood characteristic ranked fifth. Clearly, these results for all respondents call into question the assumed primacy of accessibility in the residential choice situation. In this study, the only time that accessibility factors made any significant appearance was in terms of variation in importance for family life cycle groups and socio-economic status groups. The Kruskal-Wallis H-test indicated that among family life cycle groups only three variables were found to have scores that varied significantly. They were nearness to neighborhood schools, quality of neighborhood schools, and amount of neighborhood noise, in descending order of variation. For the socio-economic status groups only two factors showed significant variation of their scores: the outdoor space of the dwelling site; and the number and size of rooms. These results are consistent with the findings of Lansing,

Table 1: Q-Sort Statement List

Accessibility:

1. nearness to place of work
2. nearness to local shopping facilities (e.g., corner store)
3. nearness of schools (elementary, secondary)
4. nearness to public transit
5. nearness to recreation and/or entertainment facilities
6. nearness of major shopping facilities (plazas or downtown)
7. proximity of major thoroughfare

Physical Neighborhood Characteristics:

8. overall cleanliness and maintenance of the neighborhood
9. amount of neighborhood noise
10. amount of traffic
11. level of public utilities service (water, sewage, etc.)
12. age of neighborhood
13. privacy

Source: Bramberger, et al., 1972.

Table 1: Q-Sort Statement List (Continued)

Social Characteristics of the Neighborhood:

14. class status of the neighborhood (lower, middle, upper)
15. religious and/or ethnic composition of the neighborhood
16. quality of local schools (elementary or secondary)
17. quality of police and/or fire protection
18. desirable number of children in the neighborhood
19. apperent friendliness of neighbors

Dwelling Characteristics:

20. suitable floor plan of residence (arrangement of rooms, number of rooms, flexibility of room usage)
21. attractiveness of exterior (trees, landscaping, house style, etc.)
22. attractiveness of interior (decor, fireplace, recreation room, etc.)
23. age of dwelling
24. outdoor space of dwelling (parking, garden, size of lot, etc.)
25. dwelling satisfies family requirements (number and size of rooms)

Source: Bramberger, et al., 1972.

Table 1: Q-Sort Statement List (Continued)

Financial Considerations:

26. **downpayment**
27. **level of property taxes**
28. ***required amount of maintenance* (time and money)**
29. **rent or mortgage payments**
30. **monthly costs (heat, water, electricity, etc.)**

Source: Bramberger, et al., 1972.

Table 2: Q-Sort Mean Scores for Aggregated Factors for all Respondents

Rank	Factor*	Score*
1.	Dweiling characteristics	4.051
2.	Financial considerations	3.841
3.	Physical neighborhood appearance	3.384
4.	Accessibility	3.326
5.	Social neighborhood characteristics	2.739

* Two most important factors in each group.
** The score of "5" is most important and "1" is least important.

Source: Bramberger, et al., 1972.

Table 3: Five Most Important Individual Factors For All Respondents

Rank	Factor	Score*
1.	Number and size of rooms	4.2899
2.	Rent or mortgage payments	4.1739
3.	Suitable floor plan	3.8116
4.	Monthly costs (heat, water, electricity, etc.)	3.5072
5.	Privacy	3.4638

* The score "5" is most important and "1" is least important.

Source: Bramberger, et al., 1972.

Clifton, and Morgan (24), which suggested that socio-economic status and life cycle are not good predictors of who will move into a dwelling unit.

The results of these two pilot studies, in conjunction with the sometimes contradictory empirical evidence on factors important in residential choice and the imprecise theoretical constructs regarding the residential choice process (for example, see Refs. 8, 10, 17, 19, 23, 30, 34, 35, 37, 39, 45), led to the decision to undertake a third study of intra-urban residential migration in Hamilton. This third study, was designed to elicit the concepts used by housing searchers and judgements involving the cognition and evaluation of housing in the Hamilton market. Data were obtained from a set of respondents who were then in the market for a new residence in Hamilton. They were interviewed at home by one of five trained interviewers. The respondents completed a variety of exercises primarily designed to simulate the two main components of their choice process, i.e., comparison and evaluation of residences. The exercises involved use of a standard display of photographs of nine dwellings selected to depict a range of vacancies available in the Hamilton metropolitan area housing market. Two complementary interview formats, (A and B), were answered by different samples. Although it was intended that these be matching samples, they were drawn from slightly different populations. Sample A was comprised of 40 households who were still in the process of search at the time of interview. Sample B was comprised of 40 households who had chosen a new home but not yet moved in. This difference in the samples was reflected in some of the questions in each format.

Format A only, collected data on the basis of a modified version of Kelly's (20) procedure for personal construct elicitation. The data collected under format B related to exploring the importance of accessibility, where this

was defined first objectively in terms of the relationship between residence and various destinations, and then subjectively based on a preliminary analysis of results of the construct elicitation from sample A. The final twenty respondents of sample B completed six trade-off matrices representing their preferences for trade-offs between residential access, price, dwelling and lot size. These variables were chosen as being the primary ones specified in the urban-macro spatial models as well as being important in most empirical research.

For sample A, both adult members of the household were interviewed simultaneously by two interviewers out of hearing from each other. For sample B, only female respondents were interviewed. Profile statistics for both samples are listed in Table 4. Sixty-two respondents completed usable questionnaires for format A, representing 40 households. The total included 22 couples. The pre-move locations of all respondents were well distributed throughout the Hamilton metropolitan area. Both samples were likely to be familiar with the city given the number of years they had lived in Hamilton. Both samples lived predominantly in single family dwellings, were married with children, and were basically middle class. Sample B differs from A, in being slightly younger, with fewer children and with more members renting, living in high rise accomodations and expecting to spend less on housing.

Respondents from format A completed the construct evaluation task. This was intended to be a detailed description of the housing concepts used in evaluating vacancies. Three hundred forty-one elicited constructs were obtained through the elicitation procedures. These were supplemented by 97 "other factors." The other factors are concepts which respondents claimed to consider when evaluating vacancies but which for some reason were not elicited using the procedures. Together, the elicited constructs

Table 4: Description of the Samples

	Sample A	Sample B
Female respondents Male respondents TOTAL	38 24 62	40 -- 40
Number of independent households and number of respondents in the main analysis	40 (2 males included)	40
Length of residence in Hamilton - median group	over 10 years	over 10 years
‡Own Rent	24 15	15 23
Occupancy - mode	25 of 40 in single family	15 of 40 in single family 12 of 40 in high rise
Occupancy standard- median	3 i.e., good	3
Median age group	30-39 years	25-35 years

‡ The entries do not total 40 or 100%; there are missing values.

* Based on Blishen, B.R. "A Socio-economic Index for Occupations in Canada" in Canadian society: Sociological Perspectives, B.R. Blishen, F.E. Jones, K.O. Naegele, J. Porter (eds.) Toronto: Macmillan, 1968, 241-253.

Source: Harman, 1975.

Table 4: Description of the Samples (Continued)

	Sample A	Sample B
Number married Number not married	39 1	38 2
With school age children Mean number of children	22 2.05	14 1.97
Median education group	4 i.e., professional or technical beyond secondary	3 i.e., 4-5 years secondary
Median income group for combined husband/wife incomes	9 i.e., $13,000-15,999	9
Mean occupation code using highest code in household	52.68	53.98
Maximum housing price respondent prepared to pay- mean	$43,750	$36,675

‡ The entries do not total 40 or 100%; there are missing values.

* Based on Blishen, B.R. "A Socio-economic Index for Occupations in Canada" in Canadian society: Sociological Perspectives, B.R. Blishen, F.E. Jones, K.O. Naegele, J. Porter (eds.) Toronto: Macmillan, 1968, 241-253.

Source: Harman, 1975.

and other factors are considered to be the main constructs, concepts or cognitive attributes respondents use in housing choice. A mean of 8.5 elicited constructs and 2.4 other factors, totaling 10.9 in all, were supplied by A respondents. Clearly, these results depict the decision in making a housing choice as being extremely complex.

The construct descriptions were content analyzed to explore their meaning. This content analysis was the basis for the development of a 25 class typology of construct types, Table 5. A number of important points emerged from this first analysis. Housing was not evaluated on the basis of a few well defined concepts. A large number of complex notions were involved. A mean of over 10 constructs were elicited from individual respondents -- all of which were claimed to be used in house evaluation. The range of housing attributes mentioned by the sample was extremely wide. However, the concepts did fall into 25 broad categories. Of the 25 classes identified, some appeared to be "natural groupings." That is, the constructs in the class have the same basic meaning. Other classes were simply convenient groupings of residual constructs.

Among the main classes, there was a clear distinction between those which seem uncomplicated and well-defined in the minds of both respondents and researchers. The reference to house size (Type 1) is an example. Others, such as the age and maintenance concerns (Type 12) and privacy (Type 15) are more complex. These are important groups having an high frequency of use in this study, although they have not been well identified in previous work. Location constructs (Types 19, 20, 21, 22, and 23) as a group were probably the most difficult of the construct categories to pin down to a specific meaning.

Table 5: Frequency of Use of Construct Types

Sample A (N = 40)

Type No.		No. Of Respondents Using this Type		No. of Uses		
		No.	% of 40 Respondents	* E.C.	** O.F.	*** T.
1	dwelling size, internal space, no. of bedrooms	37	92.5	48	3	51
2	concerns about a basement	10	25.0	6	4	10
3	concerns about a dining room	6		1	5	6
4	concerns about other rooms	2		0	3	3
5	concerns about room shape, location, versatility, redecoration and maintenance	5		2	3	5

* Elicited Constructs

** Other factors

*** Total elicited constructs and other factors

Source: Harman, 1975.

Table 5: Frequency of Use of Construct Types (Continued)

Sample A (N = 40)

Type No.		No. of Respondents Using This Type		No. of Uses		
		No.	% of 40 Respondents	* E.C.	** O.F.	*** T.
6	concerns about windows	13	32.5	14	1	15
7	concerns about fireplace(s)	4		1	3	4
8	other aspects of dwelling interior	6		3	4	7
9	general appearance of house, cleanliness, and upkeep	9		8	1	9
10	occupancy of dwelling, (single or multiple, attached or detached)	11	27.5	10	1	11

* Elicited Constructs

** Other factors

*** Total elicited constructs and other factors

Source: Harman, 1975.

Table 5: Frequency of Use of Construct Types (Continued)

Sample A (N = 40)

Type No.	Description	No. Of Respondents Using this Type		No. of Uses		
		No.	% of 40 Respondents	* E.C.	** O.F.	*** T.
11	no. of floors	12	30.0	10	2	12
12	age of dwelling building material structure and maintenance concerns	28	70.0	36	4	40
13	other aspects of house design	7		8	2	31
14	size and shape of lot	27	67.5	29	2	31
15	privacy of lot and dwelling, spacing from neighbors	23	57.0	26	1	27
16	trees, landscaping and topography	24	60.0	25	2	27

Table 5: Frequency of Use of Construct Types (Continued)

Sample A (N = 40)

Type No.	Description	No. of Respondents Using this Type		No. of Uses		
		No.	% of 40 Respondents	* E.C.	** O.F.	*** T.
17	parking, garage and driveway	25	62.5	26	6	32
18	other features of the lot	4		3	2	5
19	neighborhood considerations	19	47.5	22	12	34
20	accessibilities	18	45.0	21	11	32
21	urban downtown "in Hamilton"	5		5	-	5
22	suburban, rural "out of Hamilton"	16	40.0	18	-	18
23	place names	12	30.0	9	3	12
24	financial considerations	25	62.5	9	21	30
25	uncoded	2		1	2	3
	Totals			341	97	438

It was obvious that residential location was not a single well-defined concept. In the first place, four separate constructs were identified (when we combined Types 21 and 22). Each of these types was, in itself, multifaceted. Part of the meaning of Types 21 and 22 seems to be of their association with lot size (Type 14) and privacy (Type 15). The complexity of the neighborhood constructs was discouraging. Furthermore, respondents rarely used only one location construct or even one type. A mean of 2.00 location constructs and 1.87 types were elicited from each respondent. Finally, location was unusual in that the respondents often it easier to describe what they did not want than what they were looking for in positive terms. To further explore the meanings of the main concepts, the cognitive relation between constructs were examined next.

Two objectives were sought simultaneously in these analyses. These were the further evaluation of each of the construct classes previously described, and the systematic attempt to identify cognitive associations between concepts. The data supplied by sample A were the only data used in these analyses. The data were subjected to several different analyses aimed at identifying patterns and relationships among constructs and therefore among construct types.

The results of these analyses may be summarized as four major hypotheses. First, housing concepts can be described on at least two levels; (1) elicited concepts, which are defined as those house searchers are aware of and can articulate; (2) dimensional concepts, each of which is comprised of one relatively independent elicited concept, or several elicited concepts which have related or overlapping cognitive meanings. Dimensional concepts are often more general or summary descriptions of several elicited concepts. Second, elicited concepts include concepts of all 25 types described in

Table 5, the most frequently used being; (1) dwelling size, especially the number of bedrooms; (2) dwelling age, maintenance and related concerns; (3) lot size; (4) external privacy and separation from neighbors; (5) trees and landscaping of lot; (6) parking and garage facilities; (7) accessibilities; (8) degree of perceived urbanism ("urban," "suburban," or "rural" locations); (9) local suburbs, satellite towns or areas designated by place names; (10) financial concerns. Third, dimensional concepts in house evaluation include concepts or concept clusters relating to: (1) dwelling, specifically the dwelling size, age, maintenance, and parking; (2) lot and location, specifically parking, lot size, privacy and separation from neighbors, degree of of perceived urbanism, trees, landscaping and neighborhood concerns; (3) accessibilities. Fourth, individuals used a mean of approximately 10 elicited concepts of house evaluation which collapsed into at least three dimensional concepts. The ability of individuals to handle seemingly large numbers of complex concepts of house evaluation may, therefore, be explained by concept combination in mental processes into cognitively and functionally related sets.

The 40 respondents who answered questionnaire format A, not only supplied a list of elicited constructs and other factors, they also ranked these in order of their relative importance in evaluating dwellings. The median and modal ranks in terms of importance for each of the major types are listed in Table 6. The values and rank order of the constructs on the right hand side of the table are based on all constructs.

Of all the major constructs types, financial concerns are consistently ranked as most important or among the most important concepts. This is consistent with the findings of other researchers such as Rossi (35) and Butler, et al., (10). Only slightly less important overall are the pref-

Table 6: The Relative Importance of Constructs by Type

Ranked by Median over all Constructs		Ranked by Median; One Construct per Respondent per Type †	
Median		Median	
2	Financial	2	Financial
3	Place names, Occupancy	3	Dwelling Size, Occupancy, Place Names
4	Dwelling Size	4	Neighborhood Accessibilities
5	Privacy	5	Age-Maintenance, Privacy
6	Lot Size, Urban-Rural, Accessibilities	6	Lot Size, Urban-Rural
7	Age-Maintenance, Trees, Neighborhood	7	Trees, Windows
8	Windows, Number of Floors, Parking	8	Number of Floors, Parking

* Where several modes occur, that closest to the median is used.

† Where a respondent used more than one example of a given construct type, that with the highest rank is used.

Source: Harman, 1975.

Table 6: The Relative Importance of Constructs by Type (Continued)

Ranked by Mode* over all Constructs		Ranked by Mode*, One Construct per Respondent per Type †	
Mode		Mode	
1	Financial, Place Names Occupancy, Neighborhood	1	Financial, Place Names Occupancy, Neighborhood
2	Dwelling Size	2	
3		3	Dwelling Size
4	Accessibilities	4	Accessibilities
5	Privacy	5	Privacy, Parking
6	Windows	6	Windows, Rural-Urban
7	Lot Size, Trees	7	Lot Size, Trees
8	Number of Floors, Age-Maintenance	8	Number of Floors, Age-Maintenance

* Where several modes occur, that closest to the median is used.

† Where a respondent used more than one example of a given construct type, that with the highest rank is used.

Source: Harman, 1975.

erences for a single family dwelling, number of bedrooms, and the location as reflected in a local place name. Accessibilities head the remaining concepts, having median and modal values around 4 to 6. The various concepts belonging to the lot-location cluster come behind access. Privacy constructs appear to be almost, if not as important as accessibilities, having a median rank of 5. Ranked slightly below privacy but always close to it, are the lot size and rural-urban construct types which are closely related with privacy. Their lesser ranking suggests they are subordinate constructs compared to privacy and the lot-location cluster. The median and modal rank for neighborhood concerns are erratic.

Information on the relative importance of access to various destinations was obtained from the 40 respondents who answered format B. They stated whether or not they would be likely to change their current church, shopping place, school, and work place, to achieve the planned move, and provided information on expected changes and access to various destinations. The data indicate that a residential move has an approximately 50 percent chance of leading to a change of shopping location, and a change of school. Respondents were less willing to change their church. The access to church does not appear to be significantly affected by the move. Almost all of the respondents were unwillingly to change their work location. The concern for access to shopping and schools in the accessibility constructs, therefore, is a concern for access to reasonable alternatives to the places respondents were using at the time of the interview. Conversely, access to work was to the present work place. While the place of work did not appear likely to be influenced by a residential move, it was not a sufficient constraint on the choice to prevent losses in accessibility. More respondents expected an increase in the travel times of both spouses with the move, than those expecting a decrease.

The expected increase was greater for working females than males, moving from a pre-move mean time for the 20 working females, of 16.38 minutes to a post-move mean of 24.75 minutes. The average travel time for the 36 working males changed marginally from 21.08 minutes to 26.53 minutes.

To more closely examine the relative importance of access to work, data from the last 20 respondents who answered questionnaire format B were analyzed. These respondents stated their preferred maximum travel times to work and completed a trade-off task. The latter exercise demonstrated the respondents' preferences for four specific travel times, price levels, lot and dwelling sizes respectively (Table 7). Tables 8 and 9 provide further evidence of the greater importance of the financial and dwelling size concerns compared to access. These record how many of the final 20 B respondents described highest utility and lowest utility values respectively to any level of the four variables. Access to work is not judged "most important" by any respondent, while a price level is "most important" to the majority. Consistent with this finding, the preferential ordering of the nine displays vacancies by all forty B respondents did not have a significant positive correlation with the order of vacancies in terms of their access to the place work of either spouse, with the exception of 3 of 58 cases.

The slight tendency for some level of access to be judged "most undesirable" in Table 9, as compared to none judged "most desirable" in Table 8, suggests that access to work acts more as a constraint on choice than a determinant of preference. It should be noted as well, that price and, more particularly, dwelling size, also have levels which are highly undesirable and, therefore, probably act as constraints on choice.

Table 7: Attributes Used in the Tradeoff Analysis

A	1	Distance to Work - 5 minutes
	2	15 minutes
	3	30 minutes
	4	60 minutes
B	1	Number of Bedrooms - 2
	2	3
	3	4
	4	5
C		Size of Lot
	1	Small lot, (30 x 100); no trees, close to neighbors
	2	Average lot, (60 x 100); some trees and landscaping
	3	Large lot, (125 x 200); trees and landscaping, spaced from neighbors
	4	Very large lot, (3 acres); well landscaped
D	1	Price - The price respondent paid
		$1000 more than paid
		$3000 more than paid
		$5000 more than paid

Source: Harman, 1975.

Table 8: The Frequency with which Attributes Received the Highest Utility at some Level

Attribute	Number	Per Cent
Access	0	0
Dwelling Size	4	20
Lot Size	5	25
Price	11	55
Total	20	100

Source: Harman, 1975.

Table 9: The Frequency with which Attributes Received the Lowest Utility at some Level

Attribute	Number	Per Cent
Access	4	20
Dwelling Size	8	40
Lot Size	3	14
Price	5	25
Total	20	100

Source: Harman, 1975.

Evidence on exactly how much access to work was desirable was derived from the trade-off analysis and from the respondents statements of their preferred travel times. The data suggest that the preferred travel time was around 15 minutes (the mean preferred time was 14.38 minutes). Too much proximity, specifically five minutes, or too much distance were both undesirable states. These results confirm those of Redding (34).

Analysis of the willingness of respondents to trade off accessibility to work to obtain their most preferred levels of each of the other three attributes indicates that at least 30 percent of the respondents would travel 30 minutes to obtain more desirable dwelling size or lot size. This percentage increased to 65 percent when the extra travel involved gained a reduction in prices. All the percentages fell off drastically when the travel time was increased to 60 minutes, although 45 percent of the respondents still preferred to go this distance to get the better price. Hence, 60 minutes appeared to act as a constraint on choice more frequently than 30 minutes. Turning the rationale around, analysis of the willingness of respondents to trade off access to <u>avoid undesirable</u> levels of each of the three other attributes indicates that access was much more readily sacrificed. At least 90 percent of the sample was predicted to be willing to travel the extra distance so as to avoid living in a home which was considered undesirable in terms of dwelling or lot size, or was priced too high. The proportion fell off when the distance was increased from 30 to 60 minutes but was still well over half the respondents for all three attributes.

These results suggest one further conclusion; that housing choice was made on the basis of an attempt to avoid <u>undesirable</u> levels of several of the

main attributes, not only accessibility to work. If this is the case, it may be far more useful to attempt to model housing choice as an elimination of alternatives rather than as a selection of a residence approximating some hypothetical ideal.

These results suggest nine additional hypotheses to treat the relative importance of concepts, particularly accessibility in house evaluation and choice. First, dimensional concepts, such as location represented as a place name, were more important determinants than the individually elicited concepts which contributed to their meaning. Second, in house evaluation and choice, people sought more actively to avoid the most undesirable levels of the main attributes than to obtain the most preferred level. Third, financial concerns were the most important of the elicited concepts. Fourth, the most important of the elicited attributes relating to the dwelling were size and occupancy. Fifth, location was among the most important of all concepts, ranking consistently lower than price only, and being equally as important as dwelling size and occupancy. The importance of location occurred only when all its various connotations were combined and summarized by the use of a place name. The individual components of location were ranked as less important. Sixth, accessibilities were the most important of the individual connotations of location, followed by the lot-location cluster which was, in turn, headed by privacy. Seventh, access to the present work location and possibly also, to church, were more important than access to the present location for shopping and schools. Eighth, access to work acted as a constraint on choice rather than as a determinant for preference; the intent was to avoid too little access, commonly defined as 60 minutes or more, and to a lesser extent to avoid too much proximity, defined as within five minutes travel time. Ninth, access to work was not, however, a sufficient

constraint to prevent some losses of accessibility with a choice of residence, particularly if this involved perceived improvement in price, dwelling size, or lot size. This finding accords with the postulation than many residential moves, particularly those with suburban locations, are in response to family life cycle changes and the need for more room with increases in family size.

In all the previous analyses, the respondents have been treated as one group. The remaining analyses explore the extent of sex-based differences in the cognition and evaluation of housing.

Twenty-two couples supplied usable responses to questionnaire format A, thus providing data on personal constructs and preference orderings on the nine standard vacancies. Each spouse answered the questionnaire simultaneously, but out of hearing of each other, thus ensuring the independence of their responses. On the average, females provided slightly more information than males, producing a mean of 11.2 constructs as against 9.7. In terms of the types of concepts elicited, the results show slight but not convincing support for Beshers' notions (6) and sex-related differences reported by Hempel (17). Females, for example, had a greater tendency to refer to the dwelling itself (construct Types 1-13, Table 10), and to trees and landscaping on the lot (Type 16).

Table 10: Male - Female Differences in the Use of Housing Constructs

Constructs		No. of Respondents Who Use This Type		Median Rank	
Type	Description	Male(22)	Female (22)	Male	Female
1	dwelling size, internal space	18	20	5	4.5
2	basement	1	8	5	6
3	dining room	1	1	3	6
4	other rooms	2	0	6	0
5	room shape, location, versatility, etc.	2	4	4.5	4.5
6	windows	2	7	11.5	9
7	fireplace(s)	1	1	10	13
8	other aspects	5	5	9	10
9	house cleanliness, upkeep	7	7	9	9
10	occupancy	8	7	3	2
11	number of floors	6	6	5.5	6
12	age, building, materials, structure	11	15	5.5	7

Source: Harman, 1975.

Table 10: Male - Female Differences in the Use of Housing Constructs (Continued)

Constructs		No. of Respondents Who Use This Type		Median Rank	
Type	Description	Male(22)	Female(22)	Male	Female
13	other aspects of design	2	5	14	9.5
14	lot size and shape	18	15	5	5.5
15	lot privacy	11	13	5	5
16	trees, landscaping, etc.	6	15	6	7.5
17	parking, garage, driveway	10	12	7	6.5
18	other features of lot	3	1	5.5	9
19	neighborhood	15	13	4	8
20	accessibilities	11	12	8	6
21	urban, downtown, etc.	1	3	12	7
22	suburban, rural, etc.	8	8	4.5	6
23	specific geographical area	8	6	4.5	3
24	financial	16	17	2	3.5

Source: Harman, 1975.

At the same time, nonetheless, both sexes mentioned the postulated male concerns with finance and accessibility about equally, although women ranked them very slightly lower in importance. In this respect, it should be noted that access, as was defined by the respondents referred not only to work but also to schools, shopping centers, and open space. The latter are often seen as female concerns. However, the concepts used by male and female respondents were very similar. When the data on the constructs used by males and females, in the first two columns of Table 10, are treated as ordinal, they have a rank correlation of .7 (significant at .001). Moreover, when asked to preferentially order the set of nine vacancies, 16 of the 22 respondents independently ranked them sufficiently alike to produce rank correlations significant at the .05 level. This suggests that minor differences in the criteria they use, do not lead to important differences in the housing preferences of husband and wife. If, as is possible, the existing minor differences are due to residual cultural role stereotypes which are now diminishing in Western societies, the differences may ultimately disappear completely.

The results of this analysis also suggest that in the case of couples the housing choice process is relatively equalitarian, being a consensus on the nature and relative importance of concepts to be considered, rather than domination by either sex as reported by Klemesrud (22), or a division of the decision as hypothesized by Beshers (6). This consensus on housing needs and preferences may be the product of the couple's mutual needs as a household unit, and may change radically

for either or both partners in the event of their separation. It may also result from a convergence of the individual preferences brought about during search by the inherent similarities of two people who live together, and by information sharing and mutual persuasion.

The large increase in the number of married women entering the labor force over the last three decades has introduced the possibility of an additional constraint on housing choice particularly pertinent to the wife -- access to her place of work. Harman proposes three alternative hypotheses. First, access to work, either his or hers, is no longer a major factor in site selection due in part to increased personal mobility, rising income, and a willingness to trade off access for space and the perceived advantages of suburban or fringe locations. Catanese (11), Stegman (39), and Whitelaw (42) make arguments to this effect.

Second, alternatively, the residence is chosen in reference to his place of work, but not hers. This is most likely to occur in cases where the wife has low commitment to a career, works out of financial necessity rather than preference, or is not adverse to changes in employment. Safilios-Roschilds documents differences in the decision-making behavior of wives with high and low work commitment (36). Third, residential location is a compromise between both places of employment.

Regardless of what their personal preferences are, the final choice of a house ultimately depends on how the husband and wife compromise their views. Their respective authority and power in decision-making

determines the influence of each in this process. There are three major possibilities: (1) matriarchal decision-making where the wife is the major instrument in decision-making; (2) patriarchal decision-making; he decides by virtue of his position of a recognized authority, access needs or financial power; and (3) egalitarian decision-making; the decision is a compromise between husband and wife where all criteria are judged jointly, or alternatively, each spouse has a defined set of concerns.

Together, the conclusions drawn in this study negate or refine existing notions relating to: (1) the importance of various concepts in housing choice, for example, accessibility; (2) the interconnectedness of various concepts used in housing choice; and (3) the bases of sex-related differences. All of these have implications for the further development of behavioral theories of housing choice in particular, and individual spatial choice behavior in general.

III. SOME POLICY IMPLICATIONS IN INDIVIDUAL SPATIAL CHOICE BEHAVIOR

To conclude this paper it is appropriate to consider what, if any, policy implications may be derived from the empirical evidence and theoretical framework on intra-urban residential relocation. It is first appropriate to point out that the type of research described here and the theoretical framework are in their infancy, thus, expectations for policy input must be tempered with a realistic appraisal of the state of knowledge represented in these efforts.

It is fairly clear from the results of the Canadian studies that

accessibility plays a much more minor role in residential choice decisions than has heretofore been accepted or understood by policy makers and transportation planners and researchers. This suggests that it is a less potent tool for guiding urban development than had previously been assumed. Furthermore, the accessibility which is germane in the residential decision-making process is much more than the journey-to-work. Thus, to the extent that transportation facilities guide urban development, it is essential that policy and plans are more reflective of the various forms of accessibility requirements and preferences for urban households.

Clearly, the evidence shows little difference between husbands and wives with respect to the importance of various housing concepts in their judgements and evaluations of alternative dwellings. This situation makes it increasingly untenable for decisions to be made with respect to the provision of transportation facilities and/or residences which are not attuned to women's true role in residential decision-making.

The fact that housing concepts are not all precisely defined and many are interrelated to a greater or lesser degree, in that the use of one implies use of another, indicates difficulties for reliable questionnaire construction and further empirical research on the one hand, and for the definition of housing attributes and choice sets in modeling building and testing, on the other hand.

The evidence that people seek more actively to avoid that which they

do not want than to obtain their various preferences, suggests that the present tendency to think in terms of utility optimization or maximization as the objective in house search needs rethinking.

Finally, it is necessary to identify the physical or objective attributes of housing related to each of the subjective concepts identified in these studies. This is essential both for theoretical and design purposes, for example, for the identification of housing choice sets and for the design of more livable residential environments. Knowledge of the translation of physical referents through the mind into their mental counterparts will also help improve our ability to predict housing choice on the basis of a knowledge of population and vacancy characteristics, and the mental processes leading to choice.

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RESIDENTIAL LOCATION AND TRANSPORTATION ANALYSES MARRIED WOMEN WORKERS

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I. Introduction

The urban geography of labor supply and demand reveals both the origins and destinations of work trips within the city. Labor is supplied by households located in residential areas which are the originating places of urban work trips. On the demand side, firms, as places of employment, are the work trip destinations of the urban workforces. The following research represents a way of analyzing the work trip behavior of married women in the context of the family labor supply originating from residential areas of the city. Based on the resulting analysis, residential areas in Baltimore are shown to exhibit non-random patterns of labor supply and accompanying work trips.

Thus, in Baltimore the social process of increased family labor supply, in its current and specific form of married women entering the wage labor force, is reflected in urban structure and form. Spatial regularities of labor supply were found to exist for black two earner families.* A significant tendency toward a decentralized residential location was highly correlated with the probability of wives being the labor force.

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*Most (over 90%) of husband-wife families with wives in the labor force also have husbands in the labor force. Throughout the analysis these families are generally referred to as either two earner families or families with working wives. The concepts are assumed to be identical.

This presentation is divided into three sections. First a brief review of some of the literature is presented, providing the background to the Baltimore study. Second, there is an empirical overview of increased family labor supply, in the form of married women entering the labor force, and the parallel increase in the number of two earner families. The third section of the analysis focuses on evidence of labor market and residential patterns of families with working wives is presented.

II. Literature Background to the Baltimore Study

How is the social process of married women entering the wage labor force reflected in spatial movement and form in the city? Two factors are readily apparent. First, it is obvious that more married women are now participating in the classic journey-to-work, incurring the associated transportation costs. Second, the data show that two earner families have, on average, significantly larger incomes than their one earner counterparts to spend on housing should they choose to do so. Given these two factors, it is logical to suppose that two earner families might exhibit unique patterns of residential location reflecting their higher incomes and increasing transportation costs.

To date, neither labor market analysts, nor urban economists, have developed a comprehensive theory for dealing adequately with women's work force behavior as it is reflected in the journey-to-work. After a review of both the contributions and shortcomings of current endeavors in these two fields, Madden and White note that, especially in the case of the working married woman, an "urban model of the behavior of two earner households is clearly needed. However, constructing such a theory raises difficulty issues." (11, p. 23)

The specific geographic approach emphasized in the Baltimore study has been broached by a number of authors from a variety of disciplinary perspectives, though sometimes implicitly rather than explicitly. The approach relies on the logic of intermetropolitan economic models of labor force participation (13,4) but in the tradition of the residential differentiation analysts. (16) The analysis of intra-metropolitan variation is dealt with more explicitly.

The economic models of labor force participation of the sort mentioned above involve only an implicit use of a spatial dimension. They use aggregated summary data for several metropolitan areas in the United States and attempt to explain labor force participation of married women in the following terms: metropolitan unemployment and wage rate; median income for males; percent of families with children under six years of age; and other socio-economic variables defining the local labor market. While these models provide important general information about the labor force activity of married women, the high levels of aggregation tend to wash out many of the spatial variations which might exist at the intrametropolitan scale. In 1958 Clarence Long noted that "cities and states are unsatisfactory units for the study of labor force and earnings; they have been used only because better data were lacking". (10, p.82) Such aggregate units are obviously unsatisfactory for purposes of transportation planning and policy making.

In contrast the underlying theme to the urban geographic approach to studying the city is precisely that the city is not an undifferentiated entity spread uniformly with all variety of activities to be found in all areas within its boundaries. The city is rather understood to be a "mosaic of social whorls" and almost any criterion which can be used for differentiating among individuals and groups may become the basis for their physical separation.(16)

The interest in socio-economic variations of populations at the intra-urban small area scale of analysis has a long tradition. Techniques such as social area analysis, factorial ecology and principle components analysis have been used extensively by urban geographers to distinguish the urban residential population into neighborhoods, social areas, ecological areas, communities, and other "areas", on the basis of certain social and economic characteristics. It has recently been suggested that the increasing participation of women in the work force may become a basis for residential differentiation of the modern city. (16) It was in order to examine this topic more closely that the Baltimore study was undertaken.

An urban geographic approach was utilized in the Baltimore study of residential location of married women in the wage labor force. It draws on the logic of the intermetropolitan labor economic models described above, but uses a much smaller scale of analysis, that of census tract aggregations, (provided by the fourth count census of population detailed characteristics). While small area tract statistics still pose the problem of averaging variations among individuals within the tract, this does not preclude us from making observations about individuals on the basis of the tract information. For example, if a tract has a labor force participation rate for married women of 40 percent, then the average probability of a married women in that tract being in the labor force is 40 percent. While this "gives us only approximate knowledge about a given individual....it does give us specific knowledge of the social situation in which [s]he lives." (10, p.42) In this example we also have a valuable piece of information regarding the probability that a women will make a journey to work.

A similar research approach, using small area statistics, was utilized by J. S. Wabe who looked at the factors which accounted for the variation in the proportion of males and females of working age who were economically active for

the different boroughs in the London Metropolitan Region. Wabe found that the variation in labor force participation among women was significantly greater than that for men. In addition, employment data for London showed that labor force participation among women varied directly with the availability of local, borough employment opportunities. Availability of local employment did not prove important when explaining labor force participation of men. Unfortunately, the importance of local employment could not be measured since data are not available for directly testing this hypothesis in Baltimore.

As shown below in the Baltimore study, the logic of the intermetropolitan labor economic models, combined with the use of a much smaller scale of analysis, that of census tract aggregations, captures the intrametropolitan variations typically analyzed by urban geographers. The lack of a highly rigorous and fully refined theoretical underpinning to this empirical analysis is an admitted problem, but beyond the scope of this present work to fully remedy.

III. Changing Social Patterns of Family Labor Supply and the Increase in Income Due to Wives' Earnings

It is the marked change in family labor status in recent years which provides the first clues that family residential status and transportation needs may also be changing. Married women's work, which has historically been residential based and traditionally without direct monetary compensation, is fast becoming the exception rather that the rule.

For the nation as a whole there is a trend toward increasing family supply of labor to the market. In 1976, the United States Department of Labor, noted that families with two workers or more have increased over the 1950 to 1975 period from 36 to 49 percent. (19) A similar report in June of 1977 noted that the increased labor force participation of wives was reflected in

that 57 percent of the 47.3 million husband-wife families surveyed reported that they had been multi-earner families in 1975. (20) The report concludes that "the concept of the four person family consisting of two children, a working husband, and a wife-homemaker outside the labor force, although useful for some purposes, does not represent the typical American family of the mid-1970's." (20)

The necessity of this movement into the labor force is indicated by the considerable, and increasingly essential monetary contributions these working women make to the family. In 1975, the median income for families in which the wife was an earner was $17,100, and $19,700 when she worked all year at a full time job. (20) Wives' earnings, as a proportion of family income, averaged 26 percent - ranging from 39 percent when the wife worked year around full time to 12 percent when she worked full time for half a year or less, or part time. Among blacks, wives contributed an even greater proportion to family income averaging 32 percent of family income (42 percent if they worked year around, full time) compared with 26 percent for white wives.* (20)

The national trend toward the rise of working wives was readily apparent in Baltimore in 1969. Four observations can be made regarding the labor force status of these husband-wife families. By 1969 the majority of husband-wife families, with husbands working, depended on income from wives as well. (See Table 1A, Col. 4, Row 8.) Thus, Baltimore was characteristic of the national trend which found the majority of husband-wife households depend-

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*This difference is explained in part by the greater likelihood of black wives to work year around full time. Also black husbands had much lower earnings than white husbands, with median income of $7,800 as compared with $11,600 for white husbands.

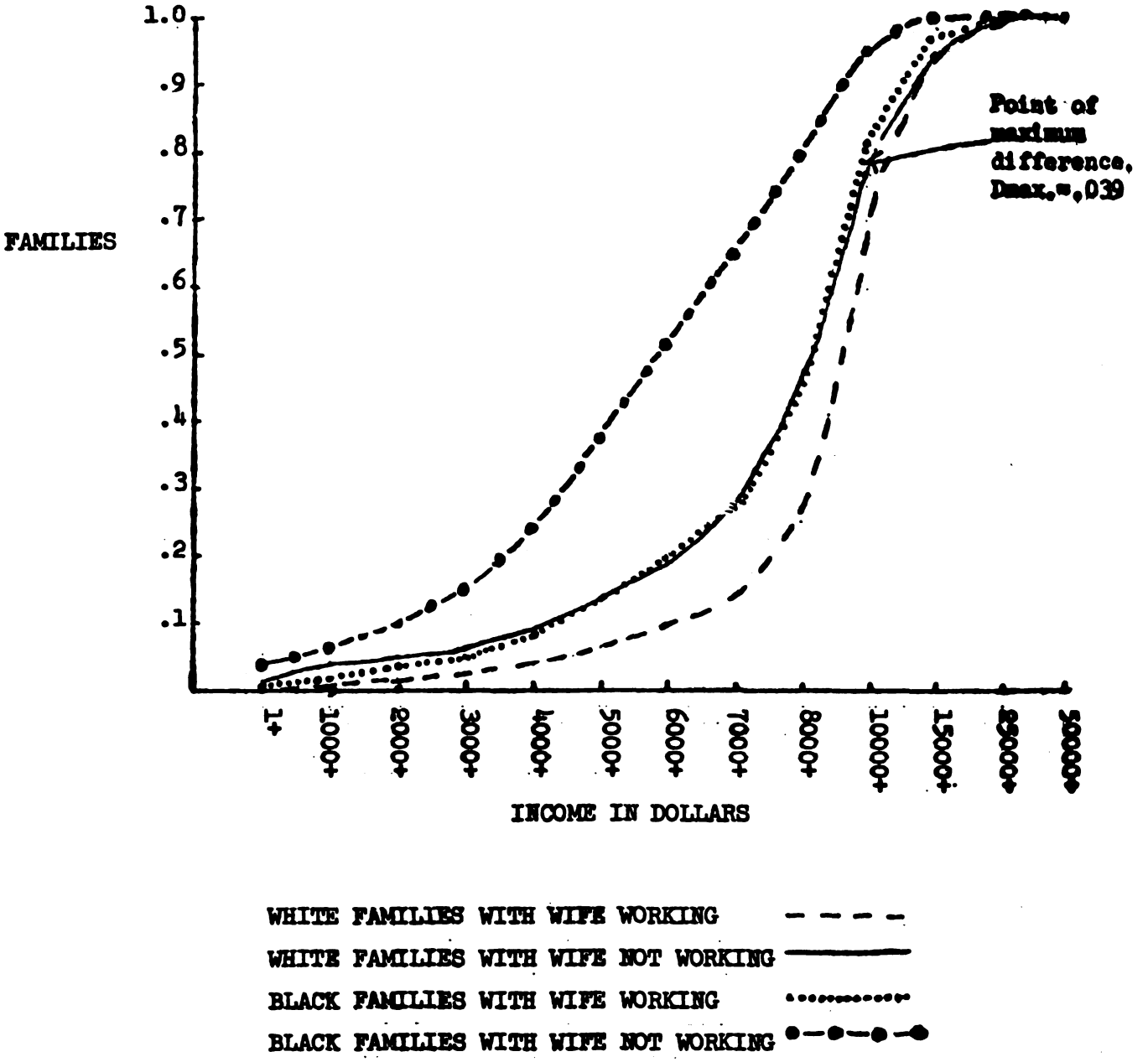
ing on two earners in 1976. Second, there was a considerable income advantage to families with working wives (Table 1B). Third, this income advantage increased as shown by the widening gap between all one earner and two earner families in Baltimore between 1959 and 1969. Finally, the 1959 difference of $1,897.31 between white one earner and black two earner families was down to $1,029.70 by 1969. (This reduction is even greater than it appears since the 1969 dollar figures were not corrected for inflation.) In other words, the mean income of black husband-wife families with working wives approached the income level of white families with one earner during the observed time periods.

A more detailed chi-square analysis of family income differences between one and two earner families by race was conducted using the distribution of Baltimore one and two earner families over several income classes for the year 1959, and also for 1969. Not surprisingly, in both cases the test confirmed that there is a significant difference (.01 level) in the distribution of income between one earner and two earner families regardless of race. In other words, there is a significantly higher probability of a family with a working wife falling into a high income class.

Further analysis by race indicated that income distributions for black families differ significantly (.01 level) from that of white families regardless of the number of earners. So, in general, earnings from working wives cannot wholly offset the lower income status associated with being black. Nonetheless, Figure 1 shows that in 1969 the distribution of income among black two earner families bears a striking similarity to that of white families with one earner, with a maximum difference between the two cumulative distributions amounting to .039. In other words, black two earner

FIGURE 1

INCOME OF HUSBAND-WIFE FAMILIES, WITH WORKING HUSBAND, BY RACE AND PRESENCE OF WORKING WIFE. (BALTIMORE 1969)



Source: 1970 U.S. Census of Population Detailed Characteristics

TABLE 1A

Number of Husband-Wife Families, with Working Husband, by Race and Presence of Working Wife, Baltimore

	1959		1969	
	No.	%	No.	%
White H-W Families	287156	100.0	327855	100.0
wife worked	112581	39.2	160872	49.1
wife did not work	174575	60.8	166983	50.9
Black H-W Families	52777	100.0	59698	100.0
wife worked	25697	48.7	39602	66.3
wife did not work	27080	51.3	20096	33.7
Total H-W Families	339933	100.1	387553	100.0
wife worked	138278	40.8	200474	51.7
wife did not work	201655	59.3	187079	48.3

TABLE 1B

Mean Income of Husband-Wife Families, with Working Husband, by Race and Presence of Working Wife.

	1959		1969	
	$	2 earner .advantage	$	2 earner .advantage
White H-W Families				
wife worked	8616.38	520.52 (6.0%)	14265.80	1680.80(11.8%)
wife did not work	8095.86		12585.50	
Black H-W Families				
wife worked	6198.55	1635.75(26.4%)	11555.70	3807.66(32.9%)
wife did not work	4560.80		7748.04	

Sources: 1960 Census of Population Detailed Characteristics
1970 Census of Population Detailed Characteristics

families were attaining nearly the same income status as white one earner families. A possible interpretation of this is that families can somewhat offset the tendency toward lower income status associated with being black by supplying twice the labor to the market. We shall look at the residential status of black two earner families in detail below.

IV. Labor Market and Residential Patterns of Families with Working Wives

The mapping of the labor force participation rates of married women, living with husbands who also tend to work, indicates that the supply of this type of labor is not uniform throughout the Baltimore urban area. While the mean participation rate for all 404 tracts is .41, dividing the tracts into those which are predominantly black and those which are predominantly white indicates a participation rate of .50 for the black tracts compared with .39 for the white tracts.

There was a noticeable clustering of high participation tracks in the northwest section of the city. This is explained in terms of a high correspondence with the area of black ghetto expansion in Baltimore City. The implications of those finding are discussed in greater detail below. Throughout the remainder of the study the sample was broken into black and white subsamples for purposes of analysis.*

Correlation analysis was performed in order to ascertain the relationship between the track labor force participation rates of married women and certain socio-economic variables (Table 2). The expected sign for correlation with female median income is positive, since, as an indication of earning power, it

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*The white tracts were also subdivided into low income and high income groups on the assumption that the results for black tracts were possibly a reflection of a low income population and would thus be similar to white low income areas. However, the results of correlation analysis for the white low income areas did not prove significant.

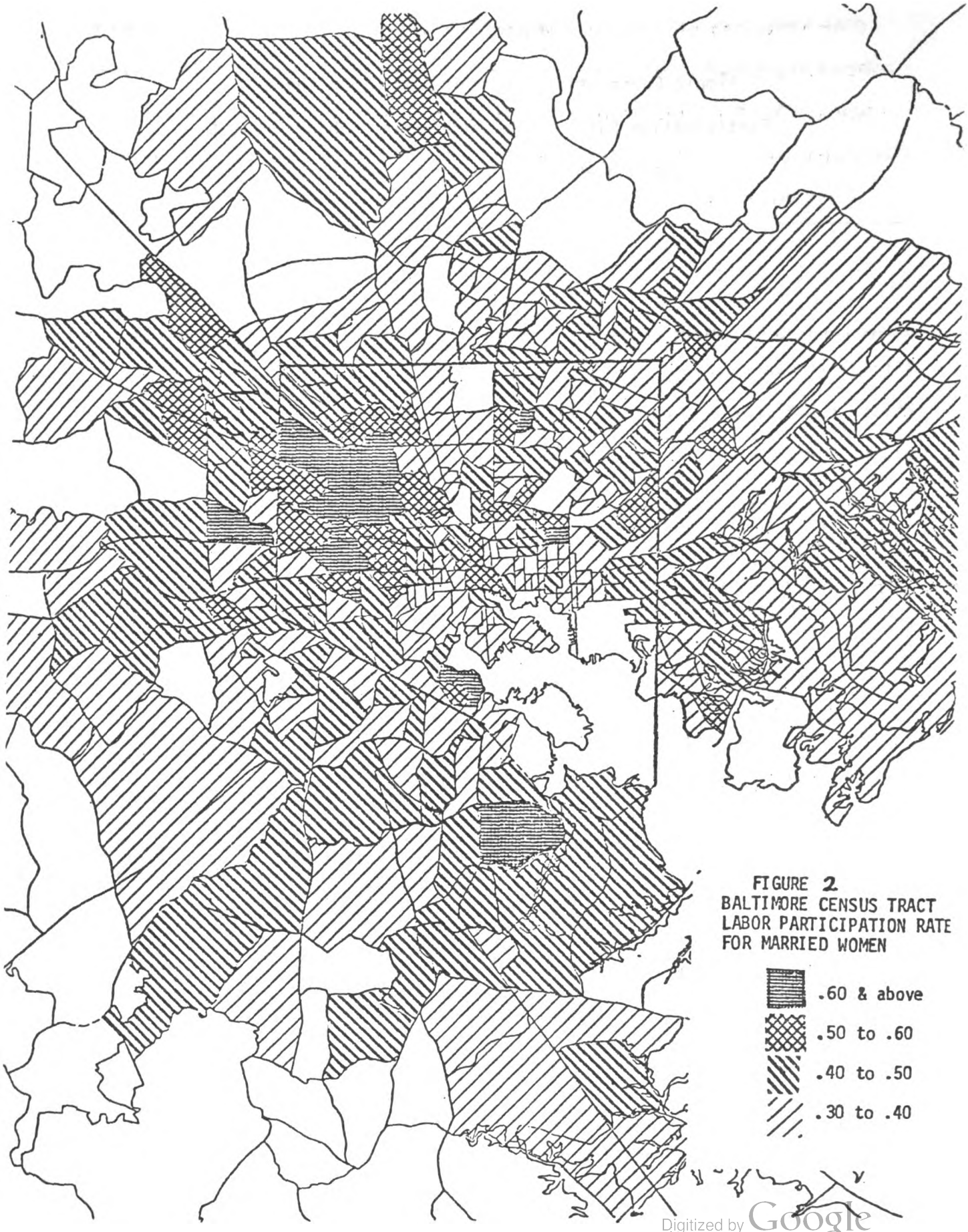

FIGURE 2
BALTIMORE CENSUS TRACT
LABOR PARTICIPATION RATE
FOR MARRIED WOMEN

TABLE 2

Simple Correlation Coeffients of Labor Force

Participation Rates of Married Women Husband Present

with Selected Variables in Baltimore

	Simple Correlation			
	FMI	MMI	MU	CBD
All 404 Tracts	.3268	-.2113	.0461*	-.1324
Whites - 318 Tracts	.3333	-.1427	.1991*	.0335*
Blacks - 86 Tracts	.7954	.7959	-.4816	.4220

All results significant at the .01 level except where indicated by *.

FMI = Female median income (hundreds of dollars) for females 14 years and older with income.

MMI = Male median income (hundreds of dollars) for males 14 years and older with income.

MU = Male unemployed rate.

CBD = Distance in miles to the Central Business District.

1970 U.S. Bureau of the Census, Census of Population, Fourth Count Summary Tapes.

is expected that higher potential earnings will attract married women into the wage labor force. Thus, tracts in the Baltimore urban area where earning potential is high are expected to be positively correlated with labor force participation rates of married women. This was found to be true as the results show in Table 2. Notice the higher degree of correlation for the 86 black tracts when they are analyzed separately.

The expected sign for correlation with male median income is negative based on the assumption that, as an estimate of husbands' income contribution to the family, as male income goes up supply of labor by the family to the wage labor force will decrease. Therefore, when male median income in an area is high it is expected that fewer married women will be found in the wage labor force. The expectations above and those in the remaining discussion are supported by the previous findings of Mincer and Cain as derived from their intermetropolitan labor market models. (13,14)

Looking again at Table 2 witness the sharp jump in the correlation coefficients for the variable male income when the black residential areas are analyzed separately. Indeed, the negative income effect exhibited by the total urban area and by the white tracks disappears altogether, and a strong positive relationship between labor force participation rates and male median income occurs for the black residential areas. This finding of a positive income affect for blacks may be due to the fact that "high" median incomes for black males are still relatively low (when compared with white males, for example). In other words, "high" male incomes in reality may not be high enough to raise family income to the point where the choice of staying at home and foregoing wage work is a rational one for black married women. In summary, high levels of both male and female median incomes are associated with high levels of labor

force participation rates for predominantly black areas of the city, while the correlation results for all tracks and for white tracks analyzed separately are not always significant and, in the case of male median income, of opposite sign.

High rates of male unemployment are indicative of high rates of general unemployment and lessened job opportunities for women. One common argument is that male unemployment will be inversely related to labor force participation rates for married women due to the discouraging labor market conditions. An alternative hypothesis, however, suggests that high male unemployment, as an indication of decreased family income, may spur more women into the labor force to compensate for the families' dwindling income. This would be reflected in a positive relationship between male unemployment and labor force participation of married women. The outcome of these two effects, known respectively as the discouraged worker and the additional worker effects, can be determined only through empirical observation. (6, p. 87)

In Baltimore, results for correlation of labor force participation rates of married women and male unemployment rates showed no statistically significant results for the study area taken as a whole or for the white tracts. However, the predominantly black census tracts showed a statistically negative relationship, indicating that high male unemployment is associated with low participation for married women. This suggests that the discouraged worker effect predominates in black sections of the study area.

Correlation of labor force participation rates of married women with distance from the central business district (CBD) (Table 2) indicates what appears at first glance to be a rather peculiar and counter-intuitive outcome. The results for the Baltimore urban area as a whole, that is for all 404 Census

Tracts, indicate a slightly negative relationship between the two variables. That is, with increased distance from the CBD, labor force participation of married women decreases. However, separating the 404 Census Tracts into those which are predominantly white and those which are predominantly black once again reveals a very different picture. The white areas of the city now show an insignificant positive relationship. But for the black areas of the city we find a statistically significant, positive relationship between distance from the CBD and labor force participation rates of married women.

In Baltimore black two earner families, which by definition have higher levels of family income than their one earner counterparts, follow the pattern of urban residential location suggested in many urban economic models. (12) That is, these families tend to live farther from the CBD than their lower income, one earner counterparts, exhibiting a preference for the newer and more spacious housing associated with locations more distant from the CBD. In case of black families, this preference can be more easily realized because of the increased ability to pay for added space associated with the higher income of the two earner black family. This suggests that black two earner families, through combined husband and wife income, have a high probability of bidding successfully for more spacious housing associated with locations distant from the CBD and a high probability of attaining a residential status once reserved exclusively for whites.

While we know that in Baltimore, black two earner families are found in more decentralized residential locations, taking advantage of the

cheap cost of space (per square foot), what we do not know is whether or not they are incurring greater per person travel costs typically associated with more suburban locations. There is no information currently published to analyze this question.

Labor supply data currently provided by the decennial census gives detailed information on characteristics of the labor force by place of residence. It is this data, at the census tract level of aggregation, that has been used thus far in the analysis of married women in the Baltimore labor force. The data are readily available at little cost for other metropolitan areas in the regularly published series and in the Census Summary tapes. Thus, an analysis of intra-metropolitan origins of work trips at the census tract level is possible for any U.S. metropolitan area.

Data are also collected by the census on worker characteristics by place of employment. These data describe the work trip destinations by worker, sex, race, and numerous other socio-economic characteristics, and thus provide information on labor demand within metropolitan areas. While currently available only at the cost of running special tabulations, there is an effort underway by an ad hoc committe of transportation planners and economists to get these data published at the tract level as part II of the already available place of residence data. If this were done then both worker characteristics such as race, sex, number of household earners, etc., by place of residence and place of work would be available for metropolitan areas with little cost of the user. Data such as this on women, already routinely collected by the census bureau,could be of great use to research scientists, planning agencies, and government officials were it economically feasible to

obtain. A second published volume of tract employment data would be an important step toward a more thorough understanding of women's labor market behaviour and travel patterns.

CONCLUSIONS

Findings from the Baltimore study have centered on the social process of married women entering the labor force as it is reflected in urban structure and form at a small scale of analysis. Baltimore was shown to be typical of the national trend toward increasing labor force participation of married women and the parallel increase in the number of two earner families. Labor market analysis showed that black and white residential areas responded differently to labor market variables leaving the analysis for whites inconclusive at this point. However, spatial regularities were shown to exist for black two earner families. The pattern of these two earner and thus higher income black families tending toward a decentralized residential location also provides information about work trip generation within the city.

The approach used in the Baltimore study, in disciplinary terms amounts to integrating two important research and educational tract traditions. It is what one well-known geographer calls building a bridge between the sociological imagination and the spatial conscious or geographical imagination. (7) This intra-urban approach is a necessary prerequisite for policy and planning to meet the work and travel needs of the increasing numbers of women wage workers.

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C. COMPARATIVE ATTITUDES AND PREFERENCES OF MEN AND WOMEN TRAVELERS

COMPARATIVE ATTITUDES AND PREFERENCES OF MEN AND WOMEN TRAVELERS

The four papers in this section present empirical research on differences in the attitudes and preferences of men and women toward transportation systems and system attributes. The Koppelman-Tybout-Syskowski paper presents not only empirical work but describes an innovative methodological approach developed to examine the impact of a number of influences on transportation decision-making. The paper specifically addresses the importance of societally defined roles in explaining the differences between men's and women's travel behavior.

The Studenmund-Kerpelman-Ott paper is based on data collected in Danville, Illinois in 1977. Danville did not then, but would later have, a mass transit system; the data were to be used to develop an attitudinally based methodology to forecast ridership response to transit innovation. The study found that some differences in attitude and behavior between men and women in that sample were in fact related to gender and not to other variables such as employment or income.

Recker and Schuler's paper is based on a survey conducted in Orange County, California in 1976. The survey was designed to find out whether there were significant differences between men's and women's preferences and attitudes toward travel alternatives. If such differences existed, the study was designed to see if they significantly affected the structure of men's and women's decision making about public transit. The paper found that there were minor differences in how males and females perceived transportation alternatives but significant differences in the structure of decision making and their behavioral intentions toward mass transit usage.

Sen's paper is based on a 1977 survey undertaken in Richmond, Virginia. Sen stratified her data in a number of ways to account for the co-varying impacts of income, car availability and occupation and found that women use transit more than men in a number of circumstances. She also found that women tended to have stronger views on transit than men; women were both more positive toward it and also more likely to note the need for transit improvement.

It should be noted that these studies are based on cross-sectional analysis; they represent the current attitudes and preferences of some women which may be determined in part by their current dependence on and their long experience with transit. Moreover, reported attitudes and stated intentions may be totally unrelated to changes in travel behavior; the Recker-Schuler and Sen papers are particularly vulnerable to this criticism. The Kerpelman-Studenmund-Ott paper does not have information on this issue but it will be forthcoming from the larger study undertaken in Danville. The empirical findings in the Koppelman-Tybout-Syskowski paper may be subject to the same criticism although their methodology clearly allows for the investigation of changes over time in key variables.

ROLE INFLUENCE IN TRANSPORTATION DECISION MAKING

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Introduction

There is increasing awareness of societal roles and their influence on a wide range of human behaviors. In view of the pervasive impact of such roles, it is appropriate for transportation planners and decision makers to examine the way in which these roles may influence the evaluation and usage of transportation services. This issue is particularly important given the current dynamic nature of social and occupational roles in our society and the need to meet the changing transportation demands of women and men as they assume new and/or additional roles.

Little prior research has examined role influences in transportation decision making. The work which has been done has generally been undertaken as part of an effort to address the relationship between demographic characteristics and travel behavior. In several studies, differences in either utilization of transportation services or in some portion of the transportation decision process have been found for individuals in different gender, occupation, and/or family life cycle groups (1, 7).* Unfortunately, some of these results of these studies

*Gender, occupation, and stage in family life cycle would seem to be valid surrogates for certain socialized or functional roles.

are limited either by the lack of statistical tests of differences or by the cursory analysis of the gender/role variables.

This conference has been undertaken in recognition that there is a need for a deeper understanding of the influences of societal roles on transportation decision making. The purpose of this paper is to contribute to such an understanding by:

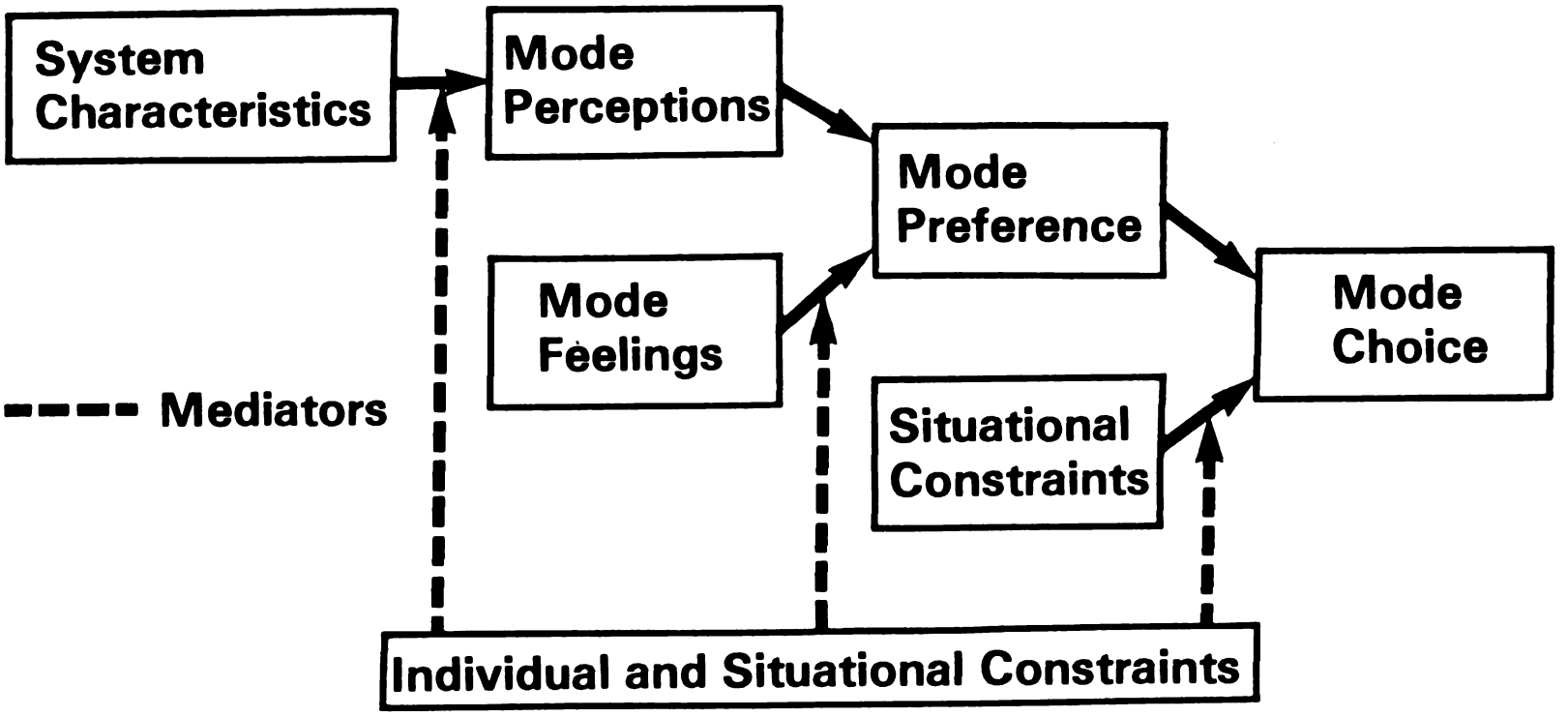
1) detailing a methodology for examining role influences in transportation decision making,
2) presenting the results of application of this methodology to an existing data base, and
3) using the findings of this analysis as a basis for drawing theoretical, methodological, and practical implications for future research in the area.

Methodology for Examining Role Influences in Transportation Decision Making

A fundamental approach to understanding individuals' transportation decision making must underlie any effort to examine role influences in transportation decision making. The approach that provides the foundation for the methodology developed here is the consumer oriented approach to analysis of transportation behavior, which has been developed by the Consumer Oriented Transportation Service Group at the Transportation Center of Northwestern University. Basically, this approach entails studying transportation behavior through the analysis of three processes: 1) how consumers use actual system characteristics (i.e., travel time, wait time, speed) in forming their perceptions of mode attributes (i.e., convenience, reliability); 2) how consumers' perceptions of mode attributes, along with their more general feelings about modes, combine to determine mode preference; and 3) how consumers'

preference, in conjunction with situational constraints such as mode availability, guides their choice behavior. Under this approach, individual and situational differences, such as roles, are viewed as mediators of the three processes which may potentially affect how perceptions and feelings are formed, how perceptions and feelings are aggregated to form preference, and how preference and situational constraints influence choice behavior. (See Figure 1 for a graphic representation of the consumer oriented transportation decision making process.)

We feel that the consumer oriented approach is the appropriate foundation for examining role influences in transportation decision making for two major reasons. First, this approach provides a more detailed understanding of consumer decision making processes than traditional models of consumer travel behavior, (i.e., models examining the direct relationship between system characteristics and mode choice), in that it includes cognitive factors--perceptions, feelings, and preference--that intervene between system characteristics and mode choice. In general, this detailed understanding is desirable because it provides transportation planners and managers with a better basis for diagnosing the source of problems in the transportation system (i.e., problems may be the result of actual system performance, consumer misperceptions of system performance, the importance consumers place on various perceptions in determining their preference, or the impact of situational constraints in determining choice) and developing strategies to overcome these problems (i.e., problems may be overcome by altering any of the variables in Figure 1, not just system



Consumer oriented transportation decision making process

characteristics). This level of understanding is particularly important if the impact of roles on transportation decision making is to be assessed because more simplified models may obscure or distort role related differences in decision making--role related differences are likely to exist in perceptions and preferences though not in actual system characteristics. Second, previous research employing the consumer oriented approach provides support for the structural model in Figure 1 and has yielded good explanations of consumer preference and choice behavior. (3)

Applying the consumer oriented approach to the examination of role differences in transportation decision making requires a methodology for gathering data on the major variables which appear in Figure 1 and analyzing the relationships between these variables, with particular emphasis on roles as mediators in the decision-making processes. We propose that qualitative and quantitative research techniques be combined to form such a methodology. Specifically, we recommend that qualitative research, such as in depth or focus group interviews, be undertaken to: 1) identify roles likely to mediate transportation decision making, 2) suggest methods of measuring such roles, as well as other variables in the consumer oriented transportation decision making model, and 3) generate specific hypotheses about the influence of roles in transportation decision making. Then, using the results of the qualitative research as input, a structured data collection instrument, such as a questionnaire, should be developed to measure systematically the variables necessary to test the hypotheses generated. Finally, the data collected using this instrument can be

analyzed using quantitative research methods which allow statistical testing of hypothesized relationships.

This multiple method approach is appropriate because our view of the consumer decision making process focuses on cognitive factors and relationships which are difficult to define and measure. The use of multiple methods helps to define and operationalize these constructs accurately, increasing construct validity, and allows examination of the generalizability of findings across methods (external validity). The proposed methodology is clarified through the application described in the following section.

Application of Methodology to Existing Data Base

To illustrate our approach and provide some insight into role influences in transportation decision making, the methodology outlined in the previous section was applied to an existing data base. First, the nature of the data base is described briefly. Then, the qualitative and quantitative analyses performed on the data base to explore role influences in transportation decision making are described.

The Data Base

Between 1976 and 1978, researchers at the Northwestern University Transportation Center undertook a major research effort to understand consumers' transportation decision making. The focus of the research was on measuring consumers' perceptions, feelings, preferences, situational constraints and choice with respect to a variety of urban transportation alternatives and examining the relationships between

these variables (see model in Figure 1). Some data on system characteristics and individual and situational differences were also obtained. All the data was collected from residents of the city of Evanston. The aspects of the data collection process relevant to the role related analysis reported here are summarized below.

At the outset of the project, qualitative research was conducted in the form of a series of focus group interviews on transportation in Evanston.* The purpose of these interviews; which were conducted with groups of consumers such as the elderly and handicapped, youth, students, working women, working men and women, and Blacks; was to determine: 1) the transportation service attributes important to consumers and 2) consumers' transportation language (i.e., terminology used by consumers in discussing transportation). The results of these interviews then served as input to the development of more structured research instruments.

On the basis of the focus group interviews and other input (i.e., results of a literature review and an audit of mode usage in Evanston), the major data collection instrument for the project, a set of questionnaires, was developed. Separate questionnaires were developed for each of three trip types: 1) work or school trips within or outside of Evanston, 2) nonwork/nonschool trips to downtown Evanston, 3) nonwork/nonschool trips to nondowntown destinations within Evanston. These separate questionnaires were necessary because the modes available for

*Focus group interviews are open discussions by 6-10 consumers led by a trained moderator, which center on a particular topic--in this case transporation in Evanston.

the various trip types differed. However, all three questionnaires measured the same types of variables--system characteristics, perceptions, feelings, preference, situational constraints, mode choice and individual and situational characteristics. Since only data from the nonwork/nonschool trip to downtown Evanston questionnaire is analyzed here, only this questionnaire is described further.

The major sections of the nonwork/nonschool trip to downtown Evanston questionnaire are summarized below:

1) System Characteristics. Respondents estimated: travel time, broken down by access, wait and on-vehicle time; bus frequency, distance to the nearest bus stop; and bus seat availability. They also provided data which was used to compute auto availability, a situational constraint.

2) Perceptions. Respondents evaluated each of the frequently used modes (car, bus, and walk) by responding to 21-25 statements about mode attributes on a 5 point, strongly agree to strongly disagree Likert Scale. Respondents also expressed their more general feelings about the modes by responding to an additional 6-9 Likert scaled items per mode.

3) Preference. Respondents rank ordered the three modes--bus, walk and car--in terms of their preference.

4) Choice. Respondents reported the mode they used for their most recent nonwork/nonschool trip to downtown Evanston and also estimated the frequency with which they used each of the available modes for similar trips in the preceding two months.

5) Consumer and Situational Differences. Respondents answered demographic questions (i.e., age, occupation, sex, marital status, education, income) and described characteristics of their most recent trip to downtown Evanston (i.e., purpose, time of day).

The questionnaire was mailed to 1900 Evanston residents. Forty-one percent of these individuals (782) returned the questionnaire. After screening, for completeness, a reduced set of 500 questionnaires was

selected for analysis. This set of 500 questionnaires provides the basis for the quantitative analysis described in the later sections of this paper.

The next two sections describe the procedure and results of analysis of the focus group interviews and questionnaire data to examine role influences in transportation decision making.

Qualitative Analysis

We have recommended that efforts to examine role influences in transportation decision making begin with qualitative research designed to 1) identify and develop measures of roles likely to mediate transportation decision making and 2) generate specific hypotheses about the impact of such roles on the decision making process. Therefore, we began our analysis by re-examining the focus group interviews with these goals in mind. Although this analysis is limited by the fact that certain role groupings, such as working men, single working individuals and homemakers, were either poorly represented or not represented at all in the interviews, the results still provide some suggestions about the impact of roles on transportation decision making.*

The results of the focus group interview analysis are summarized in Table 1. Four broad kinds of roles were identified as likely to

*It is important to note that the focus groups were designed to provide information about all types of travel in Evanston. As a result they provide a broader range of hypotheses than can be tested in the quantitative analyses, which examine nonwork/nonschool trips to downtown Evanston.

TABLE 1

Roles and Their Hypothesized Impact on Transportation Decision Making

Role	Possible Role Categories	Hypothesized Impact on Transportation Decision Making
General Occupation Role	- full-time worker outside home - part-time worker outside home - student - homemaker - retired/unemployed	- Because they travel at different times of day and experience different levels of service, full- and part-time workers will have different perceptions of mode attributes than students, homemakers, retirees and unemployed. - Full- and part-time workers will place more emphasis on factors which influence their ability to meet an externally imposed schedule (i.e., on time) than individuals who are not employed outside the home.
Role as Spouse/ Roommate	- live alone - live with another adult	- Individuals who live with another adult may place more emphasis on mode availability and flexibility than individuals who live alone. - Mode availability for individuals who live together may be jointly determined.
Role as Parent	- parent of pre-school child - parent of school-age child - not a parent	- Parents, particularly those with pre-school age children, will need a flexible mode which allows them to drop off and pick up children on their way to work. - When a child accompanies a parent on a trip the parent's mode choice is influenced by two factors not otherwise of concern: 1) the child's ability to use the mode and 2) the hassle to parent associated with child using mode.

TABLE 1 (Continued)

Socialized Gender Linked Roles	- Female - Male	- Women, regardless of occupational role, typically assume primary responsibility for the housewife and parent role. To perform these multiple roles women need more reliable, flexible modes of transit than men. - Because women are perceived as weaker and more vulnerable than men they are more concerned about physical safety than men. However, this may not be a critical factor in determining their mode choice, unless a mode is perceived to be extremely unsafe.
Multiple Roles	# of Roles Performed	- As the number of roles performed increases, the cost of nonproductive travel time increases, leading individuals to either minimize travel time or use a mode where travel time can be productive. - As number of roles increases, the amount of time an individual has alone may decrease, leading him/her to seek a mode which affords privacy and effective time alone.

mediate transportation decision making--occupation related roles, role as a spouse/roommate, role as a parent, and socialized gender-related roles. In addition, the number of these different roles than an individual performs was identified as a potential influencing factor in transportation decision making. In the following paragraphs, evidence for these roles as mediators and specific hypotheses about their impact on transportation decision making are detailed.

The first role identified as a potential factor in making travel decisions was the general occupation role played by the individual. Possible categories under this role are: 1) employed full-time outside the home, 2) employed part-time outside the home, 3) student, 4) homemaker, and 5) unemployed or retired.* An individual's occupational role is likely to influence transportation decisions since it may influence the time of day at which trips are made and the degree to which trips must conform to externally imposed standards. For example, the focus group interviews indicated that students, homemakers, and retired/unemployed individuals have greater flexibility in the time of day at which they make trips than those who are employed full or part-time. Given that certain characteristics of modes vary depending on the time of day (i.e., buses may be crowded and uncomfortable during rush hour, but relatively empty and comfortable in off-peak periods), these groups may differ in their experiences and, thus, their mode perceptions. In fact, some comments were made that support this contention. Individuals working outside the home

*It is possible for an individual to fall into more than one of these categories.

frequently mentioned crowding problems and difficulty in getting a seat on the buses, while students and elderly (retired) indicated no such problems. In addition, individuals who work outside the home experience more externally imposed standards for their travel behavior than those who are unemployed or work at home (i.e., they must be at their destination at a specific time). Such individuals may be more concerned with attributes of modes which affect their ability to meet these constraints (i.e., on-time performance). Support for this hypothesis stems from the fact that focus group participants who worked outside the home placed more emphasis on mode reliability than student or elderly participants. Finally, occupational role may influence decisions by mediating mode availability. It is hypothesized that individuals employed full-time outside the home may be given priority over others (i.e., part-time workers, homemakers) in their choice of models. Consistent with this hypothesis, several part-time workers mentioned choosing a mode from a set of alternatives remaining after the full-time worker in the household made his/her choice.

Another role which the focus group interviews indicate may influence transportation decision making is whether or not the individual has the role of a spouse or roommate. Specifically, the interdependency inherent in living with another person is likely to impact transportation decisions. For example, individuals who live together often coordinate their schedules to ensure (say) sharing meals, and share resources such as an auto. As a result, such individuals may place more emphasis on mode attributes which facilitate meeting a schedule (i.e., reliability, flexibility) than individuals who live alone. And,

individuals who live together may find that their mode availability is jointly determined (i.e., one person only has the car available if the other person is willing to travel by public transportation).

Whether or not an individual is a parent also may impact transportation decision making. Working parents in the focus groups, particularly those with preschool children, indicated that they typically drop off and pick up their children at day care centers, schools, etc., on their way to and from work. Such parents' mode choice for work trips may be limited to alternatives flexible enough to accomodate these side trips. In many cases, private auto is the only mode which meets this criterion. Furthermore, whenever a child accompanies a parent on a trip, at least two factors not otherwise considered appear to influence mode selection: 1) the child's ability to use the mode (i.e., can the child walk the distance to the bus stop?) and 2) the hassle for the parent associated with the child using the mode (i.e., will the parent have to carry along cumbersome equipment such as a stroller?).

In addition to occupation, spouse/roommate and parent roles, a variety of socialized, gender-linked roles that have existed historically may mediate transportation decision making.* For example, discussion in the focus group interviews reveals that women, regardless of their occupational role, tend to assume primary responsibility for the homemaker and parent roles. As a result, the women often are performing more roles than their male counterparts. In order to manage these

*Socialized gender-linked roles refer to roles which while not biologically based have been traditionally associated with either males or remales as the result of socialization processes.

multiple roles, women indicated that they not only have to schedule their trips carefully, but also make most trips serve multiple purposes. Therefore, these women place greater emphasis on having a reliable, flexible mode of transportation than men and find that private auto most frequently meets their needs.

Another socialized gender-linked role suggested by the focus group analysis is the role of women as physically weaker and more vulnerable to physical attacks than men. In the interviews women consistently mentioned issues related to physical safety in their discussions of travel alternatives and choices, whereas men rarely mentioned such concerns. In general, women perceived all modes to offer some safety risks (i.e., risk of attack in parking garages when driving, risk of attack while riding the "el", risk of attack while walking to or from the bus stop). However, only when a mode is perceived to be extremely unsafe, as is the case with the "el", does safety appear to serve as a major deterrent to mode usage.

Finally, in addition to what roles an individual plays, the combination of different roles played may also influence travel decisions. It was noted earlier than women who work outside the home may have multiple roles since they also tend to perform the homemaker and parent role and that this necessitates a reliable, flexible mode of transportation so that multi-purpose trips can be performed efficiently. The same holds true regardless of the specific roles performed or the gender of the performer--as the number of roles increases there appears to be a greater need for reliable, flexible modes of transit.

Furthermore, as the number of roles performed increases, the cost of nonproductive travel time increases. As a result, there is a motivation to find either faster means of travel or ones where travel time can be used productively. Also, individuals who play multiple roles which require considerable people contact (i.e., spouse, parent, full-time worker) may have little time alone. Consequently they may place a higher value on the privacy afforded by alternative modes of travel in making their travel decision than persons playing fewer roles. Several focus group participants expressed this desire for privacy and time alone as part of their motivation for using a private auto or the train for their work trips.

In summary, the focus group interviews suggest that several roles may mediate travel decisions. These roles and their hypothesized impacts are summarized in Table 1. In addition, analysis of the focus group interviews indicates that due to socialized gender-linked roles, this type of qualitative research may elicit different data from male and female participants. Specifically, it was observed that male participants resisted discussing their own transportation needs and feelings and instead treated the interviews as problem-solving tasks where they attempted to define and uncover solutions to abstract problems. In contrast, female participants were quite willing to discuss their own feelings, needs, and desires with respect to transportation. Given this difference in orientation in focus groups, caution should be taken in making cross-gender comparisons on the basis of this data. In the next section, quantitative analysis is undertaken to further explore some of the roles and hypotheses described here.

Quantitative Approach

The purpose of this section is to extend the qualitative analysis by quantifying role influences in the consumer transportation decision making process. This is done through analysis and comparison of consumers' perceptions, feelings, preferences, and choices of alternative modes of travel, within different role groups, using data from the nonwork/nonschool trip to downtown Evanston questionnaire.

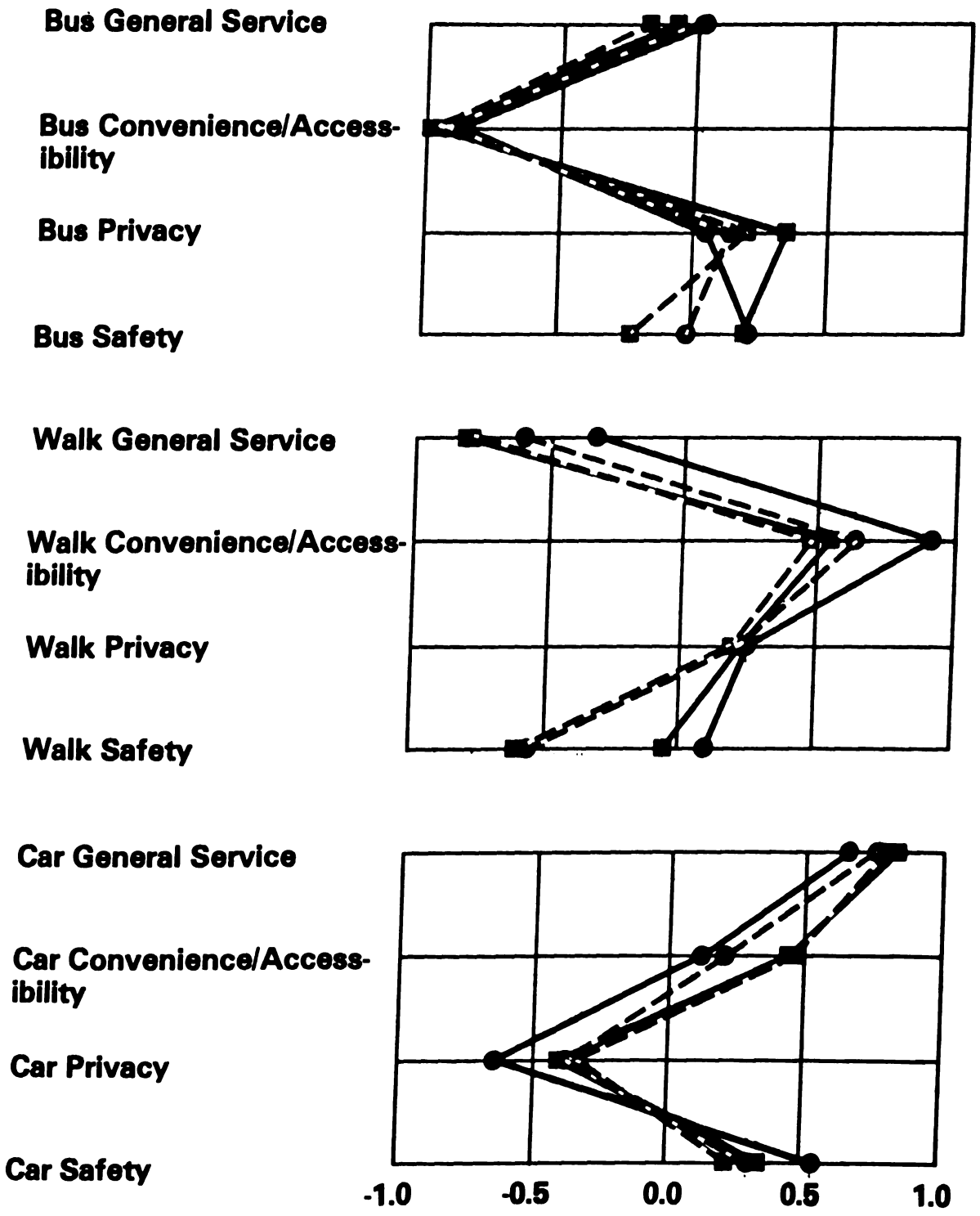
The prior identification of role differentiated groups is limited by the data available to us. Since explicit role defining data is not included in this data set, we must rely on selected demographic characteristics of the individual and his/her household to infer roles. It would be desirable to consider gender, employment status, and role in the household which might be defined by marital status, employment of spouse, or child care responsibilities. However, this range of role-related categorizations is too extensive to explore with the available data set which includes 446 individuals. Thus, the analysis is undertaken using gender and occupation (full-time worker, part-time worker or student, homemaker) categories only. The number of individuals in each category is given in Table 2. The absence of males who identify themselves as homemakers makes it impossible to separate the effects of being a homemaker from those of being female. Thus, our analysis considers first the 2 by 2 gender-occupation categorization excluding homemakers and second comparison between homemakers and other females.

Perceptions of transportation service are obtained by responses to twenty-four Likert statements for walk, bus, and car. These responses

INDIVIDUALS IDENTIFIED BY GENDER AND OCCUPATION

	Male	Female	All
Full-Time Worker	160	91	251
Part-Time Worker or Student	51	78	129
Homemaker	0	66	66
All	211	235	446

AVERAGE PERCEPTION FACTOR SCORES FOUR GENDER-OCCUPATION GROUPS



are standardized and factor analyzed to identify a reduced set of underlying characteristics identified as general service, convenience and accessibility, privacy, and safety. Feelings about transportation modes are similarly obtained by responses to sixteen Likert statements. These responses are standardized and factor analyzed to obtain feelings measures for each mode. Preferences for and choice of travel mode are examined directly and are related to mode perceptions and opinions by logit analysis. (9)

Differences between groups are identified and tested for significance. Differences in perceptions, feelings, preferences, and choice are examined by analysis of variance using each item or set of items as dependent variables and gender-occupation roles as treatments or explanatory variables. Differences in the influence of perceptions and opinions on preference and choice of modes are examined by comparison of logit models for preference and choice. The results of these tests are reported in the following paragraphs.

Average perceptions are described by plots in Figure 2 for the five gender-occupation categories defined above. Figure 2 shows substantial agreement in some perceptions for some groups but also identifies a number of specific differences. These differences in perceptions are tested for significance by (1) examining all perceptions for all modes as a group, (2) examining all perceptions for each mode as a group, and (3) examining each perception for each mode separately. The significant group comparisons are summarized in Table 3. The major finding is that highly significant differences in perceptions exist

TABLE 3

Differences in Perceptions
All Factors by Mode and Combined

Comparison	Differences Identified	Level of Significance *
All Factors For All Modes	Males vs. Females (All)	.0001
	Full-time vs. Part-time (Male)	.0001
All Factors For Bus	Males vs. Females (Full-time Workers)	.0001
All Factors For Walk	Males vs. Females (All)	.0001
	Full-time vs. Part-time (Male)	.0001
All Factors For Car	Full-time vs. Part-time (Male)	.0001

* Based on Hotelling's trace statistic
with criterion set at 0.001

between men and women and between men who work full time and those who work part time or are students. There are no significant differences between women in different occupation groups. Detailed comparisons, Table 4, indicate the sources of the differences reported in Table 3. Females have significantly lower perceptions of safety than men for bus and walk (Figure 3A). There are also significant differences between male full-time workers and male part-time workers/students primarily with respect to general service and convenience/accessibility (Figure 3B). The only significant differences between women in different occupation categories are for convenience/accessibility between full-time workers and part-time worker/students for walk and car and walk general service between part-time females and homemakers.

Average feelings rating for bus, walk, and car are plotted in Figure 4. The largest differences occur between occupation categories for men and women for walk opinions. Smaller differences in walk feelings exist between men and women in common occupation groups. Statistical tests indicate that these differences are significant at the .01 level between part-time and full-time men and between part-time and homemaking women. The differences in feelings for the bus and car modes are not statistically significant between any gender categories (even at the .05 level). It is interesting to note that homemakers have the most positive feelings about bus and car and the least positive feelings about walk.

Although differences in perceptions and feelings were obtained for the role groups, these differences could be attributable to factors other

TABLE 4

Analysis of Differences in Perceptions
Individual Factors by Mode

Mode	Comparison Characteristic	Differences Identified: Rated High By	Rated Low By	Level of Significance
Bus	General Service	Homemaker (Female)	Full-time (Female)	.004
	Convenience/Accessibility	--	--	--
	Privacy	--	--	--
	Safety	Males (All)	Females (All)	.0001
Walk	General Service	Part-time (Male) Part-time (Female)	Full-time (Male) Homemaker (Female)	.002 .002
	Convenience/Accessibility	Part-time (All) Males (Part-time)	Full-time (All) Females (Part-time)	.0002 .006
	Privacy	--	--	--
	Safety	Males (All)	Females (All)	.0001
Car	General Service	--	--	--
	Convenience/Accessibility	Full-time (All)	Part-time (All)	.0004
	Privacy	--	--	--
	Safety	--	--	--

* Based on univariate analysis of variance hypothesis tests with criterion set at 0.01.

FIGURE 3A

AVERAGE PERCEPTION FACTOR SCORES MEN VS WOMEN

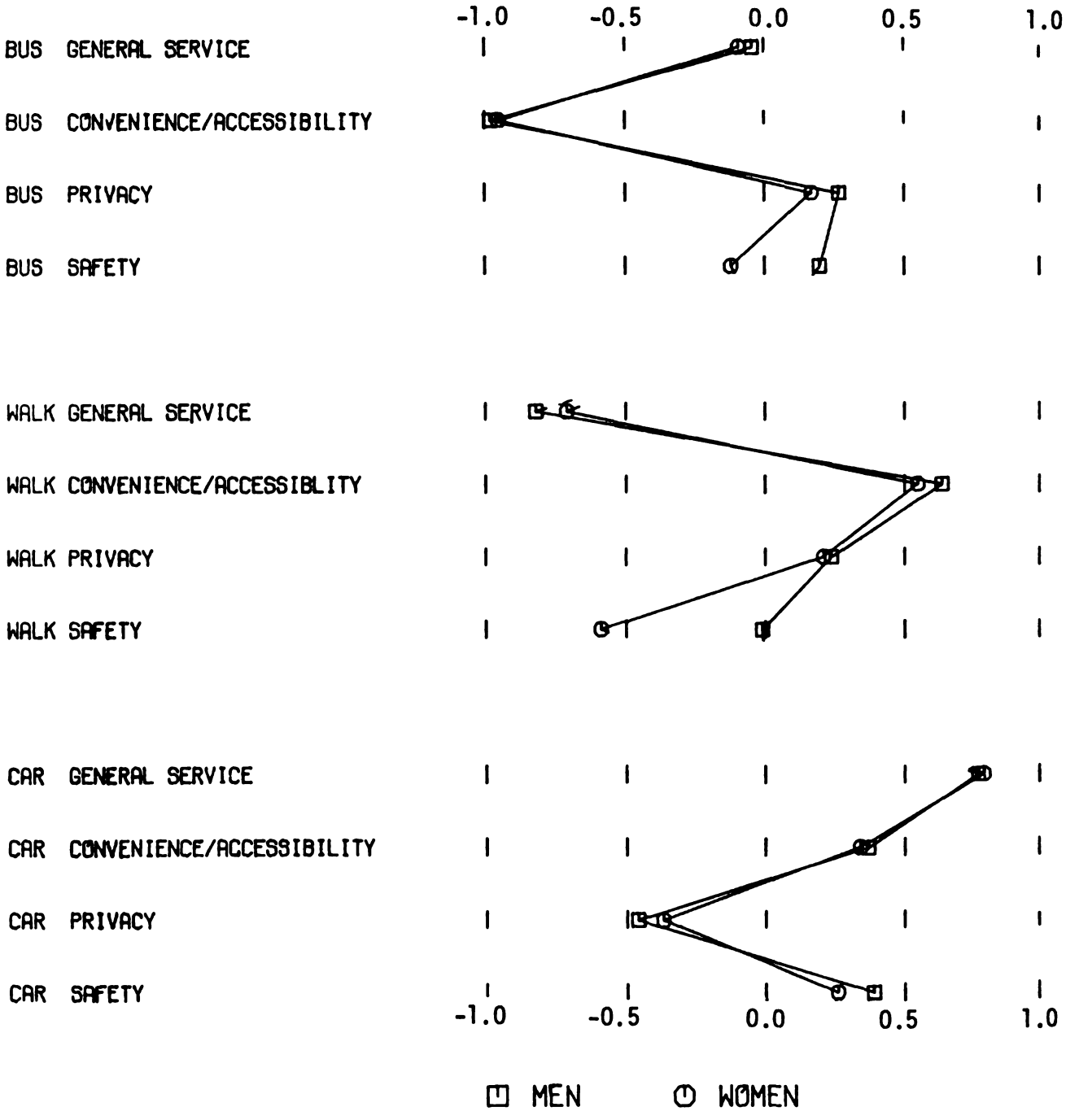


FIGURE 3B

AVERAGE PERCEPTION FACTOR SCORES
FULL TIME MEN VS PART TIME MEN

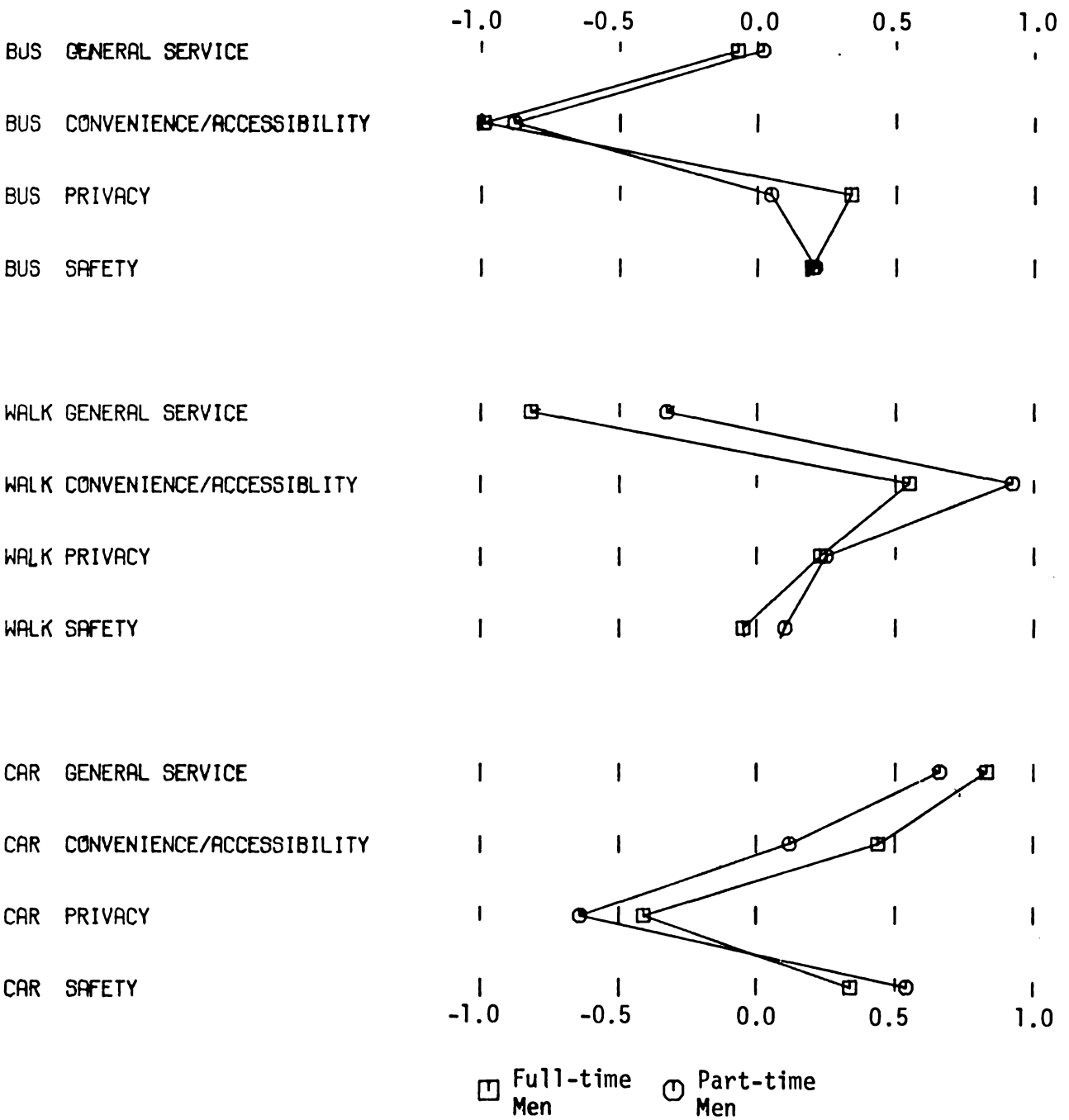
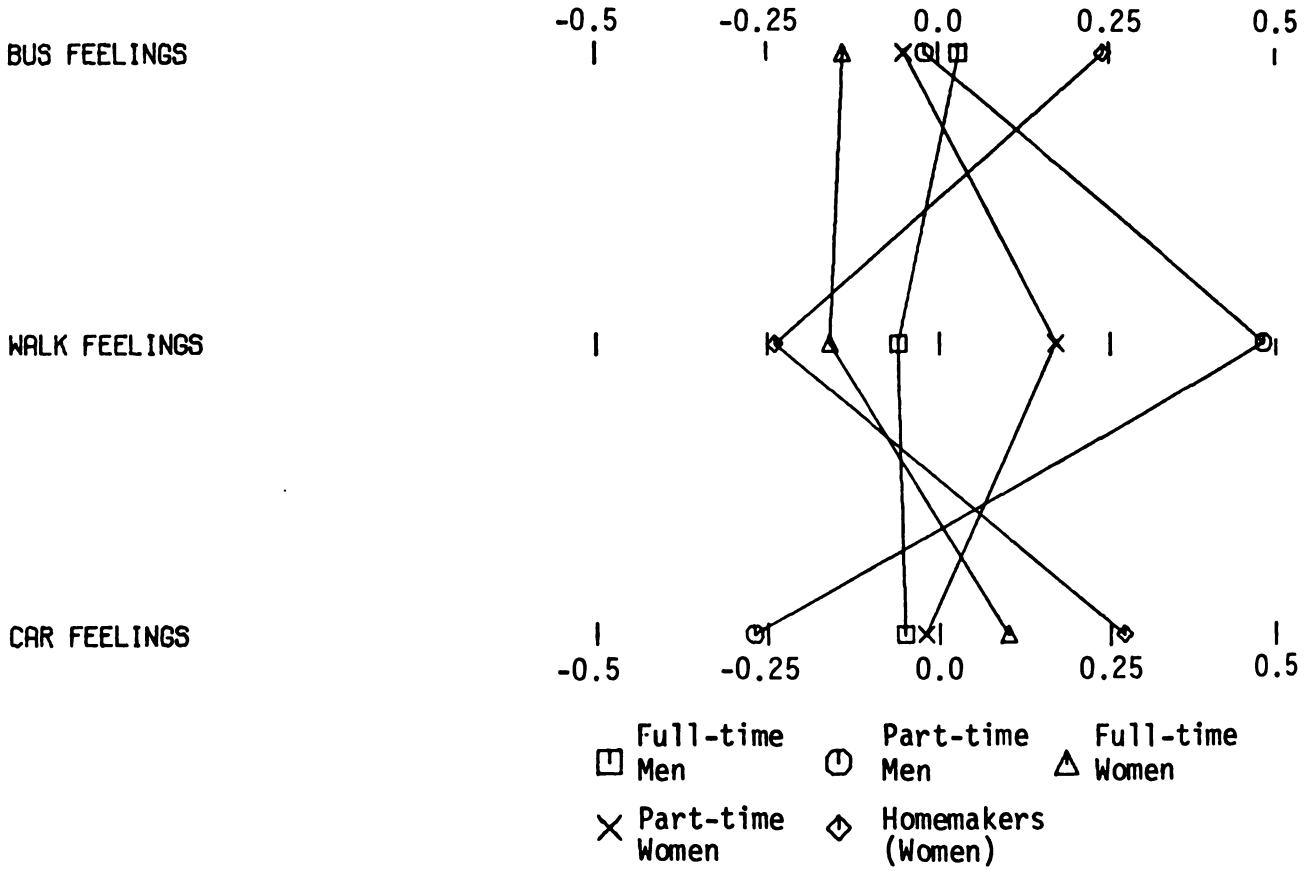


FIGURE 4

AVERAGE FEELINGS FACTOR SCORES FIVE GENDER-OCCUPATION GROUPS



than role which happen to covary with role. Specifically, individuals in different role groups may differ in their mode familiarity or experience, and this experience, in turn, may influence perceptions and feelings. To examine this possibility, differences in perceptions and feelings across role groups were re-examined within selected homogeneous experience subgroups. Sub-samples were selected on the basis of frequency of use for each mode (low, moderate, and high) and then analysis of variance for gender and occupation was performed for each sub-group. This analysis resulted in two important observations. First, significant differences exist in perceptions and attitudes for all data sub-samples, which include more than 100 observations. Second, the character of the differences between gender-occupation groups differed for the various subsets. In particular, the smallest differences in attitudes were identified for individuals characterized as high frequency automobile users.

Next, we examined differences in how gender-occupation groups use their perceptions and feelings to determine their stated first preference, and how these factors, along with a situational constraint, auto availability, guide reported mode choice. However, before turning to models predicting preference and choice, we analyzed differences in first preference and most recent choice shares for gender-occupation groups (see Table 5). The differences in preference between men and women within work group are generally small. However, first preference differences between work groups are large with full-time workers and homemakers expressing much higher first preference for car than part-time workers/students. Significance tests confirm

TABLE 5

First Preference and Most Recent Choice
Mode Shares by Group (percentage)

First Preference

		Men	Women
Full-time Workers	Bus	.11	.04
	Walk	.13	.16
	Car	.76	.79
Part-time Worker/Students	Bus	.10	.14
	Walk	.37	.27
	Car	.53	.59
Homemakers	Bus	-	.09
	Walk	-	.11
	Car	-	.80

Most Recent Choice*

		Men	Women
Full-time Workers	Bus	.06	.14
	Walk	.10	.08
	Car	.79	.78
Part-time Worker/Students	Bus	.10	.10
	Walk	.41	.26
	Car	.39	.59
Homemakers	Bus	-	.20
	Walk	-	.05
	Car	-	.70

* Shares do not sum to 1.0 as some individuals reported other modes taken such as bicycles or taxis.

these results (Table 6). The only significant differences in first preference are between work groups. Differences in choice behavior are similar in that the largest and only significant differences are between occupation rather than gender categories.

The influence of mode service perceptions and feelings on reported first preference was estimated for both the entire population and each gender-occupation subgroup. These models include four perception factors and three mode specific feelings factors. The results of significance tests for differences in preference models for gender-occupation groups are presented in Table 7. Segmentation into four groups is significant (0.05 level). The major difference is between males and females (0.01 level) and this difference is located in the group of full-time workers (0.01 level). There is no significant difference in preference models between homemakers and other women. Table 8 compares models for full-time working males versus females. The coefficients for perceptions and feelings in the models for men all have the correct (positive) sign and are almost all significant. Comparison between models estimated for men and women indicates that men place significantly greater importance on convenience/accessibility, privacy and safety than women. Both groups appraise general service and mode feelings similarly. Similar results were obtained in a comparison between all males and females.

The influence of perceptions and feelings on reported choice was also estimated for both the entire population and each gender-occupation subgroup. These models include the same variables as those in the

TABLE 6

Significance of Differences in First Preference and Choice Mode Shares*

Groups	Levels of Significance**							
	First Preference				Choice			
	All Modes	Bus	Walk	Car	All Modes	Bus	Walk	Car
Full-time vs. Part-time (Males)	.001	NS	.001	.001	.001	NS	.001	.001
Full-time vs. Part-time (Females)	.010	NS	NS	.004	.001	NS	.001	.007
Part-time vs. Homemaker (Females)	NS	NS	NS	.005	.004	NS	.001	NS

* No significant differences exist between females who are full-time workers versus homemakers or between males and females in common occupation groups.

** NS indicates not significant at 0.01 level.

TABLE 7

Significance Tests for Differences in Preference Models

Comparison	X^2	Degrees of Freedom	Level of Significance
Four Categories	41.3	27	0.05
Males (Full-time) vs. Males (Part-time) vs. Females (Full-time) Females (Part-time)			
Males vs. Females (All)	21.5	9	0.01
Full-time vs. Part-time (Males)	9.8	9	NS
Full-time vs. Part-time (Females	9.9	9	NS
Full-time vs. Part-time (All)	8.6	9	NS
Males vs. Females (Full-time)	21.3	9	0.01
Males vs. Females (Part-time)	11.4	9	NS
Homemakers vs. Other Women	9.4	9	NS

TABLE 8

Preference Model Comparison
Full-Time Workers
Women vs. Men

Variable	Coefficient Values and Differences*			Level of Significance
	Women	Men	(Women-Men)**	
General Service	2.24 (2.97)	1.94 (3.85)	--	
Convenience/Accessibility	-0.34 (-0.62)	1.18 (2.69)	-1.52 (2.17)	0.02
Privacy	-0.64 (-1.35)	0.48 (1.34)	-1.12 (1.89)	0.05
Safety	0.071 (-0.16)	0.91 (2.16)	-0.99 (1.59)	0.10
Bus Feelings	2.29 (1.75)	1.74 (2.66)	--	
Walk Feelings	2.95 (2.75)	1.68 (1.92)	--	
Car Feelings	0.76 (1.43)	1.00 (2.88)	--	
Walk Constant	2.45 (1.41)	-0.24 (0.23)	2.68 (1.33)	0.10
Car Constant	2.67 (1.67)	1.47 (1.81)	--	
Likelihood Ratio Statistic	133.0	227.6		
Percent Correctly Predicted	85.9	88.36		
Information Measure	0.71	0.71		
Observations	85	146		

* numbers in parentheses are t- statistics
** differences which are not significant at the 0.10 level are not reported

first preference model plus an automobile constraint variable defined as the number of cars per driver in the household. Segmentation into four groups is significant at the 0.05 level (Table 9). This significance is primarily attributable to differences between full-time and part-time workers (0.05 level) and particularly between male full-time and part-time workers (0.025 level). There is no significant difference between homemakers and other women. Models for male full-time and part-time workers (Table 10) indicate much better goodness of fit and correct signs for full-time workers and some incorrect but not significant parameters for part-time workers. The only parameters which are significantly different between full and part-time workers are for privacy which is considered to be more important by full-time workers. This applies to all full-time workers as well as male full-time workers considered above.

In summary, quantitative analyses identified differences between gender-occupation groups in the different stages of the consumer response process described in Figure 1. The segments for which differences were identified varied for different stages in the response process. Specific findings are:

> There are differences in perceptions about transportation services between gender-occupation groups. Significant differences between males and females are primarily related to perceptions of safety particularly for bus and walk. Significant differences between males in different occupation groups are primarily related to general service and convenience/accessibility.
>
> Differences in feelings about modes are significant only for the walk mode between males working full-time (low rating) and males working part-time/students (high rating) and between females working part-time/students (high rating) and female homemakers (low rating).

TABLE 9

Significance Tests for Differences in Choice Models

Comparison	X^2	Degree of Freedom	Level of Significance
Four Categories	45.9	30	0.05
Male (Full-time) vs.			
Male (Part-time) vs.			
Female (Full-time) vs.			
Female (Part-time) vs.			
Males vs. Females (All)	13.4	10	NS
Full-time vs. Part-time Male	20.7	10	0.025
Full-time vs. Part-time Female	11.7	10	NS
Full-time vs. Part-time (All)	18.9	10	0.05
Male vs. Female Full-time	15.8	10	NS
Male vs. Female Part-time	11.1	10	NS
Homemakers vs. Other Women	14.7	10	NS

TABLE 10

Choice Model Comparison

Male Full-time vs. Part-time Workers

Variable	Coefficient Values and Differences*		
	Full-time	Part-time	Difference (Full-time-Part-time)**
General Service	1.08 (2.65)	1.24 (2.03)	--
Convenience/Accessibility	0.72 (1.84)	1.52 (2.44)	--
Privacy	0.91 (2.61)	-0.48 (0.91)	1.39 (2.21)
Safety	0.68 (1.63)	0.03 (0.06)	--
Bus	1.81 (2.05)	1.99 (1.21)	--
Walk	0.24 (0.41)	0.42 (0.44)	--
Car	0.18 (0.52)	0.13 (0.26)	--
APD	1.81 (1.78)	0.99 (0.98)	--
Walk Constant	1.48 (1.26)	-0.00 (0.00)	--
Car Constant	2.37 (1.89)	-0.89 (0.57)	3.26 (1.63)
Likelihood Ratio Statistic	209.1	34.71	
Percent Correctly Predicted	88.3	71.1	
Information Measure	0.69	0.41	
Observations	137	38	

* numbers in parentheses are t- statistics
** differences which are not significant at the 0.10 level are not reported

Differences in preference formation are significant between males and females especially those who are full-time workers. Males place greater emphasis on convenience/accessibility, privacy, and safety, none of which significantly influence female preferences. Females have a strong unexplained bias toward walk and car over bus.

Differences in mode choice are significant between full-time workers and part-time workers/students particularly for males. These differences are primarily due to a greater emphasis on privacy by full-time workers. The differences in evaluation of mode characteristics weights between males and females observed in preference formation persist in choice but are not significant by conventional standards.

Discussion

Earlier in this paper, a methodology for examining role influences in transportation decision making was developed. This methodology, which combines qualitative and quantitative research techniques, was applied to an existing data base in an effort to gain insight into both the methodology and the effects of roles on travel decisions. In this section, the substantive findings of this application are summarized and discussed, and theoretical, methodological, and practical implications of these findings are examined.

Summary of Findings

On the basis of the qualitative analysis, a number of hypotheses about role influence in transportation decision making were developed. Then, those hypotheses pertaining to occupation and gender-related roles and nonwork/nonschool trips were tested through quantitative analysis of the impact of these roles on consumer perceptions and feelings about transportation alternatives, and the process by which such perceptions and feelings guide mode preference and choice. In general, the hypotheses about the influence of occupation and

gender-related roles on travel decisions generated in the qualitative analysis were supported in the quantitative analysis. The specific findings are detailed below.

The qualitative analysis suggested that several differences in mode perceptions and mode feelings exist for occupation and gender groups. Specifically, it was anticipated that full-time workers would have different perceptions of the service characteristics of modes than part-time workers or students, because full-time workers generally make nonwork/nonschool trips at different times of the day and, thus, experience different levels of service than part-time workers or students. The quantitative analysis supported this hypothesis in that: 1) full-time workers were found to perceive car as better on the general service and convenience/accessibility dimensions than part-time workers or students, and 2) full-time workers were found to perceive the walk mode less favorably on the convenience/accessibility dimension than part-time workers or students. These results may be explained by the fact that full-time workers are likely to make nonwork/nonschool trips to downtown Evanston in the evening or on weekends when car may provide better service due to less traffic, more parking spaces available, etc. In contrast, walking to downtown Evanston may be perceived to be less convenient/accessible for full-time workers than for part-time workers or students, because full-time workers may be tired from a long day of work or reluctant to use their limited nonwork time walking when faster modes are available.

The qualitative analysis also led to the hypothesis that, due to socialized perceptions of themselves as weaker and more vulnerable to attack than males, females would perceive all modes of transportation to be less safe than would males. This contention was supported in the quantitative analysis by the finding that females consistently rate all modes as less safe than males. These differences in ratings are significant for the walk and bus modes; those modes on which users are somewhat more vulnerable to attack than users of the car mode.

In addition, the quantitative analysis identified significant differences in general feelings about the walk mode for full-time workers and part-time workers/students. Full-time workers were found to have less positive feelings about the walk mode than part-time workers/students. Although this specific finding was not predicted on the basis of the qualitative research, it is consistent with the general argument that full-time workers are concerned about travel time. Since the walk mode typically involves a long travel time relative to car or bus, full-time workers may have more negative feelings about this mode than those who do not work full-time. An alternative explanation for this finding is that students, who are categorized together with part-time workers in our analysis, have a particularly positive evaluation of the walk mode for trips to downtown Evanston because they generally live quite close to the downtown area and are likely to have had good experiences with this mode.

The qualitative analysis also led to the hypothesis that occupation and gender groups would differ in their formation of preference and

choice. Specifically, analysis of the focus group interviews suggested that women often perform multiple roles (i.e., full or part-time worker, homemaker and parent) and as a result have a greater need for flexibility and reliability in transportation services than men. Thus, it was anticipated that women would place greater emphasis than men on general service and factors related to flexibility in formulating their mode preference and choice. The quantitative analysis of preference and choice provides some support for this prediction. In the preference models, significant differences between men and women who are full-time workers, were identified. Men's mode preference was found to be related to: 1) mode perceptions of general service, convenience/accessibility, privacy, and safety; 2) feelings about each mode; and 3) an unexplained car bias reflected in a dummy variable for this mode. Women's preference was related to: 1) only mode perceptions of general service, 2) feelings about each mode, and 3) a strong and highly significant bias in favor of car and walk compared to bus. A similar pattern of results was obtained in the choice models; however, the differences between men and women did not reach conventional levels of significance. These findings are consistent with our hypothesis. First, women place considerable emphasis on general service (although not significantly greater emphasis than men). Second, their bias toward car and walk may be interpreted as a bias toward modes offering high flexibility. That is, women's desire for flexibility may have been captured in the

general mode biases because the concept of flexibility was not well represented in the perceptual factors included in the model.*

One further observation should also be made with respect to women's mode preference and choice. Although the perceptual analysis indicated that women evaluate all modes as less safe than men, mode safety was not an important determinant of their preference and choice. This finding may stem from the fact that all modes were viewed by women as relatively unsafe and therefore safety was not a useful dimension for discriminating between them. If the mode alternatives had included a mode perceived to be extremely unsafe, such as the el, safety might have been a more important factor in determining preference and choice.

Finally, on the basis of the qualitative research it was predicted that full-time workers would place greater importance on the privacy offered by a mode than part-time workers/students in determining their preference and choice. This was expected because full time workers generally have less time alone or opportunity for privacy during the day than part-time workers/students. Although no significant differences related to the occupation groups were found in the preference models, significant differences between full-time workers and part-time workers/students were identified in the choice models. As predicted, these differences were primarily attributable to full-time workers placing greater emphasis on privacy than part-time workers/students.

*While flexibility was included in the original attribute ratings, it did not load heavily on any of the dimensions extracted in the factor analysis and thus was not represented directly in the preference or choice models.

Theoretical, Methodological and Practical Implications

From a theoretical and methodological perspective, our analysis has several implications. First, our results support the use of the consumer oriented approach (Figure 1) in research examining role influences in transportation decision making. We found that the impact of gender and occupation roles varies depending on the stage in the consumer response process. Thus, ignoring any stage in this process or compressing the process to a single stage, as is done in traditional models of travel demand, serves to reduce understanding of actual role influences in transportation decision making.

Second, the research raises the issue of how roles should be defined and operationalized. Because we employed an existing data set in our analysis, we were limited to defining roles on the basis of demographic characteristics. Clearly, this is not the only way to identify roles. An alternative approach would be to place individuals in role categories on the basis of their self-perceptions or behavior. Because individuals' self-perceptions, behavior, and demographic characteristics may or may not converge (i.e., an individual can legally be a parent or spouse but neither perceive himself/herself to have that role or behave as if he/she is playing that role); it is important to decide which procedure for defining roles truly captures the construct of interest. This is an issue which participants in this conference and other researchers must resolve. Perhaps all three role indices--self-perceptions, behaviors, and demographic characteristics--should be developed and compared. If this is to be done, methods of

measuring role self-perceptions and behavior must be developed and included in research instruments.

Third, before unequivocal causal statements about the impact of roles on transportation decision making can be made, the impact of factors which may covary with role, such as mode experience, must be identified, measured and controlled for. We illustrated one approach for doing this in our application. We created groups which were homogeneous in terms of past experience and examined the impact of role on mode perceptions and feelings within these subgroups. An alternative approach is to use variables like experience as covariates in analysis of variance for role effects.

Finally, our analysis supports using a combination of qualitative and quantitative methods to examine role influences in transportation decision making. It demonstrates that qualitative analysis can help generate hypotheses about role effects and can also provide input for the development of structured data collection instruments examining role effects. Quantitative analysis compliments the qualitative research by providing a rigorous test of the hypothesis generated. When the results of the two methods converge, the researcher can have increased confidence in the finding obtained. When convergence is not achieved, the disparity may provide insights for future research. However, one caution should be noted in using qualitative research to generate hypotheses about role influences. It was found that this type of research was not highly effective in eliciting personal feelings and desires from male participants. Although this problem

may disappear as men redefine their role and move away from stereotypes, it is something researchers should be sensitive to and try to overcome.

Our analysis also leads to several practical implications. The general finding that individuals in different gender and occupation-related roles vary in their transportation perceptions, feelings, preferences, and choice indicates that it is useful for transportation managers and planners to consider roles in designing transportation services. More specifically, the results suggest that women desire highly flexible, reliable means of transportation. Further, the demand for flexible, reliable transportation service is likely to increase as more women enter the labor force and as the number of male and female single heads of households increase. Thus, transportation planners would be wise to focus their efforts on developing a flexible, reliable alternative to the private auto. Further, our findings suggest that if transportation planners and managers desire to attract commuters to public transportation they must provide not only a high level of general service, but also find ways to insure the privacy of users.

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WOMEN'S TRAVEL BEHAVIOR AND ATTITUDES: AN EMPIRICAL ANALYSIS

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Introduction

Travel behavior models and transportation research in general have paid little attention to gender as an important descriptive and predictive variable, and even today only a small amount of data on the subject is readily available. Given that women may have different travel patterns from men, and given the likelihood that some gender-related needs are not well met (or understood) by present transportation systems, there is a need for studies to document and explain whatever differences exist. Just as importantly, documentation of differences in attitudes towards travel and different modes of travel is needed. Such documentation is important for describing and understanding our environment and for making policies which will impact positively on our transportation problems. In addition, the techniques utilized here, if successful, may well be extended to similar gender-related questions in future research. This paper provides detailed information on travel behavior and attitudes as related to gender. It reports on an analysis which explores observed differences in male and female travel attributes in data from a recently gathered survey. The data are from Danville, Illinois and

were gathered in conjunction with the evaluation of a Service and Methods Demonstration funded by the Urban Mass Transportation Administration. A number of the individual characteristics, demographics, travel patterns, and travel attitudes studied in the sample of almost nine hundred households do indeed show significant gender-related differences. Most of the characteristics of these differences are as would be expected, but a few are somewhat counterintuitive. For a large number of travel attitudes, no significant difference between the sexes can be found, but the exceptions that exist exhibit a clear pattern of an "anti-transit" bias among males and the opposite among females.

In this study, the observed differences between the sexes are examined to see if they are really attributable to gender or whether they are instead attributable to items for which, in today's society, gender has become a proxy. Multivariate models are built to study these differences, and factors other than gender are used as explanatory variables in these models. There are a number of indications that differences which initially appear to be gender-related are indeed more likely related to income, job status, car ownership and similar variables. In short, this analysis seeks to calculate the observed characteristics of male and female travel behavior and attitudes and then to discover whether many of the observed differences in these norms are actually more related to a third set of characteristics than they are to gender.

Succeeding sections of this paper describe the data set used in this study, profile the sample population and its responses to various

attitudinal questions, and discuss multivariate analyses of some of the more interesting differences between males and females observed in the population profile are presented.

The Data Set

As mentioned above, the data set for this study is drawn from the responses to a survey undertaken in conjunction with the evaluation of an UMTA Service and Methods Demonstration in Danville, Illinois. Danville is a city of 42,000 people some 120 miles south of Chicago. It is the county seat, it is served by interstate highways and five railroads but it had no public transit until the demonstration, and it has many of the characteristics of a typical midwestern small city from the standpoint of industrial, population, and weather patterns. Of particular note is that while median income is not significantly different from national or midwestern norms, there are a few more elderly and minority (mainly black) residents than might otherwise be expected. Not too surprisingly, a large majority (over 80%) of the households in the city own automobiles.

The data used in this paper were collected prior to the implementation of the demonstration (which was a unique user-side subsidy of a new fixed-route transit system). Three different surveys (a screening survey, a telephone interview, and an at-home follow-up) were given to eight hundred and thirty individuals from an equal number of randomly chosen households. The data used in the analysis that follows was drawn entirely from the twenty-minute long telephone survey in part because of the paucity of responses to the at-home follow-up survey.

The sampling procedure was constructued such that every contacted zero-car household was interviewed but only every third one-car household and every eighth two or more car household was interviewed. In addition, the screening procedure resulted in a population sample of which 75% were females. Only 4% of the sample were males in zero-car households. Thus, unfortunately, any analysis of differences between males and females in zero-car households must be regarded as inconclusive. Table 1 summarizes the characteristics of the sample.

One should also bear in mind that these data were not collected specifically for an analysis of male/female travel attitude and behavior differences. This study thus had to be content with existing information which did not include all the variables that one would desire for this type of analysis. Information on additional items for which gender might be a proxy, particularly educational background, type of job and salary would have been desirable but was not available in the data set. More detail on the demonstration, the site, and the surveys (including the actual instruments) is available from Abt Associates (in its various project reports) or from Crain and Associates (in particular, see "Danville Evaluation Plan" Crain and Associates, March 1978).

Initial Analysis

The initial analysis of the data set consisted of documenting male and female travel behavior and responses to the attitudinal questions in order to identify significant differences. This section presents these results; multivariate analysis of some of the differences is discussed in the next section.

TABLE 1. SOCIO ECONOMIC DESCRIPTIONS IN THE DANVILLE DATA SET

HOUSEHOLD DESCRIPTORS

- **# CARS**
- **INCOME**
- **FEMALES/MALES** 10-15, 16-20, 21-54, 55-64, 65+
- **# VEHICLES**

INDIVIDUAL DESCRIPTORS

- **SEX**
- **RELATION TO HEAD OF HOUSEHOLD**
- **WORK STATUS**
- **AGE (5 CATEGORIES)**
- **YEARS LIVED IN DANVILLE**
- **DRIVER'S LICENSE**
- **DIFFICULTY DRIVING**
- **PROBLEM USING REGULAR TRANSIT**
- **AUTO AVAILABILITY**
- **TRIPS, PURPOSE, MODE, FOR ONE DAY**

The tables that follow summarize the responses of the individuals to selected questions. Because of the different sampling ratios (as a function of the number of automobiles in the household) mentioned above, means for each questions were calculated for each car ownership stratum. The stratified means were then factored into a sample-wide mean by using a weighted average (weighted by the reciprocal of the sampling ratio) in order to arrive at a mean for a random individual from a random household. The means were not adjusted for telephone non-response bias.

Travel behavior responses are presented in Tables 2 and 3. The means for trip purpose (see Table 2) show striking differences between males and females in three rather unsurprising categories. For the entire (weighted) sample, males are almost twice as likely to make a work trip as are females (27% to 15%), but females are over three times as likely to make shopping (13% to 5%) and "serve passenger" (10% to 3%) trips as are males. The responses are not significantly different (based on a Chi-squared test) for any other trip purpose. Such results are as might have been expected before the calculations were done; while the male is off working or going to work, the female is doing domestic work (and taking domestic trips) like shopping and driving the family around town.

The means for trip frequency (Table 3), where a trip is defined as transit from one point to another (so that a round trip counts as two trips), are also quite sensitive to work status. The weighted averages show that males take about half a trip per day more than

TABLE 2. TRIP PURPOSE AS IT RELATES TO AUTOMOBILE OWNERSHIP AND GENDER

DESTINATION PURPOSE (% OF TRIPS)	0-CAR		1-CAR		2 (OR MORE) CARS		WEIGHTED AVERAGE	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
HOME	49%	39%	39%	39%	40%	38%	40%	38%
WORK	5	16	19	14	33	15	27	15
SHOPPING	21	15	5	11	4	14	5	13
SOCIAL/RECREATIONAL	10	13	11	12	10	9	11	11
SERVE PASSENGER	0	1	5	9	1	11	3	10
SCHOOL	5	1	4	1	4	5	4	4
OTHER	10	12	16	12	8	8	11	10

TABLE 3. TRIP FREQUENCY

	AVERAGE DAILY TRIP FREQUENCY	AVERAGE DAILY NON-WORK TRIP FREQUENCY
0- CARS		
MALES	1.52	1.30
FEMALES	.88	.57
1-CAR		
MALES	2.74	1.70
FEMALES	2.08	1.45
2—(OR MORE) CARS		
MALES	3.04	1.00
FEMALES	2.68	1.80
WEIGHTED AVERAGE		
MALES	2.86	1.37
FEMALES	2.32	1.65

females do (2.86 to 2.32), but this difference is understandable when the number of work trips documented in the previous table is considered. When the means of non-work trips per day are calculated, the ranking reverses, and females appear to travel more than males by a bit less than a third of a trip per day (1.65 to 1.37). Whether this difference in frequency between males and females is related to gender totally, or whether it can be tied to characteristics of individuals such as income and work status, is investigated by multivariate analysis below.

Travel attitudes were investigated with three general types of attitudinal questions, and the means for the responses to these questions are presented in Tables 4, 5, and 6. The first set of questions (modal preferences) asked the respondent to state preferences for the various available and soon-to-be-available modes in Danville. The second set of questions (attribute preferences) asked the respondent to rank five modal attributes such as speed and comfort. The final set of attitudinal questions analyzed in this paper (the questionnaire contains other sets less applicable to the present study) was a list of travel-related statements with which the repondent was asked to agree or disagree.

Modal preferences show quite similar means for the two sexes when only the presently available Danville modes (car, taxi, and walking) are analyzed. As can be seen in Table 4, both males and females show a strong (over 90%) first preference for the car and split their second preference between walking and taxi. When the respondents are asked in what place (first through fourth) they would place the new

TABLE 4. MODAL PREFERENCE

"THINKING NOW JUST ABOUT TRAVELING BY CAR, TAKING A TAXI, OR WALKING, WHICH DO YOU PREFER MOST FOR GETTING AROUND IN DANVILLE? WHICH DO YOU PREFER SECOND MOST FOR GETTING AROUND IN DANVILLE?"

PREFER MOST (PERCENT)	0 CARS		1 CAR		2 (OR MORE)CARS		WEIGHTED TOTAL	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
CAR	69%	66%	92%	93%	96%	96%	94%	91%
TAXI	12	21	1	3	0	0	1	3
WALKING	19	13	7	5	4	4	6	5
PREFER SECOND MOST								
CAR	17	20	6	6	5	3	65	6
TAXI	54	52	42	54	61	41	52	48
WALKING	29	29	52	40	34	55	42	46

WHEN THE BUS SERVICE BECOMES AVAILABLE IN DANVILLE, WHERE IN THIS LIST WOULD IT FALL? WOULD YOU PREFER IT MOST FOR GETTING AROUND?, SECOND, THIRD OR FOURTH MOST?

MOST	69	56	25	33	13	24	20	32
SECOND	30	30	53	52	49	58	50	53
THIRD	0	7	15	8	28	13	22	10
FOURTH	0	7	7	6	9	5	8	6

TABLE 5. ATTRIBUTE PREFERENCES

RANKING OF INDIVIDUAL QUALITIES OF GENERALIZED TRAVEL MODES FROM MOST IMPORTANT TO LEAST IMPORTANT BROKEN DOWN BY AUTOMOBILE OWNERSHIP AND GENDER.

PERCENT RESPONSE	0 CARS		1 CAR		2(OR MORE) CARS		WEIGHTED TOTAL	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
INEXPENSIVE								
MOST IMPORTANT	17%	24%	26%	28%	29%	21%	27%	24%
LEAST	22	13	15	14	14	9	15	12
ENJOYABLE								
MOST IMPORTANT	18	8	3	5	0	8	2	6
LEAST	18	23	35	22	36	33	35	27
FAST								
MOST IMPORTANT	4	2	10	6	13	13	11	9
LEAST	43	55	33	49	39	39	33	45
COMFORTABLE								
MOST IMPORTANT	0	11	5	9	4	6	4	8
LEAST	6	15	18	12	11	19	14	15
CONVENIENT								
MOST IMPORTANT	65	61	65	64	80	63	73	63
LEAST	4	3	1	3	0	2	1	2

bus service when it becomes available in Danville, however, some noticeable differences between males and females appear. While only 20% of the males (in the weighted average) would prefer the bus system (for getting around Danville), fully 32% of the females rank the bus first. Females also rank the bus second more frequently (but not significantly more) than males do, and the lower ranks have offsetting differences in the opposite direction. While this result in and of itself has little importance, the direction of the difference corresponds to those found in the sections below.

Attribute preferences also showed little difference that could be attributed to gender. The five attributes ranked by respondents -- that trips be inexpensive, enjoyable, fast, comfortable, and convenient -- showed more ranking variation due to car ownership (see Table 5) than they did due to gender. The most striking difference between males and females appeared to be that males preferred convenience more than females did (by a 73% to 63% margin). This is caused mainly by the huge preference (80%) of males from multicar households for convenience as an attribute. (It should be noted that percentages do not necessarily add up to 100% in this section because some respondents used the words "most important" as a descriptor rather than a ranking, so that two attributes could be "most" important to them.) The major conclusions to be drawn from this analysis of modal and attribute preferences is that, on the whole, the preferences of the two sexes are surprisingly similar and only differ slightly with respect to preferences for transit and for convenience.

The final set of attitudinal responses to be analyzed in this paper consists of the interviewees' aggrement or disagreement with a series of eighteen statements which were read to them. If a respondent could not make up her (or his) mind for a particular statement, then a response of "neither agree or disagree" was coded. The degree of non-response, which was not analyzed by gender, can be determined by subtracting the summed percentages from one hundred. As can be seen from the left side of Table 6, the statements themselves ranged from questions about personal travel preferences to statements about preferred transportation policies for their city. The responses to these statements provide the most revealing and useful description of the differences between male and female attitudes toward travel that we encountered in the survey.

Three of eighteen questions showed significantly different responses (as measured at the .05 level by the chi-square test) with respect to gender. These questions (noted with an asterisk in Table 6) related to enjoying driving, feeling uncomforable on public transportation, and giving up a car in the city. In each case, the male response to the statement was far more "pro-car" or "anti-transit" than was the female response. For instance, 60% of the weighted sample of the males agreed that no public transportation system imaginable could get them to give up their cars, while only 44% of the females felt the same way. A similar grouping of male-female differences was also found in the pattern of resonses which were almost (but not quite) significant at the .05 level. Of particular interest is a statement that cities should actively discourage people from

using cars: Though the weighted response for the entire sample showed that 22% of females agreed compared with only 12% of the males, this result missed being significant at the .05 level by an extremely small amount. Just as interestingly, the major reason for the decrease in significance is that in zero-car households the males were the ones who agreed most vehemently (46% to 13% for females). In effect, then, the females changed their opinions only slightly in different car ownership categories, but the males changed by a factor of ten.

A useful sidelight to the analysis of the statements emerges from a factor analysis that was performed on these items. In a varimax rotated factor matrix* four factors emerged: "Quality of Transportation Life", "Anti-Car", "Pro-Car", and "Anti-Transit". Of the four items that loaded significantly on the "Anti-Car" factor, three were the same items discussed above (enjoy driving car, discourage autos, and no system would make me give up my car).

Multivariate Analysis

The preceding section has described numerous apparent gender differences in the Danville survey. Most of these differences might have been anticipated before the research was begun. Women do more non-work travel than men, and they tend to travel more for shopping or to serve a passenger. In addition, the responses to a series of attitudinal questions indicate that women express a more favorable

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*For more information on the factor analysis, see Abt Associates' preliminary report on the subject.

attitude towards public transit (and less of a love for the private automobile) than do men.

The purpose of this section is to attempt to analyze these differences in detail in order to discover which can be attributed to actual differences between the sexes and which are instead attributable to personal (or household) characteristics other than gender. Multivariate analysis enables one to test hypotheses concerning the explanatory significance of the particular variables.

Five questions showing some of the largest male/female response differences were selected for multivariate analysis which attempted to explain the various responses in terms of income, job status, age, car ownership, and similar descriptors. The hypothesis tested was that the observed differences between the sexes were attributable to other variables; thus the expected impact of gender on the responses to be modeled was hypothesized to approach zero as the other items which are in actuality causing the responses were included in the model. This hypothesis would be rejected in cases where gender continues to be a significant factor in explaining responses even after appropriate other independent variables had been introduced.

The econometric techniques chosen for this analysis are multivariate regression and binomial logit analysis. Both techniques allow for the introduction of numerous independent variables to explain the movements of a dependent variable, and both estimate coefficients which then allow for forecasts and test of the model based upon predictions (or simulations). Regression has the flaw that when the dependent

variable only assumes two values (as in an "agree-disagree" situation) the estimates of the coefficient and the fitted dependent variable values have reduced precision. A better functional form is the logit which allows for a binary dependent variable. For this application, the independence of irrelevant alternatives property (IIA) of the logit is not restrictive because the agree-disagree alternatives define the universe of alternatives.

An even more appropriate model than the logit would be probit because it allows for taste variation among individuals (probit can also incorporate information about the unobserved similarity of alternatives by specifying the disturbance components to be correlated across alternatives). However, probit was not used for several reasons: among them the discouraging initial analysis which indicated few interesting differences and the feeling that the data set was not rich enough in explanatory variables.

The application of the logit to five of the "agree-disagree" statements summarized in the previous section is contained in Table 8 (Table 7 describes the variables used). The five statements chosen for analysis were those five which exhibited the largest differences in the distributions between male and female answers (i.e., the three significant ones and the two just approaching significance). Since a number of reasonable sets of independent variables probably exist that will allow the rejection or non-rejection of our hypothesis, the experimental steps used in choosing the independent variables were strictly controlled. First, a number of models were tested

TABLE 7. DESCRIPTION OF VARIABLES USED IN MULTIVARIATE ANALYSIS

VARIABLE	DESCRIPTION
SEX	0 = MALE, 1 = FEMALE
INCOME	1 = UNDER 5,000
	2 = 5-10,000
	3 = 10,-15,000
	4 = 15-20,000
	5 = OVER 20,000
CARS	# CARS, (2 OR MORE CODED AS 2)
FULLT	1 = FULL TIME WORKER
AGEOLD	1 = 65 OR OVER
AGEYNG	1 = UNDER 20 YEARS OLD
DRIVOK	1 = HAVE LICENSE AND NO DIFFICULTY DRIVING
HMEN	# HOUSEHOLD MEMBERS
TEBOP	# HOUSEHOLD MEMBERS 10-15
KIDS	# HOUSEHOLD MEMBERS UNDER 16

COEFFICIENTS FROM

TABLE 8. MULTIVARIATE ANALYSIS OF ATTITUDINAL QUESTIONS USING BINARY LOGIT

VARIABLES	GIVEUP QUES 16	PUBTRANS QUES 4	NICECAR QUES 7	DISCRGE* QUES 13	LIKECARS QUES 10
CONSTANT	-1.411	-.666	1.091	.429	.279
	(-4.091)	(-1.578)	(2.591)	(.985)	(.567)
SEX	.140	-.735	-.429	-.143	-.81
	(2.027)	(-2.901)	(-1.739)	(-.541)	(-2.34)
INCOME	.095	-.149	.015	.221	-.073
	(1.064)	(1.257)	(.157)	(1.975)	(-.567)
CARS	.094	.051	-.364	.372	.120
	(.495)	(.211)	(-1.776)	(1.539)	(.497)
FULLT	.547	-.134	-.179	.123	.646
	(2.558)	(-.487)	(-.787)	(.477)	(2.063)
AGEOLD	.319	-.538	.620	.134	.217
	(1.289)	(-1.739)	(2.118)	(.473)	(.650)
AGEYNG	-.372	-1.182	-.796	1.209	.361
	(-.623)	(-1.110)	(-1.348)	(1.230)	(.463)
DRIVOK	.737	.079	.360	-.179	2.161
	(2.887)	(.243)	(1.223)	(-.565)	(6.521)
% PREDICTED CORRECTLY	60%	84%	69%	77%	83%

$U_1 = C + \beta^1 \text{SEX} + \beta^2 \text{INCOME} + \beta^3 \text{CARS} + \beta^4 \text{FULLT} + \beta^5 \text{AGEOLD} + \beta^6 \text{AGEYNG} + \beta^7 \text{DRIVOK}$

$U_2 = 0$

*FOR THIS MODEL, 1=DISAGREE, 2=AGREE, ALL OTHERS, 1=AGREE, 2=DISAGREE

(T-SCORES IN PARENTHESIS)

and calibrated for the question which exhibited the highest chi-square difference between the sexes (#16 - on whether any transit system could get people out of their cars). Then the model which best explained responses to this question was calibrated to the other four statements. For this reason, obviously, the independent variables in all five models are identical; for this same reason, not every independent variable is significant, as measured by the t-test, in every model. Since the purpose of this analysis is to test a hypothesis about the significance of a single variable when included in a reasonable multivariate model, however, the theoretical advantages of this particular configuration seem to outweigh the slight improvements in fit that could be obtained from more refined modeling.

As can be seen from Table 8, the independent variables (other than gender) chosen were household income, number of cars in the household, employment status of the individual, and whether or not the individual was capable of driving, or was particularly young or old. The hypotheses behind the choices of these variables were fairly straightforward. We theorized that as incomes, jobs, cars and driving ability rose, so also would "pro-auto" or "anti-transit" types of answers to our questions. It was expected that the inclusion of these variables along with gender in a multivariate model would make the gender variable fairly insignificant.

While the models themselves do a fairly good job of explaining the agreement/disagreement to the statements, the coefficients (and the significance of the gender variables in the analysis clearly show that our null hypothesis of no significant male/female differences

can be rejected).

In four out of five cases, the sign of the gender variable remains as it was before the multivariate analysis, and in three out of the five, the sign is significantly in that direction. Only in the analysis of question #16 (already referred to) does the negative significance disappear, and in this case, the variable actually switches sides and becomes significantly different from zero in the opposite direction. It thus seems quite likely that differences between the attitudes of males and females are indeed gender-based since the attitudinal differences cannot be explained solely by the standard socio-economic variables. The sole exception to this conclusion, Question #16 - on getting people to give up their cars - is fascinating in and of itself. It was the only question on which males and females actually came to different conclusions, and it also was the only questions on which the "female" response switched sides significantly after multivariate analysis was introduced.

In addition to analyzing attitudinal differences between males and females, this study analyzed differences in observed behavior through a trip frequency model. Table 3 presents observed trip frequencies for males and females in zero, one and two or more car households. These observations suggest that there may be significant differences in the amount of travel by males and females. In order to test the hypothesis of this paper, namely that travel behavior (and attitudinal) differences are actually attributable to other characteristics that are often a proxy for gender, trip frequency models were estimated.

Several specifications were tried for both total and non-work trip frequency models; Tables 9 and 10 present the results. Work status and the number of cars in the household or ability to drive a car were the only consistently significant independent variables. Full-time work status was shown to increase overall trip making, as expected, and to decrease non-work trip making, also expected. (Full-time workers have less time to make shopping trips, chauffeur children, etc.) The gender variable was more significant in the non-work models than in the total trip frequency models. Such a result helps substantiate a hypothesis of increase female travel in non-work situations irrespective of work status or other influences. The coeffiecient of the sex variable is positive (i.e., females travel more) in all models; though the magnitude of the coefficient is small relative to the other coefficients. This is to be expected and is in keeping with preliminary results of other studies which found that women travel more frequently than men.

The results of the trip frequency models are inconclusive as to whether sex is an important determinant of trip frequency. While the hypothesis that the coefficient of the gender variable is different than zero can be rejected at the 95% confidence level for these models, it can be shown to be consistently different from zero at levels slightly worse than 95%. Since the estimated models have a poor fit, typical of most frequency models, it seems likely that improved analytical approaches will eventually yield better results. Of course, linear regression is not a good functional form for a trip frequency model because it assumes a continuous dependent variable, but the estimated

TABLE 9. TRIP FREQUENCY MODEL

VARIABLES	MODELS 1	2	3	4
CONSTANT	1.397 (2.764)*	.883 (1.702)	.921 (1.678)	.551 (1.739)
INCOME	.156 (1.711)	.150 (1.663)	.152 (1.675)	.153 (1.69)
CARS	.578 (3.298)	.258 (1.332)	.267 (1.346)	.260 (1.326)
SEX	.064 (1.033)	.070 (1.152)	.070 (1.156)	.070 (1.146)
FULLT	.748 (3.626)	.665 (3.238)	.661 (3.210)	.696 (3.231)
AGE	-.104 (-1.065)	-.0822 (-.897)	-.088 (-.873)	
DRIVOK		1.017 (3.682)	1.007 (3.600)	1.027 (3.698)
HMEN			-.0127 (-.213)	
AGEOLD				-.076 (-.296)
AGEYNG				.175 (.300)
(R^2)	.104	.126	.126	.125

* (T-SCORES IN PARENTHESIS)

TABLE 10. NON-WORK TRIP FREQUENCY MODEL

VARIABLES	MODELS 1	2
CONSTANT	.679 (2.297)*	1.065 (4.824)
INCOME	.080 (.952)	.081 (.962)
CARS	.0929 (.509)	.415 (2.558)
SEX	.1116 (1.963)	.103 (1.779)
FULLT	-.772 (-3.852)	-.665 (-3.580)
DRIVOK	1.019 (3.938)	
AGEOLD	-.068 (-.285)	
AGEYNG	.257 (.473)	
KIDS		.160 (1.52)
TEBOP		-.115 (-.720)
(R^2)	.076	.052

*(T-SCORES IN PARENTHESIS)

coefficients do provide some insights into travel behavior. The disappointingly low fit of the regression models suggests that estimation of limited dependent variable models to this data set might not be worthwhile.

This research has shown the significant advantages of multivariate analysis over single or dual variate analysis of gender-related differences in travel behavior and attitudes. While the hypothesis originally put forth in this study could not be confirmed, the multivariate approach has proven to be valuable in undertaking such studies. It is hoped that a major result of this paper is that future work will benefit from the application of appropriate multivariate techniques to the questions of differences in travel behavior and attitudes between the sexes.

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SEX DIFFERENCES IN TRAVEL PREFERENCE AND DECISION MAKING

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INTRODUCTION

Travel demand and mode preference models traditionally have been estimated for populations assumed to be homogeneous with respect to decision making precesses. These forcasting models rely on descriptive measures and averaging techniques to estimate parameters on the basis of total sample results. Recentanalyses provide evidence that these models can mask variability associated with particular sub-groups in the total sample leading to erroneous conclusions regarding the travel behavior for the population (Nicolaidis and Krishnan, 1977; Nicolaidis, et al., 1977; Recker and Golob, 1976a, 1976b; Recker and Stevens, 1977).

In this paper, market segmentation techniques are introduced to examine the travel decision structures of male and female residents of Orange County, California. These decisions are analyzed for work trips to evaluate perceptions and preferences for transportation alternatives in the context of the evolving role of women in society.

Models of intended use of public transit are estimated for each segment of the sample. Comparison of the results of the estimation indicate significant differences in travel decision making processes of male and female transportation consumers. Moreover, it is found that significant differences in travel value structure exist within both segments of the sample that can be related to socio-economic characteristics and

social roles. The analysis points up important aspects of travel choice for women which can be linked both to policy decisions and to marketing strategies for public transit.

The Study Area

Orange County is a microcosm of suburban America. The geographical size of the County is approximately 786 square miles. The county has no dominant metropolitan center, only segmented markets, and its population of nearly two million residents is broadly distributed among its 26 city centers. Most of the population growth has occurred over the past 15 years, during which time the population more than doubled, with migration accounting for over 70% of the increase. This large influx of population has led to vast changes in urban form. During the period 1960-1977, the 26 cities within the County experienced a 150% increase in population density; between 1970-1977, this increase was about 25%.

Public transit in Orange County has undergone tremendous growth. During its first year of operation in 1972, the Orange County Transit District (OCTD) serviced 270,000 passengers (260,000 vehicle service miles) with 20 buses operating on a fixed route system.

At the time of the travel behavior/attitudinal survey used in this study (November, 1976), the level of service had grown to a total fleet size of 334 buses servicing over 14,000,000 passengers per year (11,500,000 vehicle miles), including over 550,000 passengers (2,000,000 vehicle service miles) on park-and ride, dial-a-ride, dial-a-lift, and other community services.

As a result of economic pressure associated with cost of living in the County, the vast majority of women residents have, by necessity, entered the labor market. The stereotypical housewife/mother is employed, and distinctions between men and women have decreased significantly. As such, the area presents an excellent laboratory for studying the evolving travel needs of women in contemporary society.

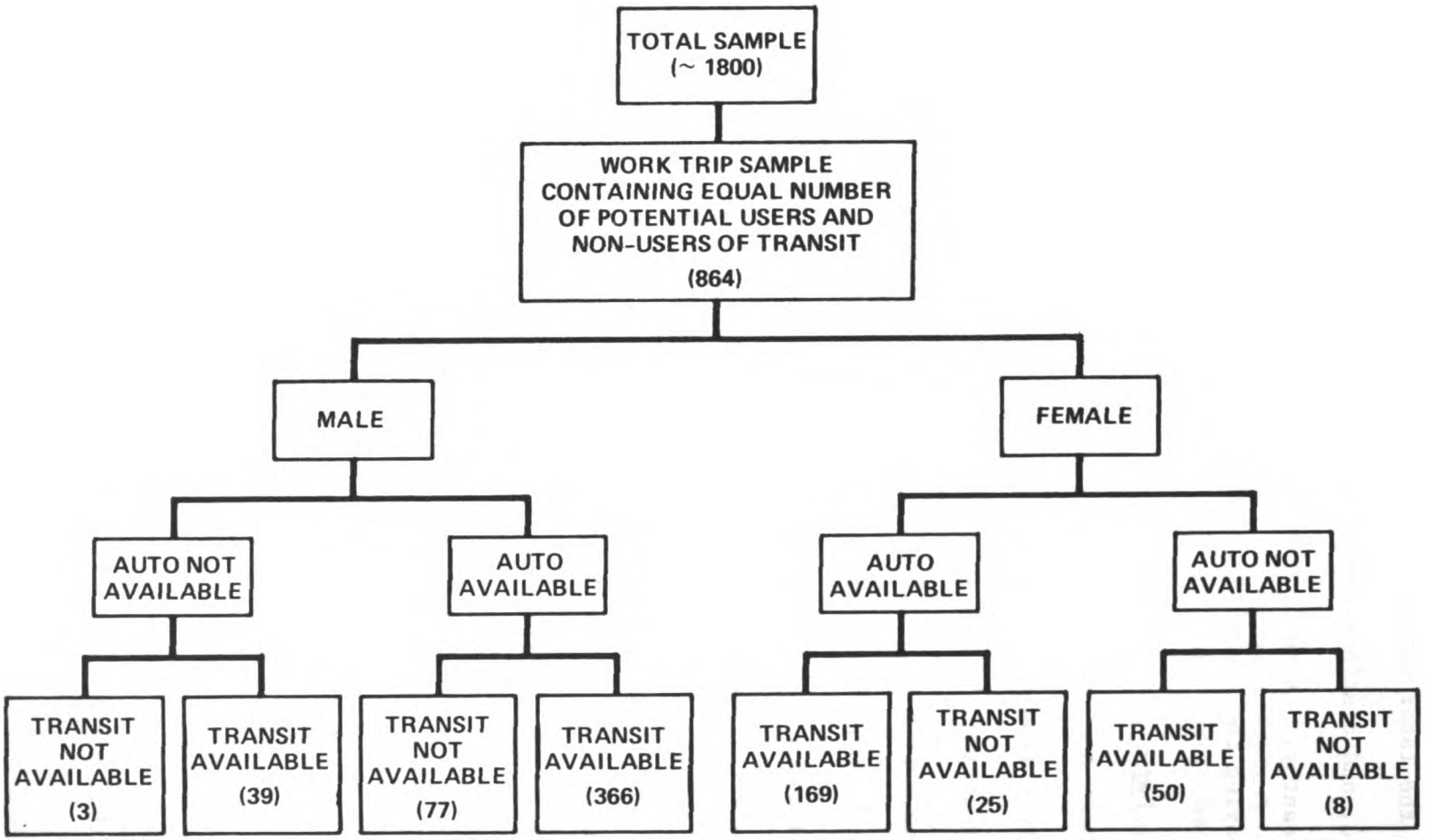
The Data Base

The primary source of data for this study is a countywide travel behavior/attitudinal survey conducted by the Orange County Transit District during the fall of 1976. The number of respondents in this survey is approximately 1,800. From this total sample of respondents, a random subsample was drawn containing persons with regular work trips that indicated a strong intention to use transit and an equal number who stated a strong intention not to use transit. The resulting sample size was 864 individuals.

These individuals were then categorized by sex and by perceived availability to transit and private automobile (see Figure 1). Detailed analyses were carried out only for the samples of male and female respondents who had both modes of travel available for their use, a sample of 169 females and 366 males.

In the analyses that follow, results quoted for the sample of male respondents are based on the full 366 members; however, these results were also verified using random subsamples of 169 male respondents to insure that sample size was not significantly influencing the results.

OCTD 1976 SAMPLE OF RESIDENTS



Male and Female Perception Spaces

Survey respondents' perceptions and attitudes were obtained in the form of a five-point scale of agreement, ranging from "strongly agree" (value of one) to "no opinion" (value of three) to "strongly disagree" (value of five), with a battery of statements related to transit and its use, as well as to general opinions and interests. These scales are assumed to constitute measurements with equal appearing intervals. The statements are grouped in three major categories: 1) General Attitudes Toward Transit, 2) Attitudes Toward Using Transit, and 3) General Opinions and Interests. The actual questions used in the survey are reproduced in the Appendix.

Male and female subjects' ratings in each of the three categories were factor analyzed using principal components analysis followed by varimax orthogonal rotation. (9) The purpose of the factor analysis is two-fold: 1) to simplify the structure of the attitudinal data for subsequent analysis, and 2) to identify the salient dimensions of perception for comparison of the response patterns of male and female market segments. To assure consistency in the analysis, the number of factors retained in each case was determined by a comparison of the set of eigenvalues of the associated correlation matrix with that obtained from repeated sampling of random data matrices of like order. In the summaries of the factor analyses, obvious abbreviations of the actual original variables are employed.

Attitudes Toward Transit

The rotated factor structures associated with respondents' general attitudes toward transit appear in Tables 1a and 1b. The first column

TABLE 1a. FEMALE RESPONDENTS ATTITUDES TOWARDS TRANSIT

FACTOR LABEL (% VARIANCE EXPLAINED)	VARIABLES INCLUDED IN EACH FACTOR			
	VARIABLES	FACTOR LOADINGS	PERCENT VARIANCE	
			IN FACTOR	IN ALL OTHER FACTORS
FAMILIARITY (9%)	INFO ABOUT ROUTES	.60	.36	.07
	INFO ABOUT SYSTEM	.65	.42	.06
	INFO ABOUT BUS STOPS	.71	.50	.07
	ACCESSIBILITY	.52	.27	.23
SOCIAL CONSCIOUSNESS (9%)	SOLUTION	.57	.32	.08
	BUS FOR ENVIRONMENT	.58	.34	.04
	SUBSIDIZE	.52	.27	.21
	REDUCE POLLUTION	.56	.31	.06
VEHICLE CHARACTERISTICS (7%)	INCONVENIENT FOR SHOPPING	.57	.32	.17
	FOUL ODORS	.56	.31	.01
	NO PRIVACY	.57	.32	.11
	NO RADIO	.55	.30	.03
TIME (7%)	TOO SLOW	.51	.26	.14
	LATE AT DESTINATION	.67	.45	.14
	NEVER ON TIME	.63	.40	.18
HOUSEHOLD STATUS (5%)	BUS LESS TO OPERATE	.53	.28	.27
	EXPENSIVE CAR – NO TRANSIT	.51	.26	.10
	TRANSFERS USUALLY NECESSARY	.54	.29	.04

TABLE 1b. MALE RESPONDENTS ATTITUDES TOWARDS TRANSIT

FACTOR LABEL (% VARIANCE EXPLAINED)	VARIABLES INCLUDED IN EACH FACTOR			
	VARIABLES	FACTOR LOADINGS	PERCENT VARIANCE	
			IN FACTOR	IN ALL OTHER FACTORS
ECONOMIC-ENVIRONMENTAL (10%)	BUS FOR ENVIRONMENT	-.70	.49	.06
	BUS LESS TO OPERATE	-.58	.34	.03
	COMFORTABLE	-.51	.26	.17
	AVOID TRAFFIC	-.51	.26	.04
	FARES LOW	-.58	.34	.06
	CONVENIENT	-.56	.31	.07
	REDUCE POLLUTION	-.61	.37	.10
TRANSIT USE (6%)	BUS FOR OLD AND YOUNG	.58	.34	.09
	LAST RESORT	.51	.26	.09
INFORMATION (6%)	INFO ABOUT ROUTES	-.53	.28	.05
	INFO ABOUT SYSTEM	-.69	.48	.06
	INFO ABOUT BUS STOPS	-.66	.44	.07
TRANSIT COST (4%)	USERS PAY SERVICE	.68	.46	.05
	SUBSIDIZE	-.59	.35	.14
TRANSIT CHARACTERISTICS (7%)	NO PRIVACY	-.61	.37	.03
	TOO SLOW	-.54	.29	.03

identifies the subjective label attached to each factor and the percent variance in the original measures accounted for by that factor. The "variables" column lists the variables with loadings that are greater than 0.5 on that factor. (It is noted that other variables that may significantly affect the subjective interpretation of the factor may not appear in these and subsequent tables because of this arbitrary cutoff.) The "variance" columns indicate respectively the strength and uniqueness of the relationship of the original variables with the factors.
The five factors identified as significant to female respondents are labelled: FAMILIARITY, SOCIAL CONSCIOUSNESS, VEHICLE CHARACTERISTICS, TIME, and SOCIAL STATUS. Alternatively, the significant factors for the male counterpart group are labeled: ECONOMIC-ENVIRONMENTAL, TRANSIT USE, INFORMATION, TRANSIT COST, and TRANSIT CHARACTERISTICS.

The FAMILIARITY dimension identified in the female respondents' factor space consists principally of loadings on four original variables which detail user knowledge regarding the transit system. In this factor, three information variables (familiarity with route structure, bus stops, and system characteristics) are linked to an accessibility variable. Perceived accessibility to the system is thought to be directly related to the amount of information available to the respondent.

Factor two identifies a SOCIAL CONSCIOUSNESS dimension concerning the perceived positive benefits associated with public transportation use. Women with high scores on this factor perceive transit to be a viable solution to the current transportation problem in urban areas and to be a good public investment. In addition, environmental quality is thought to be improved with increased transit use. As a result, the aggregate

response pattern suggests that federal subsidies should be granted to underwrite transit operations.

The third factor summarizes general attitudes toward particular VEHICLE CHARACTERISTICS. A high score on this factor indicates that transit is perceived as inadequate for shopping travel and is very often associated with foul odors. Such respondents also believe that privacy is lost with transit use, inconvenience occurs as a result of requiring exact change fares and the benefits derived from listening to a radio are missing.

Factor four may be regarded as a TIME dimension. Three variables directly related to the importance or value of time load on this particular factor. A high score indicates transit service is perceived as slow and vehicle schedules are believed to be inaccurate. The reliability of transit to transport these respondents to predetermined destinations on time is seriously questioned.

The fifth factor identified is associated with the SOCIAL STATUS of transit riders. A high score indicates transit is perceived as an inexpensive service well suited to the needs of low income groups. Alternatively, people who drive expensive automobiles are judged to be less likely to use transit. The combination of variables correlated with this factor suggests that female respondents with high scores on this factor identify with social roles and consume goods (or use services) commensurate with perceived status.

Male attitudes toward transit exhibit a number of characteristics which can be used to distinguish the two market segments (see Table 1b).

Factor one in the male respondents' factor space is labelled an ECONOMIC-ENVIRONMENTAL dimension. The economic considerations identified as significant to the male respondents include loadings on variables that denote the bus as less expensive to operate than the automobile. Complementing these considerations are a set of variables that denote adequate service characteristics. Individuals with high scores perceive transit as convenient and comfortable, and riders are believed to escape the stress associated with driving in heavy traffic. As such, transit is believed to be a good public investment. On the environmental side, these individuals perceive transit use as reducing air pollution and improving the overall quality of the environment.

Factor two is labelled a TRANSIT USE dimension. Male subjects with high scores disagree with the remarks that senior citizens and children are the main passengers on the bus and that transit is utilized only as a last resort. This would suggest that such men believe that transit ridership encompasses all age groups and that transit provides an alternative to automobile use that is seriously evaluated.

The third factor identified is an INFORMATION dimension. This factor is similar to the familiarity dimension identified in the female respondents' factor space. However, it does not display the linkage between level of information and accessibility noted with the segment of women respondents.

Factor four details a TRANSIT COST dimension. Subjects with high scores disagree with the remark that people who use transit should pay all of its costs. This view is complemented by a response pattern that favors

the use of federal monies to support transit operations.

The last significant factor in this analysis is labelled TRANSIT CHARACTERISTICS. Male respondents with high scores believe that personal privacy is lost with transit use and that bus service is slow. These variables were also identified by female respondents in factors three and four, respectively (see Table 1a).

Comparison of the factor structures of men's and women's general attitudes toward transit is difficult. In general, there are few factors for which the subjective interpretation could be considered clear. However, several distinctions do appear to surface and call for further investigation. First, it appears that women link the level of information regarding use of public transit with their perception of accessibility to transit. Lack of information is perceived as an impedence to using transit. No such correspondence is noted for the group of male respondents. Second, the segment of women respondents associates the payment of federal subsidies to public transit with the realization of a social good--protection of the environment, relief from congestion and solution of the "transportation problem." Among males in the sample, the question of federal subsidies is linked to their perception of the cost of using public transit, rather than to any public good derived from such subsidies.

Attitudes Toward Using Transit

Interpretation of the factors associated with respondents' attitudes toward their actual use of public transit is much clearer than in the previous case. The dimensions identified are summarized in Tables 2a and 2b for female and male respondents, respectively.

TABLE 2a. FEMALE RESPONDENTS ATTITUDES TOWARD USING TRANSIT

FACTOR LABEL (% VARIANCE EXPLAINED)	VARIABLES INCLUDED IN EACH FACTOR			
	VARIABLES	FACTOR LOADINGS	PERCENT VARIANCE	
			IN FACTOR	IN ALL OTHER FACTORS
PERSONAL AUTONOMY (14%)	FUN TO DRIVE	.63	.40	.01
	LIKE TO TRAVEL	.72	.52	.01
	NEED PRIVACY	.61	.37	.12
	EXTRA TIME FOR BUS	.60	.36	.08
	BUS UNCOMFORTABLE	.60	.36	.13
SOCIAL ACCEPTABILITY (17%)	BUS UNACCEPTABLE	-.59	.35	.23
	BUILD MORE X-WAYS	-.64	.41	.05
	SORRY FOR RIDERS	-.67	.45	.12
	FRIENDS DON'T RIDE	-.67	.45	.10
	SYSTEM ADEQUATE	-.64	.41	.01
	BUS EMBARASSMENT	-.82	.67	.01
	OBJECT TO BUS ROUTES	-.61	.37	.04
INFORMATION PERSONAL CONVENIENCE (15%)	UPSET WHEN LATE	-.60	.36	.04
	INCONVENIENT	-.58	.34	.17
	NO INFO ON ROUTES	-.74	.55	.04
	OTHER CAR RIDE FIRST	-.51	.26	.21
	NO INFO ON OCTD	-.62	.38	.05

TABLE 2b. MALE RESPONDENTS ATTITUDES TOWARD USING TRANSIT

FACTOR LABEL (% VARIANCE EXPLAINED)	VARIABLES INCLUDED IN EACH FACTOR			
	VARIABLES	FACTOR LOADINGS	PERCENT VARIANCE	
			IN FACTOR	IN ALL OTHER FACTORS
SOCIAL ACCEPTABILITY (12%)	BUILD MORE X-WAYS	.54	.29	.13
	SORRY FOR RIDERS	.55	.30	. .11
	FRIENDS DON'T RIDE	.52	.27	.08
	SYSTEM ADEQUATE	.70	.49	.04
	BUS EMBARASSMENT	.72	.52	.02
	OBJECT TO BUS ROUTES	.68	.40	.01
PERSONAL AUTONOMY (11%)	FUN TO DRIVE	.54	.29	.02
	LIKE AUTO TRAVEL	.74	.55	.01
	EXTRA TIME FOR BUS	.68	.40	.05
PERSONAL CONVENIENCE (12%)	COST OF GAS	.69	.48	.01
	BUS NOT ACCEPTABLE	-.64	.41	.18
	BUS INCONVENIENT	-.63	.40	.15
	OTHER CAR RIDE FIRST	-.59	.35	.05
INFORMATION (9%)	NO INFO ON ROUTES	-.67	.45	.13
	NO INFO ON OCTD	-.68	.46	.04
	TRANSFERS INCONVENIENT	-.55	.30	.13

Three factors are identified as respesentative of the female respondents. The first factor is labelled PERSONAL AUTONOMY. Three variables that connote personal satisfaction associated with automobile use load negatively on this particular factor. In addition, positive loadings on two variables that present the bus as compromising personal comfort and requiring additional travel time between locations supports this interpretation. The combination of these sets of variables underlies the importance of privacy and personal space associated with movement patterns.

Factor two represents a SOCIAL ACCEPTABILITY dimension. Women with high scores on this dimension believe transit to be unacceptable and depend on the automobile. This response pattern is reinforced by negative views regarding transit use by family and/or friends.

Factor three is labelled INFORMATION-PERFORMANCE ACCEPTABILITY. The information summarized by this factor is in concert with the description of the FAMILIARITY dimension associated with general attitudes toward transit. Women with high scores indicate that transit is inconvenient and that they would rather seek out another automobile ride before riding the bus. Again, information to use the system is constraining. The poor image of transit is thought to be directly linked to the dissemination of information regarding transit operations. Such women do not perceive transit as a viable alternative to the automobile.

The salient dimensions of male attitudes toward actual use of public transportation are shown in Table 2b. Four factors are identified as significant to male respondents and are labelled: SOCIAL ACCEPTABILITY, PERSONAL AUTONOMY, PERSONAL CONVENIENCE, and INFORMATION.

The first factor alludes to the SOCIAL ACCEPTABILITY of public transit and is very similar to that obtained for the sample of female respondents. The second factor is labelled PERSONAL AUTONOMY and is also similar to the corresponding dimension associated with the sample of female respondents.

Unlike their female counterparts who link information with transit performance acceptability, male respondents view these characteristics as two, distinct, dimensions of transit. The INFORMATION dimension consists principally of negative loadings on three variables (see Table 2b) that denote user knowledge regarding the transit system. Along the PERFORMANCE ACCEPTABILITY dimension, high loadings of male respondents would imply disagreement with remarks that transit is both unacceptable and inconvenient. This interpretation is supported by negative responses toward a third proposition--to seek out an automobile ride before using transit, and their positive responses to use public transportation if gasoline prices rose to one dollar per gallon.

Attitudes Toward General Interests and Opinions

Male and female responses to a set of questions involving general interests and opinions were also factor analyzed to determine compact psychographic profiles that may influence travel desires and decisions. The results of these factor analyses are summarized in Tables 3a and 3b. Five factors are identified as significant to female respondents. These factors are labelled: INNOVATION, COMPETENCY, HOUSEHOLD CONSERVATISM, ORDERLINESS, and LEADERSHIP. The factors identified as representative of the general interest and opinion section of the attitudinal survey for the male respondents include: COMPETENCY, HOUSEHOLD CONSERVATISM, INNOVATION, PAYMENT

TABLE 3a. FEMALE RESPONDENTS ATTITUDES TOWARD GENERAL TOPICS

FACTOR LABEL (% VARIANCE EXPLAINED)	VARIABLES INCLUDED IN EACH FACTOR			
	VARIABLES	FACTOR LOADINGS	PERCENT VARIANCE	
			IN FACTOR	IN ALL OTHER FACTORS
INNOVATION (6%)	TRY NEW THINGS	.68	.46	.13
	TRY NEW BRANDS	.69	.48	.08
	TRY NEW ITEM AFTER PROVEN	-.54	.29	.16
COMPETENCY (6%)	SELF CONFIDENCE	.54	.29	.20
	PERSONAL ABILITY	.58	.34	.20
	DISORGANIZATION	-.71	.50	.02
HOUSEHOLD CONSERVATISM (7%)	EVE AT HOME	.58	.34	.04
	PAY CASH	.53	.28	.07
	HOMEBODY	.60	.36	.01
	OLD FASHIONED	.51	.26	.12
ORDERLINESS (7%)	DRESS SMARTLY	-.61	.37	.01
	CARELESS DRESSING	-.62	.38	.06
LEADERSHIP (9%)	LIKE CHALLENGE	.57	.32	.10
	LIKE NEW PLACES	.54	.29	.07
	GIVE ADVICE	.55	.30	.03
	INFLUENCE FRIENDS	.61	.37	.12
	HOBBIES	.60	.36	.05

TABLE 3b. MALE RESPONDENTS ATTITUDES TOWARD GENERAL TOPICS

FACTOR LABEL (% VARIANCE EXPLAINED)	VARIABLES INCLUDED IN EACH FACTOR			
	VARIABLES	FACTOR LOADINGS	PERCENT VARIANCE	
			IN FACTOR	IN ALL OTHER FACTORS
COMPENTENCY (7%)	LIKE CHALLENGE	.52	.27	.10
	SELF-CONFIDENCE	.61	.37	.15
	PERSONAL ABILITY	.59	.35	.06
HOUSEHOLD CONSERVATISM (6%)	EVE AT HOME	.72	.52	.09
	HOMEBODY	.66	.44	.13
	OLD-FASHIONED	.60	.36	.04
INNOVATION I (6%)	TRY NEW BRANDS	.72	.52	.13
	TRY NEW BRANDS BEFORE FRIENDS	.64	.41	.15
	TRY NEW THINGS	.58	.34	.19
	TRY NEW ITEMS AFTER PROVEN	-.54	.29	.16
FRUGALITY (5%)	USE CREDIT	-.68	.46	.12
	PAY CASH	.77	.59	.03
	WISE TO PAY CASH	.71	.50	.06
ORDERLINESS (5%)	DRESS FOR FASHION	-.66	.44	.07
	DRESS SMARTLY	-.71	.50	.06
	CARELESS DRESSING	-.62	.38	.13
PRICE CONSCIOUSNESS (4%)	SHOP FOR SPECIALS	-.73	.53	.10
	WATCH FOR SALES	-.70	.49	.09
LEADERSHIP (6%)	INFLUENCE ON FRIENDS	.69	.48	.06
	ADVISE ON BUYING	.70	.49	.05
INNOVATION II (4%)	LIKE NEW PLACES	-.60	.36	.13
	DON'T LIKE UNCERTAINTY	-.54	.29	.12
INDEPENDENCE (4%)	GIVE ADVICE	-.63	.40	.12

POLICY, ORDERLINESS, COST CONSCIOUSNESS, LEADERSHIP, CAUTION, and INDEPENDENCE. A discussion of the implications of these factor structures is not attempted.

Models of Behavioral Intention

Factor scores on the thirteen factors identified for the sample of female respondents (5 factors associated with general attitudes toward transit, 3 factors associated with attitudes toward using transit and 5 factors associated with general interests and opinions) and the eighteen factors identified for the sample of male respondents (5 factors associated with general attitudes toward transit, 4 factors associated with attitudes toward using transit and 9 factors associated with general interests and opinions) were input as explanatory variables in logit models of intention to use transit. (11) Respondents were queried as to the likelihood of their using transit for their work trips if service compatible with their work trip needs were provided. Their responses to this question were used as values for the dependent variable in the maximum likelihood estimation of the logit model.

Results of the estimation indicate that only three of the thirteen factors associated with the sample of female respondents and five of the eighteen factors associated with the sample of male respondents were significantly determinant to the individual's stated intentions regarding future use of public transit. This conclusion is based on significance tests of the estimated values of the coefficients with rejection of the null hypothesis at the 0.05 level.

In the case of the sample of female respondents, the estimated model

of intended behavior correctly classified 70% of the individuals. Two of the factors with coefficients that tested significantly different from zero at the 0.05 level are associated with attitudes toward using transit, the PERSONAL AUTONOMY and the SOCIAL ACCEPTABILITY dimensions, while the third is associated with general interests and opinions, the ORDERLINESS dimension (see Table 4). The estimated coefficients for all other factors are not significantly different from zero at the 0.05 level. The coefficients of the three significant dimensions are all plausibly signed and offer some insights to women's intended behavior relative to transit use. Expectedly, along the PERSONAL AUTONOMY dimension, strong desires for personal autonomy are likely to decrease women's stated intention to use public transit, and concern with the SOCIAL ACCEPTABILITY of using transit is also likely to result in a lower probability of intention to use transit. It appears that the performance characteristics of transit have little effect on women's stated intentions. Factors aligned with these characteristics tested highly insignificant as determinants associated with general interests and attitudes that are significant in this choice situation. A proclivity toward order and neatness is positively associated with the intention to use transit among women workers in the sample. This can be explained by the correspondence between the certainty imposed by the schedules, routes and costs of public transit and the desire for order in contrast with the travel flexibility associated with the private automobile. No dimension associated with general attitudes toward transit tested significant in the determination of intended behavior, reinforcing the conclusions of other researchers that attitudes toward the actual use of an alternative,

TABLE 4.
LOGIT MODEL OF INTENDED BEHAVIOR FEMALE SAMPLE (N = 169)

A) SIGNIFICANT DIMENSIONS

DIMENSION	t
PERSONAL AUTONOMY	2.91
SOCIAL ACCEPTABILITY	-3.03
ORDERLINESS	2.67

B) DIRECTIONALITY

BEHAVIORAL INTENTION	CHARACTERISTIC		
	PERSONAL AUTONOMY	SOCIAL ACCEPTABILITY	ORDERLINESS
USE TRANSIT	NON-AUTONOMOUS	SOCIALLY ACCEPTABLE	ORDERLY
NOT USE TRANSIT	AUTONOMOUS	SOCIALLY UNACCEPTABLE	NOT ORDERLY

rather than attitudes toward characteristics of the alternative, are the proper determinants of choice.

Factors leading to intended behavior among the sample of male respondents are more complex than the case for female respondents (see Table 5). Five dimensions were found to be significant in determining behavioral intention among male respondents and the resulting logit model correctly classified 70% of these respondents (a percentage equal to that for the case of female respondents). As is the case with female respondents, individuals in the male sample base stated intended use of transit on aspects of SOCIAL ACCEPTABILITY and PERSONAL AUTONOMY. However, unlike the sample of female respondents, male respondents also appear to be influenced significantly by their perceptions of the PERFORMANCE ACCEPTABILITY associated with bus use and by the level of INFORMATION they have regarding bus use. Understandably, along the PERFORMANCE ACCEPTABILITY dimension, feelings that use of public transit is inconvenient decrease the intention to use buses. However, the model results indicate that the less information a male respondent has regarding bus use the more likely he is to state an intention to use public transit in the future. A possible explanation for this result is that respondents with little information regarding transit service are likely to be those who have never critically analyzed the choice between private automobile and bus. Because the choice is so remote to these respondents a positive response represents a "fail-safe" answer with no commitment, typical of "Would you. . ." type of questionnaires. In contrast with the results obtained with the sample of female respondents, the ORDERLINESS dimension did not test as significant

TABLE 5.
LOGIT MODEL OF INTENDED BEHAVIOR MALE SAMPLE (N = 366)

A) SIGNIFICANT DIMENSIONS

DIMENSION	t
PERSONAL AUTONOMY	1.98
SOCIAL ACCEPTABILITY	1.99
PERSONAL CONVENIENCE	-3.70
INFORMATION	1.81
INDEPENDENCE	3.07

B) DIRECTIONALITY

BEHAVIORAL INTENSION	CHARACTERISTIC				
	PERSONAL AUTONOMY	SOCIAL ACCEPTABILITY	PERSONAL CONVENIENCE	INFORMATION	INDEPENDENCE
USE TRANSIT	NON-AUTONOMOUS	SOCIALLY ACCEPTABLE	CONVENIENT	LESS INFORMATION	LESS INDEPENDENT
NOT USE TRANSIT	AUTONOMOUS	SOCIALLY UNACCEPTABLE	INCONVENIENT	MORE INFORMATION	MORE INDEPENDENT

in determining male respondents' intended behavior. Rather, the only factor in the set associated with general interests and opinions that is determinant to stated intention to use transit among male workers in the sample is the INDEPENDENCE dimension. The likelihood of a positive response to intention to use transit is inversely proportional to the individual's self perception of his independence. This result is understandable in light of necessary loss of personal control associated with transit patronage.

A comparison of the model results for the male and female samples indicates a degree of similarity in the two groups' decision structures regarding statements of intended use in that aspects of SOCIAL ACCEPTABILITY and PERSONAL AUTONOMY appear to be important determinants of behavioral intention. However, significant differences are also apparent. Whereas women's behavioral intention appears independent of convenience and service characteristics of transit, male respondents are influenced significantly both by their perceptions of personal convenience of using transit and its performance characteristics as well as by their familiarity with the transit system. The desire or need to live in an ordered environment is also influential in women's stated preference for transit. For men, this aspect appears unimportant while perceptions of personal independence play an important role.

Market Segmentation

To obtain a clearer understanding of the potential market for public transit, each of the two samples (male and female) with both modes available was segmented into groups that are relatively homogeneous with

respect to group members' profiles along those dimensions that are significantly determinant to stated intention to use transit. A k-means clustering algorithm was used in the segmentation using both the Wilks Lambda and a pseudo F-ratio as criteria for determining the proper number of natural groups. (1)

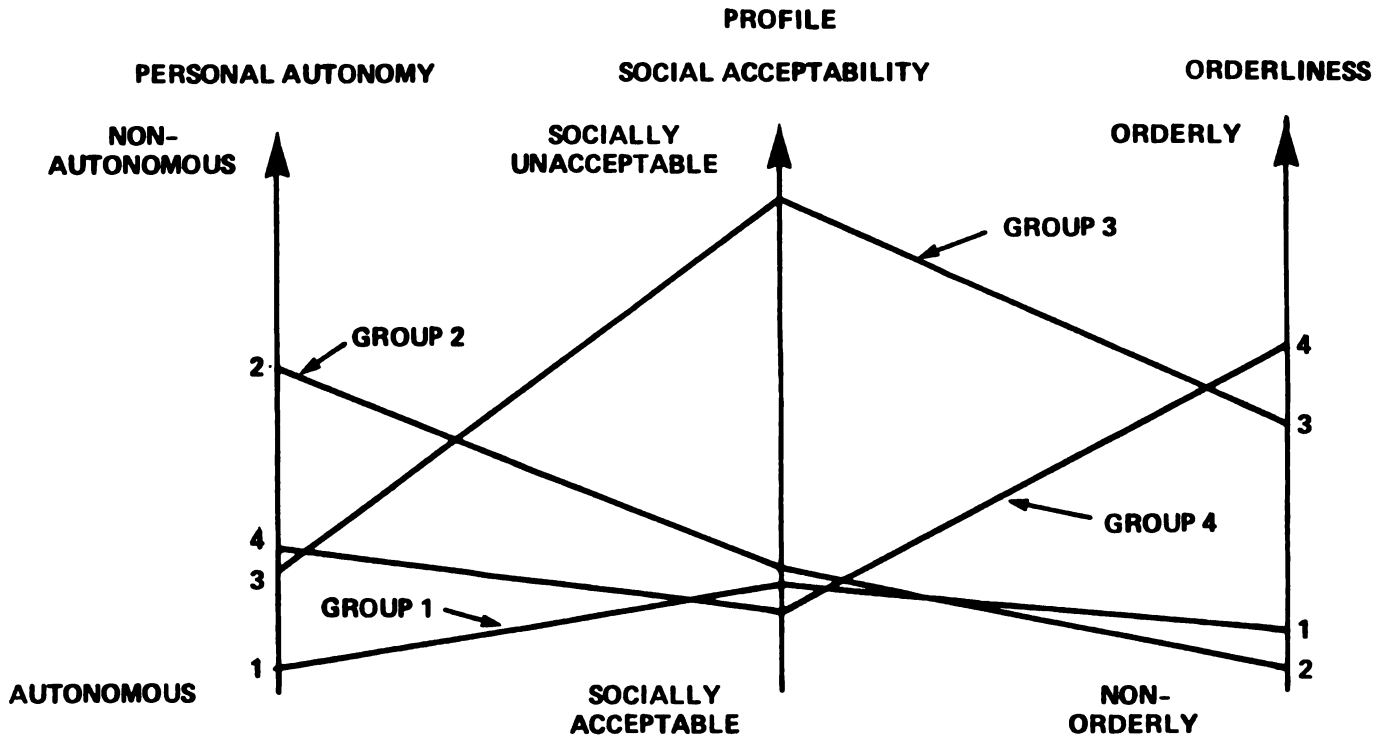
The sample of female respondents was segmented into four homogeneous groups with respect to members' scores on the three factors found to be important in the determination of behavioral intention, PERSONAL AUTONOMY, SOCIAL ACCEPTABILITY and ORDERLINESS. The centroids for each group are shown in Table 6.

Group 1 is composed of women who are characterized as being relatively autonomous individuals with little concern for an ordered environment. Members of this group are highly unlikely to become transit patrons in the future (over 60% of the members of this group actually stated this).

While similar to their counterparts in Group 1 along the SOCIAL ACCEPTABILITY and ORDERLINESS dimensions, members of Group 2 differ markedly on the PERSONAL AUTONOMY dimension. The highly non-autonomous inclinations of the members of this group make them prime candidates for becoming transit patrons (approximately 75% of this group indicated they would likely use transit if compatible service were provided).

The relatively high score on the ORDERLINESS factor associated with Group 3 is offset by their extreme concerns about the SOCIAL ACCEPTABILITY of bus travel (over 60% of the women in this group indicated that they would be highly unlikely to use transit in the future).

TABLE 6. CENTROIDS FOR FEMALE GROUPS



CENTROIDS

GROUP	N	CHARACTERISTIC		
		PERSONAL AUTONOMY	SOCIAL ACCEPTABILITY	ORDERLINESS
1	53	–0.75	–0.29	–0.56
2	47	1.02	–0.23	–0.76
3	23	–0.20	1.98	0.66
4	46	–0.07	–0.42	1.09

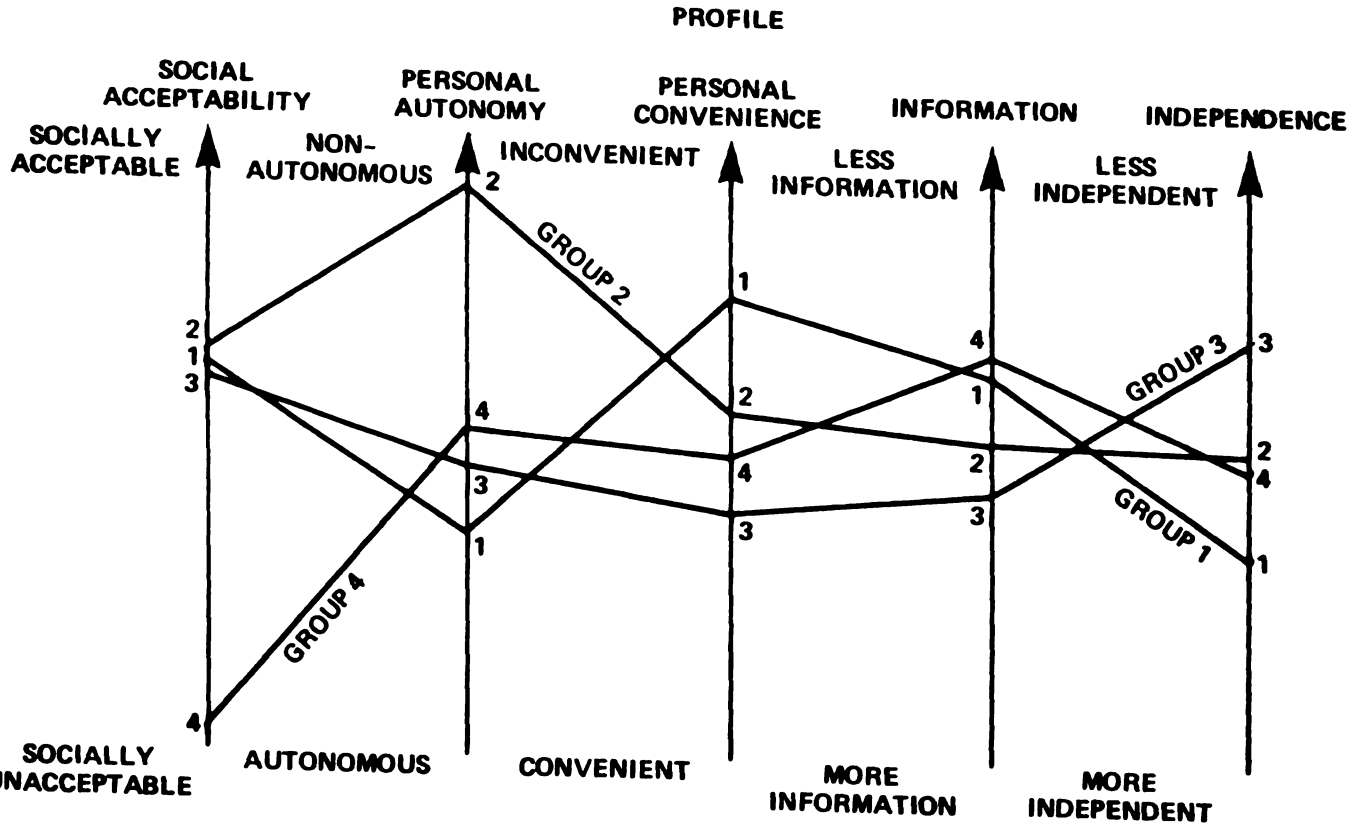
Finally, Group 4 appears to be the most likely potential market for public transit (with approximately 75% of the membership stating that they would be highly likely to use transit if compatible service were provided). The centroids for this group are the most favorable of all groups for bus use along two of the three determinant dimensions, SOCIAL ACCEPTABILITY and ORDERLINESS.

The results of the cluster analysis suggest that distinct marketing strategies are appropriate for each of the four groups identified. For women in Group 1, for example, any successful marketing strategy must be directed toward improving perceptions of privacy and personal comfort associated with bus travel. For women in Group 3, on the other hand, a marketing strategy aimed at dispelling the belief that it is socially degrading to ride the bus and emphasizing the punctuality and dependability of bus travel is more appropriate.

A similar analysis was performed on the sample of male respondents that had both transit and auto available. The cluster analysis of respondents with respect to scores on the five factors determinant to their intended behavior (the SOCIAL ACCEPTABILITY, PERSONAL AUTONOMY, PERFORMANCE ACCEPTABILITY, INFORMATION and INDEPENDENCE dimensions) resulted in four homogeneous groups with centroids shown in Table 7.

The men in Group 1 can be characterized as highly independent, disliking transit both because of loss of personal control and personal inconveniences associated with traveling by bus. Approximately 65% of the men in this group voiced no intention to use transit.

TABLE 7. CENTROIDS FOR MALE GROUP



GROUP	N	CHARACTERISTICS				
		SOCIAL ACCEPT.	PERSONAL AUT.	PERSONAL CONVEN.	INFORMATION	INDEPENDENCE
1	96	0.30	-0.64	0.76	0.32	-0.72
2	78	0.33	1.38	0.09	-0.04	-0.11
3	142	0.28	-0.29	-0.50	-0.35	0.62
4	50	-1.88	-0.10	-0.19	0.45	-0.20

The members of Group 2 differ markedly from their counterparts in Group 1 along the PERSONAL AUTONOMY dimension. Whereas members of Group 1 voiced strong concerns for personal autonomy, men in Group 2 were the least concerned of all groups about this aspect. This characteristic is the dominant reason over 57% of the members of this group indicated they would use transit.

Members of Group 3 are the least independent of the male groups. This, together with their relatively high opinion of the convenience of transit, led to a 62% favorable response to using transit.

Group 4 is characterized by an extremely low opinion of the SOCIAL ACCEPTABILITY of bus travel. Consequently, 58% of the men in Group 4 indicated they would not use transit in the future.

As in the case of the groups of female respondents, obvious marketing strategies can be associated with each group of male respondents.

Socio-Economic Characteristics

The final phase of the analysis examined the interrelationships between each homogeneous sub-group (identified in Tables 6 and 7) on the basis of socio-economic variables. Empirical research suggests that travel behavior is directly related to the characteristics of individuals (Hathaway, 1975; Nicolaidis and Dobson, 1975; Sommers, 1970; Tardiff, 1974). Socio-economic variables, motives and personality, and perceived status are all important to understanding variations in travel behavior.

The household data profiles of the four homogeneous groups found in the female sample appear in Table 8. Displayed in this table are: the

TABLE 8. FEMALE RESPONDENTS HOUSEHOLD DATA PROFILES

VARIABLE	CLASS	GROUP 1 (N = 53)	GROUP 2 (N = 47)	GROUP 3 (N = 23)	GROUP 4 (N = 46)	TOTAL (N = 169)
MARITAL STATUS	MARRIED	47%	57%	70%	50%	54%
	SINGLE	28%	13%	22%	28%	23%
HOUSEHOLD SIZE	2 OR MORE	90%	76%	99%	87%	87%
# CHILDREN AT HOME	0	50%	40%	41%	50%	48%
	1-2	28%	50%	46%	43%	41%
AGE	L.T. 24	30%	22%	35%	32%	30%
	25-34	32%	28%	26%	35%	31%
	35-44	17%	26%	9%	15%	18%
	G.T. 45	21%	24%	30%	17%	21%
EMPLOYED	YES	98%	98%	87%	99%	98%
OCCUPATION	LABORER	–	13%	–	–	8%
	SERVICE	20%	23%	27%	–	19%
	CRAFTS	–	–	–	–	2%
	CLERICAL	–	21%	–	20%	16%
	SALES	–	–	–	–	13%
	PROFESSIONAL	27%	–	18%	37%	25%
EDUCATION	H.S. GRAD	26%	20%	48%	11%	23%
	SOME COLLEGE	45%	57%	30%	54%	49%
	COLLEGE GRAD	22%	13%	9%	22%	18%
INCOME	L.T. $10,000	40%	34%	21%	52%	31%
	$10,000-$14,999	13%	21%	37%	–	21%
	$15,000-$19,999	21%	17%	21%	22%	20%
	$20,000-$24,999	9%	14%	–	16%	12%
	$25,000-$29,999	10%	7%	16%	5%	10%
	G.T. $30,000	–	7%	5%	5%	6%

likelihoods that typical members of each group will become transit patrons, the distinguishing attitudes associated with members of each group and socio-economic profiles of members of each group. The information is not inclusive and has been summarized to present profiles typical of modal responses.

Group 1 is composed of women characterized as either single (28%) or divorced (21%) and living in childless households (55%). These women are relatively young (30% are less than 24 years, 49% are 25-44 years) and work primarily in professional (27%) or services (20%) industries. A sizeable proportion of this group attended or graduated from college (67%). A sizeable percentage of women in this group classify themselves as "head of household" (31%), while few (10%) live alone.

Most women in Group 2 are married (57%) and live in households with one or two children (50%). However, this group also contains the highest percentage of women who live alone (24%) and who are female heads of household (36%). Respondents are relatively young (22% are less than 24 years, 53% are 25-44 years) and work primarily in clerical (21%) or service (23%) positions.

Group 3 contains the highest percentage of married women (70%). Virtually none of these women live alone and the majority live in households with one or two children (46%). This group also contains the highest percentage of women over 45 years of age (30%) as well as the lowest percentage that attended college (39%).

The fourth group is characterized by married households (50%) with

one or two children (43%) and the youngest age distribution of the four groups. This group also contains the highest percentage of women who have attended college (76%) and, correspondingly, occupations are primarily in professional (37%) fields.

While cell size restrictions do not permit adequate statistical confidence to support the contention that differences in these socio-economic characteristics are directly linked to attitudes toward travel alternatives, certain patterns are apparent in Table 8 that warrant further testing with larger samples. First, the attitudinal profiles of Group 1, which is composed of unlikely candidates for transit patronage and Group 2, which contains likely candidates, are similar with the exception of their need for assurance of personal autonomy in the travel model. The primary socio-economic distinctions between these two market segments lie in the number of one-person households and in the occupational profiles associated with each of these groups. Whereas a typical member of Group 1 may be a well-educated young woman professional unmarried and with no children but living either as part of a couple or with a roommate, the corresponding member of Group 2 is also young, well-educated and unmarried, but is much more likely to be either living alone or with one or more children and employed in lower paying laborer or clerical positions.

More striking differences in socio-economic characteristics exist between Groups 3 and 4, which differ in their attitudes toward using public transit only in their concern regarding social status. The representative woman of Group 3 is typically an older, not well-educated, woman who is the spouse of the head of household. Women in Group 4,

conversely, tend to be well-educated, young women professionals.

Male respondents' household data profiles for the four homogeneous groups described in the previous section, appear in Table 9. The men in Group 1 are characterized as married (63%) and living in childless households (53%). Respondents' ages are evenly distributed across all classes and principal occupations are in either professional (28%) or service (18%) industries.

Most males in Group 2 are married (78%) and live in households with one or two children (40%). These men are relatively older than their counterparts in other groups (69% are more than 35 years) and work primarily in professional (30%) or craftsmen (20%) fields. The highest percentage of college graduates (36%) is identified with this particular group.

Similarly, the majority of males in Group 3 are married (62%) and live in households without children (52%). However, unlike their counterparts in Group 2, males in Group 3 are relatively young (33% are less than 24 years, 47% are 25-44 years) and work as laborers (12%) or in service (20%) and professional (23%) fields. Reported incomes in this group are relatively low (43% earn less than $15,000).

The fourth group is characterized by married (67%), childless (48%) households and male respondents are relatively older (32% are more than 45 years). Education levels are high (38% attended college, 26% are college graduates) and occupations are primarily in service (23%), crafts (19%), and professional (17%) fields. Reported incomes are relatively high (53% earn more than $20,000).

TABLE 9. MALE RESPONDENTS HOUSEHOLD DATA PROFILES

VARIABLE	CLASS	GROUP 1 (N = 96)	GROUP 2 (N = 78)	GROUP 3 (N = 142)	GROUP 4 (N = 50)	TOTAL (N = 366)
MARITAL STATUS	MARRIED	63%	78%	62%	67%	66%
	SINGLE	28%	11%	30%	30%	26%
HOUSEHOLD SIZE	2 OR MORE	90%	97%	93%	92%	93%
# CHILDREN AT HOME	0	53%	40%	52%	48%	50%
	1-2	37%	40%	30%	38%	35%
AGE	L.T. 24	28%	12%	33%	24%	27%
	25-34	26%	19%	29%	26%	26%
	35-44	21%	26%	18%	18%	20%
	G.T. 45	25%	43%	19%	32%	27%
EMPLOYED	YES	98%	100%	99%	98%	98%
OCCUPATION	LABORER	–	–	12%	–	8%
	SERVICE	18%	–	20%	23%	17%
	CRAFTS	–	20%	–	19%	13%
	CLERICAL	–	–	–	–	13%
	SALES	15%	–	–	–	12%
	PROFESSIONAL	27%	30%	23%	17%	25%
EDUCATION	H.S. GRAD	21%	21%	18%	22%	11%
	SOME COLLEGE	48%	31%	42%	38%	41%
	COLLEGE GRAD	21%	36%	29%	26%	29%
INCOME	L.T. $10,000	15%	7%	24%	16%	18%
	$10,000-$14,999	16%	20%	19%	11%	17%
	$15,000-$19,999	22%	26%	19%	21%	22%
	$20,000-$24,999	19%	20%	17%	21%	18%
	$25,000-$29,999	18%	11%	8%	16%	12%
	G.T. $30,000	10%	14%	12%	16%	12%

A comparison of socio-economic characteristics of the four groups of male respondents indicates there is much less variation in these characteristics between groups than is apparent with the corresponding groups of female respondents. While no definite conclusion can be derived, it appears that women's attitudes influencing travel choice decisions are more sensitive to social and household roles than are those of men.

Conclusions

Comparisons of factors and other variables determinant to travel decision making were examined for two markets segmented on the basis of sex and auto-transit availability. Significant differences in perception and in the travel decision making processes were documented for each market segment.

Differences between men's and women's perception of transit appear to be mostly subtle. The most important distinction between male and female perceptions of transit is that women appear to interpret level of information regarding use of transit as part of an impedence to using transit.

Among female respondents, behavioral intention appears independent of convenience and service characteristics of transit. Alternatively, male respondents are influenced significantly both by their perceptions of the performance characteristics of transit as well as by their familiarity with the transit system. Both male and female respondents indicate a degree of similarity in decision structures regarding statements of intended use that connote social acceptability and personal autonomy.

Socio-economic variables were examined as another source of explanation

of travel behavior. Among women, differences in household data profiles appear to be linked to attitudes toward using public transit. Among male respondents, such correspondence was not evidenced.

It is concluded that travel demand forecasting models that rely on time and cost descriptors and/or base parameter estimation on total sample results may exclude important aspects of travel choice for women. More importantly, perhaps, the evidence suggests that not only are there significant differences between men's and women's travel desires, but there are also significant differences among the population of women travellers themselves.

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TRAVEL PATTERNS AND BEHAVIOR OF WOMEN IN URBAN AREAS

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I. Introduction

The preponderance of women as transit users have been indicated by many previous studies. Yet there have been few systematic attempts to analyze, if in fact there are major differences between the travel behavior, attitude and perceptions of men and women; and if public transportation policies should in fact reflect the needs of this particular segment of the market.

This research therefore will focus on the travel behavior, attitude and perceptions of women and provide answers to the following:

(1) Is there any substantial difference between men and women in their travel behavior, attitude and perceptions toward transportation? If there is, in what respect do they differ?

(2) Do factors such as income, age or stage in the life cycle, or education influence women's perceptions and travel behavior?

(3) If women are taken as a market segment, what are the factors which can explain their travel behavior attitude and perceptions toward transportation?

A significant outcome of the research will be to show if men and women have different or similar behavioral characteristics and if there is any significant difference, then isolating factors which can explain the difference should help to focus on problem with current transportation systems and needs for differential planning for the future.

Focusing on women's travel needs if different from men is an important

issue for public transportation systems, in desperate need to increase ridership and develop a broader public appeal. Future population projections indicate the rapid increase in the percentage of women, especially elderly women with special transportation needs. These estimates can be combined with the anticipated energy shortage and the results need to reduce the use of the private automobile. It is even more imperative to ascertain the needs of a substantial majority of this future potential market for the public transportation sector.

II. Study Results

A. Data Base

This study is based on a data set collected in the Richmond SMSA in 1977. A sample of about 500 individuals, both men and women, were selected using a stratified three stage probabilistic sampling technique to separate low and middle income households. After stratifying the area into an inner low income zone (Zone I) and an outer middle income (Zone II), a random sample of 10 pairs of census tracts was selected (without replacement) from each zone. At the second stage a systematic sample of one pair of households was chosen from each block.

The instrument for data collection was pretested and designed to obtain responses on use and attitudes towards various modes of transportation including the transit facilities in the city, general travel behavior, and background socio-economic data on the individual and the household. In selecting individuals in the household, an attempt was made to interview an even distribution of males and females over eighteen years of age in each zone as well as to have an equal representation from each zone.

Preliminary analysis of the data indicated that Zone I is composed primarily

of black and low-income residents with low levels of education, while Zone II is inhabited primarily by white, higher-income, and more educated residents. There also appears to be a higher proportion of elderly and handicapped individuals in Zone I. In Zone I, 52.6% of the individuals are unemployed, retired or are housewives, and 27.5% of the residents do not have access to a car. In Zone II, 46.7% are unemployed, retired or are housewives, and only 5.1% have no access to a car. These characteristics are reflected by the fact that Zone I residents tend to make use of other modes other than the car more often than Zone II residents. As a result, dissatisfaction with the public transportation services currently available is expressed mostly by Zone I residents who are also in favor of improving services. Zone II residents rarely use any other means besides the car, appear to spend less time in travel for various activities, and appear to be least affected by the existing transit services. Finally, if income is used as a major characteristic, there appears to be some major difference in the travel patterns and needs between the income groups.

While the results of the analysis by zone did not indicate any strong influence of sex as a factor explaining behavior, attitudes, or preceptions, it did indicate that females tend to rely on and use public transportation services more frequently than do the males in the sample.

B. Sex as a Determining Factor

An initial need is to determine whether or not there is any substantial difference in the characteristics, travel behavior patterns, attitudes and perceptions between men and women. To do this the chi-square test was applied to the bi-variate distributions of sex by the appropriate variables, with a total of 301 females and 202 males in the sample.

For socio-economic and other general characteristics of the sample, there appears to be few significant differences between male and female population of the sample. Those characteristics which do differ significantly are driver's license, ownership of car, length of residence in the third location in the past, occupation and physical handicap status. Of these five characteristics where females appear to be significantly different than males, perhaps the most unexpected is that of physical handicap. A much higher percentage of the females appear to have some physical handicap out of the total of 12.7% of handicapped individuals in the sample. The remaining characteristics are as expected; 32.2% of females do not have driver's license compared to only 15.3% of the men. This may be an explanation of the fact that almost 40% of the women do not own cars but use cars belonging to relatives. Furthermore, a very high percentage of the females are either housewives, retired or unemployed and therefore unlikely to have the need or the ability to own and maintain a car. Of the smaller percentage employed, most women work in offices, in schools as teachers, or in some semi-professional work. Lastly, to the extend past residential location is significant, the females appear to have had more stable residential patterns than the men.

While there are few significant demographic differences between the men and women, the differences are more pronounced in their travel behavior (summarized in Figure 2). The major areas of difference appear to be in the mode of travel for different trip purposes as well as the frequency of use of different modes. From the statistics it is clear that females tend to make a greater use of other modes besides their own car, especially the bus, or the cars of relatives, for trips that are made generally more often by the women in the household, such as grocery trips, visits to medical facilities, household and clothes shopping, church, etc. Females clearly use the bus and taxis more

FIGURE 1
GENERAL CHARACTERISTICS: SIGNIFICANT DEVIATIONS BETWEEN MALES AND FEMALES

Characteristics	Chi Square Value	Significance
Driver's license	19.02096	.0001
Ownership of car	39.76318	.0000
Length of residence in the third location in the past	11.64867	.0202
Occupation	155.09039	.0000
Physical handicap status	6.30792	.0120

FIGURE 2
AREAS OF SIGNIFICANT DIFFERENCES BETWEEN THE TRAVEL BEHAVIOR OF MEN AND WOMEN

		Use of Own Car	Other Means	Chi Square
Mode of Travel				
To church	Female	58.2%	41.8%	20.63361
	Male	78.4%	21.6%	
To visit friends	Female	55.5%	44.5%	19.43984
	Male	69.7%	30.3%	
For medical trips	Female	59.0%	41.0%	22.60105
	Male	76.8%	23.2%	
For household and clothes shopping	Female	62.2%	37.8%	17.93570
	Male	76.7%	23.3%	
For groceries	Female	64.0%	36.0%	12.71164
	Male	76.0%	24.0%	
For professional meetings	Female	72.0%	28.0%	11.00240
	Male	83.3%	16.7%	
To work	Female	55.6%	44.4%*	21.55166
	Male	73.2%	26.8%	

* Especially as car passenger or bus

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		Percentage	Frequency	Chi Square
Frequency of Travel				
To medical facilities	Female	71.2%	Go 3-4 times a year	11.57907
	Male	60.5%		
By bus	Female	30.3%	Use it at least once a month	17.39410
	Male	24.4%		
By taxi	Female	11.7%	Use it at least once a month	15.84637
	Male	6.9%		
By car	Female	54.5%	Use it daily	26.80213
	Male	74.3%		
Reason for not walking more	Female	5.9%	Dislike walking with remaining % stating other reasons	11.92089
	Male	13.7%		

frequently while men make more use of the car. Likewise, walking is more frequently avoided by men than women. From these differences it is clear that women are more likely to make use of some form of public transportation for any number of trip purposes than men. This can partly be explained by the fact that a higher proportion of females live closer to the bus stop.

The previous conclusion is further reinforced by the areas of significant differences in attitude and perceptions between the sexes (Figure 3). Although numerous questions regarding attitude towards different modes, especially transit, were asked, only a few areas indicated any significant difference between the responses of men and women. Figure 3 clearly reinforces the more positive attitude of women towards the transit system, as well as their greater use of transit, which inconvenienced them during a city transit strike in December 1976. The less favorable attitude of men toward transit is additionally proven by the higher levels of dissatisfaction indicated by men on variable social climate in the bus.

Summarizing the impact of sexual differences in their travel behavior, attitude and perceptions, the results clearly endorse the viewpoint that women are more likely to use some form of public transportation than men, both for work and discretionary trips and have a more favorable attitude toward transit and the use of public funds to subsidize transit. These differences can partially be explained by the characteristics of the women in the sample.

III. Factors Affecting the Travel Behavior, Attitudes and Perception of Women

Since there are some significant differences between the travel behavior of men and women, it is important to isolate and identify those factors which

FIGURE 3
ATTITUDINAL AND PERCEPTION DIFFERENCES BETWEEN MEN AND WOMEN

		Good or Better	Fair to Worse	Chi Square
Cost of transit fare	Female	35.2%	64.8%	10.15898
	Male	32.5%	61.5%	
Nearness to bus stop	Female	68.4%	31.6%	9.68805
	Male	58.3%	41.7%	
		Yes	**No**	
Will transit be used more if problems are corrected	Female	66.9%	33.1%	4.41599
	Male	51.8%	48.2%	
Should public funds be used for transit	Female	77.6%	22.4%	12.08722
	Male	62.1%	37.9%	
Affected by transit strike	Female	29.6%	70.4%	7.98071
	Male	18.0%	82.0%	
Inconvenience of strike	Female	41.9%	58.1%	13.01145
	Male	28.5%	71.4%	

appear to be critical in explaining women's behavior and attitudes. In most behavioral studies, income, occupation and the stage in the life cycle appear to be important. To test for the significance of these factors in explaining women's travel behavior, the chi-square test was applied on the effect of income, age and occupation on all behavioral, attitudinal and perception variables for only the female population of the sample. Since education is highly correlated with occupation, age, and income the effects of education were not analyzed separately. Household income was considered extremely important in determining car ownership and availability, while age can be considered as an appropriate surrogate measure for the stage in the life cycle and in turn influences the behavior. Lastly, occupation is also an additional indicator of travel needs and will influence the frequency and location of discretionary and non-discretionary trips.

If the effect of income is analyzed against the socio-economic characteristics of the women, higher purchasing power, higher car ownership and availability, higher levels of education, and race shows up as significant for the higher income households. What is, however, unexpected is that the higher income households also appear to have somewhat larger household size which may be the result of higher earning capacity of a few members, or a greater number of earning members in the household. It is also somewhat unexpected that higher income households own more older cars. More surprising is the evidence that lower income households appear to have a higher percentage of physically handicapped women.

Income affects women's choice and frequency of use of various modes for both discretionary and non-discretionary trips. The lower income women make use of other modes besides the car, travel longer for trips to church, and

the modal choice is determined by convenience as well as necessity. Car use by low income women is limited due to nonavailability, while taxi use is much higher in spite of the expense. Higher income women generally use the car more often, but appear to make fewer trips for those trip purposes which are significant with respect to income. Reasons for less frequent use of various modes appear to be inconvenience.

Attitude is also affected by income (Figure 4). Variables which stand out as being significant are primarily those related to the use of and attitude towards various specific characteristics of the mass transit service available in the Richmond area. Lower income women are more positive towards certain transit service characteristics and find it less inconvenient to use transit for various trip purposes than do higher income women. The only negative reaction of low-income women appears to be in the increased fare after the transit strike, and the inconvenience caused by the strike. Clearly this is another indication of their greater dependence on transit for transportation.

To measure the impact of age on behavior, attitude and characteristics, the sample was subdivided into four age categories in an attempt to reflect different life cycle stages; 18-25, 26-45, 46-65, 66 years and over, and chi square tests applied to the bi-variate distributions between age and all other variables. From Figure 5 it is clear that age is related to many of the same characteristics as with income. This is reinforced by the strong inverse relationship indicated between age and income. What is perhaps unexpected is the similarity in travel expenditure of the very old and youngest women in the sample. The women in the middle age range clearly spend more.

The significant travel behavior characteristics which are related to age (Figure 6) are somewhat similar to those which are affected by income with

FIGURE 4

ATTITUDES OF WOMEN WHICH ARE SIGNIFICANT WITH RESPECT TO INCOME

Characteristics	Relationship to Income	Chi Square	Level of Significance
Reliability of bus service	Responses are more positive with higher income women.	30.45.40	.0024
Cost of fare	Responses are more negative with lower income women.	22.05049	.0370
Cleanliness of bus	Responses are more positive with lower income women.	35.87439	.0003
Reaction to possibilities of increased usage of transit if improved	More positive responses by lower income women.	8.9357	.0302
Response to the effect of strike	Lower income women more affected.	27.39355	.0000
Inconvenience of transit strike	Lower income women most inconvenienced.	20.06299	.0027
Reaction to increased fare	Lower income women pay more and make fewer trips.	39.37264	.0000
Allocation of increases on income	Lower income women would allocate it to items such as housing, food and clothing. Higher income women would have an inclination to add to savings.	29.89872	.0384
Attitude towards use of transit for social visits	The degree of inconvenience increases with increased income of women.	39.44713	.0001
Use of transit during rush hours	Inconvenience is felt more by higher income women.	30.06816	.0027

FIGURE 5
THE GENERAL CHARACTERISTICS WHICH ARE SIGNIFICANT WITH RESPECT TO THE AGE OF THE FEMALE POPULATION

Characteristics	Relationship to Age
Driver's license	Older women are less likely to have driver's license.
Availability of car	Older women have fewer cars available to them.
Age of car	Older women are more likely to own older cars.
Car ownership	Older women are less likely to own car.
Occupation	Older women are more likely to be housewives or retired while younger women are evenly distributed between being housewives, unemployed, office workers, or teachers.
Period of current employment	Older women have worked longer in their present employment.
Length of residence in current residence	The older women have lived longer in current residence.
Ownership of residence	Older women are more likely to own their residence.
Monthly expenditure on housing	Older women pay less on housing while younger women pay a greater range of housing costs.
Monthly expenditure on food	The very old and young women pay less for food than those women in the middle stages of the life cycle.
Monthly expenditure on travel	The very old and young women spend less than other women.
Income	Older women have lower household incomes than younger women.
Race	There is a higher percentage of black and American Indians among the younger women.
Education	Younger women are generally more educated.
Physical handicap	There are greater numbers of older handicapped women.

FIGURE 6
TRAVEL BEHAVIOR CHARACTERISTICS WHICH ARE SIGNIFICANT WITH RESPECT TO THE AGE OF THE FEMALE POPULATION

Characteristics	Relationship to Age
Mode of travel to the following:	
Medical visits Social service agencies	Older women are less likely to drive, and more likely to get rides or use transit or taxis.
Household and clothes shopping Grocery shopping	The very old and young women are less likely to drive.
To baby sitters	Younger women are more likely to drive than be driven or use other modes.
Travel time for the following:	
To visit friends	Older women are likely to travel longer.
Household and clothes shopping To baby sitters	Younger women are more likely to travel longer.
Frequency of trips	
To grocery store For vocational training	More younger women go more frequently.
By car By bicycle	Younger women use these modes more frequently.
Reason for using car	Younger women prefer the convenience while older women find it a necessity.
Reason for not traveling by car pool	Most younger women stated non-availability as the reason, while older women gave other reasons for non-use.

the exception of mode of travel to social service agencies, mode and travel time to babysitters, and frequency of trips for vocational training. Clearly all these activities tend to be concentrated amongst certain age groups. Frequency and reasons for certain modal use again reflects the preferences for certain modes by different age groups. In measuring the impact of age on attitudes and perceptions, various service characteristics of the transit company, issues related to the strike, and reaction to taxis as a mode, came out to be important (Figure 7). Generally older women had a positive attitude towards transit, as compared to younger women who were most frequently negative or indifferent. From the analysis of the effect of age on all the variables; it is clear that there are some areas of behavior, attitude and perceptions which are clearly affected by age.

To test for the impact of occupation, a frequency distribution of all occupation categories was used to identify six distinctive occupation categories for the female population; housewife, retired, unemployed, professional, semi-professional (semi-skilled and blue collar workers), and others. These six categories were ten utilized for the bi-variate distributions between occupations and all other variables to test for dependence, using the chi-square test. Significant relationship between occupations and other variables show up some of the same characteristics as with income (Figure 8). However, since the occupation categories are more distinct, it is harder to establish a general pattern for the relationship. The travel behavior characteristics which appear to be important (Figure 9) are again similar to that indicated by income groups. Although the modal choice appears to be more definite by occupation groups.

Significant relationships between attitudes and occupation of women show

FIGURE 7
ATTITUDINAL CHARACTERISTICS WHICH ARE SIGNIFICANT WITH RESPECT TO AGE OF THE FEMALE POPULATION

Characteristics	Relationship to Age
Reliability of the bus service	More negative response from younger women.
Cost of bus fare	
Cleanliness of bus	
Comfort	
Courtesy of drivers	
Transit-transfer system	The younger women are more neutral.
Early departure of bus from stop near home	The younger women felt that departures were earlier than scheduled.
Overall rating of bus service	Older women were more positive.
Manner in which the strike affected respondants	Younger women reported difficulties in transportation while older women were affected in their essential travel needs.
Impact of increased fare	The younger and the very old women were not affected, the former decreased usage of the bus and the latter paid more.
Could the strike have been settled earlier	The young and the very old definitely felt that it could have been resolved sooner.
Attitude toward the transit strike	The older women were against it while younger women were for it.
Dissatisfaction with the lack of comfort on the bus	Younger women are more dissatisfied.
Dissatisfaction with the lack of privacy	
Attitude toward the transit system available	Younger women are negative or indifferent, older women are more positive.
Attitude toward taxis	
Reaction to continued use of transit with an increase in income	Older women would continue to use it.

FIGURE 8
SIGNIFICANT RELATIONSHIP BETWEEN OCCUPATION AND VARIOUS GENERAL CHARACTERISTICS

Characteristics	Relationship with Occupation
Household size	Housewives have larger household size than various employed women.
Driver's license	Retired women are least likely to have a license.
Availability of cars	Unemployed women are most likely to have no cars available.
Age of car	Women employed in the other category are most likely to own new cars.
Ownership of car	Professional women are most likely to own their cars.
Expenditure on housing	Professional women and housewives pay more for housing and retired and unemployed women pay the least.
Expenditure on travel	Retired or unemployed women spend the least on travel.
Income	Retired or unemployed women have the lowest income.
Race	There is a high percentage of non-whites in the unemployed, semi-professional and other employment categories.
Education	Professional women have the highest level of education.
Physical handicap	There is a higher percentage of retired or unemployed women who have some handicap.

FIGURE 9

SIGNIFICANT RELATIONSHIP BETWEEN TRAVEL BEHAVIOR AND OCCUPATION

Characteristic	Relationship with Occupation
Mode of travel to church Mode of travel for entertainment	Unemployed or retired women use cars of relatives.
Travel time to entertainment facilities	Unemployed and retired women travel the shortest distance.
Mode of travel to medical facilities	Bus is used most often by unemployed or semi-professional women.
Travel time to medical facilities	Retired or semi-professional women travel for longer time.
Mode of travel for clothing and household shopping	Relative's car or the bus is used most by retired or unemployed women.
Travel time for clothing and household shopping	Relative's car or the bus is used most by retired or unemployed women.
Travel frequency for clothing and household shopping	Retired or unemployed women go shopping more often.
Mode of travel for grocery shopping	Retired or unemployed women walk, use other's cars, taxis or bus more often.
Travel time for grocery shopping	Professional women travel for the shortest time.
Mode of travel for vocational training	Semi-professional women depend on cars of relatives.
Mode of travel for babysitters	Professional and housewives use their own cars while retired women use relative's cars.
Mode of travel to professional meetings	Unemployed women make heavy use of bicycle.
Trip frequency to professional meetings	Unemployed women go to meetings most frequently.
Frequency of travel by car	This mode is used most frequently by professional women.
Frequency of travel by car pool	This is used most often by professional women.
Mode of travel to work	The car is used most by professionals and taxis and jitneys are used by unemployed women.

up in a few of the transit service characteristics as well as responses to the strike (Figure 10). However, all of these with the exception of the variable on the use of public transit for work trips also show up as being significant with respect to income.

IV. Conclusions

The major areas of differences between men and women in their characteristics, travel behavior, perception, and attitude were as follows: driver's licenseship, ownership of car, occupation, physical handicap status modal choice for trips to church, visit to friends, medical trips, household and clothes shopping, grocery shopping, professional meetings and work; frequency of travel to medical facilities, and the frequency of use of the bus, taxi, and the car; and attitudes towards transit strike, cost of fare, and use of public funds for transit. Clearly the attitude towards transit and the modal choice becomes a differentiating factor between males and females, which cannot be completely related to the characteristics identified as significant with respect to sex.

Most of these same characteristics then stand out as being significant in differentiating between occupation, income and age groupings for the women in the sample. Since occupation appears to provide little new information over income in explaining the general characteristics of the women, their behavior, attitude and perceptions, it can be concluded that age and income of women are the critical independent variables. These two variables can then be readily used to identify the travel needs and behavior of different segments of the female population in an area for developing potential markets for transit and other forms of public transportation. For clearly the study has indicated a very favorable response to, as well as a dependence on

FIGURE 10
SIGNIFICANT RELATIONSHIP BETWEEN ATTITUDES AND OCCUPATION OF WOMEN

Characteristics	Relationship to Occupation
If affected by the transit strike Inconvenience of strike	Housewives and professional women were least affected and least inconvenienced.
Reaction to increased fare	Unemployed women either made fewer trips or paid more for transport.
Dissatisfaction with the lack of flexibility of service Dissatisfaction with the lack of comfort Dissatisfaction with the lack of privacy	This was felt most by unemployed, semi-professionals and those employed under all other categories.
Use of public transit for work trips	Inconvenience of using this mode is felt mostly by professionals or semi-professional women.

transit by certain income and age groupings of women.

The needs of younger and very old women appear to be quite unlike other women and sufficiently different from men to warrant special attention by transportation planners. The higher percentage of physically handicapped individuals amongst the older women point to the potential need for specialized transportation. The significance of such a group is even greater if future projections for elderly women are considered. The findings of this study may be representative of a middle-sized urban area. In order to apply the results to women in general, there is a need for more empirical studies in many different areas.

D. PERSONAL SECURITY

PERSONAL SECURITY

The two papers in this section deal with how people, particularly women, feel about personal safety and any changes they may make in their activities or travel patterns because of fear. The Richards-Jacobson-Pepler-Bloom paper stresses the importance of perceived safety; in their review of the literature they find significant differences between men's and women's perceptions of safety and security. Either set of perceptions may be largely unrelated to knowledge of actual security techniques in force or actual crime rates. The Richards et al. paper reports on a study involving differential treatment of two transit stations located in matching neighborhoods in an unnamed city; at one station nothing was done, at the other station intensive security procedures were implemented and widely advertised. Before-and-after studies were conducted. Initially women were found to be extremely concerned about personal security, particularly at night and outside their own neighborhoods. The striking finding of the after study is that after the implementation of security measures women felt safer but men suddenly felt less safe both in their own neighborhoods and at distant points.

The Klein-Kahn work presented here was originally a short, informal presentation at the Conference; the authors had hoped to present an analysis of empirical data collected around Boston Hospital on the impact of fear of rape on women's travel habits and even employment choices. Unfortunately, the data collection was not accomplished prior to the Conference. From their experiences in rape prevention, the authors present some qualitative evaluations of the relationship between sexual

harassment and transportation choices, and they make some personal assessments of the influence that such fears have on women's travel behavior.

The idea that security was a major concern of women was one generally accepted by everyone involved with this Conference. It is then striking how few data exist on the impact of such concerns and fears on women's short and long term decisions about employment and other activities. It is also clear that, while women are more concerned about personal safety, men are also concerned and most in fact change their perceptions and perhaps their evaluation of the importance of safety in their daily travel decision.

PERCEIVED SAFETY AND SECURITY IN TRANSPORTATION SYSTEMS AS DETERMINED BY THE GENDER OF THE TRAVELER

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Introduction; On the Importance of Perceived Safety

Various authors have drawn conflicting conclusions about the role of perceived safety in transportation choice. Part of the problem is the literature on perceived safety and security, and part has to do with basic psychological processes. The literature is uneven in quality, and several studies have failed to ask the relevant questions. Intuitively, transit users would be expected to prefer the safer of two systems in a modal choice situation. In practice, there are many other relevant factors which determine the choice, such as convenience, reliability, cost, and frequency of service.

Thrasher and Schnell, have summarized the results of six different studies in five cities each dealing with the importance of fear of transit crime as a determinant of modal choice. These six studies appear to give inconsistent results, but that is largely because the authors choose to interpret ambiguous measures as relating unambiguously to perceived safety. In fact, whenever they directly asked people about safety, it seemed to be a factor in modal choice and in the frequency and pattern of system use.

One of the Chicago studies reported by Thrasher and Schnell examined the conditions under which CTA passengers reported feeling secure. Telephone interviews were conducted with 1586 persons sampled at random from all Chicago households. Respondents were asked 45 questions, two of which dealt with safety: (1) "While using the CTA, under which conditions do you feel most secure and under which do you feel least secure?"; and (2) "Which of the following conditions make you feel most secure?" After each question, respondents were given a list of conditions from which to select their response. In general, people felt most secure if they knew there was a high probability of obtaining help when it was needed. Concern for safety was least when actually riding the bus or elevated transit and when returning home from the ride on the bus or el. Zones of perceived safety within the transit system were established: people felt least safe on the stairs, ramps, and platforms of a station. They felt more secure riding in the train than waiting in the station. Thus, this study did suggest what situations worry or reassure the transit user. It does not establish whether concern for safety actually influences system use.

Ferrari and Trentacoste surveyed Chicago residents along a bus route which was selected because of its proximity to an el (elevated train) route serving the same areas. (2) Thus, a situation was found in which mode choice was possible and for which convenience, cost, travel time, and comfort were about equal on the two modes. Surveys were distributed both through personal contact and by mail. Bus users were approached with the questionnaire at selected sites. A total

return rate of 18.5% was achieved (371 questionnaires completed), but this represented a 12% return rate for the mail surveys and a 33% return rate for the personally distributed ones. Despite the small overall return rate, this study is one of the better ones in the literature on perceived safety. Therefore, its conclusions will be reviewed in detail and compared to those of other workers.

In comparing bus versus el use, safety was one of the most important reasons patrons gave for choosing the bus over the el when other service factors were held constant. The el/subway system in Chicago was rated much less safe than the bus system. This difference was greatest among el nonusers.

Among demographic variables, sex, age, and frequency of use tend to be the most important. The Ferrari and Trentacoste study found that females are more concerned about safety than males. (2) A study by Olsen and others of a demonstration bus system in Clearwater, Florida, also found a significantly greater concern for safety among females. (4) Similar results were obtained for age in both studies: older passengers were much more concerned about safety. Olsen, et al. also found a much greater concern for safety among people with health problems. (4)

Nonusers have in general been found to place a much greater emphasis on safety and to perceive much lower levels of safety than users for the same system. In a Washington study, 40% of the people who did not take the bus thought that the security on the route used in the study was poor as opposed to only 13% of the bus users. (6)

Siegel, and others have summarized and evaluated the results from several studies of perceived safety and security. (5) They have offered several general conclusions: (1) transit crime seems to have at least some role in determining passenger perception and ridership; and (2) the importance of perceived safety varies with the volume of crime in an area, the availability of alternate modes of transportation, and time of day; (3) within modes, differences can be found in the perceived safety of different parts of the system; and (4) perceived safety does not always mirror the true safety performance of a transit system. According to Siegel, people are generally correct in their attribution of risks to different types of systems, different times of day, different aspects of the same system, and so on. (5) In the Ferrari and Trentacoste study, the difference between sexes in the perceived risk for the el suggests that either different criteria for safety are being used between the sexes or that something other than the true statistical safety level is accounting for the perceived safety level. (2)

A panel study of perceived security was conducted by Feldman and Vellenga. (1) They used the Focus Group Interview technique to collect attitudes toward public transit in the city of Chicago. Homogeneous groups of nine respondents each were formed. All members of each group were of the same race (black or white), sex, and residential designation (city or suburban dweller). Thus, one group consisted of nine Chicago white males, another of nine Chicago black females, etc. There were eight such groups in all, and both users and nonusers were present in each group.

The results are presented by the authors as a series of generalizations followed by specific comments to illustrate the generalization. The "results" should be taken as hypotheses to be verified by other data or to be used in the design of future studies. They cannot be taken as proven or supported by this type of study. In general, security or personal safety does concern the members of these groups, although there appeared to be differences between groups in its salience. Group members expressed both generalized fear (of the transit system as a whole) and location specific fears (downtown). Respondents indicated that they were unlikely to use the el during off-peak hours for fear of crime, and they were most fearful of night use. Concern was expressed for family safety; many respondents didn't want their family members using the el. Men appeared to be more concerned about family safety than women.

Group members felt that if they were threatened while using the transit system, neither transit employees nor other passengers could be expected to help them. These groups did indicate that various security measures (alarm and communications systems, more police patrols) would make them feel more secure, but many members were unaware of security equipment and procedures already in use. Finally, various defensive behavior was described. People try to protect themselves and their property by sitting in certain locations and avoiding specific people and situations. This article is an especially rich source of conjectures to be studied in detail in future work. It is highly suggestive regarding a theory of perceived safety and indicates the need for extended followup surveys.

Elements of a Theory of Mode Choice

Perceived safety and security is one of several factors influencing transportation choice. Others are comfort, convenience, cost, dependability, scheduling, system image, time saving, and stress of using system. Each of these constructs or factors represents an impression about a transportation mode. Such impressions are global- not particular statements about features of the modes. Thus, the person believes and states "buses are inconvenient", "trains are uncomfortable", and "cars are dependable". If you ask "why ?" or "what do you mean by that?" a person can, of course, generate particulars (instantiations of the construct or impression), but the impression is probably the key variable in modal evaluation and choice, not the particulars.

The impression of greatest concern in the present report is perceived safety and security, but in order to understand its role in modal choice it is necessary to study it in the presence of other impressions or constructs which also influence whether people use a particular mode. A variety of possible determinants of modal choice must be examined to see which ones are relevant, and critical. An initial test of the relevance of an impression is whether users and nonusers differ on it: if users and nonusers do not differ in how they rate the safety of a system, then perceived safety is probably not a critical feature in modal choice.

The components of our theory of passenger evaluation of safety and security are shown in Figure 1. Input to the individual may be direct,

FIGURE 1

TASK IV -- PASSENGER SURVEY INFORMATION

I. DEMOGRAPIC CHARACTERISTICS

AGE, SEX, SOCIOECONOMIC STATUS, ETC.

II. USE OF SYSTEM

FREQUENCY; REGULARITY; DISTANCE TRAVELED,

ALTERNATIVES AVAILABLE? CONSIDERED?

III. EXPERIENCE WITH CRIME AND VANDALISM

DIRECT--INVOLVED; WITNESSED; SEEN RESULTS.

INDIRECT--MEDIA, ADS, FRIENDS, ETC.

IV. PERCEPTIONS

AWARENESS OF SYSTEM FEATURES AND OPERATING PROCEDURES.

AWARENESS OF CRIMES, ACCIDENTS, DELAYS, ETC.

V. BELIEFS

CONDITIONS FOR CRIME.

SPATIAL DISTRIBUTION OF CRIME.

TEMPORAL DISTRIBUTION OF CRIME.

VI. EVALUATIONS

PROBABILITY OF CRIME OR ACCIDENT INVOLVING SELF.

FEELINGS OF SAFETY, SECURITY.

FEARS OF CRIME, ACCIDENT, MISHAP.

SATISFACTION WITH SYSTEM.

ATTRACTIVENESS OF SYSTEM.

*VII. SCENARIO SCALING

indirect or both. One may obtain information about transportation systems through experience with the system or indirectly, from the media, advertising, or contacts with other people. Our theory traces the processing of this information through the stages from perception to ultimate intention to use or not to use the system. Components will include models of perceptions, beliefs, evaluations, attitudes, values, decisions and intentions. The content of these constructs are statements about transportation systems and their attributes.

Each of the components of the subjective information processing model can only be assessed by asking passengers about them and having them indicate a value in some way. So, for each hypothesized process or stage, questions or rating scales are used to assess what the person knows, believes, or feels with respect to the system or aspects of it.

These ideas on transportation choice have led to the development of a survey which is being conducted in conjunction with an experimental change in the security procedures at one transit station in a major city. Figure 2 outlines the basic survey information being obtained.

The possible existence of sex differences in the perception of attitudes and toward transit crime motivated the data analyses reported here. Sex differences have often been reported in psychological research, but have been relatively ignored in human factors studies. (3) The few hints of sex differences in the literature discussed above need to be verified and extended before they can be taken

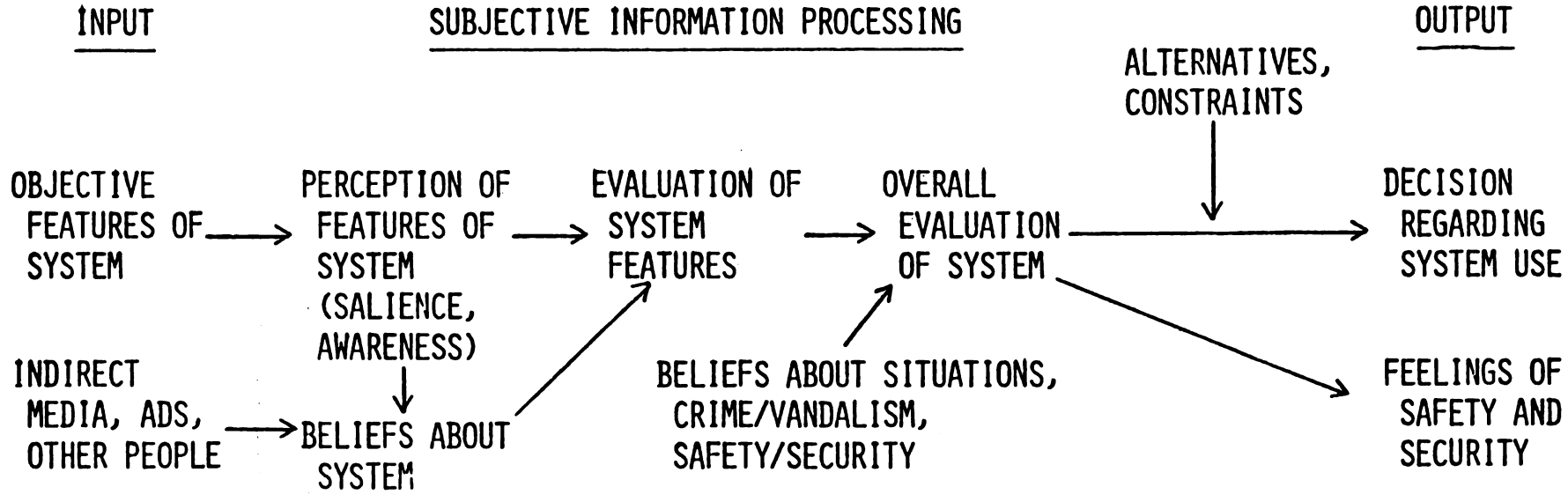

FIGURE 2 INFORMATION PROCESSING MODEL

too seriously. If such differences are found in well controlled studies, then their theoretical implications will need to be assessed and their etiology examined.

Method

This study is part of a large project on system safety and passenger security in rapid transit systems. The data were gathered in a relatively large metropolitan area with an older and very extensive transit system. Surveys were distributed to randomly selected households in the areas surrounding two transit terminals. The terminals had been selected for physical similarity, location, and the socio-economic characteristics of the surrounding neighborhoods. At one terminal, changes in security procedures and equipment were instituted with extensive media coverage. This was the experimental station. At the control station, no changes were made.

In the area surrounding both terminals two surveys have been conducted and a third is planned. These are respectively a pretest, or baseline, survey; an immediate reaction survey, and a delayed, or long term, reaction survey. The pretest survey was completed before any security changes were initiated or announced. The immediate reaction survey was started shortly after new equipment was installed and press coverage announced its existence and potential benefits. In both waves of the survey, the target population included both users and nonusers and various levels of sex, age and income.

The questionnaire was designed to assess several facets of perceived safety and security. Items were included to assess experiences with

crime and vandalism, feelings of security as a function of time and place in the transit system, and perceptions of various aspects of the system and its operation. Other types of items asked for demographic information,system use patterns, and the availability of personal vehicles.

In general, there were two distinct classes of survey items: those that should (or might) be responsive to experimental changes in the transit system and those that should be unaffected by such changes. These latter questions provide the basis for assessing the comparability of two samples: in theory, the results of the second survey on these items should replicate those of the first. Discrepancies between the two samples might explain differences in results at the two times (survey waves), but if similar samples are obtained at both times, then any changes found on the target items are likely due to the experimental manipulations.

Very specific hypotheses were formulated about which items should reflect experimental changes. Basically, users of the experimental station should perceive it as safer after the announced changes. But their perceptions should not change regarding some other terminal which remains unchanged. Respondents in the area around the control station should not change their perception either of their home terminal or of a second selected terminal. In the discussion below, the local or home station differs for experimental and control respondents, but the remote terminal is the same for both. It is a well known, central business district terminal accessible from both home stations.

Results

Demographic Information

The basic demographic information for the two samples is summarized in Table 1. The samples do not differ appreciably from each other in any respect. However, there are some differences between the distributions of women and men within each sample. There are more women than men in the younger age levels, and the reverse is true for the older ages. There is a slight overrepresentation of women in the lower income categories. In general, however, a reasonable distribution of sex, income and age is found in the two samples, with no strong interdependencies of the three variables.

Most respondents have drivers' licenses, although somewhat more men do than women; and most consider themselves to be frequent drivers (see Table 2). About seventy five percent of all respondents have one or two personal vehicles available in their household. In both samples, about one fifth of the women had no personal vehicle in their household, as compared to 14% of the men. Thus circumstances would seem to indicate that slightly more women than men would need to use public transportation.

Patterns of Public Transit Use

Table 3 shows the frequency of use of the transit system by gender for the two waves of the survey. A larger percentage of women than men say they never use the transit system in both surveys, and about 6% more men than women use the system every day. Most frequent trip purpose is summarized by gender in Table 4. Half of the women and

TABLE 1

BASIC DEMOGRAPHIC INFORMATION

	WAVE 1		WAVE 2	
	Male	Female	Male	Female
N	352	389	387	363
%	46	51	49	46
Age (in years)				
30 or less	19%	33%	19%	31%
31 - 59	48%	46%	50%	46%
60 or older	33%	21%	31%	23%
Income				
under $5,000	3%	10%	4%	7.5%
$5,000-9,999	10%	16%	8%	13%
$10,000-14,999	19%	20%	16%	18%
$15,000-19,999	20%	15%	23%	22.5%
$20,000-24,999	19%	14%	18%	12%
$25,000-29,999	11%	10%	11%	12%
$30,000-34,999	7%	7%	5%	6%
$35,000 and up	10%	8%	15%	8%

TABLE 2

AVAILABILITY OF AUTOMOBILES

	WAVE 1		WAVE 2	
	Men	Women	Men	Women
Have Operator's license	88.5%	66%	88.9%	70.3%
Frequent Driver	68.5%	73.5%	78%	63.8%
Number of Personal Vehicles in Household:				
None	14.5%	20.3%	12.9%	19.3%
One	55.2%	48.4%	55.3%	50.3%
Two	24.4%	27.7%	28.2%	26.8%
Three	4.7%	2.7%	3.0%	3.0%
Four or More	1.2%	.8%	.5%	.6%

TABLE 3

FREQUENCY OF USE OF TRANSIT SYSTEM*

Frequency	WAVE 1		WAVE 2	
	Male	Female	Male	Female
Never	8.5	19.3	9.7	17.1
A few times a year	25.0	28.4	25.0	23.0
A few times a month	13.6	9.6	11.8	11.2
A few times a week	9.7	5.7	10.5	12.4
Daily	43.2	37.0	42.9	36.2
N	352	384	380	356

* Table entries are percents of column totals.

TABLE 4

PURPOSE OF MOST FREQUENT TRIPS
USING THE TRANSIT SYSTEM

Trip Purpose	WAVE 1		WAVE 2	
	Men	Women	Men	Women
Work	71	56	70	54
School	3	2	3	5
Shopping	8	18	10	29
Social	8	14	6	7
Other	10	10	11	5

Table entries are percents of row totals.

70% of the men most frequently use the transit system for trips to and from work. There is no differential pattern of system use by gender. Both men and women use the system mostly in the time periods from 6 to 9 a.m. and 4 to 7 p.m., which correspond to the trips to and from work. Slightly fewer women than men use the system during these peak periods and during the night hours. System use is very limited in the period from 7 p.m. to 6 a.m. (see Table 5).

The Role of Personal Security in System Use

The primary focus of these surveys was perceived safety and security. To what extent do users of the transit system adjust their system use for reasons of safety? When asked whether they considered safety and security in deciding whether to use the system, half of the women and a third of the men said safety was a major factor; another 35-38% of each said it was one of several major factors (see Table 6). In both survey waves, substantially more men than women said that they did not consider security in deciding whether to use the transit system. Among nonusers of the system, the primary reason given for not using the system was that it was unsafe; 41% of the responses from male nonusers and 58% of those from female nonusers so indicated.

When the respondents were asked whether there were times of day during which they were reluctant to use the transit system for reasons of safety and security, the results shown in Table 7 were found. Most users of both genders are reluctant to use the system at certain times. Which times are shown in Table 8. Both men and women are reluctant to use the system at night (7:00 p.m. to 6:00 a.m.).

TABLE 5

PERCENT OF RESPONDENTS OF EACH SEX IN EACH SAMPLE WHO USUALLY USE THE SYSTEM AT PARTICULAR TIMES OF DAY

	WAVE 1		WAVE 2	
Time	Male	Female	Male	Female
Midnight- 6 a.m.	7	1	5	1
6 a.m. - 9 a.m.	58	52	62	54
9 a.m. - Noon	21	23	20	23
Noon - 4 p.m.	26	20	22	27
4 p.m. - 7 p.m.	51	46	56	46
7 p.m. - Midnight	11	5	11	8
N	351	389	387	363

TABLE 6

QUESTION: DID YOU CONSIDER SAFETY AND SECURITY IN DECIDING WHETHER TO USE THE TRANSIT SYSTEM?

	WAVE 1		WAVE 2	
Response	Male	Female	Male	Female
Yes, it was a major factor	33%	51%	36%	50%
Yes, one of several important factors	35%	36%	38%	37%
No, I did not consider it	26%	11%	21%	9%
I don't know	7%	2%	5%	4%
N	319	354	358	322

TABLE 7

ARE THERE TIMES WHEN YOU ARE RELUCTANT TO USE THE TRANSIT SYSTEM BECAUSE OF CONCERN FOR SAFETY AND SECURITY?

	WAVE 1		WAVE 2	
	Male	Female	Male	Female
YES	80%	92%	81%	90%
NO	16%	3%	13%	4%

TABLE 8

PERCENTAGE OF RESPONDENTS OF EACH SEX WHO EXPRESSED RELUCTANCE TO USE THE TRANSIT SYSTEM AT CERTAIN TIMES.

	WAVE 1		WAVE 2	
TIME	Male	Female	Male	Female
Midnight - 6A.M.	75.5	85	54	63
6:00 A.M. - 9:00 A.M.	10	19	6.5	13
9:00 A.M. - Noon	14	18	13	24
Noon - 4:00 P.M.	17	22	15.5	27.5
4:00 P.M. - 7:00 P.M.	4	9	5	13
7:00 P.M. - Midnight	71.5	83	70	80

Relatively more women than men are reluctant to use the system at all times.

Thus, personal security is clearly implicated in one's decision concerning whether to use the transit system at all and for users it helps determine the times of system use. Perceived security seems to have a greater influence for women than for men.

Ratings of System Attributes

Respondents rated ten attributes of the transit system. These included the standard factors usually discussed in models of mode choice (cost, convenience, frequency of service, reliability and comfort), in addition to factors relating to perceived safety and security (personal security, frequency of police patrols, accident safety, condition of vehicles and of stations). Each attribute was rated using a six point scale varying from very good = 1 to very bad = 6; thus a mean rating of 3.5 represents the neutral point. Mean ratings for the various factors are shown by gender in Figures 3 and 4 for the two waves of the survey. Labels are provided only for those factors related to perceived safety and security. The ratings are surprisingly similar for men and women - the same pattern of ratings is evident for the two sexes in both surveys. In both cases, women tend to rate the attributes more negatively than men do - with this tendency being more pronounced in the second survey. On the attributes personal security, frequency of police patrol, and accident safety, women rated the system worse than the men did. However, the overall ratings on accident safety are quite favorable, while those for the other

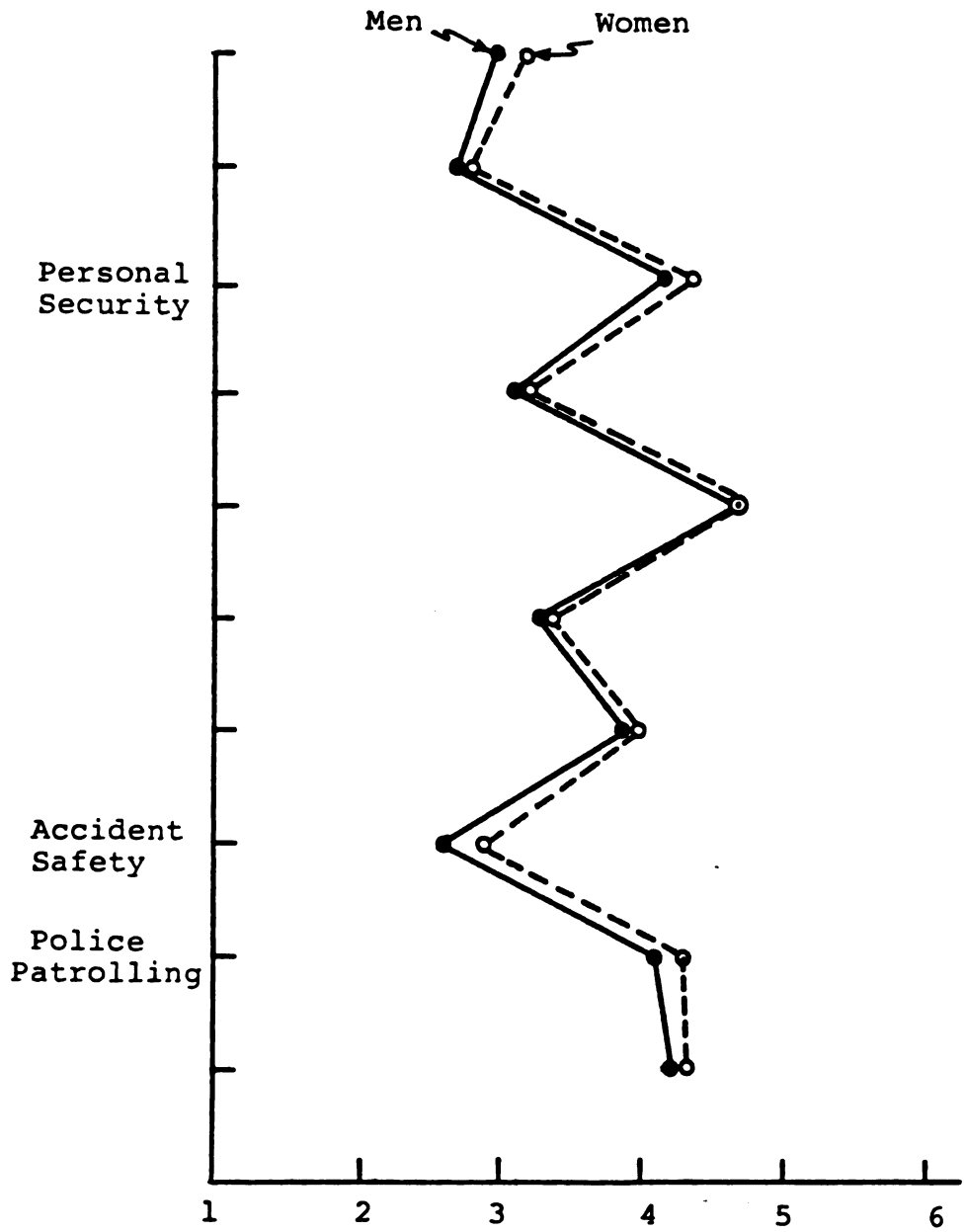

Figure 3 Ratings of System Attributes; Data From First Survey

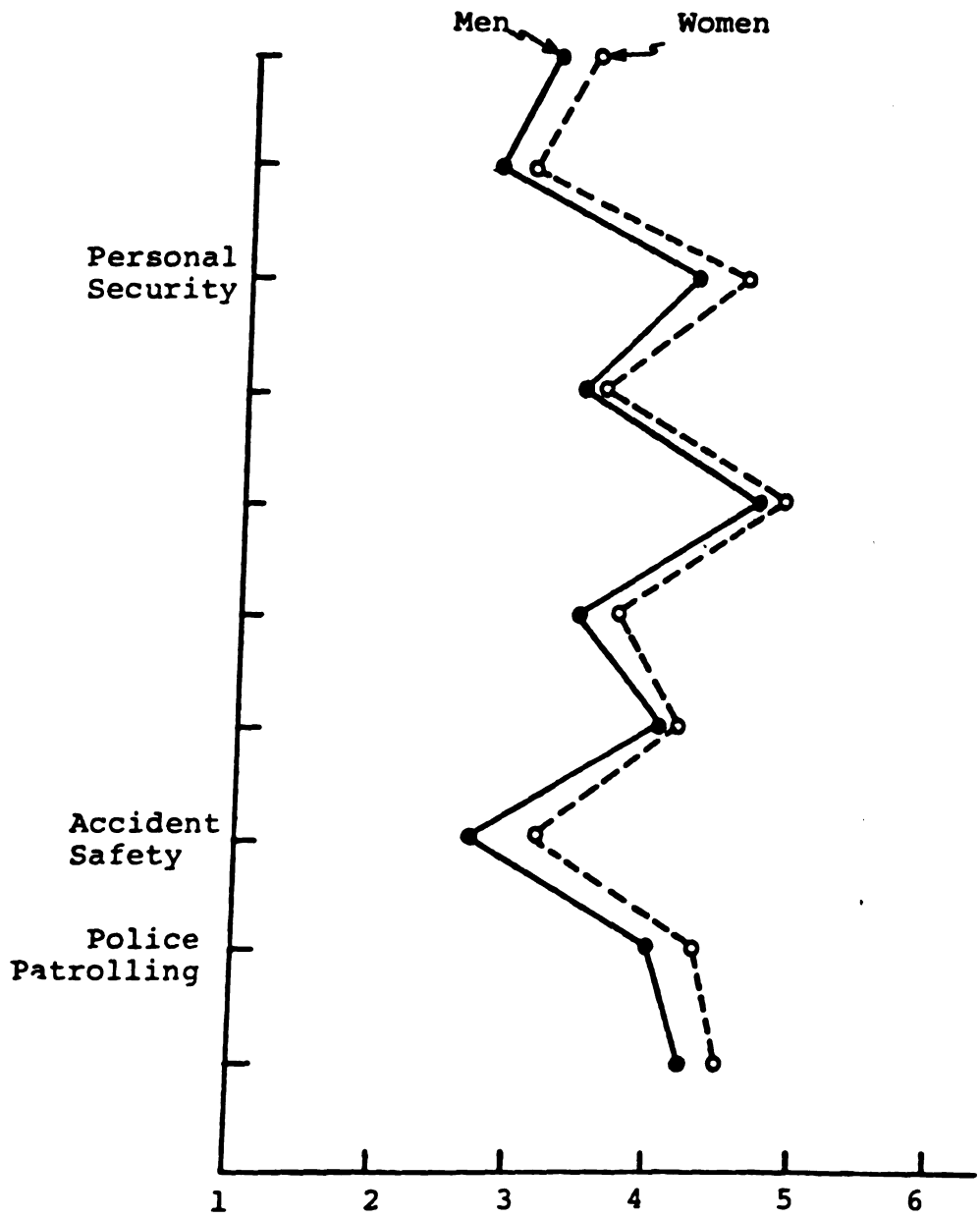

Figure 4 Ratings of System Attributes; Data From Second Survey

two attributes are unfavorable. The critical finding for this context is that in both surveys, women rate the transit system less favorably in terms of personal security than men do.

Security Ratings by Time and Place

Respondents rated how secure they felt at different times and places in the transit system. Their ratings were done using 6 scale points with 1 meaning "very secure" and 6 meaning "very unsecure". Figure 3 illustrates the task, the distinctions involved, and the main results. These results are based on data from the first survey. Perceived security was rated as a function of time of day (day, evening, night) location (inside or around a terminal), and terminal (local vs. remote, but well known central business district, station). Several findings are apparent in Figure 3: (1) in all cases, women felt less secure than men did; (2) the local terminal is regarded as safer at all times than the remote terminal; (3) the area around the home station is perceived as more secure than inside the home station; and (4) there is a strong time of day effect - night is less secure than evening which is less secure than day.

The data in Figure 5 were aggregated over all home stations and represented only results from the first survey. A user's home station is the terminal through which he/she usually enters the transit system. The next four figures partition the data by home station and include Wave 2 results. In Figure 6, rated security at the local terminal is shown for those repondents who identified the experimental site as their home station. It was hypothesized that these respondents

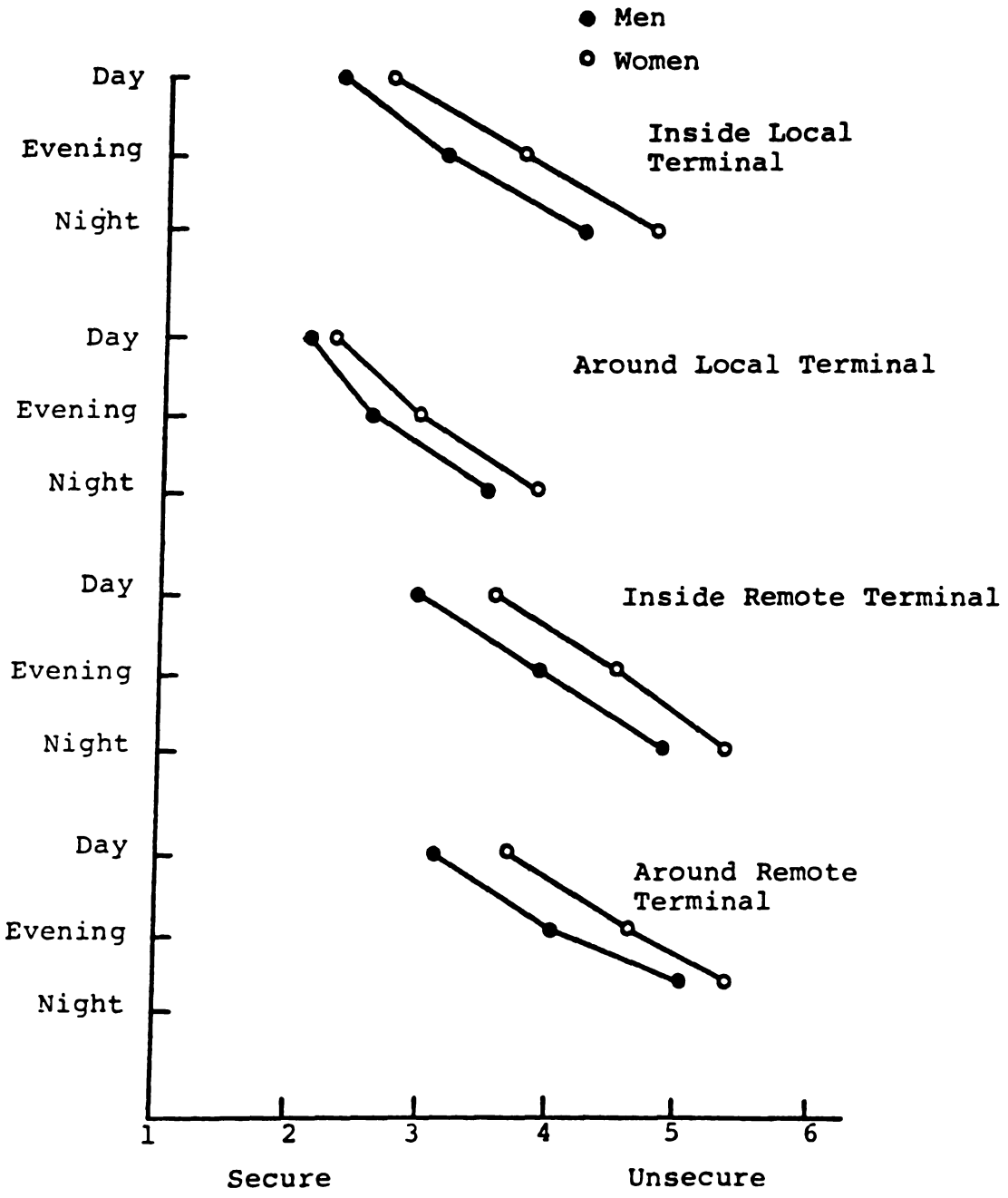

Figure 5 Rated Security by Situation and Time of Day

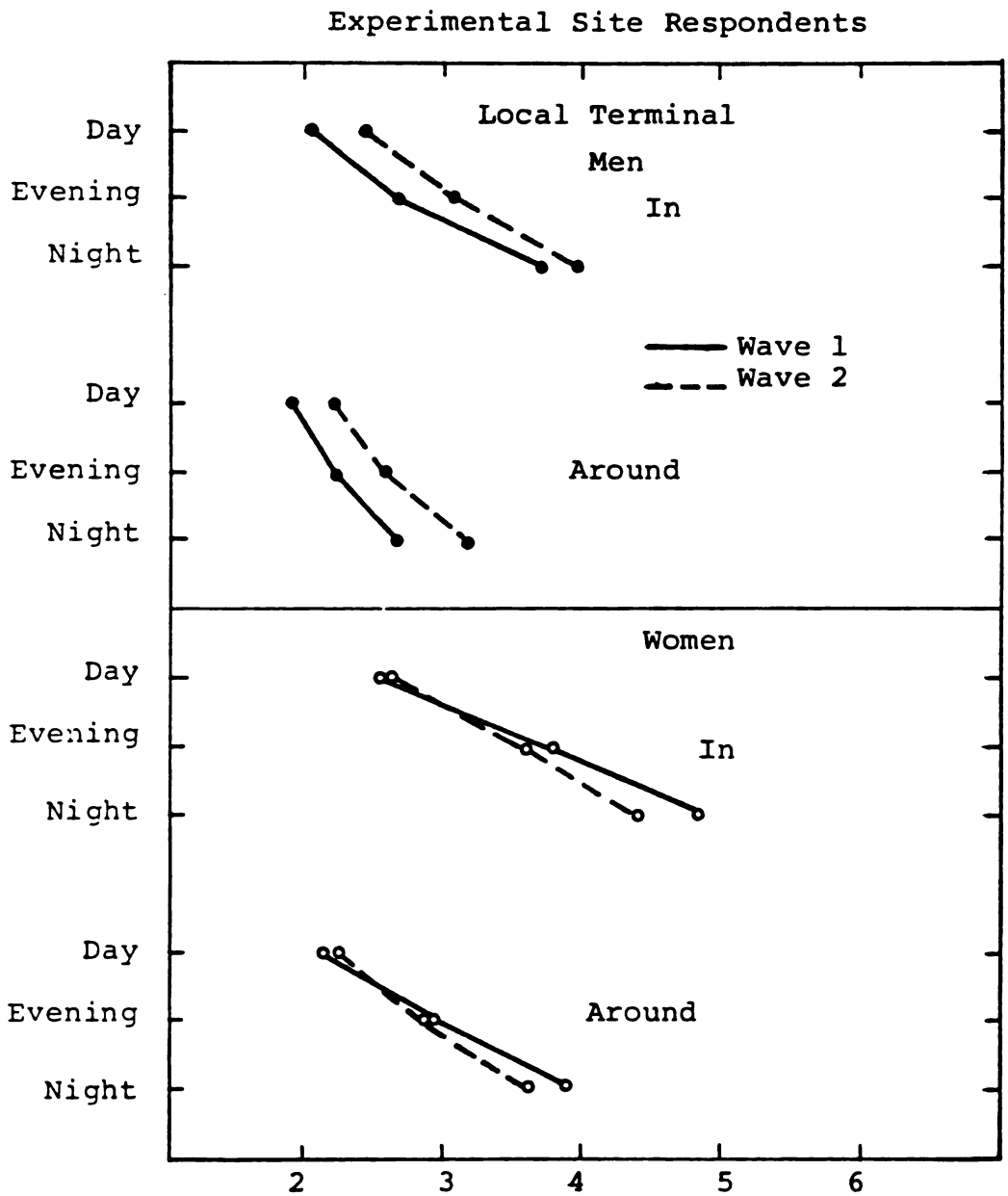

Figure 6 Rated Security by Situation, Time of Day, and Gender of Respondent

should feel safer after the experimental changes in their home station than they did prior to such changes. Such enhanced safety should be specific to the home station and should be limited to inside the station. The hypothesized results were wrong in several respects: (1) men rated the local terminal less safe after the change than before; they also rated the area around the local terminal as less safe in the post-test survey - this difference occurred at all times of day; (2) women rated the local terminal as more secure in the evening and at night following the station alterations, but there was no difference in their ratings concerning the day. A similar pattern of ratings was obtained for the neighborhood around the home station. Thus, men seem to feel less safe in and around their home station after the experimental modification of the terminal, while women feel more secure in and around the station in the evening and night.

When these same respondents rate a remote terminal, the results in Figure 7 were obtained. Men tended to rate the remote terminal as somewhat less secure at the time of the second survey; and the surrounding area was seen as slightly less secure. For women, there were no differences in their ratings of either the remote terminal or its neighborhood between the two surveys.

Data from respondents who identified the CONTROL site as their home station are shown in Figures 8 and 9. Here men rated both their local terminal and the remote terminal no differently in the two surveys. The only discrepancy is a slight tendency for men to rate the area around the remote terminal as less safe in the day. Women, however,

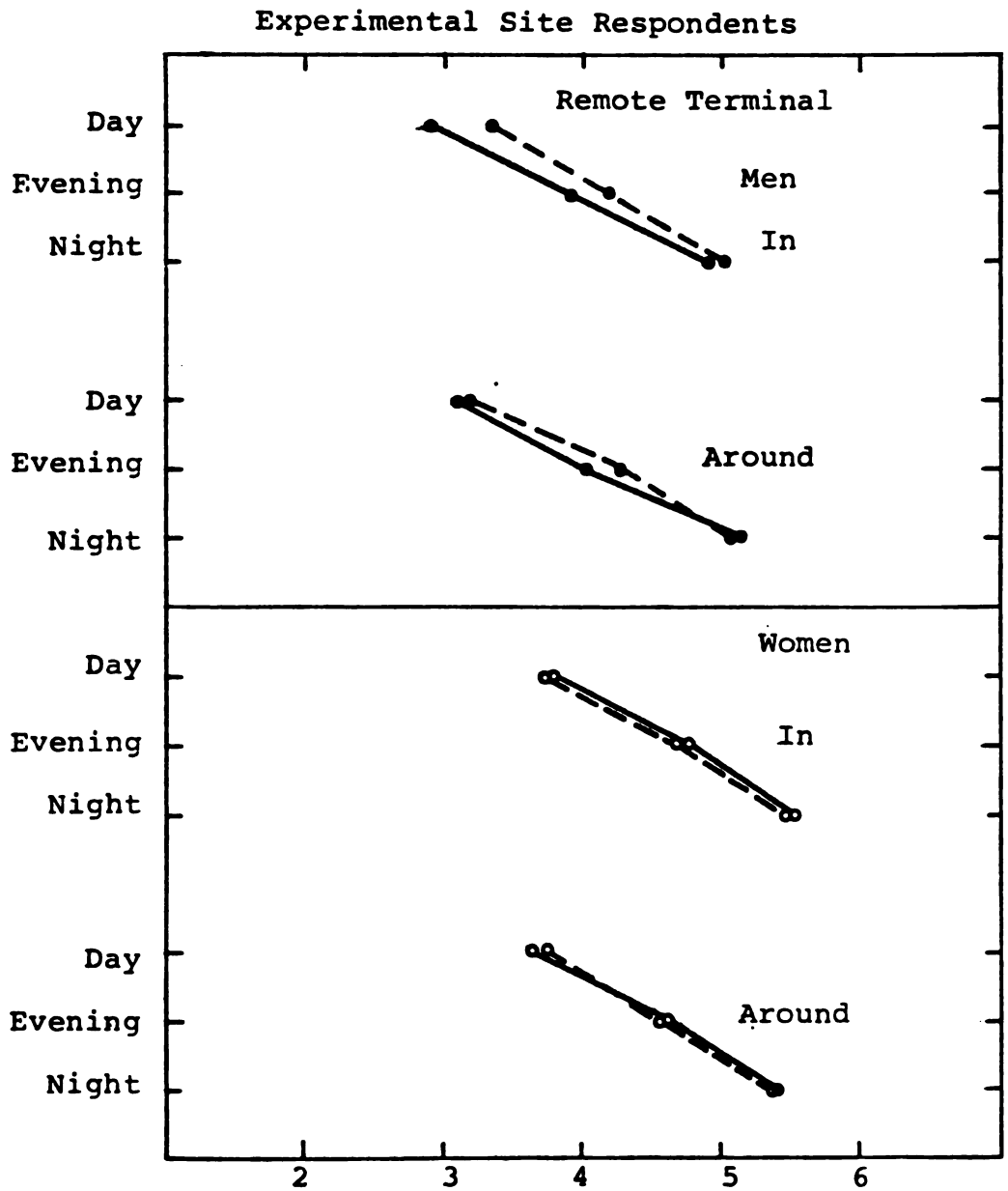

Figure 7 Rated Security by Situation, Time of Day, and Gender of Respondent

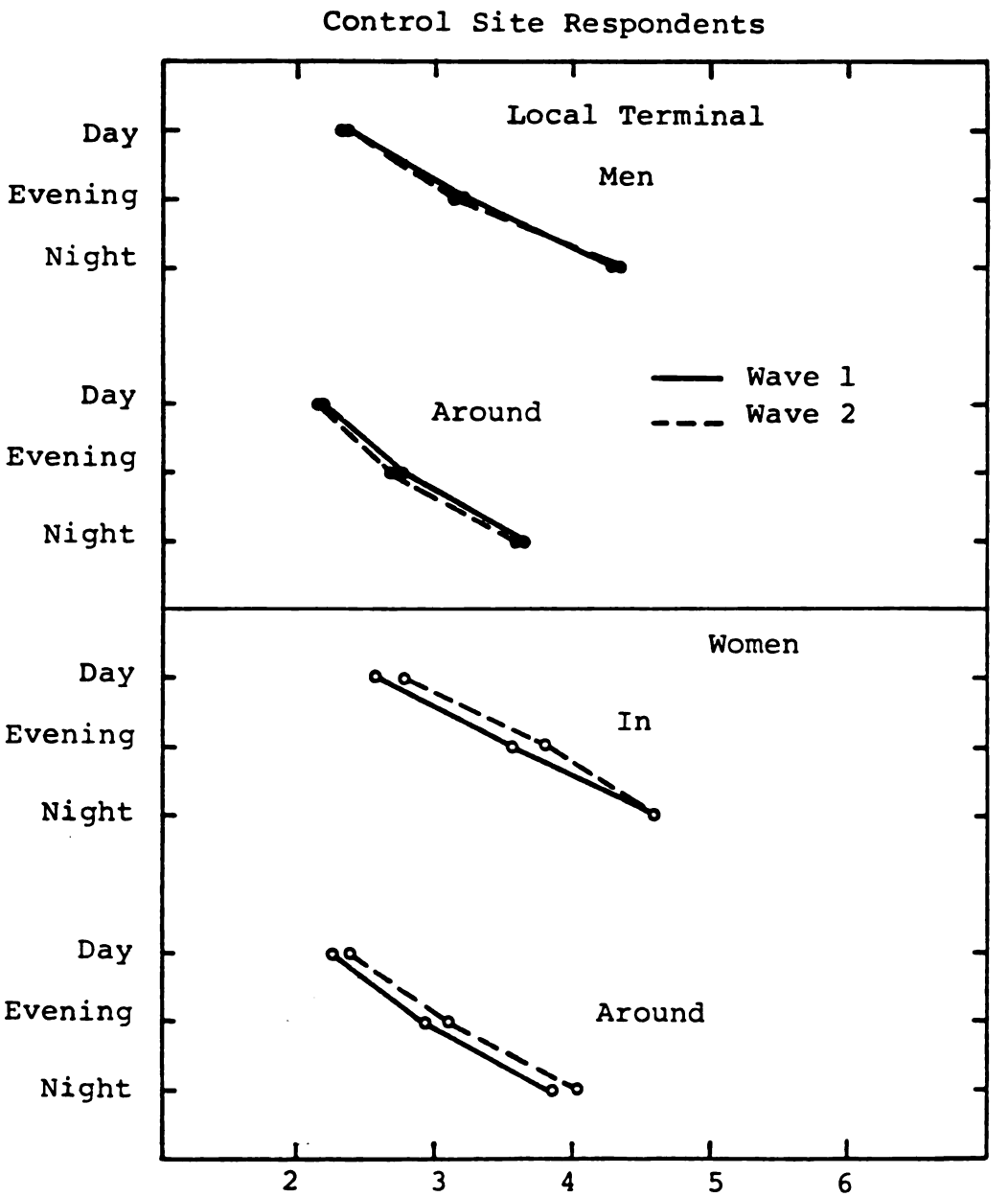

Figure 8 Rated Security by Situation, Time of Day, and Gender of Respondent

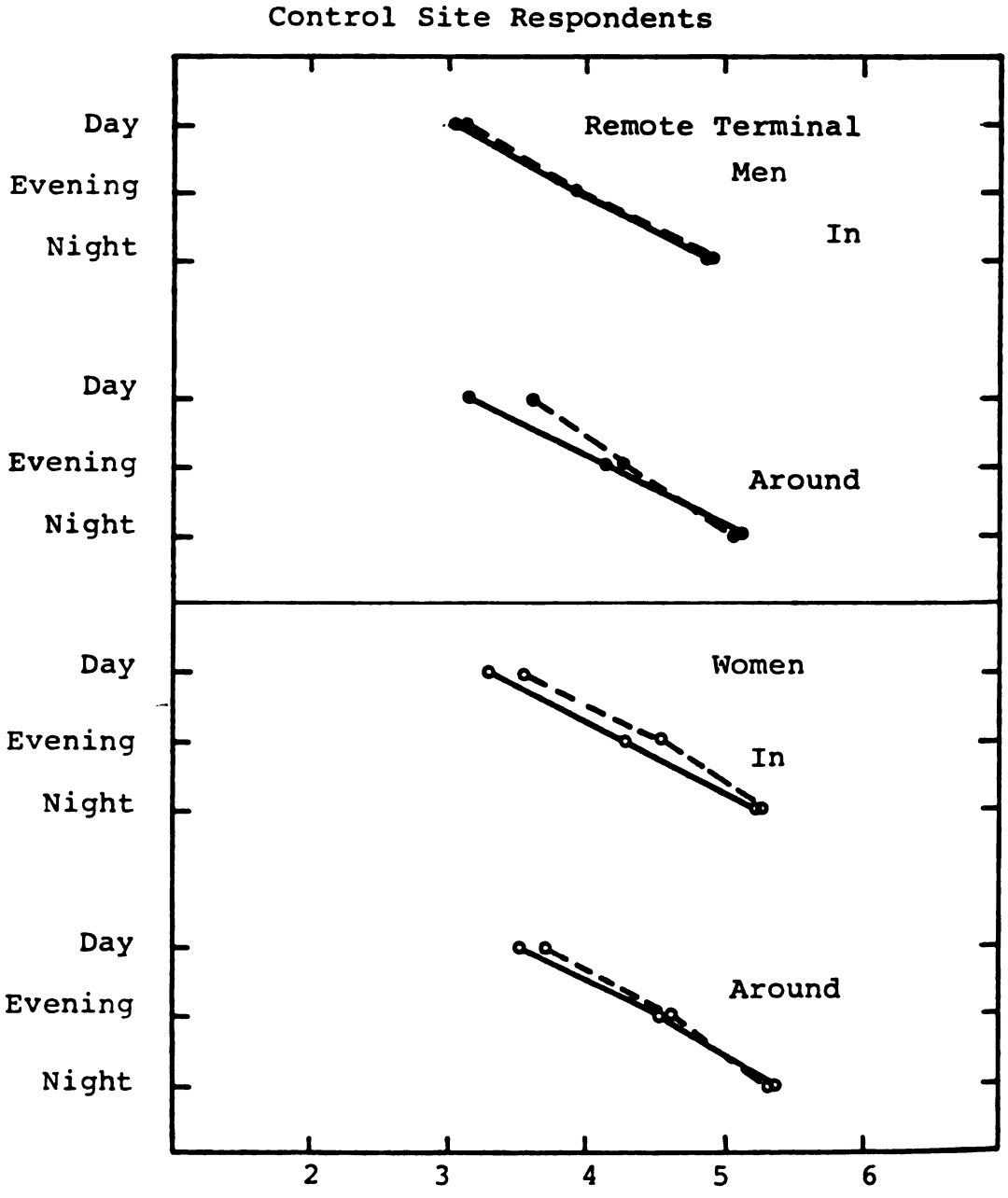

Figure 9 Rated Security by Situation, Time of Day, and Gender or Respondent

tend to rate both stations as slightly less safe in the second survey than in the first.

Thus, the effects of experimental changes in the target station were to enhance perceived security for women at certain times, but to decrease perceived security for men at all times. Perhaps women felt more secure because transit police were trying to improve security, while men felt less secure for the same reason. The men might be thinking "if these security gadgets are necessary, things must be worse than I thought". Recall that in general men do feel more secure initially than women do while using the transit sytem. When the data were separated for frequent and infrequent users, the trends reported above hold for both data sets.

Perceived Changes in Crime Levels

Respondents were asked whether they had perceived any change in the level of crime at their local station over the prior six months. The distribution of responses by gender is shown for the two surveys in Table 9 for respondents from the two target stations. In the second survey, about one-fourth of the female respondents said crime had decreased at the experimental site; while only 5% of them said it had increased. This pattern is quite different from that for men or for either gender at the control site. The percentage of respondents at the control site saying that crime decreased is about equal to the percentage saying it increased - for both sexes. For men at the experimental site, 16% say crime decreased, but 11% say it increased. Thus the only clear effect of the crime countermeasures was on

TABLE 9

CHANGE IN CRIME LEVEL AT LOCAL TRANSIT STATION, PARTITIONED BY HOME STATION

	WAVE 1		WAVE 2	
	Men	Women	Men	Women
Experimental Site				
Decreased	10%	3%	16%	24%
Remained the same	79%	87%	73%	71%
Increased	11%	10%	11%	5%
Control Site				
Decreased	5%	7%	12%	16%
Remained the Same	88%	82%	76%	70%
Increased	7%	11%	12%	14%

women - more of them believed that crime had decreased at the experimental site.

Respondents indicated what sources of information they though influenced their beliefs about the level of crime at their local station - similar results were evident for men and women (see Table 10). Personal observation and discussions with friends and relatives are said to be the primary sources. Media coverage is cited by fewer respondents but it is a potent source of information.

When asked about their personal experiences with crime, few respondents had actually been victims, but a larger proportion had witnessed crimes and most people reported having friends who had been victims (see Table 11). The crimes most frequently witnessed were against personal property, such crimes were more frequent than all other crimes combined. There were no differences by sex in the types of crimes observed. The final question in this series asked respondents whether they feared being victims of crime while using the subway: about 90% of the women respondents and 80% of the men did.

There is a large discrepancy between the number of people who have seen crimes and those who fear crimes - this difference reflects the importance of indirect sources of information in shaping peoples' perceived security. The importance of discussions with friends and relatives was evident in Table 10, and most respondents do have a friend who was a crime victim. The problem, of course, is that a single criminal incident is reflected in the fears of many people.

TABLE 10

BASES FOR BELIEFS CONCERNING CRIME LEVEL AT LOCAL TRANSIT STATION *

SOURCE OF INFORMATION	Wave 1		Wave 2	
	Men	Women	Men	Women
Personal Observation	91%	85%	91%	87%
Media Coverage	66%	65%	55%	62%
Discussions with Friends, etc.	82%	91%	83%	83%
Other Sources	24%	24%	20%	17%

* Entries are percent of respondents to each item indicating that each source influenced their beliefs.

TABLE 11

EXPERIENCE WITH CRIME

	WAVE 1		WAVE 2	
	Men	Women	Men	Women
Crime Victim	14%	12%	14%	16%
Crime Witness	29%	26%	29%	30%
Friend who was Victim	70%	72%	70%	77%
Fear being Victim	79%	88%	79%	91%

DISCUSSION

Perceived safety and security does make a difference in mode choice and use. In another report, we have shown that the single best variable for differentiating users from nonusers in this data is perceived personal security. There are important differences between men and women in how they perceive the safety and security of this transit system. More women than men express concern for their safety while using the transit system. Women use the system less, and are somewhat more reluctant to use it in general. Furthermore, a greater percentage of the women say that safety and security was a major factor in their decision as to whether or not to use the transit system.

While similar percentages of men and women have been crime victims or crime witnesses, more women fear being the victims of crimes. Those crimes actually observed by men and women were similar in type and severity, but women are generally more fearful in the transit environment.

In the first survey, women rated the transit system as less secure at all times and places asked about than did men. In the second survey, which followed an experimental change in security procedures at a selected transit terminal, the perceived security of this station was rated better in the evening and at night by the women, but worse at all times by the men. This pattern of results was found for both frequent and infrequent system users. Impressive converging evidence that women had changed their perceptions of personal security is

provided by Table 9. A substantial number of female respondents thought crime had decreased at the experimental site by the time of the second survey. This trend differs from that observed for women at the control site. Thus, visible signs of attempts to improve security are reassuring to women but not to men. Men start out feeling more secure and become a little less so by the second survey. Women feel less secure initially but become more secure as a result of the security measures. Thus, there is a group of users whose feeling of personal seucrity is enhanced by the experimental changes. The rated security is still less than that for men but it has improved and that might increase use of the transit system.

This study shows the importance of perceived safety and security, but it also shows that the same objective situation can lead to different perceptions and certain of thsoe perceptions are associated with the gender of the respondent. We do not know why women feel less safe (from this data) - they have neither seen nor been victims of any more crimes than the men. One possibility is that women are more subject to harassment - which is not serious enough to be criminal but does influence one's felt security. But whatever the cause of their insecurity, these women felt safer as a result of the changed situation at their local transit station.

Why women changed their perceptions of personal security for the better while men changed their's for the worse after the system change is the basic mystery in this data. Our explanation of it is as follows: at the time of the first survey, men in the area of the experimental terminal are relatively unconcerned about personal security. They

are basically unaware of it, it has low salience for them. When the system change in instituted and publicized, personal security becomes more salient and is seen as a problem. The man says to himself "If they need to install all these gadgets, then the crime situation must be worse than I thought."

Women, on the other hand, are concerned with security from the start. They are aware of it as a problem, and it has high salience for them. When they see that something is being done to control crime, they feel safer as a result. This enhanced feeling of safety is limited to the evening and night hours, but those are the times they were initially least likely to use the transit system. Now, perhaps their use of the system will increase during those time periods.

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THE TRANSPORTATION IMPLICATIONS OF WOMEN'S FEAR OF ASSAULT

An Oral Presentation: Frieda Klein, Alliance Against Sexual Coercion

A few presentations at the conference have discussed women's perceived fear of personal security in relation to their use of public transportation. I am going to address the question of how real is this fear.

Janet Kahn and I had originally proposed to present a paper based on a survey at the Harvard Medical Complex in the Boston area. The need for the survey grew out of a specific problem at that medical area.

The Harvard Medical Complex is comprised of approximately ten institutions, and at any point in time employs between 18,000 and 23,000 employees. Two-thirds of these employees are women. In a six week period during August and September of 1977, 24 rapes were reported to the police. These rapes occurred at one subway stop in front of one hospital in the one hour between 11:00 pm and midnight. The victims were women who were coming to work on the graveyard shift or those who were leaving the afternoon swing shift. Nearly half of all women working these shifts are black and Hispanic and have no access to private vehicles.

The survey, which was to be sponsored by the Harvard Joint Commission on the Status of Women proposed to find out the type of transportation used by all employees at all times of the day in cases where public transportation was chosen, and how many men and women had access to private vehicles. In addition, the survey sought to determine the prevalence of rapes or assaults of all types to and from work and the perceived

effect of fear on job performance.

Between the time of approval and projected start date for the administration of the survey, the head of security at Harvard Medical Complex was fired after 19 years of service. At the same time, rape education courses were offered for all women employees of the institution. We had to delay the administration of the survey because of these changes. We still intend to conduct the survey, although we have no idea how these new measures will affect our results. Therefore, we do not yet have much direct data on the impact of rape on travel behavior or employment choice.

Through the efforts of rape crisis programs we do, however, know something about the overall crime of rape. There are many problems with statistics on rape, mostly because very few are reported to any official agency. The FBI is in charge of compiling all statistics on all violent crimes, including rape. They estimate that as many as 90 percent go unreported. Household surveys have taken self-reports from women, calculating victimization rates. These surveys confirm the assertion that 90 percent of all rapes are unreported. The latest estimates by the FBI are that one out of three women in the U. S. will be raped sometime during her life. This has been confirmed by two household surveys. The first in the Los Angeles area conducted by the L. A. Commission on Assaults Against Women, found a one in 2.8 victimization rate. The second, in the San Francisco Bay Area, has to date found one in 3.2.

The other things we know about rape is that slightly more than one-half of such assaults occur out-of-doors. Data from different urban areas, throughout the U. S. indicate that anywhere from 42 to 57 percent of

rapes occur at night. However, it is more than the outdoor rape rates which directly involve transportation choices. An additional one-quarter of rapes taking place within the victim's home are those in which a woman is followed home from a subway stop, from a bus stop, or from her parking space.

One particular survey done in the Cleveland area, jointly sponsored by the Cleveland Rape Crisis Center and Cleveland Women Working is noteworthy. There were 1200 women office workers in the sample who usually relied on public transportation to and from work. Eighty-nine percent of these women reported harassment by men on public transportation. This included verbal harassment and minor physical unwanted contact. These were women reporting on rides from 5:00 to 6:00 pm coming home. Women who left work late, riding public transportation from the downtown area between 6:00 and 9:00 pm reported a significant decrease in harassment, as the number of other riders went down, but a ninefold increase in violent assaults.

The Cleveland data appears to indicate that some women may be forced to choose between personal security and occupational mobility, since a woman's willingness to work overtime for her office may be directly related to a promotion.

The effect of chronic harassment on women is unclear. What the literature suggests, however, is that its cumulative effect is to keep women fearful and without a sense of control over their mobility in particular. While we are waiting for specific results from our survey and from others like it at the Harvard Medical Complex, there are immediate measures that the U. S. Department of Transportation could take to reduce both violent assaults

on women and harassment.

One of these is, of course, to place more security guards at transit stops and stations. Also, something that is obvious is the need for better lighting. Emergency phone systems can be implemented at subway stops as well as pathways between large workplaces and the subway or bus stop. In addition, many rape crisis centers have offered sensitivity training for security personnel who would take a complaint from a rape victim.

In addition, we need to look at other alternatives. A week ago in the Washington Post there was a report that Mexico City is dealing with the harassment of women by men on subways by segregating one line of the subway; that all male users are to use one car, women an children are to use another car. I do not think that that is a good alternative because it doesn't deal at all with the cause of the problem.

There are several other alternatives to be considered. One of those is in California. A self-defense bill was sponsored by the Clerical and Service Employees, which is a California State Union of women employees. What it asks is that employers be responsible for providing self-defense training on company time to any woman employee who requests it.

Other solutions that women have developed involve so-called paratransit or flexible services. There are two women's transit authorities in the U. S. serving exclusively women. They operate in Madison and in Milwaukee and offer free door-through-door rides to women who need that service. The systems avoid charges of discrimination by pointing out that the crime of rape and of itself is discriminatory.

In closing, I would like to encourage transportation researchers to involve the expertise of local rape crisis programs. To better assess the relationship between women's fear of assault, actual rates of assault, and their transportation choices.

E. HUMAN FACTORS AND REACTIONS TO VEHICLE ENVIRONMENTS

HUMAN FACTORS AND REACTIONS TO VEHICLE ENVIRONMENTS

The two papers presented in this section deal tangentially with the same subject; how do women perceive the attributes of particular transportation systems? However, the orientation and chief concern of each paper is strikingly different. The Richards-Jacobson paper examines both physical and psychological differences in men's and women's reactions to the environment and attributes of several transportation modes; their particular concern is the attribute called "ride quality". The authors find differences both in how men and women respond to differences in motion and comfort, and also how they make different assessments of the importance of these perceptions. The authors conclude that further research should be undertaken on reactions to rolling motions on public transit vehicles, and on motion sickness in general in order to allow better prediction of reaction to transportation innovations.

Hunt's paper summarizes findings from a national survey of women car buyers; those women who registered the car in their own name regardless of age or marital status were considered buyers. Hunt's study is not a comparative one; it does not analyze comparable attitudes among male car buyers, but it is interesting to note that auto manufacturers feel that there is a definable "women's market" at which they wish to aim. The study found that the woman car buyer was neither typical of the average American woman nor of the average car buyer. In addition, buying a car appeared to be more of a problem for these women than for men.

These papers present two different aspects of women's perceptions of transportation systems. Women are shown to have distinct perceptions, both of physical and psychological aspects of ride quality as well as of specific features in automobiles. The existence of these unique perceptions suggests that further research is warranted to provide a better understanding of what women look for in transportation systems in areas other than the transportation service itself. Again, such an understanding would allow for better prediction of travel choices and behavior.

GENDER DIFFERENCES IN REACTIONS TO VEHICLE ENVIRONMENTS

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In a recent article in the journal Human Factors, Hudgens and Billingsley (2) note the neglect of sex or gender as a variable in human factors research. Reviewing the articles from both Human Factors and Ergonomics over an 11 year period, they found that half the studies used only male subjects and nearly one-third of the studies failed to even indicate the sex of their subjects. Of the 166 studies which did include subjects of both sexes, only one-third analyzed their data for sex differences. But 73% of the studies that did analyze for them found significant sex differences.

The literature on human reaction to motion and vibration has generally ignored the possible existence of gender differences. Indeed, in the standard reference sources (1), there is no mention of possible sex differences in this context. Since most early laboratory studies of reactions to vibration were done in either military or industrial settings, it is likely that most of them used only male subjects. In most of sensory psychology, there is an implicit assumption that sensory receptors are pretty much the same across individuals, and that the structure of, say, the retina, the vestibular system, or the auditory receptors is independent of sex.

However, at the level of the individual reacting to the total vehicle environment, one might expect sex differences for a variety of reasons: (1) men and women are physically different from each other, with respect to physical size and gross anatomy, (2) there may be psychological differences which are associated with gender (due, for example, to different levels of experience or familiarity with various vehicles), (3) there could be cultural or social expectations or constraints which influence one's reactions and vary with sex, and (4) different role demands might alter how one reacts to vehicle inputs.

As we shall show in this paper, there are differences between men and women in how comfortable they find vehicle environments. Are such differences due to differential sensitivity to motion and other environmental factors? Or, are the differences really due to other factors which correlate with gender, but do not necessarily depend on it? Examples of such factors might be (1) physical size, (2) experience with the transportation system, and (3) purpose of trip or role of traveler.

Results from the University of Virginia studies of transportation users will be discussed to help provide answers to these questions. The data base includes (1) extensive surveys of the users of commuter air services (1619 respondents), (2) results from experiments on ride quality in buses and trains (90 subjects), and validation results from regular users of those vehicles (162 respondents), and (3) results from experiments on ride quality in diverse vehicles.

These results represent the products of two distinct modes of inquiry. The airline data come from surveys of passengers on board regularly scheduled commercial flights. Comfort ratings in this context represent global information. The rating is included as part of a questionnaire answered near the end of a flight. Many other kinds of information were obtained in addition to the comfort ratings.

The work with ground based vehicles concentrates explicitly on comfort. People were hired to ride these vehicles and rate their comfort levels repeatedly throughout a trip. Participants were selected to represent different levels of age, sex, and experience with the transit vehicle. Test segments were selected to insure wide variability in the quality of the vehicle ride. Thus, these studies have some of the features of laboratory experiments.

We shall recognize these two types of data by presenting our paper in two parts. But all of this data centers on the reactions of people to vehicle environments and, of course, the role of gender in determining those reactions.

Air Mode Studies

All fare paying passengers on the commuter flights of several commercial airlines were asked to complete a questionnaire dealing with their impressions and experiences with air travel. The questionnaires were distributed late in each flight--shortly before landing. In the first flight program, 758 completed questionnaires were obtained; in the second, 861. Four types of aircraft were involved: three planes and a helicopter. Both questionnaires contained items to assess

(1) demographic information, (2) attitudes about, purpose of, and frequency of flying, (3) the perceived importance of various physical factors as determinants of comfort, (4) a comfort rating for this flight, and (5) an evaluation of their willingness to use this mode of travel again.

Characteristics of the two samples of passengers are shown in Table 1. Each sample represents a return rate of about 95%. The proportion of women flying these commuter air services is quite small. The ratio of men to women is higher than that found in the General Travel Surveys summarized by Lee and Jacobson. (4)

Trip purpose is related to the gender of the respondent in Tables 2 and 3. Most men are traveling on business, while women are traveling mostly for personal reasons.

Data on the number of previous commuter flights are partitioned by gender in Tables 4 and 5 for the two samples. In both cases, women have less flight experience than men. The second sample has a much larger representation of first time commuter flyers and relatively inexperienced passengers than the first.

Table 6 shows that sex is unrelated to attitude toward flying. Both men and women have predominantly favorable attitudes toward flying. In the second survey, a separate item asked whether one had to use this particular mode of travel or not. Sixty-six percent of the male passengers say they have to fly, while 57% of the women have to fly.

	General Travel Surveys	First In-flight Sample	Second In-flight Sample
N	3000+	758	861
Sex			
Male	75%	88%	80%
Female	25	12	20
Age			
20 & under	12	6	4
21-40	40	47	45
41-60	35	42	45
over 60	13	5	6
Education			
College	80	81	N.A.
Noncollege	20	19	N.A.
Occupation			
Executive Managerial Professional Technical	60	68	66
Other	40	32	34
Purpose of Trip			
Business	75	79	72
Other	25	21	28
Income			
Median	$22,000	$22,293	$24,069

Note: N.A. = not asked on this questionnaire.

Table 1 Characteristics of the Flight Samples

	Purpose of Trip			
	Business	Personal	Other	#
Male	86.6	9.5	3.9	588
Female	32.1	60.3	7.7	78

Table 2 Purpose of Trip by Sex*

(*table entries are percentage of row totals)

	Purpose of Trip			
	Company Business	Personal Business	Pleasure	#
Male	82%	9%	9%	681
Female	31%	24%	45%	164
Overall	72%	12%	16%	

Table 3 Purpose of Trip Related to Sex of Respondent

	Times Flown					
	None	1-3	4-5	7-9	10+	#
Male	1.4	4.1	8.1	6.1	80.4	591
Female	7.4	17.3	18.5	13.6	43.2	81

Table 4 Distributions of Flight History by Sex*

	First Time	1-3	4+	#
Male	12.3	12.6	75.2	661
Female	31.6	19.4	49.0	155

Table 5 Number of Commuter Trips by Sex*

(*table entries are percentage of row totals)

	Love Flying	No Strong Feelings Toward Flying	Dislike Flying	Have To Fly	#
Male	44.0	34.9	0.7	20.4	588
Female	49.4	29.6	0.0	21.0	81

Table 6 Distributions of Feelings About Flying by Sex*

(*table entries are percentage of row totals)

Factors determining one's satisfaction with air travel are ranked similarly by men and women. There are only minor differences (local inversions), and these are probably a function of trip purpose (see Table 7).

In the first survey, passengers were asked to rank physical factors for their importance in determining one's comfort while flying. The overall rank ordering by gender is shown in Table 8. There are noticeable discrepancies in ratings for seat comfort and up and down motion. Figure 1 shows the nature of these differences. Seat comfort is more important to men than women. Motion variables are more important to women, and are not distinguished from each other as strongly as they are with men.

All passengers were asked to provide a rating of their level of comfort on their flight. Table 9 shows the results by gender using data from the second flight program. A seven point rating scale was used for which 1 means "very comfortable" and 7 means "very uncomfortable." As a group, women were significantly more comfortable in these flight environments than men were.

There are, of course, several possible explanations of this difference. As we have seen, there are several ways in which female passengers differed from the male passengers: (1) they were less experienced travelers--especially with respect to commuter flights: in the second survey, 75% of the men, but only 49% of the women, had used commuter flights four or more times, (2) they were less likely to be traveling for business related reasons than were men, and (3) as a group, they

	Total Sample	Sex		Purpose of Trip	
	All	Male	Female	Bus	Pers
Safety	1	1	1	1	1
Reliability	2	2	2	2	2
Time savings	3	3	4	3	4
Convenience	4	4	3	4	3
Comfort	5	5	5	5	5
Cost	6	6	6	8	6
Services on board	7	7	7	6	7
Ability to read	8	8	9	7	9
Surroundings	9	9	8	9	8
Ability to write	10	10	10	10	10

Table 7 Rank Ordering of Factors in Satisfaction for Various Subsamples

	Total In-flight Sample	Sex		Purpose of Trip		Ground-based Sample
		Male	Female	Bus	Pers	
Seat comfort	1	1	[4]	1	1	1
Noise	2	2	2	2	3	3
Temperature	3	3	3	3	2	2
Up & down motion	4	5	[1]	5	4	4
Pressure changes	5	4	6	4	5	[7]
Side-to-side motion	6	6	5	6	6	5
Work space	7	7	9	7	[9]	9
Lighting	8	8	7	8	7	6
Smoke	9	9	8	9	8	8

Table 8 Rank Ordering of Physical Factors in Comfort

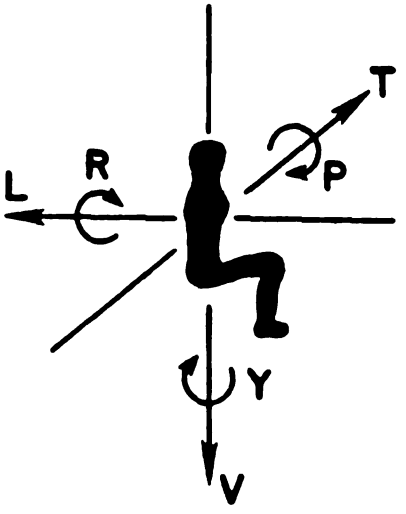


FIGURE 1

NOMENCLATURE

	Comfort Rating							
	1	2	3	4	5	6	7	#
Male	7.1	32.8	16.9	17.8	17.1	5.7	2.6	662
Female	15.6	42.5	11.3	10.0	15.6	2.5	2.5	160

Table 9 Distribution of Comfort Responses by Sex*

(*table entries are percentage of row totals)

attached different importance ratings to the factors that might influence their comfort than did men. However, there were no differences in attitude due to gender.

In the second questionnaire, passengers' perceptions of various physical factors were assessed directly. They were asked to rate their discomfort due to motion factors, seat factors, spacing factors, and various sensory inputs (noise, pressure, temperature, etc.). Thus, passengers rated which factors they thought influenced their comfort.

Despite the fact that women tend to rate their flights as more comfortable than men do, there were no differences between men and women in their ratings of discomfort due to the motion variables--either individually or as a composite MOTION index. Women are slightly more uncomfortable due to pressure and tobacco smoke than men.

Significant differences between men and women are evident in their reactions to seating and physical space within the aircraft. On all five seat items, a higher proportion of females agree with the item-statement than do males. Thus, 68% of the women think the seats are wide enough, 61% think there is enough leg room, and 55% like the seat adjustment; the corresponding percentages for the men are 46%, 43%, and 30%. Seat shape is satisfactory to 81% of the women, and firmness to 96%. Table 10 shows the distributions by sex for a composite SEAT index. Thus the comfort responses of the women appear to reflect their reactions to the seats; women are more comfortable because they find the seats more comfortable. Perceived workspace also shows a strong relation to sex: women rate the available workspace as more

	Values on Seat					
	5	6	7-9	10-12	13-15	#
Men	18	14	45	17	6	591
Women	38	18	32	11	1	136

Table 10 Distribution of Values of Seat for Each Sex*

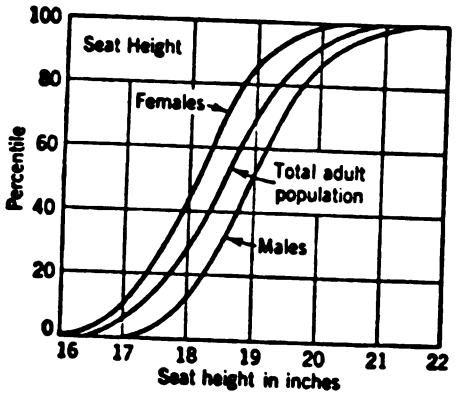
(*table entries are percentage of row totals)

satisfactory. However, differences due to sex are apparent in the time spent on various activities. Men report doing more reading and writing; women report doing more talking and looking out the window. Such differences are reasonable since more men report travelling for reasons of company business. No sex differences were found for time spent thinking.

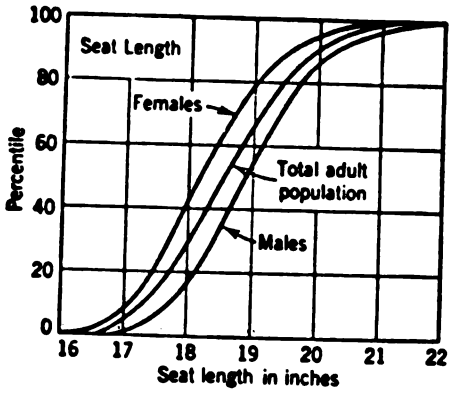
Women found their flights comfortable because they found their seating space comfortable. That, in turn, is probably a result of physical size rather than gender per se. Only indirect evidence of effects of size is available from the air surveys. The percentage of passengers satisfied with seat width and leg room was plotted against the measured dimensions of the seat. The difference in seat width that satisfies 61% of the passengers and one that satisfies only 31% is 11 centimeters. Leg room is related to percent of passengers satisfied when leg room is increased from 24 to 27 centimeters. Further, the people who say the seats are not wide enough or that there is not sufficient leg room tend to rate their flights less comfortable.

These observations make sense in terms of the data on human measurements. The three graphs in Figure 2 show how people vary in seat height, seat length, and hip breadth. Airline seats have been designed for the average man. This has proven satisfactory to most women.

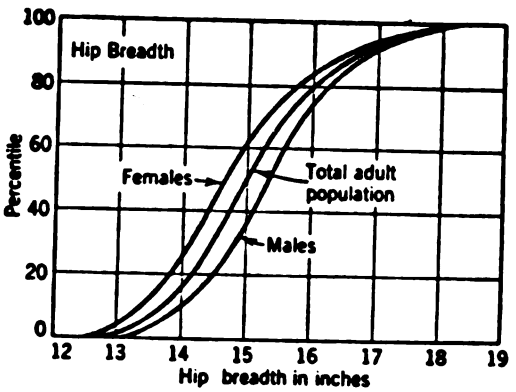
The only indication, in the airline situation, that women and men might react differently to motion is the incidence of motion sickness in the two groups. People vary in how prone they are to motion



How people vary in seat height. Seat height is the distance from the seat to the ground when a person is seated with feet planted on the ground and the knees at right angles. This is a percentile graph like Figure 161. It shows the percentage of people who have seat heights equal to or less than any given height. (Based on data of Hooton, 1945)



How people vary in seat length. The measurement is from the back of the buttocks to the back of the leg underneath the knee. The graphs tell what percentage of people have a seat length equal to or less than any particular length. (Based on data of Hooton, 1945)



How people differ in the width of their hips and seats. Hip breadth and seat width are about the same, and, if chairs have arms on them, it is hip breadth we are interested in. Again the graphs tell what percentage of the population have hip breadths equal to or less than any particular value. (After Hooton, 1945)

Figure 2

sickness and to airsickness in particular. Reported incidence of airsickness was very low on these flights, although it did vary with plane type. The two planes which were perceived as having the least troublesome motions did have the lowest rate of motion sickness, and a composite index of perceived motion was correlated with the experience of airsickness. Reported presence of symptoms did not vary with the number of previous flights taken or whether or not the respondent had to fly. However, a larger proportion of women experienced motion sickness on these flights than did men. As shown in Table 11, a larger percentage of women have previously taken airsickness medication, took it on this flight, and experienced airsickness on this flight. Geldard (7) asserts that fear of motion sickness is a major deterrent to flying. It would be interesting to know (1) the relative incidence of motion sickness for men and women in the general population, (2) what percentage of air travelers experienced motion sickness on their first flight, and (3) how many of them never returned for another flight.

As we have shown in other papers, comfort in the air mode is largely a function of vertical and transverse accelerations. Angular rates have a relatively minor role for most aircraft. But, rolling motion is one inducement to motion sickness, and roll rate is a dominant influence on comfort for ground vehicles. Do men and women differ in their reactions to rolling motion? That question is the concern of Part 2 of our paper.

	Medication Taken Previously		Medication This Flight		Airsickness This Flight	
	Yes	#	Yes	#	Yes	#
Male	5%	656	2%	633	4%	651
Female	15%	161	5%	154	8%	161

Table 11 Responses to Items on Airsickness Partitioned by Sex

Ground Vehicle Studies

Using ground based vehicles, it was possible to gain some control over the motion inputs to the vehicles (by selecting road or track segments) and to use large groups of paid passengers to rate the comfort of many ride segments. Consequently, persons selected to represent various levels of age, sex, and experience with each vehicle were hired to ride buses or trains and rate their comfort at various times during the trips. There were between 25 and 30 such paid riders on each trip on each vehicle, and different persons were involved on each trip. Recordings of the physical environment were made and related to the mean comfort rating for each segment. Clearly, the primary physical component of ride quality is the motion of the vehicle. Motion may be analyzed into six degrees of freedom: three linear accelerations (vertical, lateral, and longitudinal) and three angular rates (roll, pitch, yaw). Analog recordings of motion in all six degrees of freedom are taken using the PEMS II apparatus (the Portable Environmental Measuring System). The RMS values are obtained for the motion in each of the six degrees of freedom. The values for linear accelerations are expressed in g's and the angular rates in degrees per second (or radians per second).

Passengers rated individual ride segments using a seven point rating scale for which 1 = "very comfortable," 4 = "neutral," and 7 = "very uncomfortable." All persons in a group rated preselected ride segments throughout their trip; the mean comfort rating for each segment was taken as the basic data for modeling.

Simple linear and multiple regression are the basic modeling techniques used. Various more complex models have been tried, but they failed to produce a meaningful increment in predictability over the simpler models. For each physical input, the linear regression relating it to rated comfort is obtained. In these models, we may think of the slope coefficients for each physical variable as sensitivities of human subjects to the particular motion inputs or as the salience of the inputs. Such sensitivities are, of course, in the presence of all other motions. That is, they occur in the context of whatever motion variation is present. To make any general statements about human reaction to motion, we need to show that sensitivity coefficients remain the same over different contexts and under different experimental conditions.

For the buses, motion traces and comfort ratings were obtained for a total of 52 ride segments. Mean comfort ratings correlated strongly with RMS roll rate (Pearson correlation = .76) and RMS vertical acceleration (r = .56). When a multiple regression equation was obtained relating all the motion variables to comfort, no significant improvement was obtained over the model with roll alone.

Train data were obtained from 79 track segments. With trains, there is substantially more variability in noise levels than with buses. Indeed, for the train, noise correlated most strongly of all the physical variables with comfort (r = .63). Both roll and transverse acceleration were moderately correlated with comfort (r's = .44 and .43, respectively).

The experiments with buses and trains involved equal numbers of men and women. In these experiments, roll rate was found to be the dominant motion variable influencing comfort. Regression equations were developed separately for several subgroups of the total sample. Table 12 and Figure 3 show the results. The differences in the intercepts of the two functions merely reflect the fact that men and women consistently differ in comfort (which is apparently due to seat comfort), but the difference in the slope suggests a difference in sensitivity to roll rate.

The dominant motion in planes were vertical and lateral accelerations. In the ground based vehicles, angular rates were more important. Women seem to be more sensitive to roll rate than men are. This greater sensitivity was apparent in subsequent validation studies as well.

Other Vehicles

Extensive data have been collected on diverse vehicles which we hoped would confirm our hypothesis that women are more sensitive to angular rates than men are. The data are suggestive, but not conclusive. One of two conditions need to be met to test this hypothesis; either (1) the angular rates must be the dominant motion of the vehicle, or (2) the contribution to comfort of the angular rates must be independent of the linear acceleration. For a luxury bus, an urban rapid rail car, and an AGT vehicle, linear accelerations showed the strongest correlations with rated comfort. Furthermore, the angular rates tended to be highly correlated with the linear accelerations. Thus these systems can't be used to test our hypothesis.

	Bus Data	Train Data
All Subjects	1.05 (.13)	.96 (.21)
Seldom Riders	1.12 (.12)	1.05 (.22)
Frequent Riders	.97 (.13)	.88 (.24)
Ages 16 - 24	.91 (.12)	.81 (.21)
Ages 25 - 48	1.01 (.15)	1.01 (.23)
Ages 49 and older	1.28 (.14)	1.00 (.28)
Males	.99 (.12)	.86 (.24)
Females	1.09 (.14)	1.06 (.21)

Table 12 Roll Rate Regression Coefficients for Bus and Train Data

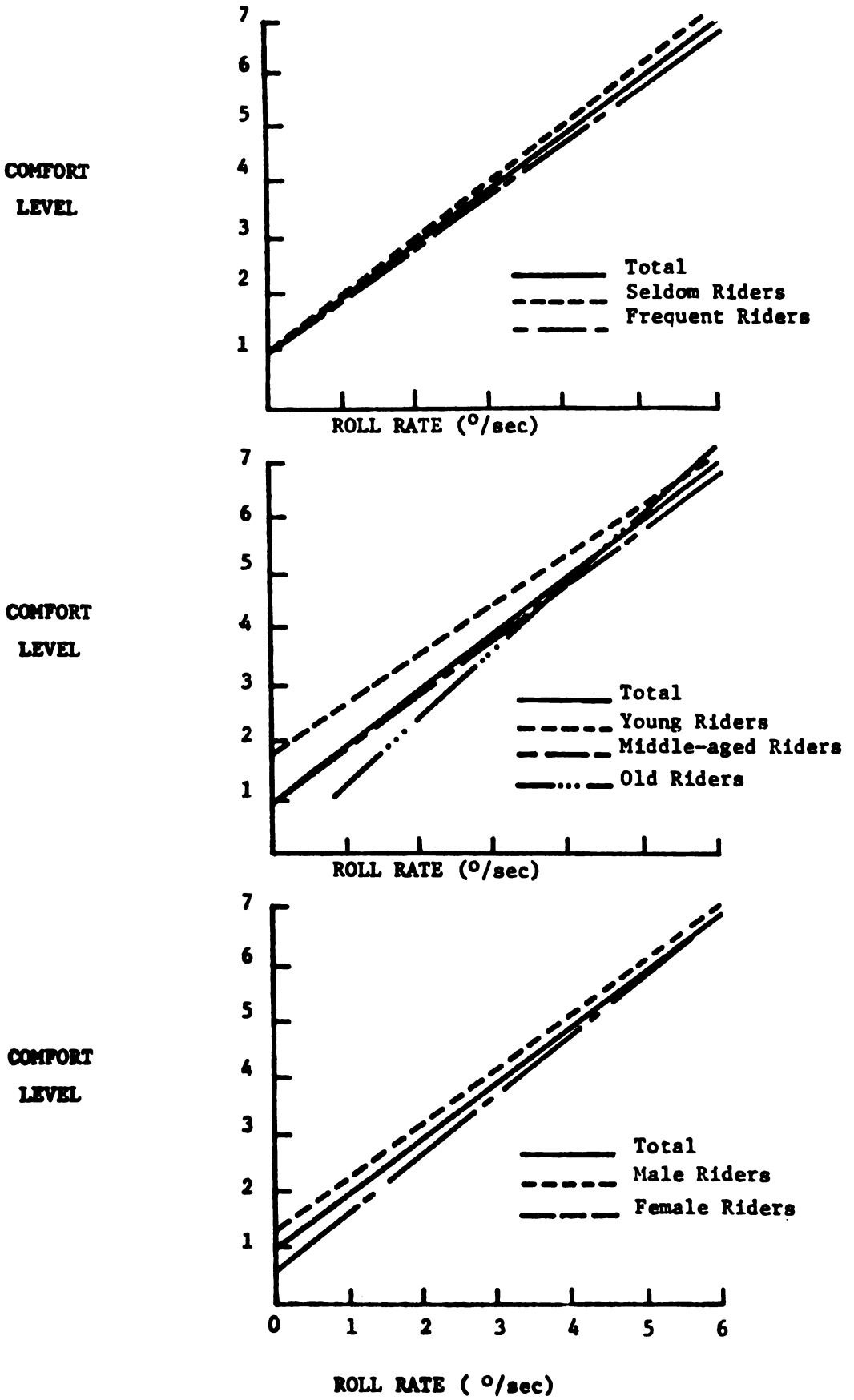


Figure 3 Comfort Versus Roll Rate by Category of Subject

Using a short haul intercity train, vertical motions predominate, but there is some evidence that angular rates are important to women. Roll rate is significantly correlated with comfort for women, but not for men.

Conclusions and Implications

The influence of angular rates on human comfort and performance has been relatively neglected. Indeed, the International Organization for Standardization (ISO) has not yet formulated standards for roll, pitch, and yaw. Yet there is sufficient data to show that these motion components do affect human comfort. Our data further suggest that there may be gender differences in reactions to the rotational axes. Basic parametric research using motion simulators to attain the desired combinations of vibration axes is clearly needed.

If reliable gender differences in response to the angular rates are found, then vehicle design should include methods of controlling rotations to the satisfaction of the more sensitive subject population (which appears to be women).

In summary, we find that (1) women are more comfortable in vehicle environments than men are, (2) this difference is in part due to their greater satisfaction with seating and space factors, (3) there is a greater prevalence of airsickness among women, and (4) women appear to be more sensitive than men to the rolling motions of vehicles.

A COMPARATIVE STUDY OF WOMEN CAR BUYERS

Martin F. Hunt, Jr.
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I. Introduction

This paper presents part of the findings from a recent nationwide survey of women car buyers conducted by J. D. Power and Associates. Traditionally, women have been considered to hold a secondary position to men in purchasing an automobile. Previous studies (1,2) have shown that in the majority of husband and wife households, the husband decides upon the make and model of the automobile to purchase while the wife chooses the color, upholstery, and interior trim. A current trend, however, is toward multi-automobile households, with every member who is of driving age having their own car (obviously this trend varies with income). As a result, more women in traditional husband and wife households are purchasing their own automobiles. Finally, it is important to note that in addition to the multi-car trend, the household composition in this country is changing with more and more women living alone and therefore more likely to purchase their own car; yet, little attention has been given to the car purchasing behavior of women.

In 1976 and 1977, 13% of all new cars were registered in the name of a woman. In addition, previous J. D. Power and Associates studies have ascertained that in 30% of the cases where the automobile is registered in the name of the head of the household, a woman is either

the principal purchaser or the principal user of the vehicle.

Because the woman car buyer is becoming a larger and larger segment of the vehicle purchasing market and because of the increasing importance of this market segment, we conducted a survey of the women who bought and registered a car in their own name. The purpose of our study was to give a fresh and objective profile of the women who purchase new cars and a better understanding of the woman's perceptions and attitudes toward buying a new car.

II. Background and Objectives

The major objective of our survey was to provide automobile manufacturers with; information on the types, body styles and options that women prefer in an automobile; some specifics about the use that women make of their automobiles; information on the purchasing process the women used in choosing an automobile; and women's perceptions of automobile advertising. As a result of this survey we found that women are similar to men in choice and use of an automobile; however, there are some important differences encountered when acquiring an automobile. This paper will specifically discuss the problems indigenous to women buying a new car. Questions asked in this area included:

(1) Who is the typical woman car buyer? How does she compare with other women and other car buyers?

(2) Do women who register their new car in their own name generally make 100% of the buying decision or do they rely on other people to help them make the decision? On whom do they rely and for what part of the decision process?

(3) Do women car buyers feel that it is more difficult or easier for a woman to buy a new car? Why or why not?

(4) Do women who shop for new automobiles feel that they are treated differently than men? Do they feel it is positive or negative?

(5) Do the women who finance a new car have any financing problems because they are women? If so, what types of problems do they encounter?

(6) What percentage of women who buy and register a new car in their own name have total responsibility for keeping their car adequately serviced and maintained?

(7) How many of the women actually enjoy driving their car and to what degree?

A. Sample and Method

A national sample of 4,000 passenger vehicles registered to female owners was drawn from R. L. Polk & Company's June, 1976 and June, 1977 files. The sample was divided into 1976 and 1977 car buyers. In order to gather as much information as possible and still retain a four page questionnaire, ten questions were varied on each questionnaire. In terms of this paper it should be noted that only the 1976 car buyers were asked how many dealers they visited, who accompanied them, how they felt about the dealer's treatment of them and whether or not they dealt with a saleswoman.

The questionnaire with a cover letter, a 25¢ incentive, and a postage-paid return envelope was mailed to the sample in September, 1977.

On November 1, 1977, the returns were closed and a total of 763 useable returns were tabulated and analyzed. Of these, 419 were 1976 car buyers and 344 were 1977 car buyers.

B. Results and Discussion

The results of this survey provide a demographic profile of the typical woman who buys a car in her own name. In addition, it gives information on whom a woman turns to for aid when purchasing a new car and discusses the particular problems the women had when shopping for a new vehicle.

Profile Of The Woman Car Buyer

We found that the typical woman who buys and registers a car in her own name differs from the average American woman on several dimensions. She is more likely to be younger, single, divorced or widowed, employed full time, and to have some college education. Figure 1 summarizes these comparisons.

Further, not only did the survey women differ from the average American woman, they differed from the typical car owner on many of the same dimensions (see Figure 2). Again, they were more likely to be younger, single or widowed, and better educated. In addition, other differences arise. For instance, there was an 11% difference in employment rate, with the women car buyers slightly less likely to be employed full time. The difference between the median income of the woman car buyer and the median income of the typical car buyer was approximately $4,000 less. The median household size

Profile of Women Car Buyers Compared to All Adult Women in United States

	WOMEN CAR BUYERS	TOTAL ADULT U.S. WOMEN*
MEDIAN AGE	36 YRS.	43 YRS.
MARITAL STATUS		
MARRIED	33%	68%
SINGLE	33	14
DIVORCED/SEPARATED/WIDOWED	34	18
SOME COLLEGE OR BETTER	60%	26%
MEDIAN FAMILY INCOME	$14,750	$15,000
EMPLOYED FULL TIME	67%	33%

FIGURE 1

*COMPILED FROM A VARIETY OF SOURCES INCLUDING THE U.S. DEPARTMENT OF CENSUS AND LABOR

Profile of Women Car Buyers Compared to Typical Car Buyer

	WOMEN NEW CAR BUYERS	ALL NEW CAR BUYERS*
% FEMALE	100%	27%
MEDIAN AGE	35 YRS.	41 YRS.
MARITAL STATUS		
MARRIED	33%	73%
SINGLE	33	15
DIVORCED/SEPARATED/WIDOWED	34	12
MEDIAN HOUSEHOLD SIZE	1.7 PERSONS	3.1
SOME COLLEGE OR BETTER	60%	56%
MEDIAN FAMILY INCOME	$14,750	$19,000
EMPLOYED FULL TIME	67%	78%

FIGURE 2

*J.D. POWERS & ASSOCIATES – BASED ON OWN SURVEY DATA AND OTHER SOURCES

for the woman car owners was 1.7 persons as compared the 3.1 of the average car buyer. (The lower household size for women is most likely due to the single status of the majority of the women surveyed.)

Occupational Profile

Reflecting the use of the automobile as a major means of commuting to and from work, two-thirds of the women surveyed were employed full time with an additional eight per cent employed part time; further, 30% were employed in either professional, technical, or managerial positions. Another 23% had clerical positions. (See Figure 3)

Household Composition

A frequent theme of car advertisements is the woman chauffeuring a station wagon full of children; however, we found few chauffeurs in our survey.

Twenty-one percent of the women who registered a car in their own name were under 25 years of age and 21% were 55 years or older (Figure 4). The remaining 48% were between the ages of 25 and 49. So it would appear that about half the women would be of child-bearing age; however, 71% of the total group had no children under 18 years of age. (Figure 5)

Since these women come from small households and the majority of them have no children, it is not surprising that 41% of them purchased a compact or sub-compact car and 20% purchased an intermediate sized car.

Occupational Profile of Women Car Buyers

OCCUPATION	TOTAL
PROFESSIONAL/TECHNICAL	20%
MANAGERS/OFFICIALS/PROPRIETORS	10
CLERICAL	23
SALES WORKERS	4
CRAFTSWOMEN/FOREWOMEN	2
OPERATIVES	3
SERVICES WORKERS	9
LABORERS	1
FARM WORKERS/MANAGERS	*
NO ANSWER	3
NOT EMPLOYED/NO ANSWER TO EMPLOYMENT	25
	100%

FIGURE 3

Age Breakdown of Women Car Buyers

AGE	TOTAL
18-24	21%
25-34	26
35-49	22
50-54	9
55-64	12
65 AND OVER	9
NO ANSWER	1
	100%

MEDIAN AGE **35.7 YRS.**

FIGURE 4.

Household Composition of Women Car Buyers

PRESENCE OF CHILDREN BY AGE GROUP	TOTAL
NO CHILDREN UNDER 18 YRS.	71%
ONE OR MORE CHILDREN UNDER 6 YRS.	9
ONE OR MORE CHILDREN 6-11 YRS.	13
ONE OR MORE CHILDREN 12-15 YRS.	10
ONE OR MORE CHILDREN 16-17 YRS.	11
	114%*

* TABLE ADDS TO MORE THAN 100% BECAUSE SOME RESPONDENTS HAVE CHILDREN IN MORE THAN ONE AGE GROUP.

FIGURE 5

Our profile of the women who register a car in their own name indicates that these women are neither typical of the average American woman or the average car buyer. While they represent all age groups, the women we surveyed were more likely to be single, well educated, employed and either live alone or with one other person. On the average they are childless or have grown children.

Use Of Car Purchased

The women surveyed indicated that they purchased this car for their own use. Fifty-five percent of them stated that they were the only driver of the car and an additional 33% considered themselves the principal driver of the car. Seven percent shared the car with someone else and only 3% considered someone else as the principal driver. Again, this could be a reflection of the woman alone who naturally would be the only driver of the car, however, of the married women included in our survey, 15% listed themselves as the only driver of the car and 59% considered themselves the principal driver of the automobile they purchased. (Figure 6)

Purchasing Decision

It would follow that these women would be quite involved in the decision as to which car they purchased and 71% of the women surveyed indicated that they had made over 80% of the decision. Nearly half (49%) of the women were totally responsible for the purchasing decision while only 5% of the women surveyed indicated they had made less than 50% of the decision. (See Figure 7) Again, this doesn't necessarily reflect the single woman with no one to help her in this process as

Personal Use of Car

	TOTAL
ONLY DRIVER	55%
PRINCIPAL DRIVER	33
SHARE WITH ANOTHER DRIVER	7
SOMEONE ELSE IS THE PRINCIPAL DRIVER	3
NO ANSWER	2
	100%

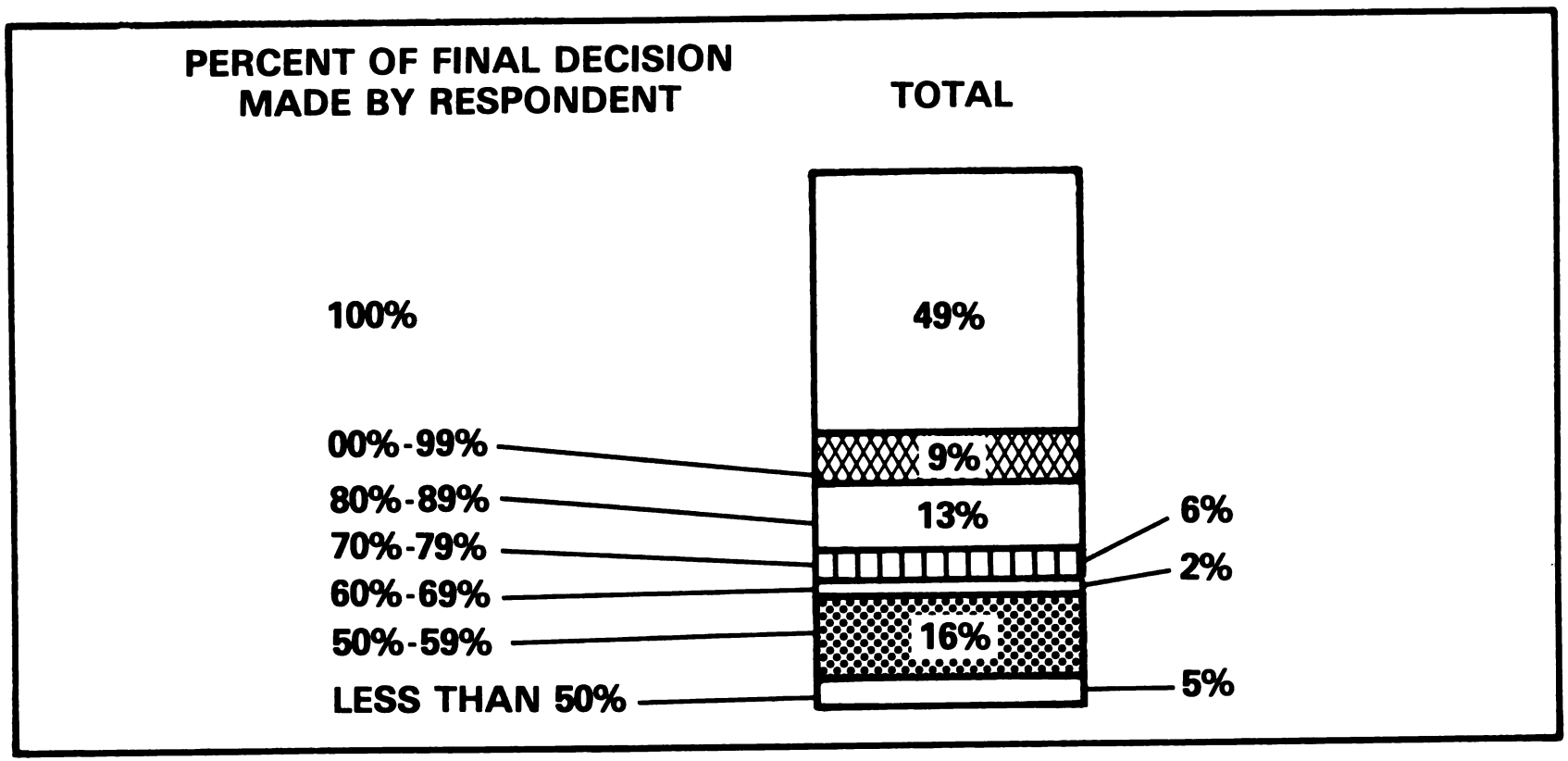
SAMPLE SIZE: (763)

FIGURE 6

QUESTION: HOW WOULD YOU DESCRIBE YOUR USE OF THIS CAR; THAT IS, ARE YOU THE ONLY DRIVER, THE PRINCIPAL DRIVER, OR DO YOU SHARE THIS CAR EQUALLY WITH ANOTHER, OR IS SOMEONE ELSE THE PRINCIPAL DRIVER OF THIS CAR?

SOURCE: SURVEY OF WOMEN CAR BUYERS
1977

Degree of Involvement in the Purchase Decision



SAMPLE SIZE: (763)

FIGURE 7

QUESTION: HOW INVOLVED WERE YOU IN THE PURCHASE DECISION OF THIS CAR? THAT IS, WHAT PERCENT OF THE FINAL DECISION WAS UP TO YOU?

SOURCE: SURVEY OF WOMEN CAR BUYERS 1977

of those women who made 100% of the purchasing decision 26% were married.

Of those who did not make the total decision alone, 23% of the women were aided by their husband and another 8% by their father, male friend, or son. Only 9% of the women surveyed were aided in their decision by their mother, daughter, or a female friend. (Figure 8)

When asked to indicate areas in which they received help, 24% of the women who received help indicated they were aided in negotiating a price while an additional 15% had help deciding upon the make of the car or optional equipment. (Figure 9)

III. Results and Discussion

Problems Encountered

Probably the most pertinent information available from this survey has to do with the women's attitudes about buying a car and their perceptions of how they were treated by the dealers.

Sixty-two percent of the women we surveyed felt it was more difficult for a woman to buy a car than a man. Twenty-one percent of these women felt that it is much more difficult and another 41% felt it is sometimes more difficult. About a third (32%) felt it was the same for a woman as a man. Only two percent felt it was easier for a woman and a remaining 4% had no opinion. (See Figure 10)

When asked why they felt it was more difficult, 27% of the women indicated that they thought that dealers take advantage of women; an equal number felt it was more difficult for them because "women

Other Persons Involved in Purchase Decision

	TOTAL
HUSBAND	23%
FATHER	8
MALE FRIEND	7
SON	4
MOTHER	3
DAUGHTER	2
FEMALE FRIEND	2
FIANCE	1
OTHER PERSON	4
(NO OTHER PERSON INVOLVED)	(49%)
NO ANSWER	2
	105% *

SAMPLE SIZE: (763)

FIGURE 8

* TABLE ADDS TO MORE THAN 100% BECAUSE SOME RESPONDENTS CONSULTED MORE THAN ONE OTHER PERSON.

QUESTION: IF YOUR INVOLVEMENT IN THIS PURCHASE WAS LESS THAN 100%, WHO ELSE WAS INVOLVED IN THE DECISION WITH YOU?

SOURCE: SURVEY OF WOMEN CAR BUYERS 1977

Parts of the Decision on Which Respondent Received Help

	TOTAL
NEGOTIATING THE PRICE	24%
DECIDING ON MAKE OF CAR	15
SELECTING OPTIONAL EQUIPMENT	15
EVALUATION TRADE-IN ALLOWANCE	13
DECIDING ON MODEL OF CAR	13
DECIDING WHICH DEALER TO BUY FROM	13
ARRANGING THE FINANCING OF THE CAR	12
DECIDING ON SIZE OF CAR	10
(NO ONE HELPED)	(49%)
NO ANSWER	1
	165%*

SAMPLE SIZE: (763)

FIGURE 9

*TABLE ADDS TO MORE THAN 100% BECAUSE SOME RESPONDENTS RECEIVED HELP ON MORE THAN ONE PART OF THE PURCHASE DECISION

QUESTION: WHICH OF THE FOLLOWING PARTS OF THE PURCHASE DECISION DID HE/SHE HELP YOU WITH?

SOURCE: SURVEY OF WOMEN CAR BUYERS 1977

Opinion of Women Versus Men Buying a Car

	TOTAL
IT IS MUCH MORE DIFFICULT FOR A WOMAN	21%
IT IS SOMEWHAT MORE DIFFICULT FOR A WOMAN	41
IT IS ABOUT THE SAME FOR A WOMAN OR A MAN	32
IT IS SOMEWHAT EASIER FOR A WOMAN	1
IT IS MUCH EASIER FOR A WOMAN	1
DON'T KNOW/NO ANSWER	4
	100%

SAMPLE SIZE: (763)

FIGURE 10

QUESTION: BASED UPON YOUR EXPERIENCES, WHICH OF THE FOLLOWING STATEMENTS BEST DESCRIBES YOUR FEELINGS ABOUT A WOMAN BUYING A NEW CAR COMPARED WITH A MAN BUYING A NEW CAR?

SOURCE: SURVEY OF WOMEN CAR BUYERS
1977

know less about cars"; and another 5% said women are more inexperienced in buying cars. Although the majority of the women felt that it was more difficult for them to buy a new car than it would be for a man, they tended to blame their own inexperience and lack of knowledge as much as the dealers' attitude for this problem. (Figure 11)

Half of the women were asked to indicate the major reasons that made car buying more of a problem for a woman. Nearly a quarter (24%) of the women checked "Women's own insecurity about entering the male domain of cars"; another 17% checked the car dealers' hard sell approach; and 13% considered the car salesmen's insensitivity to women's car needs. One in ten of the women went beyond the salespeople and said that this difficulty was due to the manufacturers' complacency about women. (Figure 12)

Previously we discussed who helped our respondents in deciding upon which car to purchase, now we will discuss who accompanied them when they actually shopped for their new car.

The average respondent to our survey visited three dealers while shopping for her car. Twenty-nine percent of these women visited the dealer alone. Again this was not necessarily the single women, as 14% of the married women also visited the automobile dealers alone. Fifty-four percent of those women who were accompanied in their visits to the automobile dealers chose either a husband (26%), father (11%), male friend (11%) or son (5%) or fiance (1%) to go along with them. Only 18% chose either a mother, daughter or a

Reasons for Feeling It Is More Difficult for Women

	TOTAL
MUCH/SOMEWHAT MORE DIFFICULT FOR WOMEN	62%
DEALERS TAKE ADVANTAGE OF WOMEN	27
WOMEN KNOW LESS ABOUT CARS	27
WOMEN ARE INEXPERIENCED IN BUYING CARS	5
WOMEN HAVE MORE CREDIT PROBLEMS	3
DEALERS THINK WOMEN ARE NOT SERIOUS BUYERS	1
OTHER	4
DON'T KNOW/NO ANSWER	3
SAME FOR A WOMAN AS A MAN	32%
SOMEWHAT/MUCH EASIER FOR A WOMAN	2%
DON'T KNOW/NO ANSWER	4%
	100%

SAMPLE SIZE: (763)

FIGURE 11
QUESTION: WHY DO YOU FEEL THAT WAY ABOUT A WOMAN BUYING A CAR?
SOURCE: SURVEY OF WOMEN CAR BUYERS
1977

Most Responsible Reason Car-Buying Is More of a Problem for Women

	TOTAL
WOMEN'S OWN INSECURITY ABOUT ENTERING THE "MALE DOMAIN" OF CARS	24%
CAR DEALERS HARD SELL APPROACH	17
CAR SALESMEN'S INSENSITIVITY TO WOMEN'S CAR NEEDS	13
CAR MANUFACTURERS' COMPLACENCY ABOUT WOMEN	10
OTHER	9
DON'T KNOW/NO ANSWER	3

SAMPLE SIZE: (763)

FIGURE 12

QUESTION: WHICH OF THE FOLLOWING REASONS DO YOU FEEL IS MOST RESPONSIBLE FOR MAKING CAR-BUYING MORE OF A PROBLEM FOR WOMEN?

SOURCE: SURVEY OF WOMEN CAR BUYERS 1977

female friend to accompany them in shopping for a car. (Figure 13) There is some overlap in figures as some of the women were accompanied by more than one person. The fact that the majority of the women chose a male companion when shopping for an automobile reinforces the conclusion that these women considered the automobile an area of male expertise.

The 419, 1976 car buyers were asked if they felt that they were treated the same as a male car buyer; the opinion was divided about evenly. Forty-four percent of the women felt that they were treated the same and 43% felt they were treated differently. Apparently age makes a difference in this perception as 52% of the women over 55 years felt they were treated the same and 52% of those under thirty-five felt they were treated differently. It may be possible that the younger women are more aware of such differences in treatment. (Figure 14)

Of those women who felt they were treated differently, 11% of the women felt they were talked down to, eight percent said the dealer didn't take them seriously, and another 7% reported that the dealer talked to the male accompanying them. (Figure 14)

Feelings About Saleswomen

A small number (8%) of the women dealt with a saleswoman rather than a salesman. When asked if they thought a saleswoman would be easier to deal with, 48% of all of the women surveyed indicated that dealing with a car saleswoman would be no different than a car salesman, while 13% indicated that a car saleswoman would be better. Again,

Whether Visited Dealers Alone or With Someone

	TOTAL
VISITED ALONE	29%
TOOK SOMEONE WITH ME	64%
HUSBAND	26
MALE FRIEND	11
FATHER	11
SON	5
MOTHER	6
DAUGHTER	6
FEMALE FRIEND	6
FIANCE	1
OTHER	5
NO ANSWER	6%
	100%

SAMPLE SIZE: (419)

FIGURE 13

QUESTION: DID YOU VISIT THE DEALER(S) ALONE OR DID YOU TAKE SOMEONE WITH YOU? WHO WENT WITH YOU?

SOURCE: SURVEY OF WOMEN CAR BUYERS 1977

Opinion of Treatment by Dealers

	TOTAL
TREATED SAME AS A MAN	44%
TREATED DIFFERENTLY	43%
TALKED DOWN TO ME	11
DIDN'T TAKE ME SERIOUSLY	8
TALKED TO HUSBAND/MALE FRIEND	7
TRIED TO TAKE ADVANTAGE OF ME	6
MORE COURTEOUS/COMPLIMENTARY	6
DEALER STRESSED APPEARANCE	4
OTHER	2
NO ANSWER	2
NO ANSWER TO SAME OR DIFFERENT	7%
NO, VISITED NO DEALERS	6%
	100%

SAMPLE SIZE: (419)

FIGURE 14

QUESTION: DURING YOUR VISIT(S) TO THE CAR DEALER(S), DO YOU FEEL YOU WERE TREATED THE SAME WAY A MALE CAR BUYER WOULD BE TREATED, OR DO YOU FEEL YOU WERE TREATED DIFFERENTLY BECAUSE YOU ARE A WOMAN?

SOURCE: SURVEY OF WOMEN CAR BUYERS
1977

age appears to make a difference in this attitude as 18% of the women under 35 felt it would be easier, while only 9% of those over 55 felt this way. The major reasons the women felt that dealing with a saleswoman would be no different were: "Women are as capable of selling cars as men" or "either a man or a woman is only interested in selling the car." (Figure 15)

Experience Gained

Their present car was either the first or second car 61% of the women surveyed had purchased, so over half of them were inexperienced in this area and 6 in 10 indicated that they had learned something from the experience. Ten percent of the women indicated that next time they would shop around more. Another 8% felt that they had a better knowledge of what questions to ask. A small percentage (6%) said they would be better able to bargain about the price, would be firmer and more assertive, and would get specific promises from the dealer. (Figure 16)

IV. Conclusions

Due to the inherent limitations of the survey method, casual conclusions cannot be made from this study, however, our data does indicate that buying a new automobile is more of a problem for women than it is for men. As one woman in our survey said, "Women are not culturally trained to be interested in and know about cars." However, our data also indicates that even when women are knowledgeable about cars, they are not taken seriously

Opinion of Dealing With a Car Saleswoman

	TOTAL
SALESWOMAN WOULD BE BETTER THAN A SALESMAN	13%
SALESWOMAN WOULDN'T TALK DOWN TO WOMAN	7
SALESWOMAN WOULD BE MORE HONEST	2
SALESWOMAN WOULD BE LESS PUSHY	2
ALL OTHER "BETTER" REASONS	3
NO ANSWER	1
SALESWOMAN WOULD BE NO DIFFERENT FROM A SALESMAN	48%
WOMEN CAN DO THE JOB AS WELL AS MEN	6
BOTH OUT TO MAKE A SALE/PROFIT	8
BOTH HAVE TO KNOW AUTOMOBILES	9
DEPEND ON INDIVIDUAL; NOT SEX	13
ALL OTHER	4
DON'T KNOW/NO ANSWER	10
SALESWOMAN WOULD BE NOT AS GOOD AS A SALESMAN	14%
MEN KNOW MORE ABOUT CARS	8
SALESMEN TREAT WOMEN BETTER	3
ALL OTHER	2
DON'T KNOW/NO ANSWER	2
DON'T KNOW/NO ANSWER	25%

SAMPLE SIZE:

FIGURE 15

QUESTION: DO YOU FEEL A SALESWOMAN WOULD BE BETTER/NO DIFFERENT/NOT AS GOOD AS A SALESMAN? WHY DO YOU SAY THAT?

SOURCE: SURVEY OF WOMEN CAR BUYERS
1977

Main Thing Learned From Recent Car-Buying Experience

	TOTAL
NOTHING	10%
SHOP AROUND	10
KNOW WHAT QUESTIONS TO ASK	8
BE ABLE TO BARGAIN ABOUT PRICE	6
BE FIRM/ASSERTIVE	6
GET SPECIFIC PROMISES	6
TAKE A MAN ALONG NEXT TIME	4
TAKE MORE TIME	4
INSPECT FOR DEFECTS MORE	3
INVESTIGATE THE SERVICE DEPARTMENT	3
KNOW FINANCIAL TERMS BETTER	3
GO BACK TO THE SAME DEALER	2
MAKE SURE SALESMAN IS INTERESTED IN MY NEEDS	2
ALL OTHERS	11
DON'T KNOW/NO ANSWER	28
	139%*

SAMPLE SIZE: (763)

TABLE ADDS TO MORE THAN 100% BECAUSE SOME RESPONDENTS LEARNED MORE THAN ONE THING.

FIGURE 16

QUESTION: WHAT, IF ANYTHING, HAVE YOU LEARNED FROM YOUR RECENT CAR-BUYING EXPERIENCE THAT WILL HELP YOU THE NEXT TIME YOU PURCHASE A CAR?

SOURCE: SURVEY OF WOMEN CAR BUYERS
1977

by the automobile dealers. It is obvious that the manufacturers need to consider the female as a viable part of their buying public and make every effort to educate their dealers on this subject. At the same time, women need to arm themselves with knowledge and confidence when approaching the new car dealers.

V. Implications

This paper discussed some specific problems women have in relation to buying a new car, and these problems raise additional questions. However, this is only a small part of the picture. There are many other areas of women's awareness and use of the automobile that also need to be explored. A few of the questions to be answered are:

(1) This study has demonstrated that many women feel it is more difficult for a woman to buy a new car, however, it was also apparent that many women accept the responsibility for this and cite their own lack of knowledge about cars as a reason for the difficulty. A lack of mechanical knowledge is a part of the female stereotype, how can this be overcome? What can manufacturers and dealers do to overcome the discrimination that the women feel in the show rooms?

(2) If women feel they are discriminated against when buying a car, do they have similar problems in having their automobiles serviced?

(3) Do women in general prefer smaller cars? How much are they influenced toward larger cars by the advice of male friends?

(4) Do single people buy the same or are the car buying preferences different for single men and women?

(5) How do women feel about various safety features on the automobile?

(6) As women become an increasing proportion of the automobile market, will they also have an effect on the design on the cars?

(7) As the proportion of multi-car families is increasing, do two or more car families buy differently than the single car family, i.e. several small cars versus one large car?

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F. METHODOLOGICAL AND PLANNING IMPLICATIONS

METHODOLOGICAL AND PLANNING IMPLICATIONS

The four papers that appear in this section address the question of how well current and traditional planning techniques and methodologies register, measure, and predict women's travel behavior, with emphasis on how well they respond to changing demographic patterns and sociological roles. Three of the four papers implicitly or explicitly claim that the actual techniques in use can or can be made to correctly measure women's current behavior. There is disagreement in these three papers over whether these techniques will produce accurate predictions of future behavior in the face of demographic and societal trends. The fourth paper, Pat Burnett's, argues that existing models and tools are structured incorrectly and therefore cannot measure even current travel behavior accurately.

David Hartgen's paper begins with an explanation of the various computer-based analytic tools and models used by transportation planners in most metropolitan areas; he describes their origin and use and briefly explains the problems such models have in dealing with sub-groups of the population including women. However, using data sets from two areas in New York State collected in two time periods eleven years apart, he finds that existing methodologies have the ability to measure and predict aggregate trends in women's travel behavior. It is interesting to note that his empirical findings, while not the central theme of the paper, are consistent with the empirical findings appearing throughout this report.

Kostyniuk and Cleveland's paper looks at the Detroit TALUS study which

is typical of a number of large-scale transportation efforts used in the formulation of transportation policy and planning in the United States. The authors are concerned with whether data handling and modelling activities in current transportation planning methodologies possibly or inevitably lead to biases in the treatment of women's transportation needs in the planning process. They found that because the trip-generation component of the process could not predict the changing roles and employment of women, it effectively "froze" in time the roles and travel patterns of women when the data were collected. In addition, while the data collection did not underrepresent the vehicular travel patterns of women, it may have underrepresented women's walking trips. It should be noted that the Kostyniuk-Cleveland paper does not perform a comparative analysis so that such commonly used models may, in fact, be misrepresenting men's travel behavior as well.

Paaswell and Paaswell's paper also analyzes the traditional metropolitan planning process, and their work finds that process deficient in some respects. First, the authors argue that the use of aggregate data in computing benefits obscures the disbenefits that any group in society may receive from a transportation investment as well as obscuring the needs of those groups. The authors assert that a new concern with the equity consequences of transportation policies and investments cannot be fulfilled within the traditional planning process, since those concerns are tacked on to the end of the process. The authors also find that the traditional reliance on definite, quantifiable economic measures of benefits, such as vehicle miles per dollar of investment, weight the

process against a number of groups in society including women. The authors conclude by advising against modifications in the technical tools. Rather they conclude that concern with women's special needs must be included at the start of the planning process when goals and objectives are formulated.

In her paper Burnett argues that current models ask the wrong questions about travel behavior; in essence, misspecifying the dependent variable. People's needs for activities are generated by and are impacted by their travel options. Instead of modelling what people do, the author asserts, we need to have models that describe how choice sets consisting of those options vary and what personal and institutional variables cause such differences. She concludes that we need to consider reformulating travel demand models to more accurately portray the decisions people make.

CAN CURRENT TRANSPORTATION PLANNING METHODS ANALYZE WOMEN'S TRAVEL ISSUES?

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INTRODUCTION

Of the numerous methodological and substantive changes which have taken place in transportation and transportation planning in the last 25 years, one of the most significant has been the general movement towards analysis of special groups and their transportation needs, and further detailed study of subgroups within American society. The most obvious example of such work has been the great amount of study of travel patterns of the elderly and handicapped, occurring particularly since 1970. Numerous other groups, of course, are also amenable to such studies. The subject of women's travel issues, being the central theme of this Conference, is an additional such group and may be viewed as a natural extension of the analyses done on other special groups.

As interest increases in a particular subarea such as women's travel issues, there follows naturally increased interest in the need for additional tools, data, methods, and procedures, which enables the transportation planner and analyst to study these questions at the appropriate scale and level of detail. Before, however, such procedures are developed, it would be wise for us to check the present capability of our current methods and techniques. For obvious reasons, we should not overlook our present capabilities. For one, from purely the viewpoint of efficiency, many existing techniques may be found to be applicable to the kinds of questions and issues being raised concerning women's travel. Also, considerable time and effort may be saved and relevant issues addressed now,

rather than later, if current tools and procedures can be used. Thirdly, the use of existing procedures allows us to sharpen our understanding of additional research needs, by highlighting shortcomings in present methods.

This paper suggests that present data and methods available to most transportation planners can, in fact, be usefully applied to analyses of women's travel issues. The central tenet of this paper is that while such methods are generally available, they have not been used in the past primarily because the issues surrounding women's travel have not been raised to the forefront of transportation planning, and that this therefore is not a shortcoming of tools and methods, but rather a shortcoming of emphasis within the profession.

Methods

It would be impractical and probably unnecessary for this audience to review in great detail all of the methods available to transportation planners. Since our intent is to identify particularly their shortcomings with respect to women's travel issues, the methods may be summarized briefly as follows:

(1) Of primary importance to many transportation planning agencies are the sets of computer based analytical procedures generally known as UTPS (Urban Transportation Planning Systems). As is well known these procedures consist of a sequence of models, embedded within computer programs, which are used to forecast traffic on various networks. The various stages of such models (generation, distribution, modal split, assignment) are well known.

(2) Closely associated with such methods are a variety of evaluation procedures, including those based on benefit/cost and its variants, as well as other procedures for analyzing energy, accident and travel time analysis, as well as accessibility.

(3) Also, of more recent vintage are the so-called disaggregate methods, which are essentially mathematical models built from individual observations. As such they may be embedded within existing UTPS and other structures, and used as part of on-line transportation planning activities, or they may be used and constructed separately for analysis of particular questions such as women's travel issues.

(4) Other methods - A host of other methods are also available in data collection, etc. Attitudinal analysis often consists of a collection of specialized data sets concerning attitudes, or public opinions, on transportation modes or alternatives. Markets are generally segmented for sub-group analysis, particularly in transit planning, but also for specialized issues such as elderly and handicapped planning.

The primary shortcomings of urban transportation planning methods have been summarized in numerous publications in the past, with respect to various other sub-groups such as the elderly and handicapped. Most of these shortcomings are generally applicable to study of women's travel issues. The primary ones are as follows:

(1) Generally speaking the methods are not sub-group oriented, and therefore it is very difficult to extract and understand the implications of transportation proposals for particular sub-groups within the population. This is true for a variety of market segments, including women.

(2) While complex in structure and in computerized form, the methods used by transportation planners are generally speaking insensitive to the causal structure of travel, and therefore are incapable of assisting the analyst in understanding the nature of travel or its probable response to a variety of policy questions.

(3) Because most of the variables used in such models are oriented primarily to broad aggregate trends in transportation (such as changes in travel time and cost), the models are generally speaking insensitive to a variety of policies which might impact different user groups, or non-user groups, within society. Methods generally are not available to assist the analyst in understanding the nature of these impacts or the way in which impacts will differ depending upon market segment or impact groups.

(4) Methodologically speaking, the procedures are complex, require a significant amount of data, and generally cumbersome to use and operate.

While these characteristics are certainly severe shortcomings, their impact on the ability of an analyst to study particular sub-groups within the market should not be overemphasized. A parallel could perhaps be drawn

with elderly and handicapped transportation planning which has evolved and proceeded without significant use of such tools as UTPS, but nevertheless has been subjected to numerous studies and analytical review by transportation planners. There is certainly no dearth of good tools within transportation planning available to study numerous questions.

Data

In order to understand how present data sets may be of considerable value in understanding women's travel issues, it is necessary first to review the kinds of data generally available to transportation planners. They generally fall into four types:

(1) So-called home interview survey data sets, consisting primarily of records of trips made by a family on a randomly selected day. The data is detailed down to the trip level and consists of a record of travel for each trip made by each member of the household. Information collected includes travel time, vehicle used, mode, purpose, destination and origin, and a variety of other descriptors. Because most such travel files have been collected for metropolitan areas in the U.S. in a standardized way, it is possible in most such surveys to summarize this information to study such questions as trip sequencing, trip chaining, role interaction of individual household members, use of family cars, and so on. While these questions have not generally been studied in the past by transportation planners, most data sets have within them the capability to permit it.

(2) On-board surveys, consisting of records of a single trip made by individuals on a given mode or method of travel, are also generally available. These studies again consist of trip records of a random sample of riders, but collected in a process of traveling, rather than at the home, as in the case of home interviews. Thus, they are not a complete picture of travel of either the mode itself nor of the individuals or their families. The same general kinds of information are collected however.

(3) Specialized data sets which may be collected either in home interview or on-board format, concentrating on attitudinal data, extended time data (e.g., diaries) and the like.

(4) Aggregate data, consisting of summaries of the number of observations of a given type, including such sources as the census, motor vehicle records, employment data, traffic counts, and so on.

The major shortcomings of available data sets for describing women's travel issues is not that the gender information per se is missing, but that certain specific useful elements of women's travel are not generally available. These include measures of role allocation and life cycle, as well as automobile use within the household. Such measures have not been collected in transportation planning files in the past, either aggregate or disaggregate, and thus questions concerning women's travel that relate to household role and such questions are not easily addressed

with such data. In addition, the data sets generally tend to be descriptive in nature and contain very few variables describing the underlying causes of travel behavior, particularly such factors as household decision-making. Thus, research-oriented studies often find such data sets lacking for such questions. While gender-based differences in travel patterns have not been the focus of much research per se, sex is almost always used as a demographic classifier of travel data. Indeed, it is a rare study that does not collect such data and subsequently tabulate information by it. This is particularly true of attitude and opinion studies. Thus, transportation planners are certainly familiar with the concept and do not hesitate to use it.

An Example

In order to understand better how conventional data sets may be used with some existing techniques to study women's travel issues, the following brief example has been developed. It consists of an application of home interview travel data, combined with simple tabulations, to understand aggregate trends in travel that may be related to women's travel issues.

The data base for the study consists of four separate home interview travel surveys collected over two points in time in Buffalo and Rochester, New York. In each city, two surveys approximately eleven years apart are analyzed to observe changes in aggregate travel patterns and how these relate to on-going changes in American society which reflect changes in the status of women. The four surveys may be summarized:

1962 Buffalo Survey - Conducted over a 12-week period (June-Sept.). Approximately 16,000 interviews*.

1973 Buffalo Survey - Conducted over a 10-week period (Sept.-Nov.). Approximately 2,000 interviews.

1963 Rochester Survey - Conducted over a 12-week period (May-July). Approximately 7,800 interviews.

1974 Rochester Survey - Conducted over a 10-week period (Sept.-Nov.). Approximately 2,400 interviews.

Travel data was collected for weekdays only; for persons 5 years of age or older; between the hours of 4:00 a.m. - 4:00 a.m. on the next day. School (and perhaps recreational) trips would be affected by summer survey times.

Using simple tabular routines, a number of summary tables have been prepared from the four travel studies and are summarized in the following tables.

Trips by Mode and Sex

Table 1 shows the distribution of travel by mode and sex for each of the four studies. The following trends are obvious:

- Vehicle driver trips increased 5 and 3 percentage points (≈ 10% and 5% increase respectively) between the two study areas over the 11 year period. This seems to have occurred at the expense of vehicle passenger and commercial bus trips.

- The proportion of vehicle driver trips of all male trips did not change much (increase for Buffalo; decrease for Rochester). Vehicle passenger trips and commercial bus trips decreased as proportion of

*Interviews = households

TABLE 1 - Person Trip By Sex & Mode

	62 Buffalo			73 Buffalo			63 Rochester			74 Rochester		
	Trips	% By Sex	% Total	Trips	% By Sex	% Total	Trips	% By Sex	% Total	Trips	% By Sex	% Total
MALE												
Vehicle Driver	1,164,623	72.5	41.2	1,184,189	74.4	38.5	642,563	72.0	39.1	683,496	71.0	36.3
Vehicle Passenger	312,140	19.4	11.0	219,526	13.8	7.1	173,675	19.5	10.6	153,981	16.0	8.2
Commercial Bus	84,025	5.2	3.0	47,187	3.0	1.5	34,052	3.8	2.1	27,653	2.9	1.5
School Bus	38,317	2.4	1.4	129,561	8.1	4.2	39,354	4.4	2.4	93,248	9.7	5.0
Taxi	2,752	0.2	0.1	5,439	0.3	0.2	812	0.1	*	1,222	0.1	0.1
Intercity B-R-A	4,313	0.3	0.2	5,049	0.3	0.2	1,540	0.2	0.1	1,754	0.2	0.1
Bicycle to Work	----	----	----	1,129	0.1	*	-----	----	----	812	0.1	*
Total	1,606,170	100.0	56.9	1,592,080	100.0	51.7	891,996	100.0	54.3	346[a]	*	*
										962,512	100.0	51.2
FEMALE												
Vehicle Driver	461,574	37.8	16.3	768,187	51.6	24.9	330,227	43.9	20.1	485,775	52.9	25.8
Vehicle Passenger	586,078	48.0	20.7	508,232	34.2	16.5	323,064	42.9	19.6	292,824	31.9	15.6
Commercial Bus	125,683	10.3	4.4	74,121	5.0	2.4	58,510	7.8	3.6	46,497	5.1	2.5
School Bus	39,351	3.2	1.4	128,773	8.7	4.2	38,539	5.1	2.3	89,225	9.7	4.7
Taxi	6,203	0.5	0.2	7,388	0.5	0.2	1,146	0.2	0.1	2,175	0.2	0.1
Intercity B-R-A	1,228	0.1	*	924	0.1	*	905	0.1	0.1	1,015	0.1	0.1
Bicycle to Work	----	----	----	----	----	----	----	----	----	208	*	*
Total	1,220,117	99.9	43.0	1,487,625	100.1	48.2	752,391	100.0	45.8	442[a]	*	*
										918,161	99.9	48.8
TOTAL												
Vehicle Driven	1,626,197	----	57.5	1,952,376	----	63.4	972,790	----	59.2	1,169,271	----	62.2
Vehicle Passenger	898,218	----	31.7	727,758	----	23.6	496,739	----	30.2	446,805	----	23.8
Commercial Bus	209,708	----	7.4	121,308	----	3.9	92,562	----	5.6	74,150	----	3.9
School Bus	77,668	----	2.7	258,334	----	8.4	77,893	----	4.7	182,473	----	9.7
Taxi	8,955	----	0.3	12,827	----	0.4	1,958	----	0.1	3,397	----	0.2
Intercity B-R-A	5,541	----	0.2	5,973	----	0.2	2,445	----	0.1	2,769	----	0.1
Bicycle to Work	----	----	----	1,129	----	*	----	----	----	1,020	----	0.1
Total	2,826,287	----	199.8	3,079,705	----	99.9	1,644,387	----	99.9	788[a]	----	*
										1,880,673		100.0
NO RESPONSE	772	----	----	8,613	----	----	110	----	----	1,447	----	----
GRAND TOTAL	2,827,059	----	----	3,088,318	----	----	1,644,497	----	----	1,882,120	----	----

* less than 0.1%

all male trips. As a porportion of all trips, male vehicle driver, passenger and commercial bus trips decreased (overall from 56.9 → 51.7 for Buffalo; 54.3 → 51.2 for Rochester) over the 11 year period.

- For female trips, vehicle driver trips increased considerably as a proportion of all female trips (37.8 → 51.6 for Buffalo = 36.5% increase; 43.9 → 52.9 for Rochester = 20.5% increase). This increase is offset by a 28.8% decrease (48.0 → 34.2) in Buffalo vehicle passenger trips and a 25.6% decrease (42.9 → 31.9) in Rochester vehicle passenger trips. The female vehicle driver trip increase indicates that more women have access to a vehicle now as compared to 11 years prior to 73/74.

Trips by Sex and Destination Purpose

Table 2 summarizes the same four studies by sex and destination purpose. An analysis of the trends in the table shows the following:

- Male trips to "work" decreased (proportionately) while female trips increased.
- Trips to "serve passengers" increased for females and decreased for males.
- Surprisingly, trips to "social-recreation-vacation" and "ride" decreased for everyone.
- The decreases are somewhat offset due to the increase in trips to "school" (the absolute increase in these trips would result in a relative decrease in the other trip purpose percentages).
- Trips to "shop" decreased proportionately for everyone.

TABLE 2 - Person Trips by Sex and Trip Destination Purpose

	62 Buffalo			73 Buffalo			63 Rochester			74 Rochester		
	Trips	% by Sex	% Total	Trips	% by Sex	% Total	Trips	% by Sex	% Total	Trips	% by Sex	% Total
MALE												
Home	584,818	36.4	20.7	628,674	39.5	20.4	325,719	36.5	19.8	377,651	39.2	20.1
Work	357,174	22.2	12.6	288,903	18.2	9.4	210,465	23.6	12.8	207,067	21.5	11.0
Shop	127,680	7.9	4.5	117,121	7.4	3.8	59,728	6.7	3.6	64,309	6.7	3.4
School	40,034	2.5	1.4	124,998	7.9	4.1	33,224	3.7	2.0	74,601	7.8	4.0
Soc-Rec-Vac	167,462	10.4	5.9	101,093	6.4	3.3	74,973	8.4	4.6	60,513	6.3	3.2
Eat Meal	41,100	2.6	1.5	51,653	3.2	1.7	24,625	2.8	1.5	27,338	2.8	1.5
Pers. Bus.	97,561	6.1	3.5	116,578	7.3	3.8	65,587	7.4	4.0	61,704	6.4	3.3
Serve Pass.	125,941	7.8	4.5	116,662	7.3	3.8	68,201	7.6	4.1	66,387	6.9	3.5
Chnge. Mode	8,031	0.5	0.3	11,397	0.7	0.4	4,096	0.5	0.2	5,681	0.6	0.3
Ride	56,369	3.5	2.0	33,334	2.1	1.1	25,378	2.8	1.5	17,209	1.8	0.9
Total	1,606,170	99.9	56.9	1,590,413	100.0	51.8	891,996	100.0	54.1	962,460	100.0	51.2
FEMALE												
Home	461,599	37.8	16.3	572,183	38.5	18.6	290,927	38.7	17.7	359,737	39.2	19.1
Work	99,449	8.2	3.5	142,483	9.6	4.6	72,114	9.6	4.4	101,918	11.1	5.4
Shop	181,969	14.9	6.4	197,804	13.3	6.4	93,346	12.4	5.7	103,518	11.3	5.5
School	39,680	3.3	1.4	112,265	7.6	3.6	32,756	4.4	2.0	72,689	7.9	3.9
Soc-Rec-Vac	163,666	13.4	5.8	111,031	7.5	3.6	76,969	10.2	4.7	71,651	7.8	3.8
Eat Meal	23,563	1.9	0.8	36,983	2.5	1.2	13,922	1.9	0.8	20,772	2.3	1.1
Pers. Bus.	87,420	7.2	3.1	130,606	8.8	4.2	67,566	9.0	4.1	76,702	8.4	4.1
Serve Pass.	79,731	6.5	2.8	122,436	8.2	4.0	60,276	8.0	3.7	79,648	8.7	4.2
Chnge. Mode	8,191	0.7	0.3	8,382	0.6	0.3	5,289	0.7	0.3	5,964	0.6	0.3
Ride	74,849	6.1	2.6	51,654	3.5	1.7	39,226	5.2	2.4	25,377	2.8	1.3
Total	1,220,117	100.0	43.0	1,485,827	100.1	48.2	752,391	100.1	45.8	917,976	100.1	48.7
TOTAL												
Home	1,046,417	----	37.0	1,200,857	----	39.0	616,646	----	37.5	737,388	----	39.2
Work	456,623	----	16.2	431,386	----	14.0	282,579	----	17.2	308,985	----	16.4
Shop	309,649	----	11.0	314,925	----	10.2	153,074	----	9.3	167,827	----	8.9
School	79,714	----	2.8	237,263	----	7.7	65,980	----	4.0	147,290	----	7.8
Soc-Rec-Vac	331,128	----	11.7	212,124	----	6.9	151,942	----	9.2	132,164	----	7.0
Eat Meal	64,663	----	2.3	88,636	----	2.9	38,547	----	2.3	48,110	----	2.6
Pers. Bus.	184,981	----	6.5	247,184	----	8.0	133,153	----	8.1	138,406	----	7.4
Serve Pass.	205,672	----	7.3	239,098	----	7.8	128,477	----	7.8	146,035	----	7.8
Chnge. Mode	16,222	----	0.6	19,779	----	0.6	9,385	----	0.6	11,645	----	0.6
Ride	131,218	----	4.6	84,988	----	2.8	64,604	----	3.9	42,586	----	2.3
Total	2,826,287	----	100.0	3,076,240	----	99.9	1,644,387	----	99.9	1,880,436	----	100.0
NO RESPONSE	772	----	----	12,078	----	----	110	----	----	1,687	----	----
GRAND TOTAL	2,827,059	----	----	3,088,318	----	----	1,644,497	----	----	1,882,123	----	----

- More women (proportionately) work in 73/74 than in 62/63. More women have a car available during the day since "serve passenger" trips decreased proportionately for them or more work-car pools are operated by women in 73/74 than in 62/63.

Trips by Destination Purpose and Trip Length

Table 3 summarizes this information. The following points can be made.

- Average trip length increased for men in both Buffalo and Rochester, but decreased for women in Buffalo and increased very moderately in Rochester over the 11 year period.
- Generally, women's trips are shorter than men's trips, indicating the tighter range of travel around the home. This trend is apparent in all four data sets.
- While average trip lengths for women's work travel increased substantially, men's trip lengths increased even more for work travel, reflecting perhaps a tendency for men to take jobs at greater distances from the home has accelerated over the last 11 years.

Sex and Employment

Tables 4a and 4b show the following:

- There has been a sharp decrease in the percentages of women identifying themselves as "housewife" in each of the cities over the last 11 years.
- The increase in women's employment has occurred across all of the employment categories. With men, however, employment

TABLE 3

Person Trips by Sex, Destination Purpose and Average Trip Length (Airline Distance - Miles)

	62 Buffalo	73 Buffalo		63 Rochester	74 Rochester	
	Trip Length	Trip Length	$\frac{\Delta_{73-62}(\%)}{62}$	Trip Length	Trip Length	$\frac{\Delta_{74-63}(\%)}{62}$
Male						
Home	4.17	4.54	+8.9	3.94	4.43	+12.4
Work	4.64	5.97	+28.7	4.10	5.77	+40.7
Shop	2.56	2.73	+6.6	2.33	2.93	+25.8
School	2.65	2.92	+10.2	2.11	3.18	+50.7
Soc-Rec-Vac	5.81	5.68	-2.2	5.66	4.77	-15.7
Eat Meal	3.15	4.51	+43.2	2.93	3.71	+26.6
Pers. Bus.	3.41	3.78	+10.9	3.72	4.18	+12.4
Serve Pass.	3.18	3.39	+6.6	2.79	3.25	+16.5
Change Mode	7.11	4.32	-39.2	9.47	4.61	-51.3
Ride	3.67	4.58	+24.8	3.13	3.76	+20.1
Average*	4.13	4.46	+8.0	3.82	4.42	+15.7
FEMALE						
Home	3.60	3.32	-7.8	3.27	3.31	+1.2
Work	3.55	4.18	+17.7	3.22	4.23	+31.4
Shop	2.63	2.89	+9.9	2.38	3.17	+33.2
School	2.30	2.53	+10.0	2.19	2.82	+28.8
Soc-Rec-Vac	5.63	3.99	-29.1	5.16	4.03	-21.9
Eat Meal	3.84	4.82	+25.5	3.43	3.82	+11.4
Pers. Bus.	2.94	3.30	+12.2	3.05	3.36	+10.2
Serve Pass.	2.74	2.89	+5.5	2.65	3.06	+15.5
Change Mode	7.71	4.70	-39.0	5.31	5.09	-4.1
Ride	3.74	3.58	-4.3	3.36	3.06	-8.9
Average*	3.62	3.35	-7.5	3.25	3.41	+4.9
TOTAL						
Home	3.92	3.96	+1.0	3.62	3.89	+7.5
Work	4.40	5.38	+22.3	3.88	5.27	+35.8
Shop	2.60	2.86	+10.0	2.36	3.08	+30.5
School	2.48	2.73	+10.1	2.15	3.00	+39.5
Soc-Rec-Vac	5.72	4.79	-16.3	5.41	4.37	-19.2
Eat Meal	3.40	4.64	+36.5	3.11	3.76	+20.9
Pers. Bus.	3.19	3.53	+10.7	3.38	3.73	+10.4
Serve Pass.	3.01	3.14	+4.3	2.72	3.14	+15.4
Change Mode	7.41	4.48	-39.5	7.13	4.86	-31.8
Ride	3.71	3.97	+7.0	3.27	3.34	+2.1
Average*	3.91	3.93	+0.5	3.56	3.93	+10.4

* Weighted Values

TABLE 4A

Persons (5 years and older) by Sex and Selected Employment Status

	1962 Buffalo			1973 Buffalo			1963 Rochester			1974 Rochester		
	# of Pers.	% Sex	% Total	# of Pers.	% Sex	% Total	# of Pers.	% Sex	% Total	# of Pers.	% Sex	% Total
MALE												
Housewife	110	*	*	----	----	----	----	----	----	208	0.1	*
Student	168,804	32.1	15.5	176,720	32.3	15.3	81,030	31.3	14.9	107,621	31.6	15.8
Total	526,014	100.0	-----	547,865	100.0	----	159,143	100.0	----	340,516	100.0	----
FEMALE												
Housewife	245,865	43.8	22.6	191,139	31.3	16.5	112,178	39.2	20.6	86,693	25.3	12.7
Student	159,873	28.5	14.7	170,809	28.0	14.7	79,221	27.7	14.5	100,971	29.5	14.8
Total	560,790	100.0	----	610,485	100.0	----	286,134	100.0	----	342,652	100.0	----
TOTAL	1,086,804		100.0	1,158,350		100.0	545,277		100.0	683,168		100.0
UNKNOWN	1,990			3,121			108,862			1,310		
GRAND TOTAL	1,088,794[1]			1,161,471			654,139[2]			684,478		

[1] Does not include 182 bypassed records

[2] Does not include 27 bypassed records

*Less than 0.1 percent

TABLE 4B

Persons (5 years and older) by Sex and Occupation

	1962 Buffalo			1973 Buffalo			1963 Rochester			1974 Rochester		
	# of Pers.	% Sex	% Total	# of Pers.	% Sex	% Total	# of Pers.	% Sex	% Total	# of Pers.	% Sex	% Total
Male												
Professional Technical	41,421	7.9	3.8	44,264	8.1	3.8	28,123	10.9	5.2	49,179	14.4	7.2
Farmers, Farm Mgrs.	1,207	0.2	0.1	1,871	0.3	0.2	850	0.3	0.2	1,741	0.5	0.3
Managers, Officials, Prop.	35,952	6.8	3.3	53,110	9.7	4.6	20,169	7.8	3.7	19,918	5.8	2.9
Clerical	23,726	4.5	2.2	15,238	2.8	1.3	9,873	3.8	1.8	8,023	2.4	1.2
Sales Workers	15,798	3.0	1.5	15,468	2.8	1.3	10,028	3.9	1.8	13,877	4.1	2.0
Craftsman, Military	74,563	14.2	6.9	77,836	14.2	6.7	38,337	14.8	7.0	43,583	12.8	6.4
Machine Operators	53,947	10.3	5.0	48,721	8.9	4.2	23,190	8.9	4.3	29,855	8.8	4.4
Private Household Workers	164	*	*	34	*	*	189	0.1	*	260	0.1	*
Service Workers	21,932	4.2	2.0	15,577	2.8	1.3	12,876	5.0	2.4	16,308	4.8	2.4
Laborers, Farm Workers	21,010	4.0	1.9	23,113	4.2	2.0	5,464	2.1	1.0	6,846	2.0	1.0
Other (Housewife, Student, Retired, Disabled)	236,241	44.9	21.7	244,220	44.6	21.1	109,941	42.4	20.2	143,915	42.3	21.1
Unknown	53	*	*	8,414	1.5	0.7	103	*	*	7,012	2.1	1.0
Total	526,014	100.0	48.4	547,966	99.9	47.2	259,143	100.0	47.6	340,517	100.1	49.9
FEMALE												
Professional Technical	18,926	3.4	1.7	32,770	5.4	2.8	13,004	4.5	2.4	29,659	8.7	4.3
Farmers, Farm Mgrs.	103	*	*	540	0.1	*	91	*	*	572	0.2	0.1
Managers, Officials, Prop.	6,883	1.2	0.6	8,823	1.4	0.8	3,487	1.2	0.6	3,499	1.0	0.5
Clerical	40,855	7.3	3.8	57,095	9.4	4.9	24,659	8.6	4.5	40,149	11.7	5.9
Sales Workers	9,356	1.7	0.9	8,769	1.4	0.8	3,682	1.3	0.7	6,436	1.9	0.9
Craftsman, Military	5,036	0.9	0.5	4,993	0.8	0.4	6,218	2.2	1.1	8.814	2.6	1.3
Machine Operators	11,218	2.0	1.0	19,845	3.3	1.7	9,628	3.4	1.8	12,146	3.5	1.8
Private Household Workers	2,855	0.5	0.3	6,281	1.0	0.5	1,983	0.7	0.4	4,237	1.2	0.6
Service Workers	20,311	3.6	1.9	33,915	5.6	2.9	9,284	3.2	1.7	16,121	4.7	2.4
Laborers, Farm Workers	1,617	0.3	0.1	2,713	0.4	0.2	824	0.3	0.2	675	0.2	0.1
Other (Housewife, Student, Retired, Disabled).	443,630	79.1	40.8	428,606	70.2	37.0	213,256	74.5	39.1	214,258	62.5	31.4
Unknown	----	----	----	6,136	1.0	0.5	18	*	*	6,087	1.8	0.9
Total	560,790	100.0	51.6	610,486	100.0	52.5	286,134	99.9	52.5	342,653	100.0	50.2
TOTAL	1,086,804		100.0	1,158,352		99.7	545,277		100.1	683,170		100.1
UNKNOWN	1,990			3,121			108,862			1,310		
GRAND TOTAL	1,088,794			1,161,473[1]			654,139			684,480[1]		

[1]Difference with Table 4A totals due to rounding

*Less than 0.1 percent

increases have generally been in the professional and technical (white collar) jobs.

In summarizing this section, it should be pointed out that our purpose is not to summarize women's travel issues for each of these cities, but rather simply to demonstrate that conventional data sets have within them considerable power to study such questions.

Conclusions and Other Research

The central conclusion of our brief review is that while methods and data presently available to transportation planners have not generally been used to study women's travel issues, they may certainly be asked to do so. Generally speaking we found the data sources and simple tabular materials extremely rich in such information, and we would expect that a more detailed analysis using additional techniques such as disaggregate models for statistical procedures would show even greater applicability of present data sets to the study of such questions. Thus, while it is certainly true that there are numerous issues and subjects which can not easily be addressed with present methodologies and data, the analysts should not despair. For within present methods and data, the power certainly rests to address such questions, should the analyst wish to do so.

In particular, present methods and data sets would appear to be quite useful for studying the following kinds of gender related questions:

(1) Changes over time in aggregate travel patterns, such as we have reviewed in this paper.

(2) Changes in working patterns, particularly by women.

(3) Changes in ridership profiles.

(4) Non-work travel reflected in both destination and purpose distributions.

(5) The choice structures of travel, particularly destination and mode choice.

On the other hand, a number of additional subjects would appear to be quite difficult to study with existing tools and techniques. These include the following:

(1) Questions concerning role and life cycle and their influence upon travel.

(2) Questions in which trip sequencing and chaining is a central issue (no good tools are available for studying trip chaining, although the data generally have within them the appropriate ties).

(3) Studies of travel as an output of the household decision-making process, such as those presently being developed by NCHRP research (8-14A).

It would appear that research in such areas could best go forward by relying heavily upon specialized data sets for attitudinal and preference information, as well as specially collected data sets such as the disaggregate Baltimore data, to further understand role and life cycle relationships.

If this information can be synthesized, it may be possible to relate it directly to conventional data sets in such a way that transportation planners will be able to use it effectively.

In conclusion, therefore, just because women's travel issues have not been studied, doesn't mean they can't be. This author would recommend that if such issues are of central importance to the transportation planning profession, they should be raised, studied, and addressed now, with conventional tools and techniques as appropriate, rather than waiting for better procedures or more carefully constructed analytical tools to come along. These tools will certainly evolve in time and will undoubtedly assist us in understanding these questions but the cost of waiting (assuming that the issues are important) is higher than the value likely to be gained. Thus, where appropriate, transportation planners should be encouraged to address these questions in a timely fashion, without worrying too much about the availability or need for ideal data sets and research methods.

Acknowledgements

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GENDER-ROLE IDENTIFICATION IN THE METHODOLOGY OF TRANSPORTATION PLANNING

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Hundreds of large scale transportation studies have been used in the formulation of transportation policy and in planning regional transportation systems in the United States for the past thirty five years. These studies rely primarily on interview and other data collected from a sample of homes and along the roads. A consistent and fully developed modeling methodology is used to predict future travel demand. This estimated demand then serves as part of the input to future policies, plans for systems and facilities, and other decisions which finally determine what is and is not done about transportation.

Despite that fact that women make up more than half of the population we have not found that any of the large scale transportation studies specifically looked at the travel needs of women. Creighton noted this but pointed out that the process should be concerned with attributes of persons and households rather than with individual persons, apparently believing that these attributes would be unrelated to gender. (4) It was recognized that the travel patterns of males and females do differ, but the only explicit reference to sex in the landmark Chicago Area Transportation Study was in connection with the mode of transportation in which it was noted that females made up 67% of the auto passengers and only 25% of the auto drivers in the 1956 period. (3)

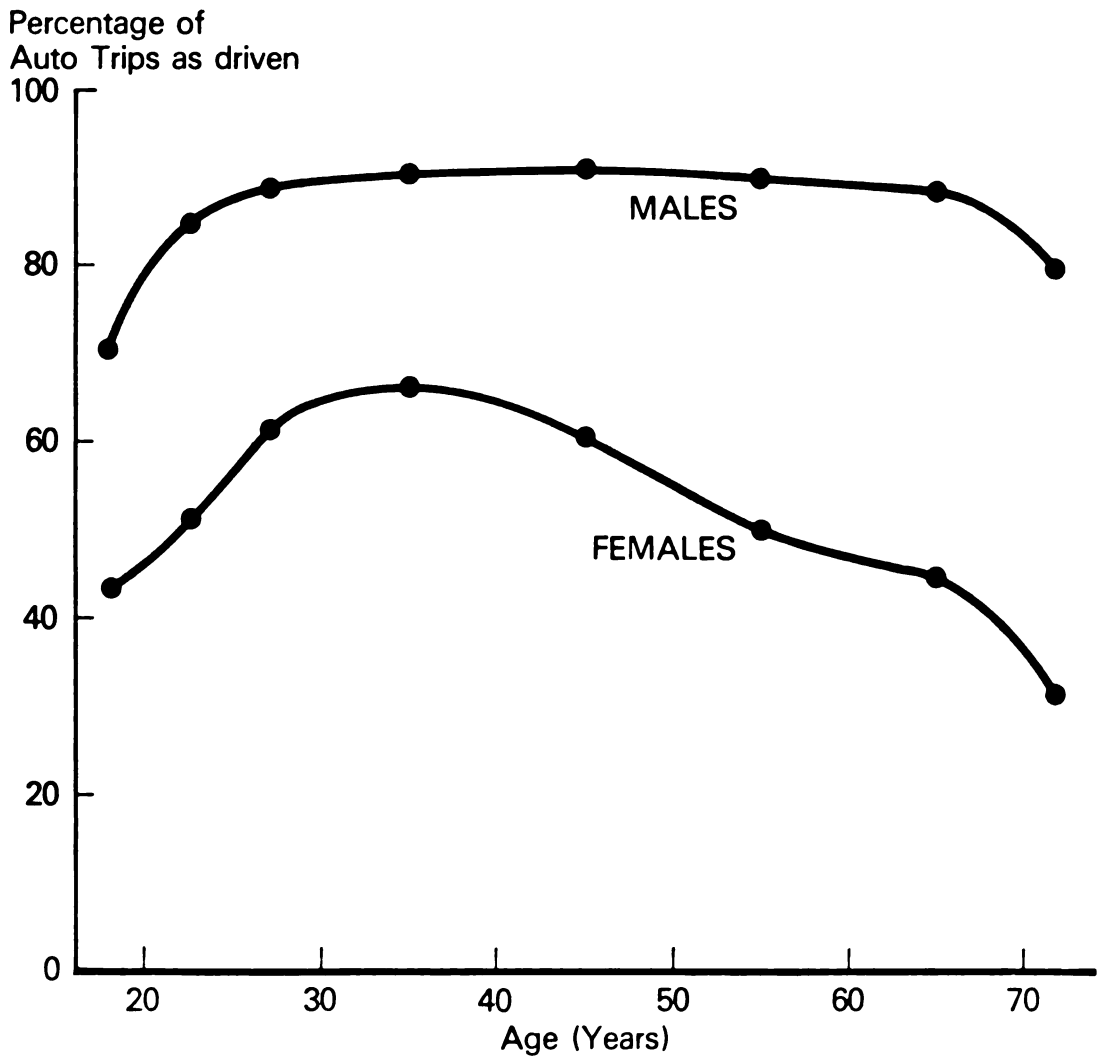
In the attitude study conducted in 1965 in Detroit as a part of the Transportation and Land Use Study (TALUS) important differences between men and women with respect to their attitudes toward freeways were identified, with men being found to be much more positively disposed toward freeways than women. Otherwise there was no indication of gender-related characteristics identified in the study.

Throughout the literature in the field and reports to the public there is a paucity of information on sex and travel characteristic interactions at a level which is causal and explored underlying determinants. Typical of naive presentations are simple tabulations of trip making length. One example is found in the predominance of male vehicle miles of travel. The U.S. Department of Transportation 1970 National Personal Transportation Survey (NTPS) reported that 73 percent of the nation's vehicle miles were made by male drivers. The average male, as a driver, exceeded 11,000 miles per year while the female averaged less than half of this or 5,400 miles per year. It was found that the most significant difference in travel behavior by the sexes was that adult males make about 60 percent of their trips as the drivers of autos while for females the percentage is 40.

The NPTS also explored age and sex characteristics of automobile travel. Not only did men make a larger fraction of their total lifetime trips as drivers but the pattern by age was quite different. With exception of the teen and over 70 year groups there was little difference for males. Female driver trips as a fraction of their total travel rose to a peak in the 30-39 year age bracket and declined continually and notably thereafter.

FIGURE 1

AUTO DRIVER TRIPS AS PERCENTAGE OF ALL TRIPS BY AGE AND SEX IN 1970



Source: NPTS, derived from Table B

Yet, characteristics of this type are changing and are changing rapidly. It has been observed that travel and licensing are related. Figure 2 shows the trend in the ratio of the number of licensed female to male drivers over a recent 12 year period. In 1963 there was no age group in which the number of women drivers exceeded 75 percent of the number of men drivers. By 1969, there were 80 percent as many women as men over the 20-44 year age groups. By 1975, 80 percent was exceeded for all ages from the youngest to 59 years of age and in the 30-39 year age group there were 90 percent as many women drivers as men. The uppermost curve represents the female to male population ratio in the United States in 1970. If this convergence toward equal licensing continues it can be expected that by 1995 this difference between the sexes will be eliminated and that there will then be a smaller rate of change in demand than has been the case. Planning should respond to this ultimate constraint as well as to the differential effects as older, previously unlicensed drivers are added to the population of drivers.

These and other similar shifts and trends call out for a scaling and exploration of the quantitative elements of gender and travel to determine the extent if any, that the present methods give erroneous results worthy of note.

It is the purpose of this paper to identify and evaluate how effectively current transportation planning methodology measures the existing travel behavior and transportation needs of women in general and of subsets of women in particular. The focus is on two of the analytic

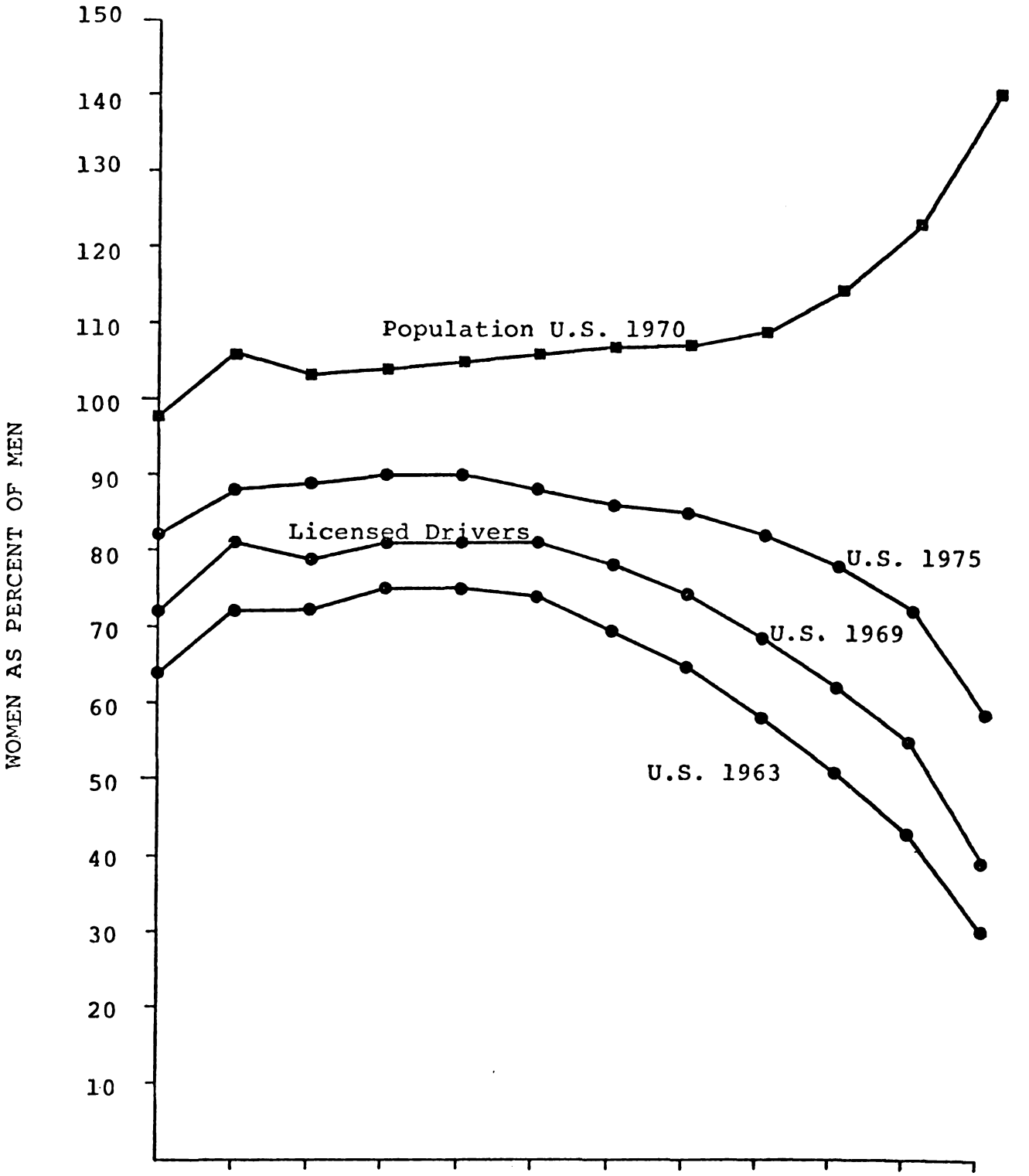


FIGURE 2

TREND IN NUMBER OF LICENSED FEMALES TO MALE DRIVERS BY AGE

portions of the process, the internal home interview survey, a sampling of the household and travel characteristics of those residing within the transportation planning area, and the transportation demand modeling process, particularly the relationships used to predict the total amount of travel, the so-called trip generation model.

The objectives of this effort are to determine whether or not the data handling and modeling activities in these two processes possibly or inevitably lead to biases in the treatment of women's transportation needs in the planning process.

In the following sections we successively describe the investigation of the possible sex bias resulting from the sampling technique, the data expansion methods, the characteristics of travel, and finally the trip generation models.

Methodology

Reports and data from TALUS and summaries of the 1953 Detroit Metropolitan Transportation Study (DMATS), two of the major large scale transportation studies, (5,6) were used with the primary data source being the TALUS person trip file.

The first area in which the problem was explored is in the sample representation of the population. The trip file sample was tabulated by sex and age distributions and compared to the distributions of the study area.

A second area in which the survey was studied lies in the expansion of data to account for refusals, incomplete reporting of trips, and

trips made by modes not seriously considered (e.g., walking), many of which are quite short.

The key element in reviewing the way in which women are considered in the transportation planning process and in ways which will be important for the future is to look closely at the household, the social unit in which there is a pooling of economic and human resources.

It is believed that the use of the household as the fundamental sampling unit of a transportation study carries with it information valid at the time of the study, particularly for the types of roles played by women at the time, which sociologists tell us are in a state of flux. It is also believed that information on trends of particular interest to transportation planners is found in such cross sectional data. Therefore, an appropriate task is the development of tabulations exploring gender and oriented toward expanding knowledge of the household to identify the roles of remales and males in more detail than exists at present.

TALUS leaned entirely on seven life cycle stages for this element. These were stratified further by such demographic variables as identification of employees in the household and age information. Auto availability and trip purpose were retrieved and used to explore the expanded data set for differences between the sexes, particularly in areas where roles are changing.

Sampling

The person trip data file from TALUS consists of 350,000 trips from 41,634 households from the southeastern Michigan region. A 20 percent

systematic random sample was drawn from this file. Only trip records from urban Detroit and suburban parts of Wayne, Oakland and Macomb counties were considered. Observations from outlying areas were not included. The sampling procedure consisted of dividing the records into 10,000 trip record sections, organizing these into 7 equal blocks and then randomly selecting sections of 10,000 trips from each of the 7 blocks. This procedure was followed to overcome spatial biases due to the organization of the original file and to simplify the data processing.

The resulting sample consisted of 50,000 person trips from 4683 suburban households and 20,000 person trips from 2792 urban households. A total of 17,811 persons made trips.

Table 1 gives the composition of the total sample by sex. Females constitute only 46.2 percent of the sample and account for 45 percent of the reported trips.

Sample and Study Area Comparison

Table 2 presents the 1965 distribution of residents by sex for the study area. It can be seen that only 18 percent of the census tracts have less than 48 percent residents who are female. Only slightly more than half of the tracts are within 2 percent of an equal sex distribution.

From these it can be inferred that more of the females do not travel, the females are underrepresented in the sample or since this person trip file does not include modes other than auto, bus, truck, and taxi, some of their trips do not qualify for inclusion.

TABLE 1

NUMBER OF TRIPMAKERS AND TRIPS IN SAMPLE

	Sample Size	Number of Trips
Females	8,234 (46.2)	31,788 (45)
Males	9,577 (53.8)	38,212 (55)
Total	17,811 (100)	70,000 (100)

( ) Indicates percentage.

TABLE 2

1965 SEX DISTRIBUTION BY CENSUS TRACTS

Percent Females	Percent of Tracts
0-37%	2%
38-42%	2%
43-47%	14%
48-52%	52%
53-57%	24%
58-62%	4%
63-100%	2%

Table 3 presents the tabulations of the TALUS trip file sample by age for both urban and suburban groups and compares them to age distributions by sex in the study area. It can be readily seen that the group of suburban females in the 46 to 65 year age category is underrepresented in the sample. Members of this group are not usually considered disadvantaged with respect to transportation, although they did have a much lower percentage of driver licenses than did their male contemporaries and younger females. In order to qualify for inclusion in the trip file a person has to make at least one trip by the before mentioned modes on the day of the survey. This explains why the over 66 group for both areas and both sexes appears to be underrepresented.

The 26 to 45 age group appears to be overrepresented across both areas and sexes. Therefore the only explanations for the underrepresentation of the suburban 46 to 65 year old women are that somehow these women were passed over in the sampling or that they did not make trips.

As a part of this study a careful review of the interviewing coding and administrative procedures followed in TALUS was conducted, with particular attention being given to possibilities of unintentional gender biases being introduced in the transportation planning process. The fundamental approach and sampling process did not have biases in terms of identifying the presence of and interviewing females in any parts of the study. Unfortunately, the data availability on sampling rates and relative frequency of refusals by sex were no longer readily available and the only checks possible were those related to total

TABLE 3

COMPARISON OF AGE DISTRIBUTION BY SEX IN SAMPLE AND STUDY AREA

		5-15	16-25	26-45	45-65	66+	Total
FEMALES							
	Number	332	501	884	721	159	2,597
	Percent of						
URBAN	Sample	12.8	19.3	34.0	27.7	6.1	
	Percent in						
	Study Area	18.6	19.0	23.3	25.3	13.4	
	Number	1,467	1,042	2,211	811	106	5,637
	Percent in						
SUBURBAN	Sample	26.0	18.5	39.2	14.4	1.9	
	Percent in						
	Study Area	25.9	14.8	23.3	25.3	13.4	
MALES							
	Number	327	545	1,070	965	183	3,090
	Percent of						
	Sample	10.5	18.0	34.5	31.0	6.0	–
	Percent in						
URBAN	Study Area	21.3	18.8	23.7	24.6	11.6	–
	Number	1,497	979	2,645	1,188	178	6,487
	Percent of						
	Sample	23.0	15.0	40.8	18.3	2.7	–
SUBURBAN							
	Percent in						
	Study Area	26.7	17.7	28.5	21.4	5.7	–

The sources for the study area age distribution are:

Urban Area - U.S. census 1970

Suburban Area - Population Projections of counties of Michigan, 1970.

population. Robert L. Smith, Jr., in the TALUS base publication made a separate study and concluded that the survey demographics agreed with independent estimates. He pointed out that non-work trips were underreported by 20 percent as were transit trips. (5) Both of these are areas where female travelers are heavily overrepresented and it would be anticipated that the resulting necessary expansion factor would be heavily dependent upon the extent to which the households interviewed cooperated fully with the work.

The areas in which the survey appeared to be most nonrepresentative were in unemployment where the survey appeared to be 5 percent off; auto vehicle miles of travel did not agree by 7 percent; and automobile availability was not properly captured with observed county differences ranging from 4 to 16 percent.

Of course, there are always situations in which the sampling variability is reduced or increased depending upon the fraction of individuals within the population. As was shown in Table 2 there are approximately 10 percent of the census tracts within the survey area with more than 62 and less than 38 percent females. Since these are approximately equally distributed it would appear that these spatial mis-sampling elements would not be a significant problem.

Of the 70,000 records which were processed, fewer than 20 internally inconsistent gender related keypunching or coding errors were identified. (An example of this would be a male coded as the daughter of the head of the household.)

Characteristics of Person-Tripmaking

The distribution of trips by the time of day by sex is presented in Table 4. A comparison of percentages shows that while more of men's than women's travel occurs during the morning peak (17.9 vs. 12.9) equal percentages (32.4) of both groups' travel happen during the afternoon peak. The implications of this are important. Most transportation plans are centered around the afternoon peak. It is sometimes hypothesized that women travel less during this period and therefore their travel is underrepresented in that portion of trips which are weighed most heavily in transportation planning. The evidence from this sample, however, supports the rejection of this hypothesis. The off-peak portion of women's travel is only slightly higher than that of men.

TABLE 4

DISTRIBUTION OF TRIPS
BY TIME OF DAY
BY SEX

	ALL TRIPS	MORNING PEAK	AFTERNOON PEAK	EVENING	OTHER
FEMALE	31788	4122	10300	7051	10315
	[100]	[12.9]	[32.4]	[22.2]	[32.5]
	(45.5)	(5.9)	(14.7)	(10.1)	(14.7)
MALE	38212	6679	12401	7846	11286
	[100]	[17.5]	[32.4]	[20.5]	[29.5]
	(54.5)	(9.5)	(17.7)	(11.2)	(16.1)
TOTAL	70000	10801	22701	14897	21601
	(100)	(15.4)	(32.4)	(21.3)	(30.1)

[ ] indicates row percentage

( ) indicates percentage of total

Figure 3 presents the distribution of elapsed time of the trips reported in the sample. It shows that 70 percent of the trips reported by women are under 15 minutes, while only 57 percent of men's trips are this short. Only 8 percent of women's trips were over 30 minutes as compared to 13 percent of men's trips, showing that the average trip length of males is longer than that of females.

Longer average trip lengths for males have been observed in other studies. For example, the average trip length for married men reported in the 1953 DMATS study was 2.14 miles. The average trip length for single men was 2.89 miles, while the average trip lengths for married and single women were reported as 1.89 and 1.95 miles respectively.

In order to examine the travel patterns with respect to role, the trip sample was stratified by destination trip purpose. Table 5 presents the distribution of trips by purpose at destination and by sex. There is no significant difference in the percentages of trips to home by sex. The most significant differences by purpose occur in the work and shopping trip. Men make 15 percent more of their travel for the work purpose and women's shopping trips are 8 percent greater. These trips are definitely role related. Smaller but still significant differences of 4 percent and 3 percent are seen for socio-recreational and serve passenger purposes, with the females spending a greater portion of their travel in these pursuits. Again, the statement can be made that these purposes are role related.

Since the roles are very heavily associated with lifecycles further stratification was conducted on the trip file by area and employment

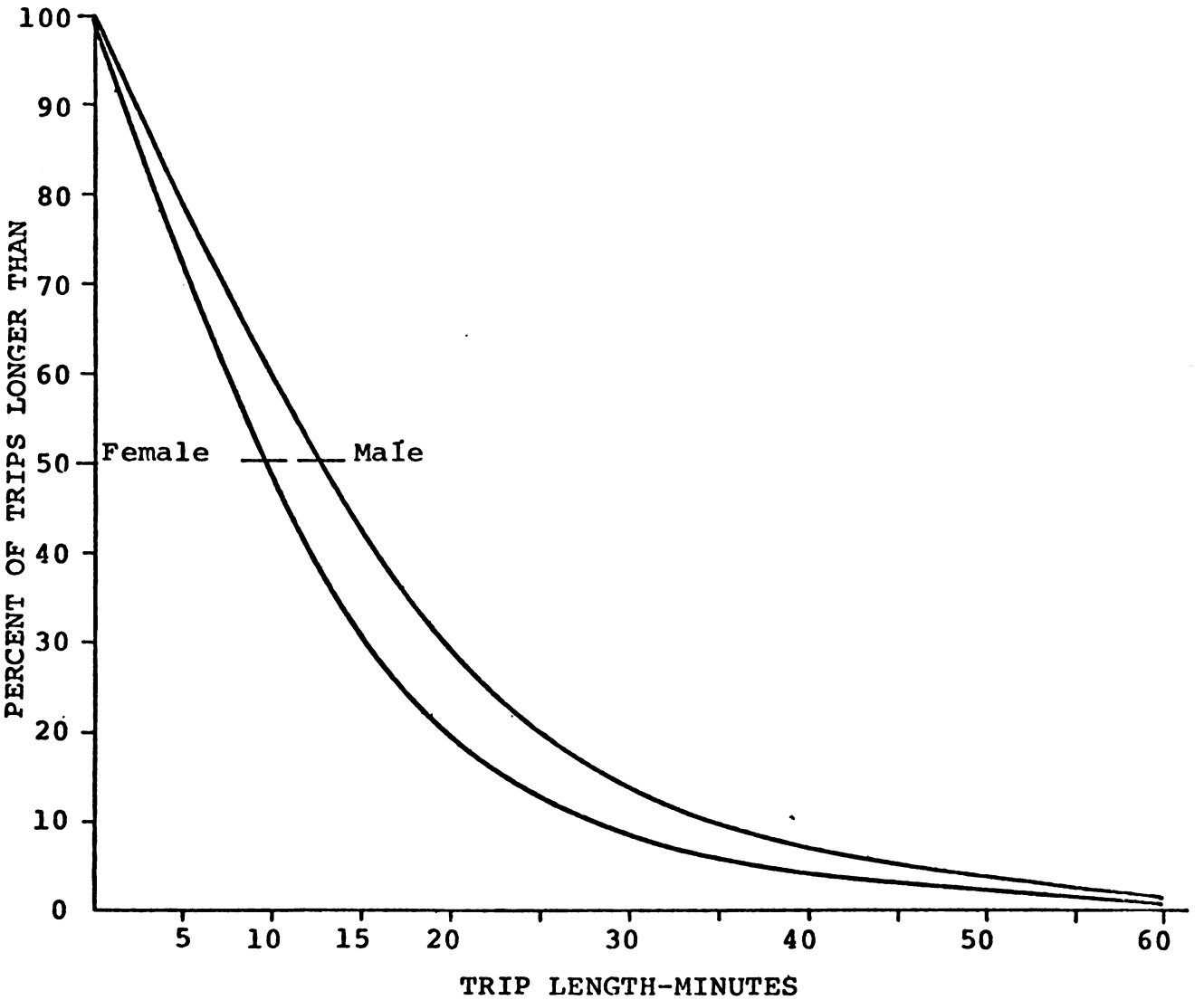


FIGURE 3

DISTRIBUTION OF ELAPSED TIME
FOR TRIPS BY SEX

TABLE 5

DISTRIBUTION OF TRIPS BY PURPOSE AND SEX IN SAMPLE

	All Trips	Home	Work	Personal Business	Socio-Recreational	Eat Meal	Shop	School	Change Mode	Serve Passenger
FEMALES	31,788	11,831	2,592	2,977	4,523	631	4,813	1,487	239	2,695
	[100.0]	[37.2]	[8.2]	[9.4]	[14.2]	[2.0]	[15.1]	[4.7]	[0.7]	[8.5]
	(45.5)	(16.9)	(3.7)	(4.3)	(6.5)	(0.9)	(6.9)	(2.1)	(0.3)	(3.8)
MALES	38,212	13,932	9,068	3,882	3,912	1,012	2,682	1,557	155	2,012
	[100.0]	[36.4]	[23.7]	[10.2]	[10.2]	[2.6]	[7.0]	[4.1]	[0.4]	[5.3]
	(54.5)	(19.9)	(13.0)	(5.5)	(5.6)	(1.4)	(3.8)	(2.2)	(0.2)	(2.9)
TOTAL	70,000	25,763	11,660	6,859	8,435	1,643	7,495	3,044	394	4,707
	(100.0)	(36.8)	(16.7)	(9.8)	(12.1)	(2.3)	(10.7)	(4.3)	(0.5)	(6.7)

[ ] indicates row percentage
( ) indicates percentage of total trips

status. Tables 6A and 6B present distribution of trips by purpose at destination as the percentage of that particular category's total trips.

Comparing the percentages of total trips by purpose, by lifecycle, employment, and sex shows that the proportion of trips of employed women for work purposes is lower than that of employed men for all the suburban lifecycle categories and for the three urban lifecycles which involve children. Since typically the number of work destination trips per day is the same for most employed individuals (close to one), this means that these women make more trips for other purposes.

In ranking shopping trips by women the highest percentages of shopping trips are associated with suburban homemakers, next by the urban homemakers, followed by the employed suburban, and finally the employed urban women. A possible explanation for the difference in urban and suburban shopping trips is the fact that some of these urban trips may be walk trips, which are not recorded in the trip file. Males in all four cases make fewer shopping trips than the females, and the unemployed male spends a greater portion of his travel for shopping.

The effect of role on the type of trips people make was explored by examining the distribution of trip purposes at destinations made by female and male heads of households, and by wives of male heads of households. This comparison for five (out of nine) purposes is presented in Figure 4. The original coding of the interview information prevented the classification of a woman as head of household if her spouse lived

TABLE 6A

TRIP DESTINATIONS AS PERCENTAGE OF TOTAL TRIPS BY SEX, LIFE CYCLE, AND EMPLOYMENT STATUS (SUBURBAN)

Life Cycle*	Employment**	Sex	Total Trips	Percent of Total Trips to— Home	Work	Personal Business	Socio-Recreational	Shopping	Serve Passenger
1	E	F	164	34	25	7	7	17	2
	E	M	341	29	30	8	13	8	5
	H	F	20	35	0	5	3	20	0
	U	M	15	46	0	13	13	13	6
2	E	F	659	36	25	6	10	10	5
	E	M	1,297	33	33	10	7	7	5
	H	F	313	36	0	11	16	29	3
	U	M	50	34	0	14	12	12	10
3	E	F	866	37	22	9	8	10	9
	E	M	7,765	34	31	11	6	8	6
	H	F	4,660	35	0	11	14	26	12
	U	M	141	35	0	7	9	14	9
4	E	F	2,594	36	20	7	8	12	12
	E	M	7,231	35	30	10	7	8	6
	H	F	4,244	36	0	11	12	22	15
	U	M	661	33	5	10	13	7	11
5	E	F	863	37	27	7	8	9	6
	E	M	1,458	38	27	9	9	7	6
	H	F	556	39	0	13	14	23	8
	U	M	493	37	3	14	15	8	9
6	E	F	603	36	25	11	8	12	4
	E	M	1,625	37	33	11	4	8	4
	H	F	953	36	0	15	13	25	5
	U	M	444	39	1	30	9	11	5
7	E	F	252	34	27	8	12	19	6
	E	M	128	37	32	15	5	4	4
	H	F	78	36	0	31	10	15	1
	U	M	52	42	6	42	2	4	6

*1 single, under 45; 2 married, under 45; 3 married, youngest child under 5; 4 married, youngest child between 5-17; 5 married, youngest child over 17; 6 married, over 45; 7 single, over 45

** E = Employed; U = Unemployed; H = Homemaker

TABLE 6B

TRIP DESTINATIONS AS PERCENTAGE OF TOTAL TRIPS BY SEX, LIFE CYCLE, AND EMPLOYMENT STATUS (URBAN)

Life Cycle*	Employ-ment**	Sex	Total Trips	Percent of Total Trips to — Home	Work	Personal Business	Socio-Recreational	Shop-ping	Serve Passenger
1	E	F	203	38	31	12	6	5	3
	E	M	246	37	30	9	11	3	4
	H	F	13	38	7	31	0	8	0
	U	M	38	32	10	30	8	3	5
2	E	F	305	35	25	9	11	7	6
	E	M	628	36	26	13	9	7	5
	H	F	135	35	0	17	2	17	7
	U	M	10	40	0	30	10	20	0
3	E	F	407	38	26	6	8	7	7
	E	M	2,313	38	30	11	6	7	5
	H	F	1,101	37	1	12	15	21	12
	U	M	62	39	3	29	4	3	5
4	E	F	1,182	39	28	8	6	9	7
	E	M	2,449	37	33	11	5	5	6
	H	F	1,219	38	5	15	13	17	15
	U	M	227	38	4	15	11	7	10
5	E	F	714	39	31	6	7	6	7
	E	M	1,143	39	35	7	8	5	4
	H	F	336	39	0	20	10	20	7
	U	M	307	42	5	26	11	6	7
6	E	F	447	40	30	6	7	9	5
	E	M	1,467	39	32	10	5	5	6
	H	F	755	38	0	16	15	21	6
	U	M	295	46	2	26	11	17	2
7	E	F	348	40	31	11	4	7	7
	E	M	361	36	30	10	8	6	4
	H	F	145	38	0	37	7	13	1
	U	M	111	42	0	35	10	7	1

* ** See Table 6A

in the same household. The sample contained only 640 households which were headed by females. Of these 400 were in the urban areas and 240 in the suburbs.

The trips of the female head of household are different from those of the male head and from those of the wife. Considering the way female head of household is defined it is to be expected. For example, the portion of female household heads' trips for work is between that of male household heads' and that of wives'. In fact, they are over twice that of wives' trips and 1/2 that of male heads' trips.

The portion of trips which are for personal business are greatest for the female head. This is not unusual since she handles most of the household business while in the other cases, two people share the job. The portion of socio-recreational trips are highest for the wives group. The percentages of socio-recreational trips of both male and female heads are much lower and closer to each other. Twenty percent of the wives' trips are for shopping purposes; only twelve percent of the female heads' and ten percent of the male heads' trips are for this purpose.

The percentage of trips in the serve passenger purpose category shows that it is the wife who serves as the household chauffeur.

Household Tripmaking

Several analyses were conducted to explore the differences in total household trip making for gender and role related elements. These differences were developed against the background of the most commonly

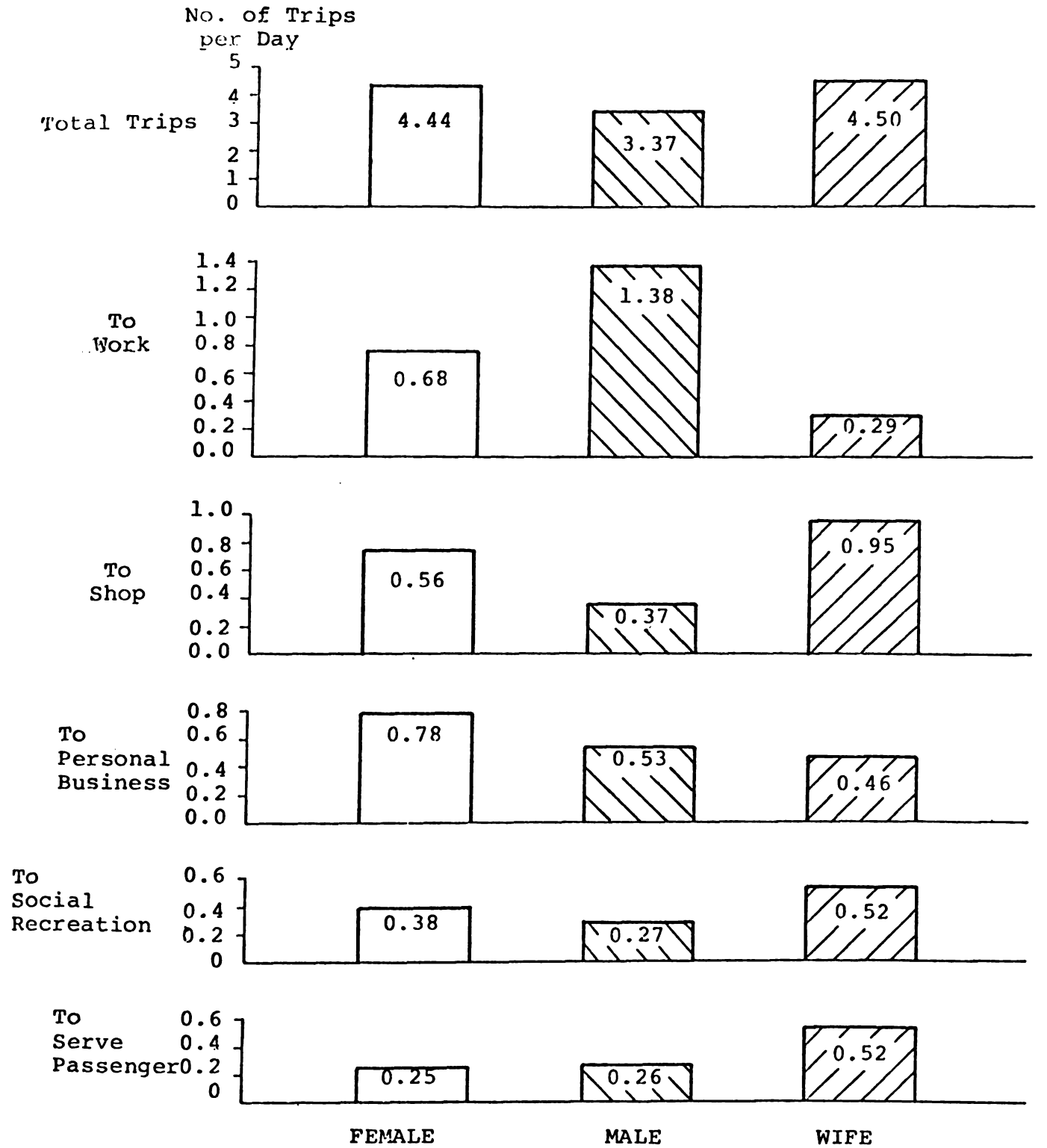


FIGURE 4

TRIPS BY TRIP PURPOSE AT DESTINATION
BY ROLE (SUBURBAN)

accepted determinants of trip making, household size and auto availability.

The exploration is based heavily on number of adult (over age 18) females found in the household. This variable was obtainable from the data and was intended as a simple surrogate for role. Use of such variables is not new. Kain, in his model of household locational and tripmaking behavior which was calibrated on the 1953 DMATS data, used the number of female workers in a zone as a role surrogate variable. (9) Because of sample size limitation, this analysis was generally limited to families in which the head of the household is in the middle years age group (26-65 years of age). Various results have been tested statistically and found to be significant at reasonable levels of the error of the first type.

Figure 5 presents results for one person households in which that individual is employed. It can be seen that there is no difference between the average daily total trip making for adult female or adult male single households, regardless of whether or not no or one car is available. The influence of the availability of a car is approximately 1.5 trips per day for such a person.

Figure 6 develops information on two adult households. It can be seen that there is a very significant difference in total travel for all levels of car ownership, depending upon whether the members of the household include a female. When the household consists of two males there are only 50-60 percent as many trips made per day as when there

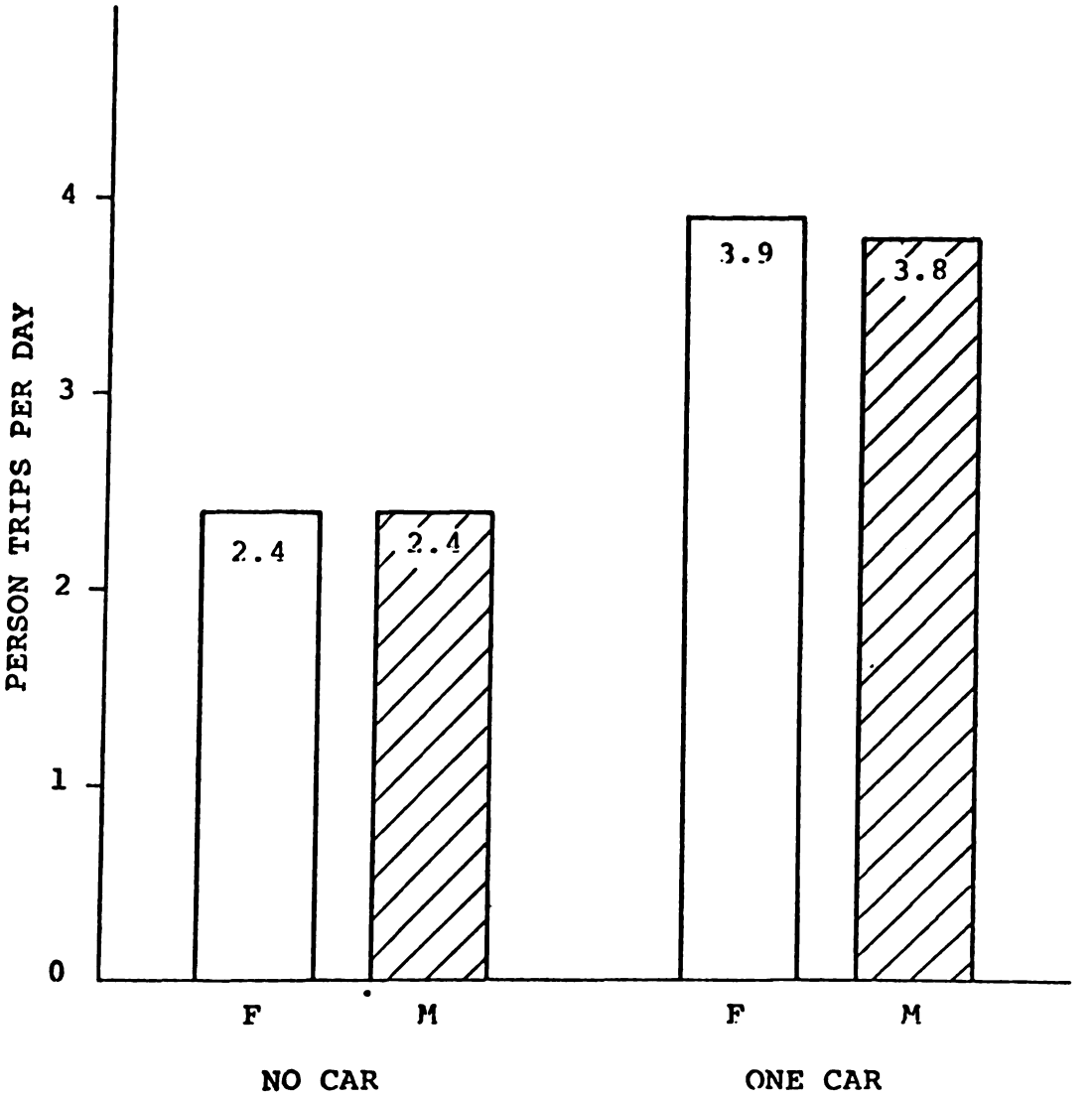


FIGURE 5

TOTAL TRIPMAKING
ONE PERSON HOUSEHOLD

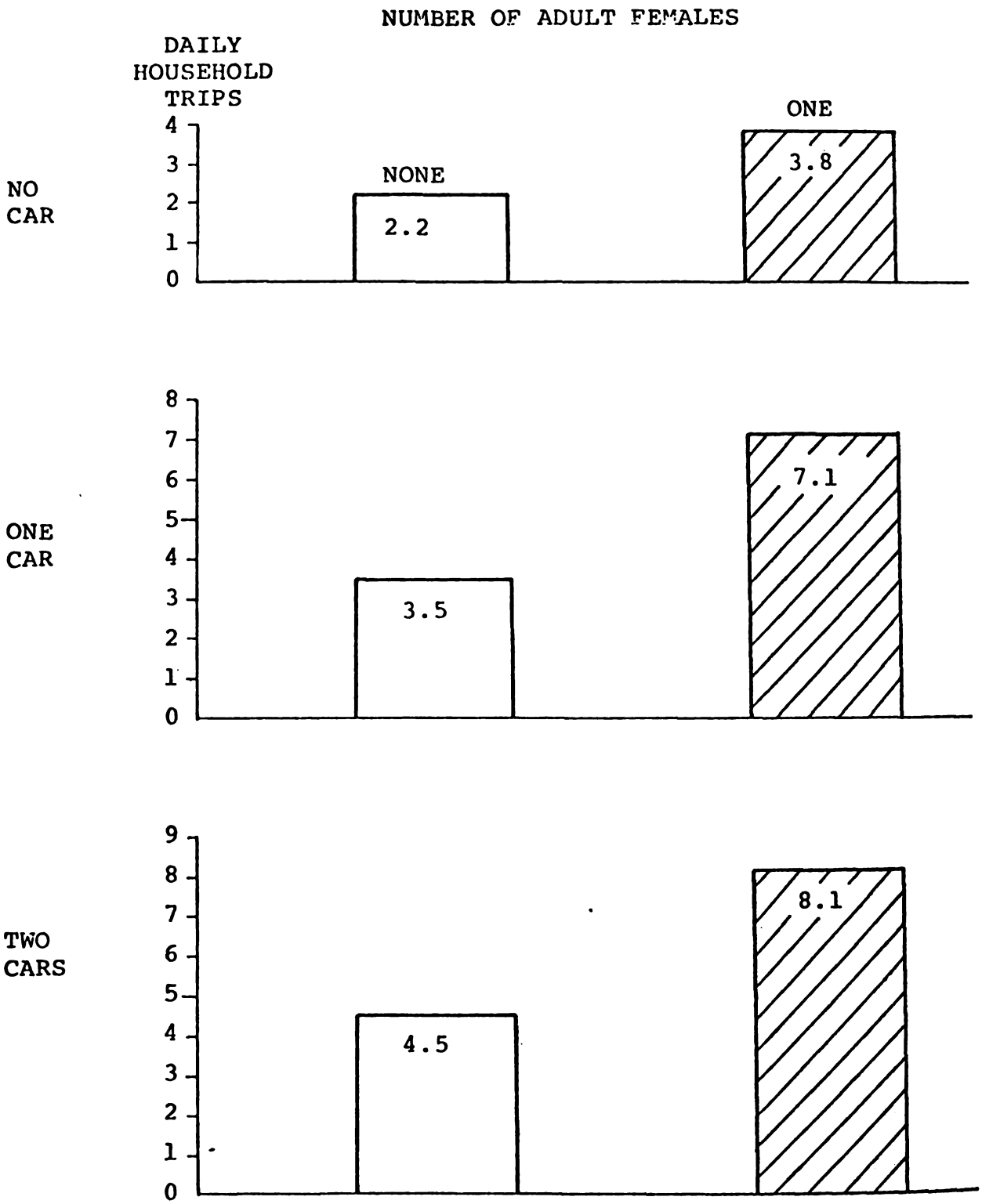


FIGURE 6

TOTAL TRIPMAKING
TWO PERSON HOUSEHOLD

is one female and one male in the household. This difference is greatest for those households in which cars are available.

Figure 7 presents similar information for larger households with children. The same general effects found for the two person family are also found. In all cases the presence of an adult female results in up to six additional trips per day.

This figure shows further effects of adding a second adult female to the household. It can be seen that 1.8 to 5.8 more trips are made per day for the same car availability than is the case when there is only one adult female in the house.

In summary, it is clear from these analyses that the presence of adult females is associated with significantly greater amounts of travel per day in the household.

Figure 8 explores the joint effects of the presence and age of children in the household and employment for households of three or more persons with one and two cars where the head of the household is in the middle years age category (26-65). The average daily travel by residents of these households ranges from 6.6 for one car families with only the male employed and with no children to 14.9 trips for families with two cars, a male and female employed and with older children.

The general effects are that the addition of the second car increases the total daily travel from 3 to 5 trips per day for each combination

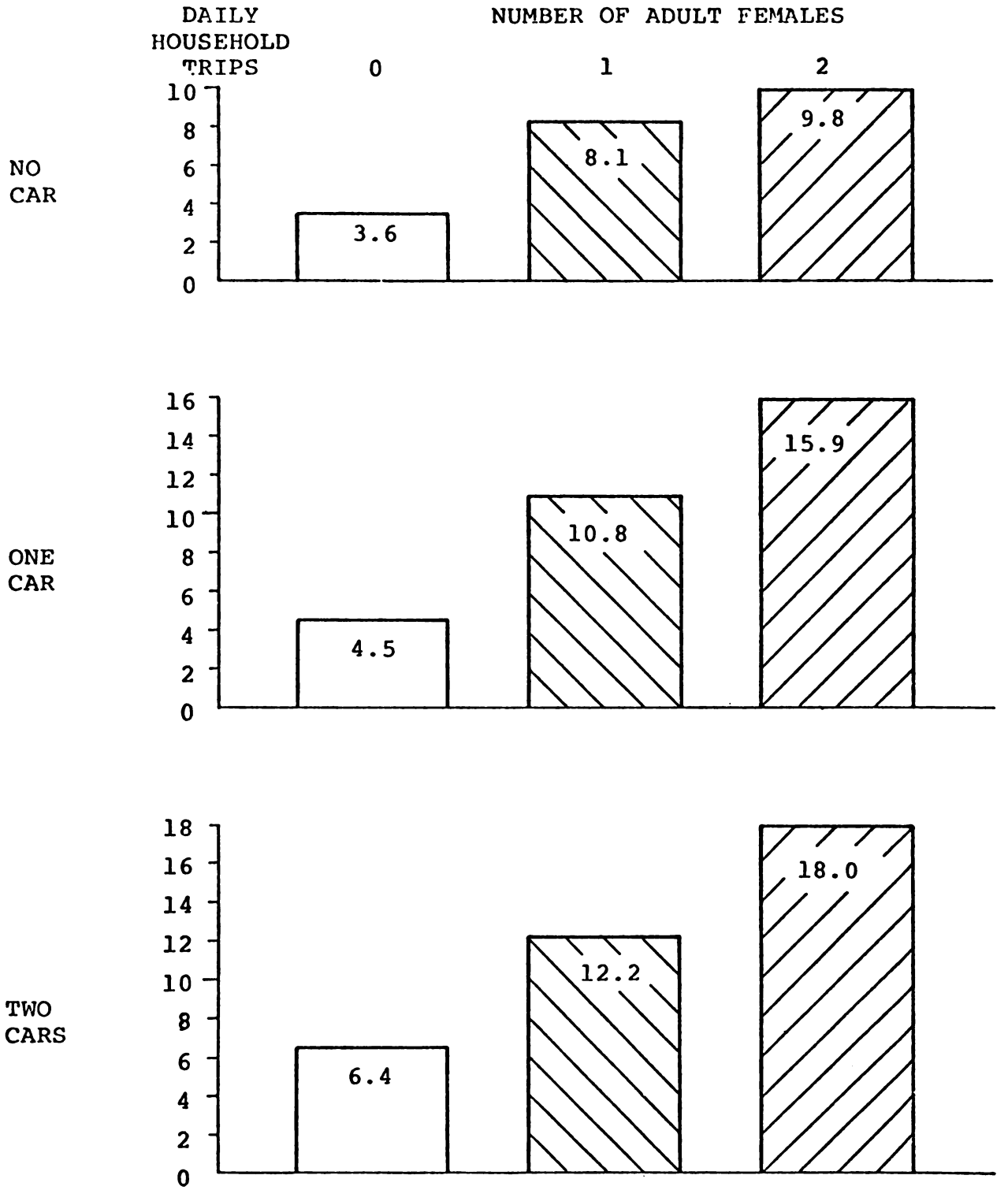
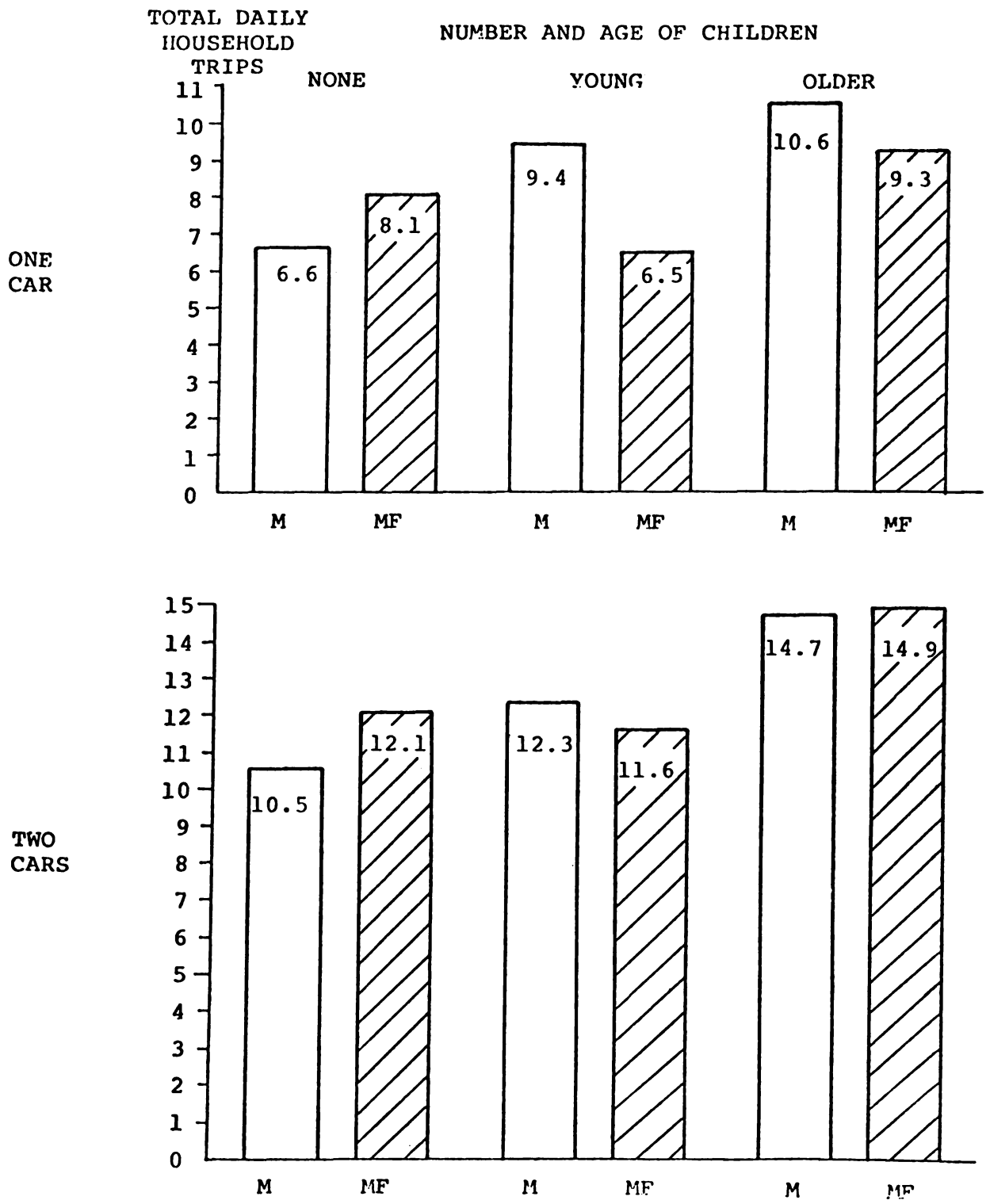


FIGURE 7

TOTAL HOUSEHOLD TRIP MAKING
LARGER FAMILIES WITH CHILDREN

FIGURE 8

TOTAL HOUSEHOLD TRIPMAKING OF LARGER FAMILIES-BY EMPLOYMENT



M, Male employed
MF, Male and Female employed

of employment and household children status. The other effects interact significantly and it is necessary to explore them separately.

For those families with no children, adding a female employee to a male employee in the family increases trips by 1.5 trips per day. For those families with older children, the number of trips is decreased by 1.3 trips per day for one car families and is virtually unchanged for two car favmilies. For families with young children the addition of a female to the employed work force results in a decrease in 3 trips per day for the one car family while for the family with 2 cars this decrease is approximately .7 trips per day. The joint effects of the role of caring for younger children, the trips made by older children, the loss of a person to non-work travel by being employed, among other elements are clearly reflected in these results.

When we compare the effects of children in the household it is found that for both one and two car families with only a male employee there is an increase in trip making when a young child is added to the family, which is further increased when the youngest child is over 5 years of age. When adults of both sexes work there is a significant reduction from 0.5 to 1.6 trips per day when a young child is added to the family. This increases by three trips per day when the youngest child is older than 5 years of age.

This figure shows the general importance of lifecycle data as a descriptor of total family trip generation. It also shows, however, the important interactions that exist with regard to employment and child care roles for these families.

Table 7 shows the average daily travel for larger families by auto availability and differential female employment. The range in trips per day is from 5.8 for 2 person households with a male employee and one car, to 12.1 trips per day for larger families with more cars and a female added to the family work force. Adding a car increases daily travel from 1.6 to 2.0 trips per day for two person families and approximately 4 trips per day for larger families. Larger families with the same employment and auto availability structures make from 0.6 to 4 additional trips per day. Adding a female to the family labor force results in no additional travel at a minimum up to 1.6 trips per day.

It is particularly interesting to note that the two person two employee household makes less than 40 percent more trips than the one car household in which the male works, while for the larger family the trip making almost doubles as an additional employee and auto is added to the household.

Implications of these results again show that the complex interaction among household size, auto availability, employment, sex, and children status have significant effects on total trip making and should be carefully considered in the trip generation process.

Some results for three female households were obtained and are presented in Table 8. It is seen that trip making again increases with car ownership but less for those families with children. There is a significant difference in the total travel when there are children in

TABLE 7

TOTAL TRIPS HOUSEHOLDS WITH TWO, THREE OR MORE PERSONS

	2		3 or more	
	M	MF	M	MF
1 car	5.8	6.4	6.6	8.1
2 car	7.8	8.0	10.5	12.1

M, Male employed
MF, Male and Female employed

TABLE 8

TOTAL TRIPS HOUSEHOLDS WITH THREE FEMALE ADULT PERSONS

Cars	No Children	Children
1	10.3	18.0
2	15.9	21.4

the household than when there are none, with the total number of daily trips being 40 percent to almost 80 percent greater.

In one of the few opportunities to explore age effects, the two person household without children with access to two cars, with the male being employed was explored over three age classifications. It was found that households with the head in the 25 years or less age group make 11.5 trips per day, those with heads between 26 and 65 years of age average 7.8 trips per day and for those over 65 years of age average only 5.7 per day. It is clear from this analysis, although not gender related, that the differential in travel among the older groups (at age 66) is important since travel is lower by more than 25 percent for older couples.

Trip Generation Model

The trip generation model developed by TALUS is typical of the trip generation models of large scale transportation studies. (11) It is based on the methodology developed by the Urban Transportation Planning process and used extensively at that period of time. In this model the basic unit of behavior was the household and household trip generation was predicted from a model derived from regression analysis with the use of dummy variables. The independent variables used in the TALUS trip generation equations are level of household car availability, income category, and lifecycle status. The TALUS trip generation model was run for total trip production for levels of these variables further stratified by the number of adult females in the household, since the preceding tabulations showed that tripmaking

behavior does vary with this variable. The actual number of trips was compared to the number predicted by the generation model for groups with more than five households.

The household size distributions were developed for each level of adult female membership and lifecycle of the household for the 4,863 suburban households. It was found that, although there are not totally independent (one can never have a household size of 2 and have three adult females in the household), there is a reasonable distribution of household sizes for levels of adult female membership in households.

Figure 9 presents the total generation model errors at the three levels of adult female membership in household. The model overpredicts for no adult female households, and underpredicts for households where adult females are present. It is clear that this variable has tremendous additional explanatory power and certainly would improve the R^2 of the original models.

Here it is recognized that the adult female number is a very simple surrogate for role. It could no doubt be improved by additional lifecycle and employment information which was not easily obtainable. However, it appears that more attention to role in such models is appropriate.

Summary and Discussion

A typical large scale transportation study has been explored with respect to gender and role. It has been found that despite the fact that the sample of households adequately represents the demographics

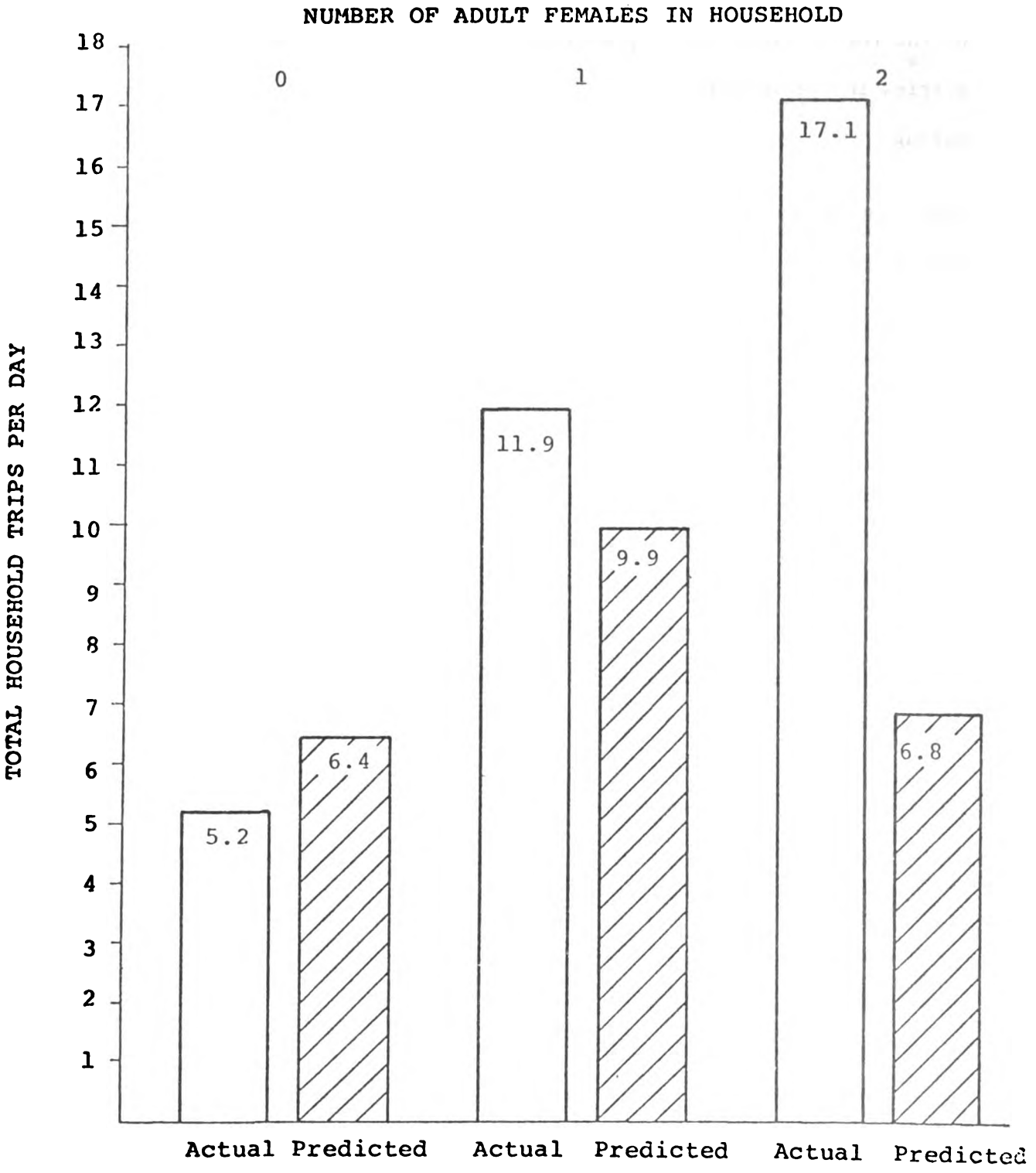


FIGURE 9

EFFECT OF ADULT FEMALES MEMBERSHIP IN HOUSEHOLD ON TOTAL TRIP GENERATION MODEL

of the region, women make up a significantly lower portion of the entries in the internal trip file, indicating a lower level of trip making.

When household size and car availability, long considered basic determinants of household tripmaking, were controlled, very different results in tripmaking were obtained for different numbers of adult females in the household. It was found that for families with and without cars the daily household tripmaking was always greater when there was an adult female in the house in place of another person.

It was also found significant that who was employed affected the number of household trips produced. Since these differences did not appear for single person households of either sex, it appears that there is an interactive effect of the above mentioned variables, which can be traced to role in the tripmaking of a household.

When the TALUS trip generation model (one which can be considered typical for the time) was run for samples with various levels of adult females in the households, it was found that there was a gross over-prediction for households with no adult females and an underprediction for households with females.

Tracing this through the chain of Urban Transportation Planning models it is obvious that an original mis-specification will be propagated through the entire process.

In the expansion to a zonal level, trips from zones with high levels of adult females will be underestimated, leading to planning of systems with lower capacities for these zones.

The tabulations of trip length of this study data as well as from elsewhere indicate that women's trips are generally shorter. Considering trip distribution, treatment of both sexes together leads to planning an excess of transportation facilities further away from these zones.

It is speculated (but has not been shown in this paper) that this difference in trip lengths is role related.

The transportation planning methods which have been used in the planning of our existing systems have not taken into account the changing roles of women and the changes in tripmaking which these changes bring about. The data collection and modelling efforts have, in fact, frozen in time, the travel patterns of women with the role distribution current at the time of the study, and then used these for the planning of future systems.

The aggregate methodology prevalent throughout the last three decades of transportation planning is incapable of obtaining causal relationships in travel behavior. The recent development of disaggregate methods and their incorporation into the planning process bring with it the opportunity to include travel patterns of women. However, no disaggregate studies have approached this problem so far.

Further investigation of women's travel patterns at the causal level are recommended.

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THE TRANSPORTATION PLANNING PROCESS

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I. Introduction

One of the implicit assumptions in the past two decades of the transportation planning process, has been that the user of transportation facilities is neuter; that is, that gender is not a variable in determining the needs of the user of transportation services. Therefore, gender has been seen as irrelevant in developing the prime information needed for planning transportation systems, such as demand estimates; transit capacity; or lane capacity of streets.

However, this assumption is now under serious challenge, or at least question. There is no doubt that such challenge arises from the general zeitgeist of the seventies; a reawakened and revitalized feminism. However, this challenge is both in response to, and supported by, significant recently observed phenomena:

Women participate in the work force in greater numbers (both absolute and relative) than ever before, and in ways that have changed significantly in the past twenty years.

Partly due to this factor, and partly due to other factors, the dynamics of household needs for all services are changing.

Women use public transit far more than men do.

There is a significant increase in shopping trips made in association with work trips and assertions that such trips are more frequently made by women than by men.

There are more licensed women drivers than in the past, both in absolute numbers and relative to the entire driving population.

The objectives of the current transportation planning process are defined in such a way that they assume that meeting the needs of an aggregate population is sufficient to meet the needs of everyone in the population. The process, as it is now structured, is not capable of dealing with needs of sub-groups of transportation users unless any such group is specifically cited by policy or law, and categorical funds are set aside to meet those needs (e.g. the elderly and handicapped). Even with these specific legal citations, the needs of such groups are in general excluded in the overall planning process; they are usually "add-ons" to the plans as developed.

This paper focuses on several elements of the current aggregate planning process and examines it with regard to its exclusiveness. Although it may seem strange to deem an aggregate approach "exclusive," it is that very aggregation which excludes, because it does not meet needs of certain groups.

A. Key Points to be addressed

Does transportation planning address the proper questions?

To what extent is the aggregate planning process, by definition, exclusive? Does such a process have neutral underlying assumptions? Can analytic techniques be used neutrally?

Has the prime dimension of travel, the household, biased travel analysis in favor of the male car driver?

Can planning have an effect on identified problems of transportation users?

Based on implementation of plans, do women pay a premium for travel?

Before discussing these specific questions, it would be useful to consider some broader issues. These very important concerns addressed briefly below really form the context for all of the issues under discussion at this conference.

B. Equity and the Definition of a Deserving Group

Equity in most urban programs has not been an explicit policy issue. Most of those programs have had equity defined fairly clearly (often as redistribution of income) and their beneficiaries clearly identified. Transportation programs carry no such legislative mandate. It is only through administrative policy or judicial action that equity, however defined, becomes a fundamental concern for transportation systems.

The technical issues in this area are complex, only beginning to be defined. Merely throwing them out for consideration is unfair; each one begs lengthy discussion. These issues are raised here primarily to provide a context for this paper and for subsequent policy discussions of this topic:

Are women really a population sub-group for transportation purposes, i. e., with a set of transportation needs distinct from the aggregate of population needs?

Corollary to this, do individual women belong to other sub-groups whose distinct transportation needs are more salient and more critical? Obviously this means at least race, income, age. Do the needs of the poor, or elderly, or black woman arise out of her poverty, her race, her age or her sex? Or both? What about middle class women in this context?

If such separate women's needs do exist and are significant, to what extent do they arise from traditional sex roles, which may be changing? More and more, males are shopping for the family; taking children to various activities; staying home with sick children; going to school conferences..... Thus transportation needs associated with those roles are only culturally those of women. Thus are they gender-related, or more related to <u>family</u> needs?

Finally, and perhaps the most complicated questions we will have to address as planners in this context are those that deal with the whole network of urban services. That is, to what extent are identified transportation needs (of women, in this case) really transportation needs and to what extent are those needs really reflections of defects in other urban systems--housing; education; child care; health care; retail services; community services? Can the transportation system provide for access to the widely dispersed sites to where people travel <u>or</u> should land use be rethought and restructured to allow people to devote less time and money to tripmaking?

II. The Transportation Planning Process

The current, structured transportation planning process is well documented (1, 2, 3,). There is a fairly well-defined process which is required in all metropolitan areas of over 50,000 people in order to qualify for Federal funds to assist in the actual design, construction and implementation of transportation programs and facilities. (5)

In order to determine whether the process itself addresses women's travel needs it is important to examine the steps in the process. It is equally important to understand the social and physical context to which the overall planning process responds.

Transportation decisions of course have always been with us. There has always been a need to move people and goods, alternative ways of moving them and different levels of investment required to implement those alternatives. And those needs were met by both the public and private sectors (sometimes in conflict, sometimes in cooperation, for public benefit, and sometimes in collusion, for private benefit).

Responsibility for transportation has moved more and more into the public domain. In most instances, public transportation decisions have, as befits a democratic society, reflected some of the prevailing values of that society at the time the decision was made, although such values may have come to be questioned at a later date.

The most recent Federal policy statement on national transportation "visualizes a market process operating within such constraints to provide efficiently the transportation the nation wants and is willing to pay for." (12)

The keys to understanding such national policy are the words "efficient," and "willing to pay for." Both of these concepts, efficient transportation systems, and affordable systems, have been the major determinants of investment and project implementation.

Selection of transportation alternatives is usually weighted to those projects which have strong and quantifiable economic objectives rather than the more difficult social objectives (which, by the way, if analyzed fully also have important economic components). Social components, as we said, are add-ons, if they appear at all.

In highway programs, decisions have traditionally been based upon aggregate travel-time savings for the journey to work. Only recently have we recognized that the economic impact of a highway is very complex and has profound effects (both positive and negative) beyond such easy numerical calculations of time-savings. For instance:

- failure to recognize poor and minority travel needs.
- disruption of neighborhoods.
- redevelopment and restructuring our cities--for better or worse.
- the decline of a once strong transit system.
- accessibility, for those with access to cars, unparalleled in any other time or place.

Suburbanization, decline of the importance of the central city, increased use of the car, may of course, reflect our national values. And that is precisely the point of this paper. The planning process reflects what the people (or those who have access to control of the process) want.

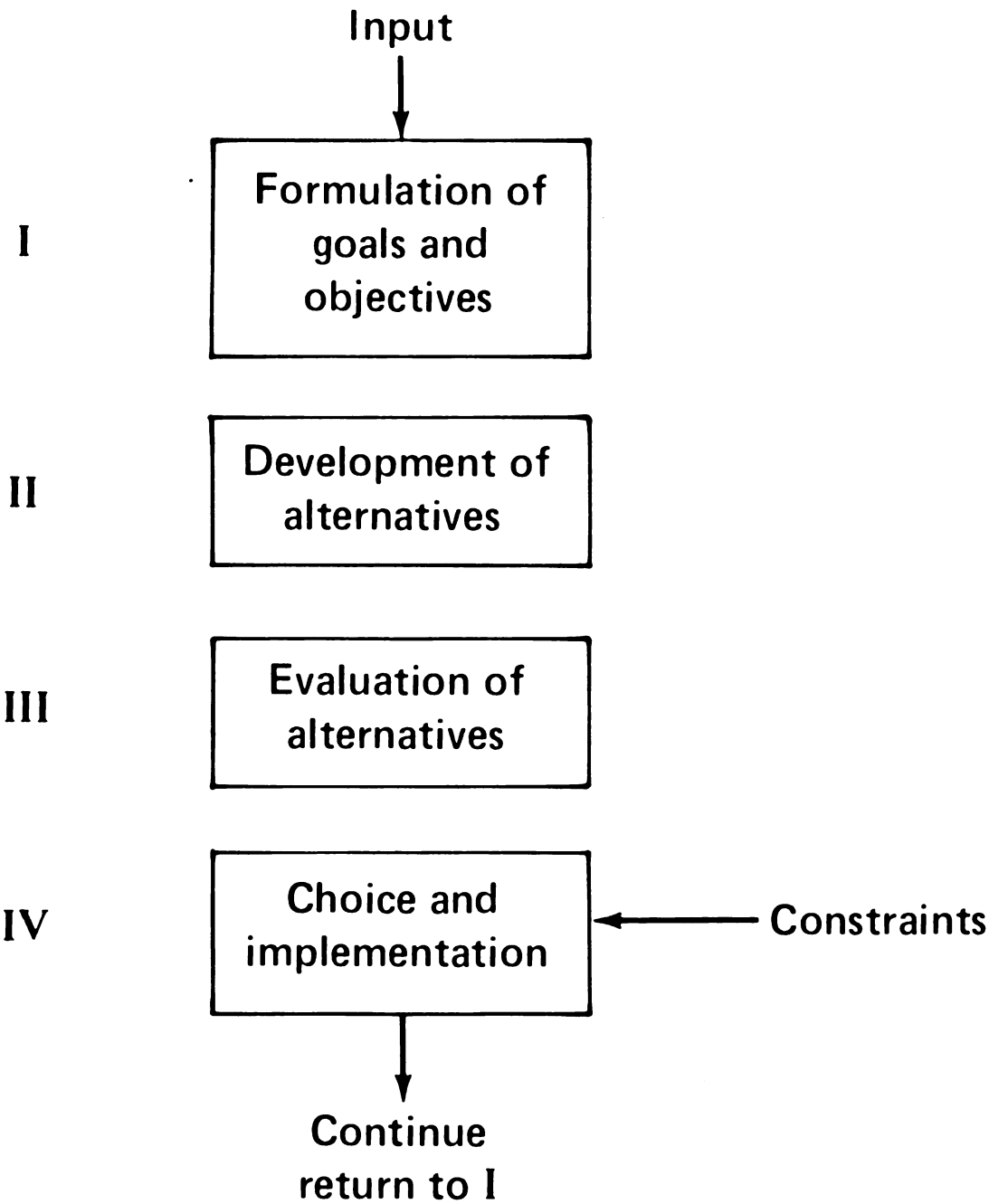
The constraints, the goals, and the outcomes have tended to reflect the social values prevalent at the time the plans were formulated. Planners have no insights or predictive powers different from the rest of society. They only have skills that permit them to package future land use and transportation alternatives so they can be measured against what society wants at any given time. It is in this context that issues of women in transportation must be addressed.

There has been an underlying assumption by planners, or those involved in plan formulation and evaluation, that the process itself is "value-free." That is, those responsible for the plans can step outside the political and social arena, and develop those alternatives that present the best solutions to the planning problems posed. This assumption, of course, is erroneous. Planners respond to local conditions, have biases of their own, and having egos as everyone else (or even stronger than most?), have a strong desire to have their plans accepted. Thus, there must be correlation between the plans and the prevailing community attitudes.

The process, as outlined on Figure 1, starts with a formulation of overall goals and objectives, and concludes with some physical implementation. There are two major factors that act as major constraints, setting limits on the planning process. These constraints often tend to aid perpetuation of a status quo, rather than allow plan makers any degree of innovation, or response to evolving needs they may uncover.

Constraint 1 - Existing conditions. Planners must deal with existing patterns of land use, infrastructure, and other aspects of the physical system--autos, transit rolling stock, etc., --and with current employment patterns. While these are common knowledge, and familiar to us all, it

FIGURE 1
GENERAL OUTLINE OF PLANNING PROCESS



is important to recognize here that they have strong impact on travel behavior by women.

Perhaps the strongest pattern is that of suburbanization, and its counterpart, reinforcement of the urban ghetto. Suburbanization has created an auto-dependent middle-class, who think nothing of long commutes or long trips for shopping, recreation, doctor visits and other purposes. Concurrent with auto dependency came the decline of transit. As improving and maintaining good public transit has become a new planning goal, transit companies have provided new levels of service to attract suburbanites in their journey to work. This has sometimes been done at the expense of the inner city resident, who has less access to a car, and increasingly less access to transit.*

The impacts of the suburban phenomena are felt by women in a number of ways. Since the 1950's the growing number of women in middle-class households who have joined the workforce have adopted patterns of journey to work which are not the same as those of suburban males. The strong dichotomy of mode use (not necessarily choice) between men and women developed early in the two decade period. (Table 1)

In low income households, women, who are heads of household, have traditionally worked. The number of jobs available in the inner city, especially if the woman is unskilled, or semi-skilled, have declined, and without access to a car, the woman worker finds jobs inaccessible, or pays a high penalty to reach them. (8)

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* USDOT has recently found that this infringed on the rights to access of inner city residents in Hartford, Connecticut, and requiring redress.

TABLE 1
JOURNEY TO WORK, 5 SMSAs, 1960, BY MODE AND SEX

City	% Using Public Transit		% Using Car	
	Female	Male	Female	Male
Boston	45	21	55	79
Chicago	56	28	44	72
Cleveland	46	15	54	85
New York	78	58	22	42
Philadelphia	54	24	46	76

In addition, the working woman, who often retains the traditional job of shopping, finds that she pays additional penalties when she does the household shopping. This, of course, is due to land use which grew up around suburban patterns of residential development. These facts have been addressed a number of times at great length. They are repeated here because they are part of the existing set of conditions which have strong impact on daily household movements, and on women's travel. They are rarely, if ever, addressed in the first, and most important, part of the planning process: formulation of goals and objectives.

Constraint 2 - Federal policy and programs. Even if plans were formulated in response to changing pressures of population and employment, implementation strategies are responsive to available funding and specific Federal requirements. Thus, the highway program was responsive to large amounts of dollars available through the highway trust fund. Recent local public transit programs have been responsive to the availability of funds for new rolling stock and the requirement of accessibility for elderly and handicapped.

In recent years, certain Federal transportation programs have provided funds for (and thus encouraged) the redress of social inequities where such inequities were in fact created by the existing transportation system. However, general Federal policy, and the resultant funding, continues to support further evolution of existing transportation infrastructures. This discourages innovation to accommodate new travel patterns, or new types of travel demand.

III. Elements of the Transportation Planning Process

As shown above in Figure 1, the first element in the formal transportation

planning process is the formulation of goals and objectives. The objectives, or measurable steps by which the goals are achieved, are the keys to the planning process. They establish the form of the alternatives and help establish the criteria against which the effectiveness of the plans are measured.

In a cursory review of the literature, it is difficult to find any specific goals or objectives from transportation plans that have dealt specifically with women's travel needs except to the extent that those needs, coincide with " general population" needs. Overall transportation planning has taken on distinct characteristics over the last three decades. These can be very generally summarized as:

1950-1960 -- Development of plans to deal with the immediate problems of suburban and urban renewal.

1960-1970 -- Development of long term strategic transportation land use plans.

1970's -- Development of short term, low capital plans and development of plans to deal with certain transportation inequities.

In the 1950's and 1960's, transportation was considered, by transportation planners, to be a major determinant of change in urban areas. In the 1970's planners are learning that other urban phenomena are equally as strong, or stronger, and further, that transportation must serve more than the journey to work. In those earlier decades planners were coping with growing congestion in downtowns, rapidly growing residential areas in suburbs, hugh urban renewal (ghetto-clearance) programs, and had available to solve these problems huge amounts of highway funds.

Analytic tools were, in the 1950's and 1960's, in the primitive stages. The use of computers was growing, and with the use of computers, the use of large scale, complex models to analyze the system under design. But the system, of course, defined the models, and the problems were, again, apparently very clear. At that time--1950's, 1960's--women, and especially college educated middle-class women, did not participate in the labor force to the extent they do now. They were still deeply enmeshed in the post war return to the kitchen. Further, households were larger (more children per household in the 50's and 60's). Thus, women's role was viewed by planners as that of running the household, and her travel needs were easy to define. Because of the growth of the suburban population, and the disperse nature of suburban tripmaking, coupled with the perceived low cost of suburban (automobile) travel, no real transportation problems were identified specifically for women.

What then were the objectives of the comprehensive transportation plans of the period? Consistent with the patterns of growth that we have discussed, there were two basic objectives to plans developed during this period.*

1. To insure that the transportation supply, (roads and public transit), was adequate to meet the demand that was developing in the target period. The demand was aggregate; and only the highest demand was considered in design.

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* This, of course, is very generalized. Yet it becomes a summary of what the planning process attempted to achieve through the transportation component.

2. To insure that the alternative selected was justified on the basis of benefits derived from costs invested.

Goals and objectives statements were not concerned with inequity of any kind. If planners and policy makers did give thought to inequities it was assumed that redress would occur through improved economic activities generated by the plans. Unless inequities are explicitly recognized, and redress is an explicit goal in planning, it is unlikely that inequities can be adequately dealt with.* The planning process models and evaluates alternatives on the basis of

(1) Comparison with what exists, and evolution from that point and

(2) Stated, measurable objectives that are almost always referenced to the status quo.

When social goals <u>are</u> specified, it is usually with such generality that specific group needs again are easily overlooked or omitted.

An example of goals is

> "Improve the efficiency and quality of moving people and goods to and from Manhattan, especially within the West side corridor." (8)

and objectives,

> "Increases access opportunities to reinforce the viability of existing economic activities within the project influence areas." (8)

Interestingly enough, even the West Side Highway project, (used as an example above) which developed in an environment which is generally

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* Again the recent decision in Hartford regarding public transportation shows clearly that redress now takes place <u>in response to</u> the planning process.

thought to be progressive had no objectives dealing with possible inequity.

The clear statement of goals and objectives shapes the plan. Therefore, the identification of inequities, or the methods by which transportation improvements can correct inequities must be a part of their first phase of the planning process.

IV. Planning Process Continued--The Analytic Phases

Once goals and objectives have been defined, alternatives are proposed, selected and evaluated. The first alternative usually studied is the do-nothing case. This analysis is intended to show whether or not there will be enough benefits from the planned change to justify the costs in comparison with the cost of maintaining status quo.

The alternatives analysis attempts to project what will happen in the region should a specific alternative be implemented. For this process a battery of forecasting tools is used. While such tools have become sophisticated enough to address policy questions, by and large, the general practitioner does not use them or does not use them for that purpose. Instead the planner runs this battery of models to determine the costs of providing capacity, by any mode, in the certain corridors, or areas of concern.

In the modelling of household demand, work trips, not surprisingly, always aggregate to create the well known peak phenomenon. Recalling data from Table 1, it is not coincidental, then, that plans were developed to reduce congestion for the (predominantly) male journey to work. This, of course, aided those females who commuted by car (50%), but generally did little for those who did not. Further, since women are a minority

on the work force (but a majority in the population), many must have been at home. No plans were developed to ease the burden of multiple daily car trips for the female at home. It is somewhat ironic then, that for the past 25 years, the unit of analysis used for these studies was (and is) the household.

It would be useful to examine here exactly what it is that modelling does. Specific land use and population forcasts are generated for a target year; patterns of travel, based on current household travel patterns, are generated; and trips are distributed primarily from or to the household and then assigned to specific networks.

By the time the data has been processed for network assignment, household travel has been changed to vehicle trips and vehicle mile. These are the dimensions that find their way into benefit cost analysis. Vehicle trips and miles are sexless, raceless and classless-neutral. This is supposed to insure an impartiality to the modelling process but instead, of course, weights it to favor those who dominate the aggregate.

In the absence of male-female splits, evaluations will continue to be made only on the basis of comparisons of detailed costs and benefits of the alternatives. Since most transportation projects of the last two decades, especially in urban areas, have been designed to provide greater capacity in congested areas, benefits were measured in terms of congestion relief. As mentioned above, the benefit considered most often was, and is, travel time savings. The dollar value of this benefit is:

(Population who use facility) x (value of time) x (time saved)

Such benefits are obviously tied to journey to work, or to a wage earner, and projects are justified by their ability to ease congestion in the journey to work (especially by white male drivers, or any segment of the population with high values of time and long commuting distances).

To this point, it has been shown that the planning process itself is essentially neuter because it simply does not consider gender. However, the specific outcomes are not. Neuter illustrations of women's travel (in particular the journey to work), and their attitudes towards different modes should be examined. Having a better understanding of the differences in travel, it will then be possible to reconsider the process, if necessary.

V. Some Examples of Travel Behavior and Attitudes

Two transportation studies, carried out in Buffalo, N. Y. looked at travel behavior as a function of a number of socio-economic variables including sex.

One study looked at travel patterns associated with the journey to work among a large group (1,937) of CBD employees. (11) Of this group, 58% were females. The predominant occupations of the entire sample were clerical workers (43.2%), professionals (17.4%) and sales workers (10.1%). Although females identified themselves more frequently as clerical workers and less frequently than males as professional, the work force is essentially white collar, so that work-day demands on travel should be uniform across sex.

Table 2 summarizes some of the more pertinent data by sex of the respondent. Females, clearly, were less likely to use car, and of those who traveled by car, were more likely to travel as passengers in a car pool. They were more likely to use public transit if available, and their responses to attitudinal questions were more favorable about public transit than were males. Female transit users came from smaller households, suggesting they were working in young families or in one person household, where commitments to large families do not reduce time available to work (or to travel).

Planners can immediately note that Women spend more time traveling (although closer to a bus stop than men), and that they are more responsive to specific public transit attributes of comfort, cleanliness and safety. Planners might note that these attributes are not generally part of cost-benefit analyses, and are rarely considered in transit improvement programs.

An earlier study carried out in Buffalo, N. Y. in 1974 (13) concentrated on non-work travel, where an even stronger dichotomy can be shown between men's and women's activities and mode used.

The men tended to use the car at all times. As a group, men did fewer activities than women, especially grocery shopping and religious trips. When possible, the women were neighborhood centered, and walked (the study was done within a dense urban area). As with women workers, the women were more accustomed to using the public transit system, and were more favorably inclined to it.

TABLE 2
TRAVEL DATA, JOURNEY TO WORK SURVEY BY SEX OF RESPONDENT

	F	M
Mode to work-percent		
Car	34.9	58.9
Transit	62.4	37.0
% travel time to work greater than		
30 min.	33	27
40 min.	16	9
% who have used public transit more than 5 times in last year, if journey to work by car	59	42
% who do not use bus because		
Not clean	29	19
Not comfortable	31	19
% who have car available for work trip	56	84
% who go directly home from work	92	84

TABLE 2 (Continued)
TRAVEL DATA, JOURNEY TO WORK SURVEY
BY SEX OF RESPONDENT

	F	M
If leave work late, and do not use bus, percent who attribute non-use to		
Bus not available	21	18
Bad frequency	30	22
Safety	62	48
Percent who have walk from work to bus stop of less than		
5 min.	54	45
10 min.	82	72
Percent in household of		
2 or fewer	50	32
4 or fewer	82	72
Cars per household		
0	12	3
1	40	41
2 or more	48	58

These brief examples can serve to illustrate that women's travel patterns are often different from men's. How should such patterns be accommodated in a "neutral" planning process?

VII. Suggestions for Planning

By referring to Figure 1, it is possible to suggest, step-by-step, how women's travel needs can be addressed in the planning process.

Step I - Goals and Objectives

1. A community must decide if their plans should deal explicitly with women's travel needs (policy). Increasing numbers of women in the work force, the strong tie of women to transit, and the changing size and relationship of household suggest they should.

2. When objectives statements are written, they must quantify, or clearly specify how the plan should deal with these users. For example, if more women are transit users, and transit users pay time penalties in their journey to work, such penalties must be addressed.

3. Data shown in Table 3 suggests that trips other than work trips should be addressed. Further, if use of car is to be discouraged as overall policy, land use policies that support and reinforce walking, or short public transit trips, for non-work activities should be developed.

4. Establish weights to be given to each of the identified objectives so that one variable, travel time savings, will not be the critical variable that determines success or failure of a given plan.

TABLE 3
TRIP PURPOSE AND MODE USE BY SEX OF RESPONDENT (13)

		Female	Male
3a.	Activities done by 75-100% of respondents (in decreasing priority)	Grocery shopping	Bank
		Clothes shopping	Clothes shopping
		Medical	Medical
		Visit friends	Visit friends
		Bank	
		Religious	
3b.	Primary mode used for activities		
	Grocery shopping	Walk	Car driver
	Clothes shopping	Bus	Car driver
	Medical	Car driver	Car driver
	Visit friends	Car rider	Car driver
	Bank	Walk	Car driver
	Religious	Walk	Car driver
	Convenience shopping	Car driver	Car driver

Step II - Development of Alternatives

Most alternatives are really incremental additions to the existing facility or structure--increased lanes, improved intersection capacity, or more public transit for the journey to work. Alternatives could deal with

1. These same factors again, but weighted towards the transit rider.

2. Travel patterns that do not involve the journey to work.

3. Travel patterns that are not tied to male use of the household car.

Step III - Evaluation of Alternatives

Hartgen has dealt adequately with data needs and fitting the data into the requisite models. (2) As noted, the models being used are neutral. It is the objectives, and weights placed on model components (e.g., value of time, transit vs. car use, land use, employment trends), that take place external to the modelling process in Step I and II that are critical. In addition

(1) The models must recognize the changes in the labor force.

(2) The models must recognize the changes in household structure.

(3) The models must recognize the change in numbers of female car drivers and owners.

(4) The models must recognize the number of women who are heads of household.

(5) The use of trips per household as a key dimension is to be questioned.

(6) Cost benefit analyses should be weighted to reflect the values placed on the plans through the objectives statement.

Step IV - Alternative Selection

(1) The choice should be clear if steps I through III truly reflect the changes to recognize female travel needs, if that is what community values indicate.

(2) Because choices are constrained by Federal policy (funding) such policies should recognize female travel needs, if it can be clearly shown (as with the elderly and handicapped) that inequities do exist.

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AN ALTERNATIVE APPROACH TO TRAVEL DEMAND MODELING: CONSTRAINTS-ORIENTED THEORIES AND SOCIETAL ROLES

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I. INTRODUCTION

1. Conceptual Issues

This paper is concerned with raising some fundamental issues which are related to the study of the behaviors of individuals and population groups, including but not limited to the travel behavior of women. It presents the case for new ways of conceptualizing, modeling, and developing experimental data analysis designs primarily for the study of the travel decisions of selected kinds of sub-populations in cities in urban-industrial societies. The paper, however, has implications which extend beyond the analyses of either travel or travel issues related to women into the general area of the development of new modeling and quantitative data analytic approaches for urban public policy. Because of the limitations on the scope of this paper, the broader implications of the approach outlined here for the study of the recurrent movement of urban population groups can only be indicated.

The first point to be made is that conceptual issues precede modeling and data collection and analysis issues, and policy prescriptions. Although this point is self-evident to many, it is worth repeating here, given the current clash between the orthodox analytical-deductive approach to modeling movement, which has been used for both aggregate and disaggregate travel demand modeling (as reflected in, for example, Refs. 23, 1) and those more recent empirico-inductive approaches adopted by workers such

as Heggie (15) and Brog et al. (3). Central to this clash are unclarified a priori positions about how the causal structures of individual and group travel should be verbally defined, prior to quantitative study, for different policy purposes.

The point which may be elaborated here is that how the world of the individual and the population group is initially conceptualized by researcher and respondents, that is, the verbal language in which it is initially conceived, reflects what is taken throughout all subsequent work as axiomatic and not axiomatic, what variables are included as relevant, how they are related to each other, and, even more importantly, what variables and relationships are omitted and what differing emphases are placed on both present and absent variables and relationships. How one initially conceptualizes the world of the individual and the population group will be reflected in whatever language is used, whether this language is employed by the respondent or the researcher and whether it is ultimately incorporated in analytical-inductive modeling approaches, empirico-inductive ones, or in the simpler questions which lay persons or planners or politicians might pose to answer about the world. Raising and resolving conceptual issues thus takes precedence over modeling and data analysis issues, and different resolutions of conceptual issues will lead to different models and/or data analysis designs, different findings, and different policy implications concerning women's travel or any other kind of human behavior. Hence it is absolutely necessary to ask whether individual and group behaviors are currently appropriately conceptualized for the study of movement of subpopulations in cities. This paper contends that for some purposes they are not, indicates how, suggests and

documents an alternative conceptualization for the study of individual and group travel, and notes the broad range of societal issues it might address, including some of specific interest to women.

Several papers illustrate these points about the way in which conceptualization determines analysis and policy prescriptions. For example, the Hartgen paper emphasizes how current data bases may be handled to give answers to some women's travel issues. In particular, the author points to how such information may be utilized to indicate current patterns and trends in womens' travel behaviors, and in the causal variables controlling them. This kind of analysis, however, rests on a conceptualization which assumes first, that the world is planned largely to accommodate present aggregate patterns and trends in behavior, without radical alterations or modifications in them, and second, that the changing distribution of behaviors over given and known alternatives reflects what individuals and groups actually prefer to do. This view of the world, while common, is nonetheless debatable.

Another illustration may be taken from the Koppelman and Tybout paper (18), which reflects current disaggregate conceptualizations of individual and group decision-making. The paper conceives the world as composed of individuals and groups who distribute choices over available alternatives, and concentrates therefore on asking what are the differences in the choices, and in the causal variables governing the choices, of different subpopulations. While this approach yields much valuable information concerning the needs of different groups, given opportunity sets (e.g., sets of travel alternatives, such as modes) as they exist now, it says little about the degree of variability between groups in the nature of the

opportunity sets in the first place and how this affects preferences and behavior; thus it cannot address questions related to the effects of unequal opportunities on, and the need to equalize opportunities for, mobility of different groups, surely a major focus for studies of minority behavior, and of women's behavior too. A world planned on the basis of distributing behavior over current opportunity sets, with no precise knowledge as to how these are formed, runs the risk of re-engraving on the city immense differences in opportunities between individuals, or at least never precisely addressing the issues which might be raised by considering explicitly differences in the availability of travel opportunities (activities, destinations, modes) for different kinds of people. This is especially important, since recurrent movement connects the individual to urban resources (places for employment, recreation, social activities, medical care and travel itself), many of which are now widely scattered at different locations outside the individual's home. A conceptualization of individual and group behavior in cities, relating the movement of different types of individual to variations in the contents of their opportunity sets, is clearly essential for the study of differences in the welfare of population groups in cities, including women, yet neither the Hartgen nor Koppelman and Tybout conceptualizations, stemming from older aggregate and newer disaggregate approaches to movement, permit this central question to be addressed.

At this point, it is wise to remark that this paper presents an argument for the explicit recognition of the need for, and effects of, plurality in research on individual and group behavior, that is, a diversity of initial conceptualizations and hence of modeling and/or

data analytic approaches and policy prescriptions. Clearly, there is a need for some other perspective than existing ones, which can at least handle some key unaddressed aspects of the welfare of different groups, including women. The features of an alternative conceptualization of individual and group behavior for the development of new models of movement are thus outlined.

2. The Need for Still More Realiatic Assumptions in New Disaggregate Approaches to Movement

At the moment, the most widespread scientific basis for understanding and predicting the travel behavior of different population groups, such as women's and men's, is provided by disaggregate travel demand models. The multinomial logit model (MNL) is often used to describe the distribution of choices by different population groups over sets of activities, sets of modes, sets of possible travel times, sets of possible destinations, etc, The MNL, as is well-known, can be derived from micro-economic theory (23). Recently, this model and its micro-economic theory base have been criticized on a number of grounds, which may be summarized as follows (see also Ref. 5):

1. The unit of behavior, the dependent variable, is considered to be simple, not complex, as, for example, a trip is considered as a path by a single person simply between two points in space;

2. The choice set of an individual for any decision is assumed to contain at least two and often "many" alternatives, and either to be the same as, or to vary randomly from, or to differ in some ad-hoc fashion from, other individuals' choice sets; there is no systematic variation assumed to exist between individuals in their choice sets, with such systematic variation explained in terms of causal variables;

3. Each and every individual is assumed to behave in a strictly utility-maximizing fashion; that is, each person characteristically develops an overall unique utility for each alternative in a set, normally derived by summing part-utilities of the alternatives on different criteria, and the person is then able to order the so-derived set of unique utilities for all alternatives and to make choices so that the ratio of the probabilities of selecting any one alternative in comparison with any other is the same as the ratio of the alternatives' utilities.

These assumptions can be criticized on the grounds that they are simply unrealistic, that it is a general goal of "science" to produce models with increasingly realistic axioms, and that this might be appropriate now, especially with reference to the choice set axioms (following Refs. 16, 7, 14, 15). However, as has been argued elsewhere (4), models in the social sciences have still more stringent requirements for realistic assumptions than do models in other sciences, because the possibility should remain open for their use to obtain desired radical alterations in societal or group behaviors, and this constitutes an additional reason for the creation of models and conduct of data analyses without "unrealistic" assumptions (for example, it is widely accepted that, to induce mode switch or changes in car ownership for energy conservation, we need to know the actual attributes of modes which govern choice and actual decision rules, implying a need for models with "realistic" assumptions about decisionmaking). Since, in the case of women as well as other population groups, we cannot rule out the notion a priori that some major changes in their world might still be required, and some radical

alterations in their travel needs or travel habits might consequently need to be allowed for, it behooves us particularly to explore the possibility of developing models and theories of travel with the most realistic possible assumptions, the better to identify policies to create desirable changes, and to accurately predict responses to proposed policy alternatives. The remainder of the paper concentrates on documenting and developing a more realistic conceptualization of travel for these purposes: one which not only assumes that the individual's behavior is complex, but also especially that choice sets are highly variant for individuals and groups and deserving of some systematic causal explanation, and that decision processes are simpler than hereto conceived.

II. THE IMPORTANCE OF THE THREE DIFFERENT TYPES OF AXIOMS AND SOME POLICY IMPLICATIONS OF RELAXING THEM

1. Documentation from the Literature

Although each of the three kinds of axioms listed above have been mentioned in recent criticisms of models of travel decisions, the relative importance of each one is different. In particular, the relaxation of the axioms regarding choice sets seems the most critical to investigate, particularly in the current context of developing improved circumstances for women and/or other population groups who might be considered disadvantaged.

By focusing on how the choice sets of individuals and groups are formed in cities, and by thus defining access to employment, educational, recreational and other urban resources, the mathematical modeling of recurrent movement for the design of urban transportation systems is related

quantitatively to broader aspects of urban environmental (physical land use) design, to group and individual welfare, and to the "quality of life." Thus--although some modeling, data analysis and policy issues which stem from a reconceptualization of travel through altering each kind of axiom will be explored--most emphasis in this and later sections of the paper will be paid to conceptual, modeling, data analysis and policy issues flowing from the explicit mathematical formulation of relations between choice sets, variables influencing them, and behaviors, for different population groups such as men and women.

Movement as complex, not simple, behavior. The assumption that the individual's behavior is simple, reflected in the definition of a trip as a single base-to-base movement by a person, has, of course, been criticized for many years. However, considering movement as a complex rather than simple phenomenon has little-known implications concerning the ways in which mobility differences between different population groups might be measured and evaluated. These latter implications can be traced out by considering in some detail what is meant by complex as distinct from simple behavior, particularly with reference to the travel of different types of individuals, including women.

At present, considering the trip as a link between two stops (bases or destinations) leads naturally into considering activity, frequency, mode, time of day and destination to be "choices" which different types of individuals conduct of each trip. The trip is theoretically the unit of "derived demand" for different kinds of individuals, though there are many varieties of trips from which to choose (trips by auto or bus or walk, for example, or trips to shopping or to work). However, American

geographers early remarked that movement was not simple base-to-base travel, but a complex sequencing by the individual of his/her activities over space and through time during a given decision period (usually considered to be a day). Thus, Marble in 1959 conceptualized the individual's travel in the form of home-to-home circuits, and categorized movement by persons into single-purpose (simple trip) and multiple-purpose (complex trip) travel (see also Ref. 6). Much emphasis was also placed on the statistical analysis of longitudinal data on the linkages of land use types by individuals in American cities in order to define as rigorously as possible the types of multiple-purpose journeys which persons tended to make (21, 12). Patterns in the linkages of other aspects of trips (such as the linkage of mode or activities on successive trips), were not, however, investigated. The contributions of this conceptualization of behavior and related data analyses were: an early emphasis on the individual's travel as movement through time and over urban space on an extended series of stops; a demonstration that patterns or regularities in the complex behaviors of individuals can be objectively identified, comprising systematic behaviors which should therefore be susceptible to scientific explanation as dependent variables in modeling and theory development (see also 9); and, above all, an implication that such patterns of behavior could be associated statistically with the sociographic characteristics of individuals, such as gender.

Of course, in the middle of the seventies, work in the disaggregate modeling of destination choice outside geography broached the question of patterns in the linking of non-work trips by individuals. Recent work by Adler and Ben-Akiva (1) is an example of an approach which independently

elaborates on the earlier conceptualization of movement as complex behavior by geographers. The proliferation of concepts such as "tours", "chains", "journeys", "travel patterns" reveals a recognition that movement is in fact a linking of stops by individuals in sequence over a space and time, implying not only destination linkages but also linkages of activities, modes, timing, and other aspects of travel as well. Little work in America has so far been carried out on the further implications of this reconceptualization of travel, namely, that quantitative research is required with longitudinal trip data for large samples of individuals now for American cities to establish what, if any, kinds of linkage patterns exist in reality, and how these might vary for different kinds of groups, including women and men.

The two-dimensional geometric representation of the individual's movement as a space-time path in Figure 1, attributable originally to Lenntorp (17), and reappearing variously (25, 7), represents the first attempt to depict in a quantitative form what the individual's movement might be in reality, once it is granted that he/she does not make a trip, but a sequence of trips to different places, that is, a sequence of stops over time, where a day is one arbitrary division of time. One of the less obvious features of the representation of the individual movement in Figure 1 is that, by portraying it just as a line in two dimensions (time of day, distance), information about what is normally considered as other crucial aspects of trip-making (activities, modes, destination types and locations) has been collapsed into that space. Technically, Figure 1 is a simplified representation of the individual's travel as a path in n dimensions, one being time of day, one being distance from

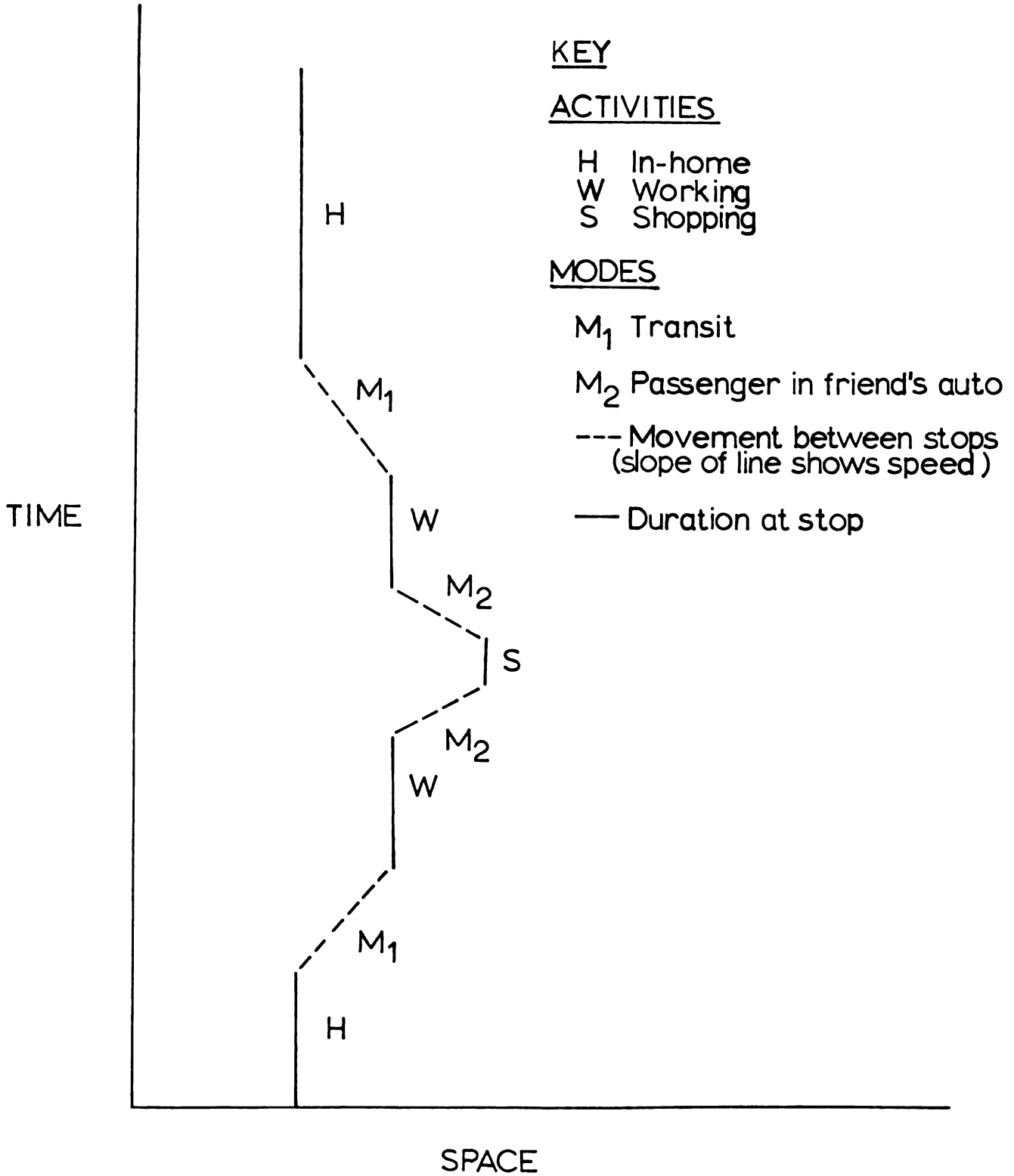
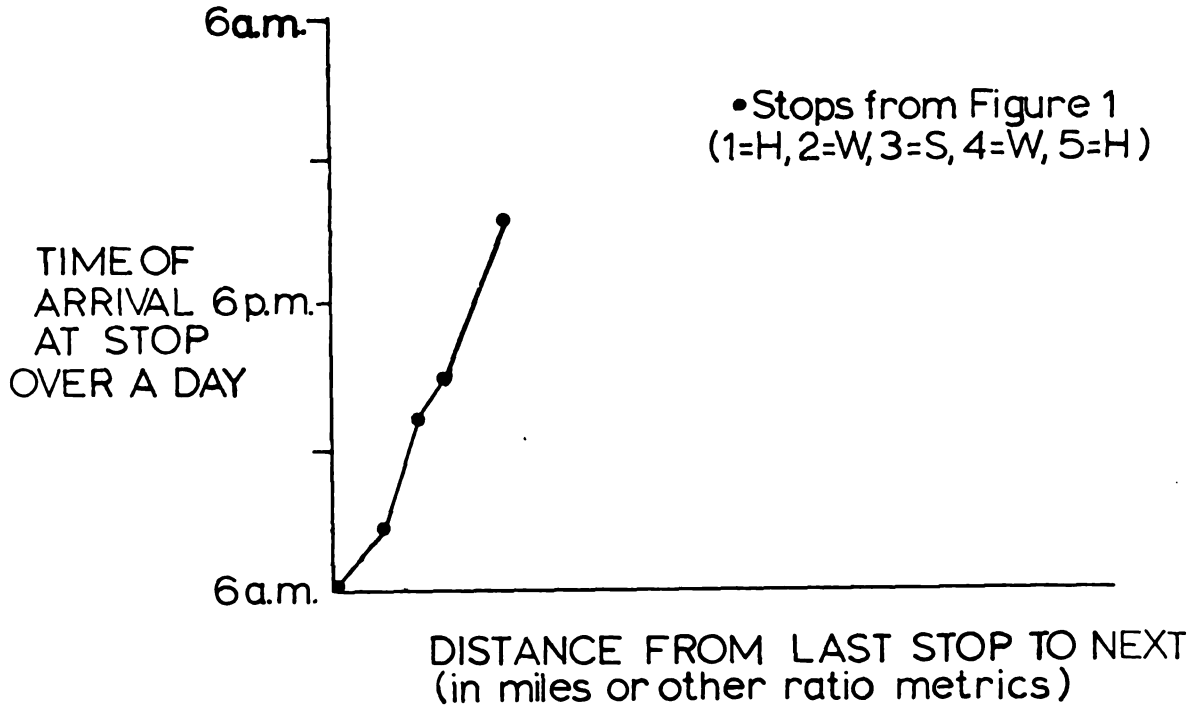


Figure 1

last stop to the next, and the others representing the remaining particularly important aspects of travel which could be considered, such as mode, activity type and location of destination, at least. The individual's path, properly represented in the n-dimensional space--where some of the dimensions are categorical or qualitative variables, and some are not--becomes a line joining a sequence of points, representing stops, each stop possessing a set of coordinates (or values) on a separate axis giving at least time of arrival at stop, distance from last stop, location of present stop on north-south and east-west axes, mode used to get to stop and activity conducted at the stop (it is clear that any other important aspects of travel could be portrayed on further dimensions, e.g., duration of stay at a stop). The more rigorous geometrical presentation of individual's daily travel as a path in n dimensions is shown in Figure 2.

What does this reconceptualization of travel imply for future modeling work, data analysis and policy relevant to the travel behavior of different population groups, such as women? First of all, it is evident that significant differences in the behaviors of different kinds of individuals, for example, between men and women, might not show up when travel for modeling or data analysis is conceived as simple interbase movement. For example, most studies show that the average distance traveled by women,measured for simple interbase trips, is shorter than that of men. This could be taken to imply that women have a shorter range about the home than men, and even as an indication that they are less mobile. However, if the total daily travel patterns of women are compared with those of men, then the number of stops in a day and the distances and directions they

A.



B.

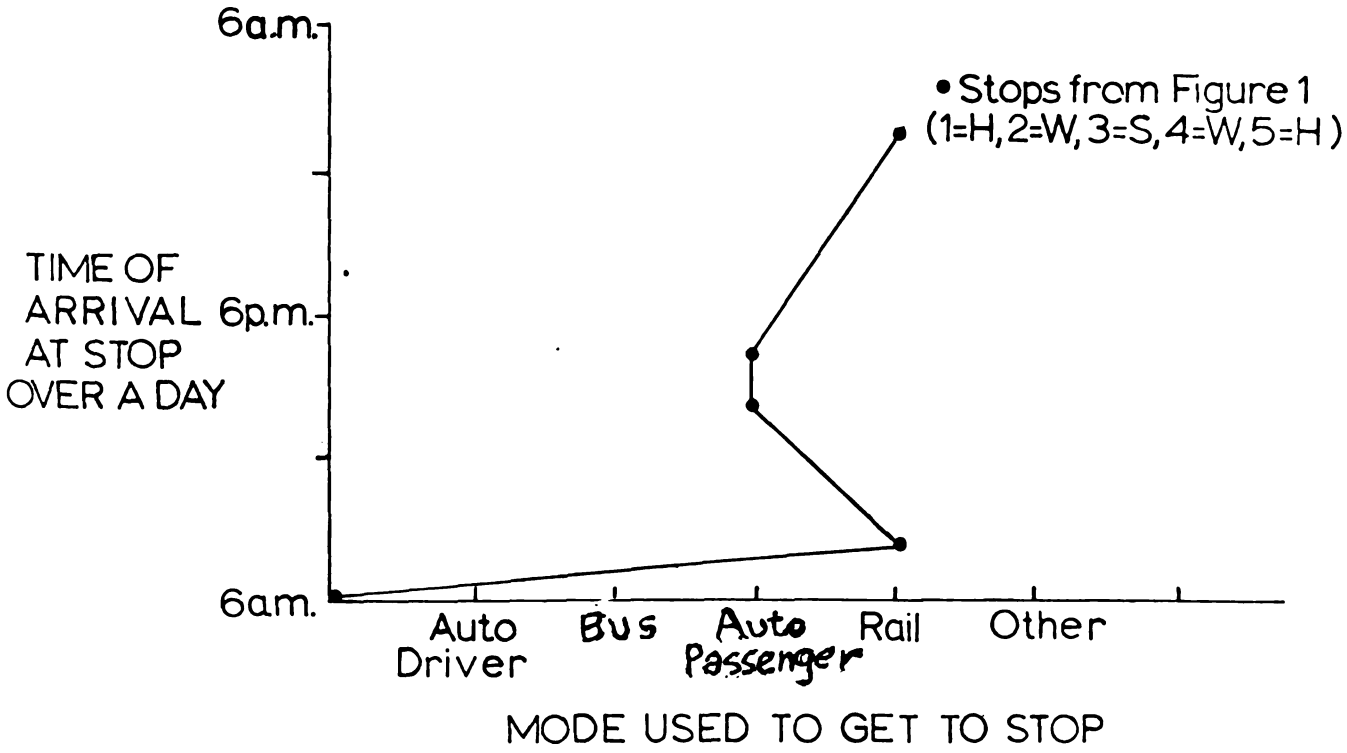


Figure 2

lie from each other will determine whether, in reality, women do travel a shorter distance, are less mobile and have a smaller range than men. It is conceivable that women, particularly women employed in the paid labor force part-time or not at all, might make many more stops over a day than do men, that their total distance traveled is greater even though the average interbase trip length is smaller, and that the maximum distance and area they need to range away from home is even greater to or equal to men's. In addition, by simply comparing the distribution of women's and men's interbase trips between different modes, no information is gained as to the complexity of the sequence of modes which men and women use to accomplish their daily activity-travel. For example, homemakers in one-car households, deprived of a car during the day, might need to use two or three non-auto modes while men might simply use a car for all trips. The total costs of the female transit-oriented group would be clearly greater in this case than the travel costs of the male auto-oriented group, to a degree that is not reflected in simple statistics showing that women use transit on trips and men use cars. Thus, it is particularly important to reconceptualize the dependent variable of travel demand models as complex behavior, that is, in the form of a path over space and time, in order to provide, among other things, for more appropriate measures of differentials between gender and also other groups, that is, of differentials in kinds of travel needs, costs and behaviors which exist under current circumstances.

One policy implication that flows from this reconceptualization is a clearer understanding of how demands for flexibility and reliability in modes might arise, particularly for some kinds of population (for example, the population groups noted in Ref. 18). Indeed, it could be

remarked that until travel is redefined in this way, crucial aspects of the routing and scheduling of different modes which might affect the demands for them are likely to be ignored in modeling, data analysis and policy. Consequently, it is exceedingly important to determine what kinds of paths exist, how they are associated with different kinds of individuals, and how they are formed under the current conditions of supply of travel opportunities. However, while such endeavors will be of considerable interest to those concerned about measurement and classification problems, of much more theoretical interest and policy relevance is the relaxation of the choice set axioms of current work.

The choice set axioms. Any attempt to relax the choice set axioms, that is, the axioms under (2) above, would first involve the development of a causal choice set formation model for the individual. Specifically, the probabilities of an individual or the members of a group selecting a particular kind of travel behavior (option), would be expressed as the joint probability or the option being in the choice set for members of the group, and the probability of its selection conditional on its inclusion in the set, i.e.,

$$P(j) = P(j \in A) \;\; P(j \mid j \in A), \; j = 1,\ldots,n$$

where A is the set of options and n is their number. The specification of $P(j \in A)$ would lead to the development of a causal choice set formation model of an explanatory-descriptive variety (the nature of some of its variables and the use of 1 to redevelop microeconomic choice theory and hence reformulated analytic-deductive travel models is further discussed in 4 and 5). Although the notion of an individual choice set formation

(generating) model was first raised by Lerman and Adler (19), a review of the spasmodic literature on the topic suggests that many more explanatory variables need to be taken into account than was originally considered. Over a decade ago, North American geographers investigated the relations between the individual's opportunity set for spatial choice (all his/her spatial alternatives in the city), his/her "cognitive" opportunity set (the known alternatives ever used) (22, 10). The variables defining each kind of set included the average distances from home or workplace of different land use types, the timing of activities at different locations (e.g., the hours of business of shops), as well as such variables as the relative prices of goods and services offered at stores in the case of shopping place choice sets. The development of choice set models by engineers, notable Tardiff (24) and Recker and Stevens (20), introduced the idea that the socio-demographic characteristics of an individual might be particularly important too in defining the probabilities of different alternatives being in the choice set. For example, car ownership and availability as well as age might affect the range over which an individual can travel and hence the opportunities in the objective and cognitive opportunity sets. Independently, workers in Europe (28, 17, 3, 16, 7, 27) began inquiring into the ways in which many possible variables (constraints) limited the number of alternatives which individuals have for many decisions, in many instances reducing the number of alternatives in choic sets to one or zero. The European work emphasized the significance of institutionally-derived constraints for choice set formation. These are constraints on the content of the individual's choice set for any purpose, resulting from organizational or collective decisions beyond his/her control and operating through the institutions

of an advanced urban-industrial society (through urban planning, corporate organizational decisions). Many such constraints are expressed and encountered by the urban individual in the form of the detailed spatial distributions of urban activities (the locations of residences, work places, shops, etc.) and their scheduling, which limit his/her travel options (space-time constraints). In addition, recent work by both Americans and Europeans emphasizes the importance of time and money budgets and "roles" as "personal" constraints on the opportunities in any travel choice set for the individual (7, 16, 15, 29).

All these constraints obviously need detailed definition and measurement for large population groups and for all kinds of travel decision, and the relative significance of institutional (space-time) constraints versus personal constraints needs to be determined. Especially, the relative importance of space-time constraints versus constraints placed by the individual's socio-demographics needs to be discussed for different population groups, including gender groups such as women and men. In the short run, there needs to be an assessment of how much of the variance in observations of the complex daily travel patterns of individuals is explained by variables under his/her control, with such behavior therefore being manipulable by marketing strategies, and how much is outside the individual's control, arising from organizational decisions restricting choice sets by the private or corporate sector, and needing government policy or industrial reorganization to handle. For example, it is quite possible that the space-time constraints of a suburban middle class housewife with

children under five and no car are such that for many hours of the day she has only one or no acceptable alternative within any choice set for travel (e.g., walk only in her mode choice set). (See 19, 26): the relative contributions of gender-related roles and the supply travel opportunities needs to be investigated here.

All this implies that in order to specify a choice set formation model for each different type of population group, considerable exploratory data analysis needs to be done to identify relevant groups, to specify the variables which define their choice sets, and to develop the mathematical statements about the ways in which these variables determine the probabilities of different alternatives being in or out of individual sets. This is clearly a very complex question for future empirical research and special simulation gaming procedures are being developed to study it (following 21, 2, 15). Consequently, before proceeding further, it is desirable to produce some data to support the contention that there might be significant inter-individual variations in choice sets indicating susceptibility to grouping, and that these variations <u>are</u> related to inter-individual differences in complex travel behavior, in order to document that the present reconceptualization of movement is a fruitful direction for further research. This question is taken up later in the paper.

<u>Variable decision rules</u>. One result of recent research in choice theory is that, in instances where individuals do have choices (more than one alternative in their set), decision strategies may vary both with the type of individual and the complexity of the situation (22).

Moreover, decision strategies are much simpler than the strict utility-maximizing assumption postulates: "In general people prefer strategies that are easy to justify and do not involve reliance on relative weights, tradeoff functions or other numerical computations." Strategies may include elimination-by-aspects, disjunctive, conjunctive, or lexicographic rules, where features of many of these are reliance on threshold values of one, or a few, critical dimensions of alternatives to partition choice sets into satisfactory and unsatisfactory alternatives; and several stages of judgement. Thus, the expansion of $P(j/j \in A)$, the choice model of Equation I, will require the identification and modeling of the simple choice strategies which different kinds of individuals use in different situations. There has been no investigation of differences between groups in decision rules in modeling travel so far, for example, in studies of differences between men and women in the set of criteria which they use for judging travel options and in their importance and in the process by which they use the criteria to make a decision. For marketing strategies in transportation, e.g., "selling" new modes, the possibility of such gender differentials should be allowed for: for example, threshold choice strategies, in contrast with utility-maximizing ones, imply zero return to anything but "critical" major alterations in "important" dimensions of alternatives such as travel modes. Similarly, the effects of intergroup differentials in all aspects of decisionmaking should be considered in choice modeling, the analysis of choice data, and policy descriptions derived from them.

Documentation from a Small-Sample Experiment

The Data Set. To document further the points which have been made about the reconceptualization of individual and group behaviors in general and women's travel behavior in particular, a pilot study was undertaken with a small sample of persons. This sample initially comprised the 35-day travel records of 34 individuals selected as a stratified proportional random sample from members of each of six life-cycle groups; the latter comprised a larger proportionate random sample of 531 individuals and 296 households by life cycle groups in Uppsala, Sweden, 1971 (Table 1).* This data set was chosen for three reasons: firstly, because it contained information about social roles and gender which are missing from other data bases; secondly, because, although Sweden by 1971 had implemented a considerable amount of social legislation to equalize the opportunities of men and women in both work and parental roles, persons of different genders undertook significantly different activities (11) as is the case in U.S.A.; and thirdly, detailed longitudinal data for individuals were available. Thus, this data set seemed ideal to explore whether travel could be treated as complex behavior, and whether gender-related explanations of it might be appropriate. There is also a considerable amount of evidence that such gender-linked roles especially comprise societal expectations of what is appropriate for each sex at different stages of the life cycle, and that life cycle and sex influence travel (14).

*For purposes of exploratory analysis with the 34-person sample, life cycle groups 1 and 2 and 5 and 6 were sometimes combined. The sample was limited to 34 persons because of restrictions in the INSCAL algorithm used later in the analysis.

Table 1

The Distribution of Sample Households and Individuals

in Uppsala, Sweden, 1971 by Life-Cycle Group

Group No.	Characteristics	Number of Sampled Households	Number of Sampled Individuals
1	Head of household 67 or older	47	68
2	Head of household between 50 and 66; no children living at home	51	80
3	Head of household between 18 and 49; single persons only	26	27
4	Head of household between 18 and 49; two person household with no children	51	99
5	Head of household between 18 and 49; at least one adult and at least one child over seven years; no preschool children	62	141
6	Head of household between 18 and 49; at least one adult and at least one child less than five years of age	59	116
TOTALS		296	531

Any lack of effects of gender-linked roles on travel in this instance could be taken to indicate either the influence of small sample size, the absence of sex and/or life cycle role effects, or an inappropriate definition of roles to define groups, or any combination of these. Which of these interpretations is favored will be considered when the results of analyzing the travel records of the small sub-sample from the larger Uppsala sample are considered.

The travel record for each individual in the sub-sample was of a standard variety, as can be seen from the example of a person's travel diary in Table 2; each individual recorded, for each stop in sequence over 35 days out of home, such aspects as mode to the stop, time of arrival and departure from the stop, activity at the stop, expenditures at the stop, and so on. In addition, on the final data tape, the land use at each stop, by one of 99 separate classes, was entered, together with the north-south and east-west grid coordinates of the location of the stop.

It must be noted here that the analysis of these data for 34 individuals is not intended to provide any definitive statements as to how different gender groups behave, but rather to examine the notion that a new, more realistic conceptualization of travel behavior for individuals and groups can yield an adequate description of information in individual trip records; it can then guide new work in modeling, data analysis and policy development for different population groups, including women. A large-scale experimental design with a set of much larger data bases is described later which will hopefully

Stop number _____ Did you plan to make this stop when you left home? Yes No

Means of Travel 1 foot 2 bicycle 3 bus 4 car (driver) 5 car (passenger) 6 taxi 7 moped 8 other _____

Were you accompanied by someone from your household? Yes No If yes, by how many? _____

Where did you make this stop? (please give address) New? _____

When did you arrive at this place? _____ hours When did you leave this place? _____ hours

What did you do at this place? Expenditure

1) _____ _____

2) _____ _____

3) _____ _____

4) _____ _____

Stop number _____ Did you plan to make this stop when you left home? Yes No

Means of Travel 1 foot 2 bicycle 3 bus 4 car (driver) 5 car (passenger) 6 taxi 7 moped 8 other _____

Were you accompanied by someone from your household? Yes No If yes, by how many? _____

Where did you make this stop? (please give address) New? _____

When did you arrive at this place? _____ hours When did you leave this place? _____ hours

What did you do at this place? Expenditure

1) _____ _____

2) _____ _____

3) _____ _____

4) _____ _____

Is this trip continued on the next sheet? Yes No
If, No, fill in the section below.

/hen did you return to home? _____ hours

leans of Travel 1 car 2 bicycle 3 bus 4 car (driver) 5 car (passenger) 6 taxi 7 moped 8 other _____

'ere you accompanied by meone from your household? Yes No If yes, by how many? _____

Table 2

Page from Individual's Travel Diary, Uppsala, Sweden

provide more substantial support for the kind of approach taken here. At this point, however, we are concerned only with producing some evidence to show that it might be worthwhile to proceed with this larger-scale analysis. The aim of the following is therefore simply to demonstrate that hypotheses consistent with assumptions about the complexity of individual travel, inter-individual variations in choice sets and simple decision rules match forms of travel data which are also currently fitted by logit models derived from different premises. Since the new hypotheses are more realistic and raise some interesting policy issues not handled by other approaches, including some related to women, further support is provided for future modeling and data analysis based on them.

Travel as Complex Human Behavior. The results of reconceptualizing travel as complex human behavior and describing it mathematically as a path in n-dimensional space are indicated in Figure 3. For each of the 34 randomly sampled individuals, the day of his/her most complex behavior, as indicated by the day with the maximum number of stops, was selected. Two dimensional plots, as in Figure 2, were prepared for each individual, showing the sequences of stops plotted against each pair of stop descriptors-activity at stop, time of arrival at stop, distance from last stop, NS and EW location coordinates of stop, land use at stop, mode to stop. Inspection of the diagrams leads to the conclusion that, even in the most complex cases, the individual's daily travel has a less--rather than more--complicated structure. The ranges of each individual through a day are apparently

limited to some maximum distance and area, and there is a limited number of different modes taken on successive stops, and some upper limit on the total distance travelled. Moreover, at least for observed travel behavior, the structure of the paths in n-dimensional space seems to be differentiated both by gender and life cycle group, with younger groups with more children showing more complex daily travel patterns in terms of the numbers and locations of stops and the variety of modes taken, and men having significantly different modal combinations from women. In some of the instances which the diagrams illustrate, too, the women of each life cycle group traveled further than the men, indicating how reconceiving travel as complex behavior might produce unexpected results about differences in movement between population groups, such as differences in modal use and distances traveled by men and women. The most important result from the simple "eyeballing" of n dimensional paths of these kinds, however, is the indication that systematic differences between the paths for different persons appear which might be identified by classifying or measuring them and associating them with socio-demographic characteristics of persons. This implies in turn that reconceiving human behavior as complex in the case of travel at least, does not lead immediately to too complex a dependent variable for handling in new kinds of mathematical models and data analysis for the study of individual and group movement. The last section of this paper describes simple procedures whereby paths like the present ones in n dimensional space may be measured and their associations with different population groups, including gender-defined groups, more thoroughly investigated.

Inter-Individual and Inter-Group Variations in Choice Sets. The revised axiomatic base for new kinds of travel models, data analysis, and policies postulates that travel choice sets of individuals are both more constrained and systematically variant between persons and groups than has traditionally been considered to be the case. One way of examining the validity of this statement is to show that it appears to be true of individual choice sets for the Uppsala sub-sample. The following represents an attempt to investigate this hypothesis by showing how, if it is true, specific patterns should appear in the data for the complex travel behaviors of men and women.

From the reconceptualization of travel in Figure 1, it is apparent that what has been traditionally conceived as separate "choices" (activity, mode, destination-location, destination-type, time of day, etc.) may in fact be simply descriptors or aspects of stops to the individual. From this, one tenable hypothesis, consistent both with the foregoing reconceptualization of the individual's movement, and with the notion of limited and systematically varying individual choice sets, is that different individuals choose between only a limited number of distinctive activity/mode/destination-type/destination-location/distance/time of day aspect combinations defining stops. For example, if the individual is a full-time employed married woman, then "shopping for groceries" may always and only be associated with "five minutes from home on the way from work to home," "travel by auto mode," and "5:30 P.M."; "shopping for clothing" might be associated always and only associated with "regional shopping center," "ten miles from home," "auto mode," and "6 to 9 p.m. Thursdays

and Saturday mornings." Only stops which can be labeled in this way will belong in the individual's choice set. Other kinds of individuals have possible stops described by different combinations.

What this implies is that, in an individual's daily n x 7 travel matrix, comprising observations for all 7 aspects of n stops (mode, activity, time of arrival, distance from last stop, EW and NS locational coordinates, land use) the column of numbers defining the set of observations of an aspect for each stop should be paired repetitively with the columns of numbers describing each other aspects of the the stops. Thus, if 1 (or any other) number represents "shopping activities," it should always, or almost always, recur with, one single number, say 7, representing mode and the appropriate single numbers for say, time of day and distance from home. This implies that some measure or pattern of association between the aspects of stops could be used to determine how restricted the individual's choice set is, and permit inter-individual and intergroup comparisons in the degree of restriction of the choice sets. In this instance, the Peasonian correlation coefficient, r, is used to measure the patterns of association between each pair of aspects for each individual; it is appropriate as a co-association index in this case, and will be invariant irrespective of the numbers assigned to different categories of qualitative variables (e.g., mode) as well as to quantitative variables . . . (It will be noted that the use of r as a pattern index is different in this instance from its use as a statistic to measure the relative influence of one variable on another, not controlling for the effects of other variables, the more common use.)

In the present case, the magnitude of r is an index of the degree of restriction of the individual's choice set; low $|r|$ values represent little association, that is, the pairing of one value for one stop aspect (e.g., representing one mode) with highly variable values of another aspect (e.g., representing many different kinds of land use or destination types). High values of $|r|$ indicate a consistent association of one value of one stop aspect (representing one mode) with one value of another stop aspect (a single land use). Consequently, the inter-correlations of all pairs of aspects of stops were computed for each individual and summary tables prepared, as shown in Table 3. From this table, it can be seen that, while the majority of individuals tend to have r values between .25 and -.25 for all aspect pairs, and while this is also the case for each aspect pair separately, there is significant inter-individual variation in both the magnitude and the nature of the association. This is reflected in the high coefficient of variation, and the symmetrical distribution, of r's over the entire range of its possible values for the set of 34 individuals, both in the case of each aspect pairs separately and all aspect pairs taken together. Certain kinds of individuals might hence be found with differences in their choice sets, or, more specifically, systematic differences in the choice sets of individuals of different types might exist which could be modeled. Of course, what variables most contribute to the choice sets and the nature of their content is left open for exploration in future work, but at least the existence of significant choice set variations is indicated. An analysis of variance of the differences in correlation

Table 3

Frequency Distributions of r Values

for 34 Individuals in Uppsala Subsample

A. All Aspect Pairs, All Individuals

$\lvert r \rvert$ Value	Number	Relative Frequency (F)	$\bar{F}^a$	V_F^a
0 to .24	260	.36	.37	.45
.25 to .49	192	.27	.27	.47
.50 to .74	179	.25	.25	.51
.25 to .99	83	.12	.12	.83

B. Separate Aspect Pairs, All Individuals

1. Mode / Time of Arrival

r Value	Number	Relative Frequency (F)	$\bar{F}^b$	V_F^b
-1.00 to -.01	6	.18	.06	7.83
-.50 to -.01	5	.15		
.00 to .49	19	.55		
.49 to 1.00	4	.12		

2. Mode / Land Use

r Value	Number	Relative Frequency (F)	$\bar{F}^b$	V_F^b
-1.00 to -.51	0	0	.43	.86
-.50 to -.01	5	.15		
.00 to .49	12	.35		
.49 to 1.00	17	.50		

3. Mode / Activity

r Value	Number	Relative Frequency (F)	$\bar{F}^b$	V_F^b
-1.00 to -.51	7	.21	-.12	-3.52
-.50 to -.01	12	.35		
.00 to .49	14	.41		
.49 to 1.00	1	.02		

4. Mode / EW Location Coordinate

r Value	Number	Relative Frequency (F)	$\bar{F}^b$	V_F^b
-1.00 to 0.51	11	.32	-.07	-7.83
-.50 to -.01	7	.21		
.00 to .49	9	.26		
.49 to 1.00	7	.21		

(cont.)

5. Mode / NS Location Coordinate

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	8	.24	-.06	-8.88
-.50 to -.01	11	.32		
.00 to .49	9	.26		
.49 to 1.00	6	.18		

6. Mode / Distance

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	0	0	.60	.38
-.50 to -.01	0	0		
.00 to .49	10	.29		
.49 to 1.00	24	.71		

7. Time / Land Use

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	2	.05	-.03	-11.22
-.50 to -.01	16	.47		
.00 to .49	15	.44		
.49 to 1.00	1	.02		

8. Time / Activity

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	15	.44	-.38	-1.08
-.50 to -.01	15	.44		
.00 to .49	2	.06		
.49 to 1.00	2	.06		

9. Time / EW Location Coordinate

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	12	.35	-.19	-2.71
-.50 to -.01	10	.29		
.00 to .49	8	.24		
.49 to 1.00	4	.18		

10. Time / NS Location Coordinate

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	2	.06	-.04	-8.87
-.50 to -.01	13	.38		
.00 to .49	9	.26		
.49 to 1.00	10	.29		

(cont.)

Table 3 (cont.)

11. Time / Distance

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	2	.05	-.04	-8.87
-.50 to -.01	14	.41		
.00 to .49	18	.52		
.50 to 1.00	0	.00		

12. Land Use / Activity

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	2	.05	-.01	-20.90
-.50 to -.01	14	.41		
.00 to .49	18	.53		
.50 to 1.00	0	.00		

13. Land Use / EW Location Coordinate

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	8	.24	-.15	-2.87
-.50 to -.01	12	.35		
.00 to .49	13	.38		
.50 to 1.00	1	.02		

14. Land Use / NS Location Coordinate

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	.15	.15	-.04	-10.11
-.50 to -.01	.41	.41		
.00 to .49	.32	.32		
.50 to 1.00	.11	.11		

15. Land Use / Distance

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	1	.03	.32	.94
-.50 to -.01	1	.03		
.00 to .49	24	.71		
.50 to 1.00	8	.24		

16. Activity / EW Location Coordinate

r Value	Number	Relative Frequency (F)	F^b	V_F^b
-1.00 to -.51	8	.24	.04	12.82
-.50 to -.01	7	.21		
.00 to .49	10	.29		
.50 to 1.00	9	.26		

(cont.)

Table 3 (cont.)

17. Activity / NS Location Coordinate

r Value	Number	Relative Frequency (R)	F^b	V_F^b
-1.00 to -.51	10	.29	-.04	-7.44
-.50 to -.01	7	.21		
.00 to .49	9	.26		
.50 to 1.00	8	.23		

18. Activity / Destination

r Value	Number	Relative Frequency (R)	F^b	V_F^b
-1.00 to -.51	2	.05	.25	2.41
-.51 to -.01	17	.50		
.00 to .49	14	.41		
.50 to 1.00	1	.03		

19. NS Location Coordinate / Distance

r Value	Number	Relative Frequency (R)	F^b	V_F^b
-1.00 to -.51	7	.21	-.13	-3.49
-.51 to -.01	16	.47		
.00 to .49	7	.21		
.50 to 1.00	4	.12		

20. EW Location Coordinate / Distance

r Value	Number	Relative Frequency (R)	F^b	V_F^b
-1.00 to -.51	7	.21	-.01	-36.71
-.51 to -.01	12	.35		
.00 to .49	7	.21		
50 to 1.00	8	.24		

a $\bar{F}$ is the mean relative frequency of $|r|$ values in each class, and V_F the coefficient of variation of the relative frequency of r values in each class, over all individuals.

b $\bar{F}$ is the mean of the r value for the aspect pair, and V_F its coefficient of variation, for the individuals.

coefficients for aspect pairs by the life-cycle, gender, and life cycle/gender combination of individuals showed no statistically significant main or interaction effects. Although this could result simply from small sample size, if gender or life cycle determinants had been highly important, one would have expected some significant effects, at least for some categories of gender or life cycle; these did not appear. The conclusion at this point should not, however, be that it is highly doubtful that there are gender-related role differences in choice sets; rather, more attention should be paid to the development of additional role descriptors (marital status, employment status) which might interact with or complement the effects of simple gender and life cycle differences. The experimental design described below for use with much larger samples of individuals will permit a much better exploration of possibly complex role effects on choice sets and travel.

Simple Decision Strategies. Finally, trip records for the sample of 34 can be used to investigate the hypothesis that decision strategies are simple rather than complex and vary between different individuals and population groups. If decision strategies are simple, one hypothesis which is tenable under the reconceptualization of travel used here is that the measures of aspects of chosen stops which reflect the nature of choice sets, should also reflect the operation of simple decision rules. Thus, we may ask, if individuals of different types are evaluating stops, which are defined by values on different aspects, how would they evaluate the range of aspects of stops in order to select the stops they chose? What criteria could be used to

judge the different aspects of stops? Two or maybe three dimensions which could be simply used to assess the costs and benefits of all aspects of stops used in travel are the familiar subjective travel time, travel cost, and, perhaps, service. The use of just two or three dimensions is, of course, supported by the now immense volume of literature on aggregate and disaggregate approaches to travel which documents the overwhelming significance of these criteria. If this hypothesis is true, then:

1. The $|r|$ values describing the association between pairs of aspects of stops for the individual measure similarities between stimuli to the individual for judgment purposes;

2. If so regarded, the 34 intercorrelation matrices for each of 34 individuals, for each possible pair of aspects describing stops, represent similarities matrices for input into a scaling algorithm such as INSCAL;

3. Recovered configurations from the algorithm should show a high degree of resolution in two or three dimensions, with a dispersion of the stimuli (aspects of stops) along each dimension in individual and group spaces;

4. There should be a high level of variation in the subject weights for each dimension, perhaps exhibiting statistically significant differences for individuals grouped by gender and/or life cycle group. (See 4, 1978, for fuller details of this use of INSCAL.)

Thus, the subjection of the individual intercorrelation matrices to INSCAL analysis will produce results to test the assumption of the simplicity of the decision rules of individuals, and their variation between different population groups, such as gender-related ones. The basic

hypothesis that there are at most two or three underlying dimensions which are used by individuals for the judgment of different stops appears to be upheld; however, MANOVA analysis of the weights on each dimension, to capture the effects of gender and/or life cycle group on configurations or decision rules, produced no significant main or interaction effects for either two or three dimensions. Again, this could simply be the result of the small sample size; however, if gender/life cycle related effects had been very strong, one would expect either or both variables to have exhibited some statistically significant effect on configurations by weights, even for such a small sample. The results indicate either that role variables are not appropriately defined, or the other variables are more significant in defining groups with different decision rules.

In sum, some evidence has been presented to indicate that, by reconceptualizing the individual's travel as complex, choice sets as constrained and systematically varying between persons, and decision rules as simple and also varying between persons, statistical hypotheses can be generated which are consistent with observations of travel behavior. Thus, hypotheses and data analyses which are derived from radically different kinds of assumptions about movement might provide just as good a fit to observations of travel behavior as current formal models like the logit, which are based on different and less realistic hypotheses. The inference from this should not be that a replacement for the logit is immediately needed for all modeling, data analytic

and policy prescription purposes, but rather that there needs to be a clearer articulation of the kinds of policy each approach might provide (5). However, in the long run, both for scientific and policy purposes, clearly there appears to be a case for developing the new kinds of model and data analysis for individual and group behavior to which the present reconceptualization can lead, and for the mathematical exploration of new ways of handling differences in travel behavior and opportunities for different groups. From the preceding discussion, however, the question as to what kinds of groups would be used for aggregation purposes in new kinds of models and analysis remains unresolved. In particular, the relative importance of gender-linked variables for behaviors, choice sets, and decision strategies deserves further considerations. This essentially requires the investigation of precisely what and how much gender-linked variables contribute to the explanation of observed complex travel behaviors, vis a vis other socio-demographic descriptors of persons, and space-time constraints. Consequently, the remaining section of this paper describes a design for the future investigation of the relative importance of gender-linked and other variables on travel, given the acceptability of the reconceptualization of travel and its explanation offered in this paper.

III. A LARGE-SAMPLE EXPERIMENTAL DESIGN FOR THE DEVELOPMENT OF NEW MODELS OF INDIVIDUAL AND GROUP BEHAVIOR

Table 4 displays an outline of an experimental design which uses large samples of individual daily trip records, together with large-scale

Table 4

Large-Sample Experimental Design: Effects of

Space-Time Constraints and Role-Related Sociodemographics on Travel

Space-Time Constraints[a] Categories	Sociodemographic Role Descriptors					
	Role Categories	Class Categories Income Group	Family Categories			
			Life Cycle	Employment Status	Marital Status	Gender
#1 Categories #2 Categories . . . . #n Categories	Entries in cells: measures of individual's complex daily travel[b]					

a. Space-Time Constraints include: distance/travel time from home to nearest bus stop; distance;travel time from workplace to nearest bus stop; number of different establishments, for each of 37 types, within given space and time intervals from home; same from work.

b. Measures of Complex Travel include: total travel distance/time for day; total stops for a day; # different modes used; # different land use types used; average interbase trip length.

Note: The Uppsala data set contains approximately 20,000 records of individual daily travel for persons of all race, income and family categories; the Baltimore data set contains approximately 500 records for all married, middle income, full-time employed, married men and women, and the West Berlin data set contains approximately 7,100 records for the same kind of population. In the latter two cases, to increase expected cell frequencies, factor analysis of individual space-time constraints data might be performed to reduce the number of space-time dimensions and categories.

data bases of the point locations and scheduling of 34 classes of urban activities, to further explore the main issues raised by the conceptualization of individual and group movement and their explanation. In particular, the following analysis investigates whether one should explicitly consider the effects of space-time constraints and the effects of socio-demographic variables on complex travel behavior for all population groups. The results should clearly demonstrate the consequences of not hitherto effectively considering space-time constraints as dominant variables in choice set formation models in the study of movement: the key conceptual shift advocated both for science and public policy in this paper. But the results should also indicate more precisely, too, the effects of gender-linked variables on travel.

In the experimental design of Table 4, the individual's complex travel behavior is determined by a vector of measures, one set of measures for each individual in designated space-time constraints and socio-demographic categories. The socio-demographic categories reflect the recent empirically- and theoretically-based tendency to segment the population by role descriptors for the study of movement; however, the complexity of the possible class-race-gender-linked "role complexes" for each person (see discussion Fried, Havens and Thall) is probably still inadequately represented by this "ad hoc approach" to role descriptors, and indicates the paucity of definition and measurement procedures in this area. The space-time constraints categories are developed from computer analysis of "Dime-Files" giving the street address and between-address distance/time for the activities in a

city. Uppsala, West Berlin and Baltimore are the only three cities to our knowledge with both the Dime-File and large samples of individual trip records for this analysis. The design is set up for data analysis by MANOVA (multiobservation, multiway analysis of variance with unequal cell frequencies) and, although statistics are not available to estimate the relative importance of space-time constraints versus socio-demographics on travel for all population groups, various indices are available for this purpose.[2]

The Uppsala travel diary data set, and geo-coded land use data set enables the contributions by all categories of socio-demographics versus all categories of space-time constraints to be explored in great detail. This data set will provide the basic control for examining the relative significance of socio-demographic categories versus space-time contraints cetegories. For the remaining two data sets, the number of categories of socio-demographics versus the categories of space-time constraints which could be set up was limited by the total number of individual travel records available. The strongest test of the hypothesis that space-time constraints are more significant than socio-demographics, or vice versa, will occur if the study population is limited to those kinds of individuals who are neither operating without constraints or under severe constraints; that is, if sub-populations at either extreme are eliminated. Thus, the Baltimore and West Berlin populations are confined to groups of

[2]The Wilkes-λF ratio for a main effect converts to a measure of the relative strength of the effect through the formula $1-\lambda^2$, for example.

persons who are not single, neither low nor high income, and not out of full-time employment. The separate analysis of the data for the three populations will not only answer the main conceptual issues raised above, but also check on the ultimate transferability of the new approach and allow cross-cultural comparisons of the movement patterns of different groups, such as women.

IV. CONCLUSION

This paper has pointed out that there are some fundamental conceptual issues in the analysis of women's travel behavior at the moment, as in the analysis of any group or individual behavior. It has been demonstrated how alternative means of defining movement as complex and then of explaining it might provide a satisfactory interpretation of ordinary trip records of individuals, but might produce different and even conflicting policy implications for women and other groups in comparison with current aggregative and disaggregative approaches applied to the analysis of movement. This implies the need for much further research into the foundations of causal explanations of the travel behaviors and mobility needs of different population groups, rather than "palliative"-oriented research immediately geared to the analyses of data or to the provision of quick answers to pragmatic policy questions. In particular, the approach of this paper shows that some sensitivity is needed to the fact that the human world is very complex; not only is behavior itself complex, but the environments in which individuals find themselves in cities are highly variable, and the decision rules and strategies and ways of acting

within the environments are also likely to vary. Unless we become less simple-minded in our interpretations of individual and group behavior, and more sensitive to the demand for complexity from the world without, rather than to the demand for simplicity for formal analysis from the world within, we run the risk of asking the wrong questions, mis-specifying models, measuring the wrong things, describing and mis-emphasizing different kinds of policies. It should also be clear from this paper that quantitative methods are not beyond our grasp for dealing with the modeling, measurement and experimental design issues raised by the complexities of real world environments and of individuals, including women, in cities, even though the outline of the models and the experimental designs for their development are not as rigorous mathematically perhaps as our former training and ways of analyses might push us to pursue. At this point, the paper suggests it might be better to strike out for informed judgments about broad societal questions related to the welfare of urban population groups such as women, including questions about the complicated connections between the realm of opportunities and the realm of preferences and behaviors of different population groups in general and women in particular. The accent on more informed judgments about complex issues represents a shift from a tendency to emphasize the development of rigorous quantitative methods and deductive mathematical models at the expense of asking less important questions; certainly the kind of approach advocated here raises specters of far more broadranging societal requirements (such as the control and redesign of the urban environment per se) for handling women's mobility needs,

than the narrowminded focus and purely technological solutions to problems of movement which current conceptualizations can propagate.

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III. ABSTRACTS OF PAPERS NOT PRESENTED IN FULL

Women's Travel Issues: American Patterns

Dr. Helena Znaniecki Lopata
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This paper discusses the consequences of the urbanization and industrialization of the United States on the travel options and opportunities available to American women at various life-stages. The paper considers the travel implications of a number of commonly held assumptions about the appropriate roles of women in American society. Using data collected in Chicago the author discusses how suburban lifestyles and childcare responsibilities can create a number of mobility barriers and constraints for women. The author also discusses how married women who seek to return to the paid labor force go about finding jobs. Lastly the author examines the mobility problems facing older widows, as they attempt to reorganize their lives after their husband's death. Overall the author argues that most U.S. transportation resources have been developed in response to traditional models of the family; in so doing they fail to respond to the needs of women at various stages of their life.

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Measuring the Distributional Impact of Transportation Service on Women

Dr. Catherine Ross
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This paper presents new ways to quantify and evaluate the differential impact of transportation services across socioeconomic groupings. The author develops measures of transportation system performance and then applies them to an assessment of the delivery of services to women of varying socioeconomic backgrounds in the Atlanta Metropolitan Area. The paper first analyzes traditional procedures used to evaluate the various impacts of a project and then considers the implication of the use of those measures for women. The author then explains how the new measures developed were applied in Atlanta and the outcome of that analysis. The author concludes that the strategies she employed in Atlanta can be the basis for policy innovation when used in conjunction with other evaluation mechanisms.

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A Comparison of Travel Attitudes and Behavior Between Male and Female College Students

Dr. Michael Spicer
Dr. Richard Weiner
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This paper is based on a 1978 survey of 1,030 students and faculty at the University of Colorado. The study examined the differences between male and female respondents with respect to travel modes, travel times and the relative importance of five variables: comfort, travel-time, cost, privacy, and dependability. The study found that male and female preferences and attitudes were very similar. The authors conclude that if greater economic equality gave more women a larger set of modal options, there would be a reduction in the use of buses and car-pools by women.

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Travel Patterns of Women and Men Based on Stage in Family Life Cycle

Dr. Linda Zemotel
University of Pittsburgh

This paper explores the impacts of a number of life cycle variables on the activity patterns and ultimately the travel behavior of households in the Washington, D.C. metropolitan area. The paper first reviews the use of the household as the unit of analysis and then discusses a typology of households based on stage in the family life cycle. The author then examines eleven different life cycle stages in Washington and finds significant travel differences among men and women when no car or only one car is available to a household. The author concludes that we need to understand the interactions within a household with regard to transportation resources and we need to examine how households adapt to their travel needs given their constraints.

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Transportation Problems of Low Income Women as Members of the Transportation Disadvantaged

Dr. Alice E. Kidder
North Carolina A & T State University

This study focuses on differences in the travel patterns of male and female low income residents in Greensboro, North Carolina. The study first reviews the literature on the disadvantaged, reporting that those studies that were concerned with sex as a possible explanatory variable of travel behavior, found clear differences between the sexes. When the Greensboro data were controlled for income, age, and other variables, there were still apparent travel differences by sex, particularly in the urban area. In addition, the author performed a discriminant analysis on the variables which are commonly associated with mode choice decisions and found that income and sex remained as powerful predictors of mode choice and dominated the employment status variable. The author concludes that even though women enter the paid labor force, their income and travel patterns will not duplicate those of men from similar income neighborhoods.

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IV. THE RESEARCH IMPLICATIONS OF WOMEN'S TRAVEL BEHAVIOR: CONFERENCE FINDINGS AND RECOMMENDATIONS

THE RESEARCH IMPLICATIONS OF WOMEN'S TRAVEL BEHAVIOR; CONFERENCE FINDINGS AND RECOMMENDATIONS

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I. Introduction

On the last day of the Conference, participants met in small groups to discuss the many issues raised in the previous sessions and to develop a set of research topics. Participants found that the papers and the discussions at the Conference raised as many questions as they answered. Each of the questions originally posed was sharpened in focus and direction as the result of Conference scrutiny and the importance of such research to planners and policy-makers became clearer. But many of the questions posed at the beginning of the Conference remained unanswered at its conclusion although the Conference discussions more than justified the need for in-depth research on those issues.

Each of the six major themes of the Conference generated significant issues in need of research and analysis. In addition, there were a number of questions generated by discussions of the impact of current transportation programs and policies. These issues and questions are presented below and their importance briefly reiterated in light of the papers and Conference discussions. Some of the research suggested below may be underway already but, in an attempt to be comprehensive, the participants felt it better to err on the side of duplication rather than to risk leaving out some important concern.

II. Intra-Household Implications of the Involvement of Women in the Paid Labor Force

The growing number of married women with children entering the paid labor force as full or part-time employees raises a number of questions. The household and childcare responsibilities members of the household retain or accept may well structure their trip behavior, the number and kind of trip-tours they take, and the mode they choose.

A. Trip Behavior

Research presented at the Conference showed some preliminary trends; the travel patterns of women entering the paid work force tend to become similar to their male counterparts. On the other hand, research also presented suggested that working women still retain disproportionate shares of household and childcare responsibilities.

There are problems with some of the data on which such analyses are based. Several of the studies which found great similarities in the travel behavior of men and women in the paid labor force did not have or did not analyze data on weekend travel, non-work walking trips, mid-day trip making, or the number of previous individual trips combined into trip-tours. Thus, it is possible that weekday and aggregate data obscure important travel differences between individual members of a household. It is also likely that such aggregate data fail to identify the travel patterns that are emerging as households carry out domestic responsibilities with less disposable time.

B. Mode Choice

A number of variables may interact with travel decisions; a working wife (or husband) may have to take children to childcare centers or pick them up in conjunction with the home to work trip. Such a responsibility may effectively prevent either worker from choosing a carpool or any form of public transit. Mid-day childcare or household responsibilities too may impact on modal choice; even a low-salaried part-time worker who has such responsibilities may elect to purchase a car rather than use public transit. Such responsibilities may also impact on the household's decisions about the allocation of travel time or money budgets or the household's car(s) among individual members.

Current methodologies have consistently underpredicted actual car ownership. This may reflect a failure to capture the need for flexibility and the need to combine trips, needs apparently characteristic of the growing number of two worker households.

C. Travel Patterns

The existence of household responsibilities and the division of those responsibilities can also impact choice of trip destinations as well as the number of trips and the mode chosen. Workers may choose to shop nearer or farther away from home, or nearer or farther away from their workplace as the disposable time of the household decreases. The need to combine trips may create a demand for high-density commercial areas rather than single-purpose sites or stores; conversely, the demand may increase for convenience or one-stop stores located near the home. Two

worker households may exhibit some trip substitutions; trips to restaurants may increase as shopping trips decrease.

In addition, there is a need to understand the travel decisions of the growing number of one worker, one adult households. Research presented at the Conference suggested that such families make different residential and employment decisions than other households with comparable socio-economic standing. It seems likely that when only one adult has all household and childcare responsibilities, there are profound implications for the travel behavior of that adult.

D. Impact of Role on Household Travel

Some Conference participants suggested that it was important to understand the impact of household role, that is, any defined way certain household obligations were divided among the members, rather than focusing on sex. Some participants contend that household responsibilities have been and would continue to be culturally linked to sex regardless of employment status.

E. Research Questions

The major research topics addressing this theme were:

- How do two worker households structure their activities and assign household responsibilities? What impact do these assignments have on the travel behavior of individual family members?

- Have there been changes over time in the way comparable households have allocated responsibilities? Is there a discernible and

predictable trend?

- How do one worker female or male headed families structure their activities and assign household responsibilities? What impact do these assignments have on the travel behavior of individual family members?

- How do households of all types allocate their time and monetary travel budgets among members? How do they allocate their available transportation resources?

- Which variables appear to be the definitive ones in the decisions within a household about activities, travel patterns and the use of transportation resources? Household role, sex, age, family income, individual income, education level?

III. Residential and Locational Implications of Changes in Labor Force Participation

Most labor economists and most housing market economists see great significance in the growing number of women entering the paid labor force; some question whether existing theories are adequate to predict either the employment or residential location choices of the growing number of two worker or female headed households.

In existing urban economic theories the primary worker trades off travel time and travel expenses against the amount of housing he (traditionally) can purchase. Since low density housing is traditionally cheaper in the surburbs, a further out locational decision implies a longer and more

expensive commute. If there is a secondary worker, she tends to find a job close to home, incurring much smaller travel costs. However, as the "secondary" worker's income and occupational status increases she may become more like the primary worker in her household.

A. The Housing Choices of Two Worker Households

The kind of housing choices two worker households make are not really well known if important variables such as travel time or costs are different from traditional patterns for the two workers.

The kind of household and childcare responsibility each worker accepts or retains may be a significant factor. Regardless of household income or even individual income, a worker with children may wish to make either an employment decision or a residential decision that will allow for a significant amount of time to be spent with those children. Other household assignments may also create a willingness to either accept lower pay or less desirable housing in exchange for shorter commutes on the part of either or both workers.

B. The Employment Choices of Households

Urban economic theory is not totally consistent with labor market analysis of employment and travel trade-off. Labor economists view travel costs as an employment, not a housing cost. If workers are attempting to maximize their income they may be willing to travel longer distances to secure higher wages. But if, because of personal preference or household responsibilities, they wish to minimize their travel time or maximize

their time at home, they may accept lower wages at a closer employment site. Since women have traditionally had lower wages, or have been employed in lower paying occupations, either of the two traditional economic theories could explain the current finding that women commute shorter distances and work closer to home than their employed spouses.

It is interesting to note that preliminary research presented at the Conference indicate that single worker, female headed families may make very different locational choices than other households. The traditional theories could be used to explain some of this behavior but so can racial or sexual discrimination in either the housing or employment markets, or simple differences in taste and preference.

Some conflicting research presented at the Conference highlighted the problem of assuming that only a few, traditional economic variables, can be used to predict travel behavior. Some research presented suggested that households do not use accessibility to workplaces as a residential choice criteria as traditional models hold. Other research suggested that journey-to-work costs are only one of many a household must consider when calculating its total location costs. More recent theories hold that households try to minimize their <u>total</u> location costs, which involves a calculation of both economic and "non-economic" variables.

Because both employment and residential location choices have profound implications for travel behavior and ultimately for the planning of transportation systems, it is important that we have a better understanding of how the growing number of two worker households define their

"total location" costs, why they locate (and relocate) where they do, choose employment locations and trade off travel costs, travel time, housing quality and personal and household responsibilities.

C. Research Topics

The major research questions addressing this theme:

- What impact do the allocations of household responsibilities among household members have on residential location choices?

- How do two worker households trade off travel times, travel costs, and employment opportunities available to each worker to effect the household's optimum position? Are there likely to be changes in such decisions over time as the opportunities available or sought by both workers equalize?

- Do current differences in the housing and employment choices of female headed households reflect conscious trade-offs, or are they in part a response to discrimination in the housing market or in employment opportunities? If so, what are those trade-offs?

- Are current differences in the location of female headed families likely to continue? Do such differences have implications for the development of transportation facilities and services?

IV. Comparative Attitudes and Preferences of Women and Men Travelers

There is a need to study the cognitive processes underlying travel attitudes and ultimately travel behavior. People make decisions about transportation system attributes and services based on their perceptions of those variables rather than "objective" reality. In order to understand why people choose the mode they do, or how they will respond to new systems, we require an understanding of exactly how they perceive those systems and how those perceptions actually effect their behavior.

A. Attitudinal Research

Attitudinal research is an important woman's issue. All of the research presented at the Conference found that women and men have different perceptions of and attitudes toward cars and transit. Moreover, research indicates that women are more likely to make different trade-offs among vehicle safety, the environment and their transportation choices. Further evidence presented at the Conference indicates that men and women have different concerns about personal security in transportation systems and different responses to crime prevention measures.

The specific concerns raised by vehicle design components and personal security issues were discussed at separate Conference sessions; relevant research recommendations appear in the sections below addressing those issues.

B. The Impact of Situational Constraints

People's perceptions and attitudes are formed by their experiences and values. Since men and women have different experiences with transit and even with cars (women are far more likely to be the car passenger), it is not clear whether differences in their attitudes towards various modes reflect differences in values and beliefs or simply differences in experience. Women who use transit because it is their only option may only see it in a better light only until they have other choices. Or, women's anti-car sentiments found in some research may continue because it is based on different attitudes toward the modes.

It is important to understand the underlying cause of women's attitudes so we can determine if they will continue into the future, even as their income and occupational status rise, or whether women's attitudes over time will tend to converge with men's. If we understand the relationship between such attitudes and travel decisions we can predict future travel choices. Many transit systems, for example, tacitly assume that women will always be their primary market, an assumption not yet proved.

C. Research Topics

The major research questions addressing this theme:

- Are differences in attitudes between the sexes toward certain modes and system characteristics based on genuine differences in taste and preference, or do they simply represent a response to the constraints under which some women currently operate?

- Can differences in attitudes and preferences be linked to household roles, life cycle stage or other individual variables?

- Can attitudinal research capture homogeneous market segments that include relevant socio-economic factors, roles, and employment status?

- What is the relationship between attitudes toward certain transportation services and systems, and actual travel behavior? Under what circumstances do favorable attitudes and expressed intention to use a mode translate into actual modal choice?

V. Personal Security

Research presented at the Conference made it clear that men and women had different attitudes and perceptions of personal security on transportation systems. Yet that research also showed that security was as much a perceptual problem as it was an actual crime problem. It became clear that there was a need to identify measures, techniques and procedures that would improve both actual and perceived personal safety and security.

The major research suggestions were:

- What are the costs and impacts of various crime countermeasures? What are the appropriate applications of different countermeasures to a number of situations including transit stations, vehicles, and parking lots?

- Does the acceptability and percieved effectiveness of various crime countermeasures differ for men and women? Longitudinal studies are necessary to trace the effects of individual countermeasures in different applications over time and assess their long term impacts on transit crime and related transportation crimes.

VI. Human Factors and Reactions to Vehicle Environments

Research presented at the Conference illustrated that men and women have both different physiological and attitudinal responses to different vehicle features and motion. Women appear to be more willing to buy smaller cars and to accept certain environmental devices. Preliminary evidence also suggests that men and women differ in their comfort due to various motion parameters of a number of vehicles and modes. Thus it is possible that certain energy conservation measures may not only be perceived differently by the sexes but also felt differently; down-sized cars, minibuses, AGT systems, etc. might effect men and women differently due to different sensitivities to their motion parameters. Therefore, we must understand reactions to particular and specific attributes of vehicle environments for both men and women.

The major research issues suggested were:

- How do men and women react to vehicle motion? Data are particularly scarce on the effects of angular rates.

- How are men and women influenced by vehicle motion and noise, and what is the differential impact on feeling and performance.

- How prevalent are discomfort and motion sickness on diverse commercial vehicles; are these symptoms associated with the sex of the traveler? The role of comfort in travel preferences, acceptance and satisfaction should be explored as a function of the traveler's sex.

VII. Methodological and Planning Implications

The transportation planning community will be the greatest user of the various kinds of research sought at the Conference. A number of specific recommendations were formulated for changes in the planning process, in the evaluation stages of that process, in the tools and methodologies used by planners, and in the data collected and used by planners. These recommendations often imply the need for additional research but in many ways they are a stronger statement than a mere listing of research topics. These recommendations assume that the transportation planning profession and research community must make a positive effort to seek out important research on women's travel issues and then see that such work is incorporated into the profession and the planning process where relevant and applicable.

A. The Need for Behavioral Analysis

There is often a symbiotic relationship between the data collected about the behavioral components of household and individual travel, and the models and techniques developed to predict travel behavior. It is often difficult to make travel demand models more behavioral in nature because we lack necessary data to calibrate those models or set reasonable parameters. Participants suggested both changes in travel theories and

models and the data collection methods supporting those models.

The kind of data and the modifications sought in current travel modes are not only justified by a need to address women's issues; they are justified by the needs of a number of other subgroups in society. Such work would make it possible to evaluate the travel patterns of many discernible market segments and to predict the behavior of any emerging group. In fact the modifications sought are complementary to the disaggregate behavioral changes already under investigation in the travel demand field.

B. Policy Research

Participants were also concerned with the need for research on the impacts and implications of current and proposed governmental policies on women and subgroups of women. These recommendations implied not only a need to understand changes in the status and resources of women over time, in order to accurately predict and respond to their behavior, but a need to understand their current position, in order to provide appropriate services right now.

C. Research Topics

The major recommendations were:

- There is a serious need for major longitudinal transportation studies which gather data on socio-economic and demographic variables and which include sex, household role, employment and occupational status, life cycle stage, and attitudes and preferences toward certain modes

or systems.

- Data must be collected on complex travel behavior including trip-chaining, differential accessibility, and purpose of trips as well as origin and destination.

- There is a need to know and understand the travel demands and patterns of subgroups of women; further research is needed on ethnic women, elderly women, suburban and rural housewives, and any other groups with discernible needs. The transportation services that would best meet current needs should be identified; research should allow prediction of changes which would impact their travel behavior.

- Household time and monetary budget studies should be significantly expanded; the impact of sex, role and changing employment status, among other variables on the allocation of household resources should be studied.

- Travel behavior theories must be revised to incorporate the complex phenomena observed in women's travel behavior and attitudes; travel demand and modal split models must be revised or augmented so that they recognize and analyze such variables as trip-chaining, multiple household roles, locational and social constraints, and differential access to key sites.

- Relationships and parameters in existing travel demand models which are based on static observations of simple socio-economic variables must be revised and up-dated to reflect current trends, including

changing household roles and employment status, so that such models will not freeze in time relationships implied by older data sets.

- Some attempts should be made to re-think travel behavior and to consider the impact of previous constraints on people's current travel demands; attempts should be made to model accessibility and opportunities for activities requiring travel rather than focusing only on trips already being made.

- Detailed studies should not be limited to urban or intra-urban behavior; data should be collected on inter-city travel and travel patterns in rural and non-urbanized areas.

- There is a need to identify long-term trends in women's choice of car types, use of cars, and vehicle miles travelled; such information is necessary to develop sound energy consumption and environmental policies and to determine the impact of proposed policies on women.

- There is a need to develop evaluation criteria for public expenditures in transportation to augment standard economic measures; such criteria should allow for the appropriate evaluation of the time of people not in the paid labor force and should include qualitative measures of increased opportunity and access. Such measures should allow for disaggregate analysis of the impact of proposed programs or facilities on various groups in a community including various groupings of women.

- There is a need to develop operational definitions of equity for both current programs and policies and those proposed for the future.

- There is a need to investigate the trade-offs and cross-elasticities between public or publicly guided land use decisions and transportation needs; certain developments automatically imply certain transportation needs. A choice of certain development patterns may require the provision of certain transportation services and/or certain restraints on travel to prevent undesirable patterns from emerging.

- There is a need to examine the relationship between transportation patterns and needs and other societal support systems; for example, a woman's need to arrange a trip-tour to drop a child at a center on her way to work might be obviated if childcare facilities were available at her work-site as they are in many European countries. An older person's need to travel to a doctor might be reduced by the provision of home-health care and nutritional counseling.

- There is a need for increased cooperation between public sector transportation agencies and the private transportation industry to assist in the identification of changing travel patterns, needs, and opportunities and to assist in data collection.

V. SPEECHES

The Honorable Alan S. Butchman
The Deputy Secretary
U. S. Department of Transportation

It really is a great pleasure for me to be with you here this morning. You are going to be looking over the next three days at an area of transportation that we really know very, very little about. As Dr. Perkins very properly pointed out, this is a first of its kind as far as conferences are concerned. We haven't had any within the Department of Transportation, nor have there been any other within the government, to the best of my knowledge, that have looked at the implications of women's travel behavior. This three day program was created by Dr. Sandra Rosenbloom during the year that she spent at the Office of University Research at the Department and, although Sandra has returned to the University of Texas, I understand that she is going to be with you for the conference; I think that's just marvelous, Sandra.

We at DOT are constantly urging companies that we do business with to do more by way of hiring women. We have an aggressive campaign to recruit more women in executive positions in government. Yet, until now, we have not looked seriously at the ways our transportation systems serve or fail to serve women's needs. As I said a moment ago, this is an oversight that this conference hopes to correct and over the next three days you are going to be looking at ways to encourage research into women's travel habits, attitudes and needs.

The speakers that we have scheduled, the papers that they will present offer a cross section of contemporary thought on these problems. We

are not looking for and we don't expect any final answers or definitive decisions in the next three days. We do hope that this conference will sensitize us to the difference between men's and women's transportation needs. We also hope to stimulate further inquiry into these needs and to confirm the government's support for equitable transportation services for all segments of our population.

Transportation has long been a male dominated field, from the era of the clipper ship until present time. Just a year ago, 14 women from the Coast Guard were assigned to ships. This is the first time ever in the history of our nation that we have had women assigned to sea duty.

Also, it's only 5 years ago that we had the first woman pilot go to work in a regularly scheduled domestic air carrier and even today, there are only 50 women pilots out of 37,000 pilots, co-pilots and flight engineers.

Until recently, you could only very rarely find a woman behind the wheel of one of the 25,000,000 trucks that daily cross our roads. Studies conducted by the Federal Highway Administration show that as far as car pooling is concerned, that women overwhelmingly tend to be the riders as opposed to the drivers. It goes without saying that it's only over the past few years, that women have attained a position of any prominence at all as far as transportation planning, administration or policy-making is concerned.

These inequities, of course, are not the province of this conference, but I mention them because the concept of male dominated transportation function is carried over into other areas. Our transportation systems

are oriented to the needs of men and it appears increasingly obvious that they often serve women inadequately.

Now, it's not my intent today to detail all the various needs and distinctions in needs between men and women and the ways in which women are ill-served. I expect I really don't have the expertise to do that. But I'm hopeful that during this conference we are going to make some attempts to answer or at least to begin to answer some of those questions.

I would like, however, this morning to make a few observations on the issues that we face. First, I really think it goes without saying -- it's obvious, but nonetheless, very important -- that women's transportation needs are often more complex than men's because their social role is much more complex. A growing number of women are taking on the dual responsibilities of homemaker and wage earner. Today, women make up 42 percent of the labor force, a higher percentage than any time before in our history. Also, women hold a disproportionate number of the lower paying jobs, and that means that they are relatively less able to obtain an automobile or for that matter a place to park it. So women jobholders are much more apt to have to improvise, to depend upon car pools, public transit or walking.

Second, an increasing percent of mothers are in the labor force. More than a third of the women with children under 6 years of age are now working outside the home, compared with fewer than a fourth just a dozen years ago. That means more children must be transported daily to schools, day care centers or to sitters. As we all know, that job, more often than not, falls to the woman.

Even for the married woman without children, daily commuting to an outside job is not as simple as it is for her husband. Odds are that she will be expected to do the marketing, run the errands and prepare the dinner, in addition to her outside job.

Nor are a woman's transportation needs simplified significantly if she does not work outside the home. Any mother of school age children knows, she must also be taxi-driver and courier. These functions are all transportation related tasks that typically do not show up in our transportation data or in the travel profiles on which we base most of our transportation policy decisions.

And finally, more and more women are qualifying for what the IRS calls "head of household". In 1977, there were 7.7 million families where women were the heads of the household and in 56 percent of these cases the women were in the labor force. These women are more likely as a group to have children under 18, to live in central cities and have low incomes and to be transportation disadvantaged. They are in 7 out of 10 cases working at clerical service and operative jobs. They are domestics, cafeteria workers, hospital employees, cashiers and things of that nature. I regret to say that these are the Americans whose transportation needs we really don't know very much about. We can guess with relative accuracy that they are often dependent on public transportation, that much of their job related commuting goes counter to the suburb-to-city traffic of most public transportation systems and that they often travel at inconvenient times.

Most transit schedules serve an 8 to 6 work day, but many service type jobs are performed at night. This is also true of many of the 20 million or so part-time workers, who make up nearly a fifth of the total work force. Many of these people are also women. The number of part-time workers have been growing at about 4 percent a year for the past two decades. And women account for about two-thirds of this increase. There are other questions that trouble us from a public policy point of view. It seems likely, actually it seems inevitable, that with a heightening energy crisis, we will be required to gradually decrease our dependency on the private automobile. But women, as we have seen, are more likely to make multiple stop trips than are men and no form of transportation is better suited to such trips than the private automobile.

How much difference do these circumstances make in the formulation, development and application of transportation policy? Would our transportation systems by modified significantly if we took greater account of women's needs? I really don't know. At present we have almost no way of knowing and that's the point. We should know. Despite all of our studies, analyses and reports that have been done on transportation, we don't have all the answers because we still haven't asked all the right questions.

Too many transportation planning efforts are based upon incomplete or inadequate data. Certainly this is true with regard to data concerning women's travels and travel needs. We cannot develop policy for a rapidly changing world unless our knowledge keeps pace with those changes.

We have called this conference because we have identified a void in our research and we are committed to fill it. During the course of the next three days, we hope that we can get an idea as to the size of this void. At least, and perhaps, a feeling for its most significant areas.

In the end the issue is equality, equality of opportunities, choices and rewards. This conference will offer a challenge to all of us. If we choose to take up this challenge we can make a significant contribution to achieving the equality that we have been seeking. Our transportation system can and will serve men and women equally.

You can help to provide the knowledge to make this possible. I certainly wish you, Dr. Rosenbloom, the very best and most successful of conferences and I will be looking forward very much to seeing the results. The conference has something very significant to contribute to transportation policy and I wish you the best of luck.

Thank you very much.

The Honorable Donna Shalala
Assistant Secretary, Policy Development and Research
U. S. Department of Housing and Urban Development

I am delighted to be here.

My staff wouldn't let me talk about transportation. They decided I didn't know anything about it. So I asked, "Can I tell my funny stories about transportation?" And they said, well, they might want to clear them first. But I wouldn't let them. They can clear my speeches, but not my jokes.

I wanted to tell you about a trip I had taken with Patricia Roberts Harris, the Secretary of the Department of Housing and Urban Development. She had invited me to go along to a speech she was making, and I was sitting there next to her on an airplane going to Cincinnati. The stewardess came running up and said, "I know you, you're someone important. You're a member of the Cabinet." And Pat Harris said, "Yes," shyly. And the stewardess said, "You're Juanita Kreps." Pat Harris said, "No, I'm not Juanita Kreps." And the stewardess said, "Sure, you're Juanita Kreps. You're a member of the President's Cabinet." And Pat Harris, getting irritated, said, "I'm a member of the President's Cabinet, but I am not Juanita Kreps."

The stewardess went off very disgusted and came back once more and tried the Juanita Kreps bit, and again it didn't work. Later, I saw her in the back of the plane talking to one of the Secretary's special assistants,

who was grinning from ear to ear. And the stewardess came tearing back and said, "I got it! I got it! Mrs. Brock Adams, we're delighted to have you on the plane."

I travel a lot but have not spent a lot of time doing research on transportation myself, except I do feel the experience as I'm wandering around. Take the Doctor business. In New York people introduce you as Doctor, mostly because of all the Jewish mothers around, and they use Ph.D.'s the way they use M.D.'s in other places. My secretary at Columbia University knew that the only way to get a decent reservation on American Airlines was to say it was for the doctor. So my tickets always said, "Dr. Shalala." I got on a plane one day and halfway through the ride to San Francisco, the stewardess came up and said, "Dr. Shalala?" I said, "Yes." And she said, "Would you come to the back of the plane?" I walked to the back of the plane and there was an obviously pregnant woman. The stewardess introduced me to the man that was standing there looking at this woman. "This is Dr. Randall," she said. I looked at Dr. Randall and said, "Dr. Randall, mine is in political science, what's yours in?" He said, "OB-Gyn."

It was suggested that I might talk about doing research on women, whether it's women in transportation or women in housing or any of the other areas. So I've called my short talk today "A Cut Called Women."

We've been spending a lot of time in Washington doing policy analysis, urban impact statements, and other kinds of research, taking various kinds of cuts. Someone came to see me the other day about a family

impact statement. I want to tell you that I'm very comfortable with taking these kinds of cuts. It is not simply that the proliferation of interest groups has placed increasing demands on policy makers at all levels of government, particularly those of us who have policy responsibilities. Not only do the demands of particular interest groups justify research, but taking certain cuts opens up whole new interests to us and allows us to look at the implications of certain policy issues in ways in which we didn't look at them before.

So if you ask me as a research scholar myself, but also as someone who manages millions of dollars worth of research, whether we ought to take a "cut called women", there would be no doubt in my mind that we ought to look at that dimension of a problem, no matter what it is. We ought to do it from a substantive point of view, first of all. It's extremely important that our justification is a substantive one. As a feminist, though, I am obviously interested in looking at aspects of problems that affect women, particularly when you look at some of the economic issues that my own department is concerned about.

It is much easier for us to get some consensus and, therefore, get some political movement in areas in which there is widespread interest -- easier than it is with other kinds of issues. Both from a substantive point of view as well as from a feminist point of view, a cut called women makes sense. And I have no problem in mixing the two.

Let me give you an example of this process. We at HUD were and are concerned with expanding the credit opportunities of a whole variety of

people in this country. One specific commitment, of course, is to low- and moderate-income people. But in expanding credit opportunities for people, we had to break out certain groups because they had special kinds of problems. And an example of the process for us in justifying a special cut called women is our own women and credit project. Let me take a few moments today to tell you a little about the women and credit project.

We did not have to go through a lot of pain to decide we ought to take a cut called women on the issue of credit opportunity because it was quite obvious from some studies that we had commissioned in 1975 and in 1976 that there was a lot of sex discrimination in the mortgage market. Our 1975 study, which was a study of sex discrimination in five cities, and our major study in 1976 on women in the mortgage market confirmed that various segments of society had taken some actions, but there continued to be extensive discrimination.

Our current research, for instance, has shown that there has been some response in terms of federal legislation; activities by the executive branch and the regulatory agencies; and some private sector response; creation of women's banks, for example. Even so, there is still much to be done. Just look at the economic potential of women in this country and see how things have changed. There has been a significant increase in the percentage of women working in this country, in the age groups between 16 and 34. In fact, if you look at what the labor force growth has been, three-fifths of the growth in the labor force in this country in the last 25 years is accounted for by women. The total number of women in the labor force today is about 46.8 percent.

In spite of those percentages, in spite of nearly 47 percent of the labor force being made up of women, women are still heavily underrepresented in the mortgage market. If you look at the number of single homeowners under 35 years of age, the number of single females is 11 percent compared to the number of single males at 18 percent. If you look at our own FHA mortgage program and the number of mortgages that have been granted to unmarried women, it is 7 percent, compared to the number of mortgages granted to unmarried men which is 2 percent higher at 9 percent. But more importantly, the FHA mortgage program is operating really for married couples, with the husband as the major earner.

Now, is this happening simply because married people tend to buy houses or because there is some concern about the availability of credit? Well, some evidence exists -- and we are documenting this in our own research -- that lender discrimination, despite the passage of a number of laws, is still lingering. In our own surveys of the savings and loans in this country, we found that single women had to present a stronger paper position than single men, that women's credit histories were more closely scrutinized than those of men, that the traditional underwriting criteria utilized more discrimination, that most people believed that women were poorer credit risks than men and that they had only a temporary attachment to the labor force, despite all the data that might show otherwise.

Our women in the mortgage market study in 1976, for example, told us that lenders and mortgage-insuring agencies were reluctant to lend single women money to buy a house or to give full credit to married women's income, which was the other problem we ran into.

In addition to that, there was evidence that suggested that women themselves were reluctant to secure mortgage credit, a set of attitudes that they had been born and brought up with, and that they lacked education and experience in the mortgage market. So after looking at what data was available and after assuming that our interest was in expanding credit opportunities for a variety of people, it was clear that there were special kinds of problems that surrounded women borrowers. We saw there was a need for a special program at HUD, a combination for us of research and action, which is something that we like to combine when we have a base amount of research already done. The role of our new women in credit program would be to fill gaps, not to overlap.

First, we surveyed what other federal government departments are doing in this area. The Federal Home Loan Bank Board, for example, has an education program in 20 cities. Our own department's Equal Opportunity Consumer Program has an activity in five cities. And there is an enormous amount of material that has been passed out by the FTC and the Federal Deposit Insurance Corporation. So, there has been some work done by existing federal agencies.

So to fill the gaps we decided to look at the extent to which sex discrimination practices continue to exist since our earlier studies, and to look at the housing conditions of female heads of households and the size of the market that they represent for alternative mortgage instruments.

In addition to that, we saw a need to redo a whole set of actuarial tables and to do a lot of work in the education area. So it's a

question of doing some original new research and translating some research that's already been done so it can be used by others around the country.

The education campaign, from our point of view, ought to include a lender component, so we can work through existing and recognized lender associations and communicate the results of our research. It ought to include a consumer component. And we also ought to be working directly in the Department, with the Executive Branch, with the regulatory agencies, with the private sector, consumer education programs, to fill gaps or to expand coverage.

This should give you a sense of what happens when another Department looks at an aspect of a problem, breaks out what we call "the cut called women," and then builds a research, a demonstration, and an expanded educational campaign around that activity. We think it makes sense. It makes sense from a substantive point of view when you look at the issue of credit-worthiness and compare that to the availability of credit for certain groups of people. We think it makes sense to break out that piece to do separate research on and then to run with the findings and to move the field. To us it makes sense from a substantive point of view as well as from a political point of view because it gives us an opportunity to move a field along much faster than it ordinarily would be moved along.

Now, obviously, my commitment to this is both as a researcher and as a woman, but I would suggest to you that there is going to be more of this

kind of activity in this administration. My colleague, Sara Weddington, the special assistant to the President, has informally, if not yet formally, announced to many of the women in the Administration that it is her intention that we not only work on the ERA campaign and develop a strategy for the Carter Administration in that area, not only worry about appointments for women in the Administration, but that we also begin to look at some of the economic issues that concern women.

So I suggest to you that it will not only be women in Transportation and women in HUD who will be looking at these issues. Throughout the Administration, we can expect some movement and some research that will make a difference and add some sensitivity to the kinds of programs that the federal government provides. You'll see people throughout government -- including some of those other people who have some cruder instruments that have more of an impact -- take some cuts from a research point of view, as well as from an action point of view, to get this government moving in a much more sensitive direction than it has before. Our commitment as researchers to taking a cut called women will extend across the government. It's our hope. And remember, it makes sense, both from a substantive and a political point of view.

I thank you for inviting me here. It's always nice to join with my colleagues in Transportation to take a fresh look at some issues that we share a joint concern, and I'm delighted that you all came today to be with us.

Thank you very much.

MS. O'LEARY: Donna has a few minutes if any of you have any questions.

SPEAKER: I have a question. I'm buying a home and I picked up some FHA papers the other day from the bank and I was quite shocked when I got home to find that the front cover asks if I were married and asks me what are my birth control procedures. I was quite shocked. I didn't think that was legal to ask that.

DR. SHALALA: It certainly is not legal to ask that. Would you send me a copy of that?

SPEAKER: The Veteran's Administration does it, too.

DR. SHALALA: It's incredible. I'd be happy to check into that. I thought we had cleaned up most of those pieces of paper. They could have some old copies around. We had gone through --

SPEAKER: It was right in front of my very eyes. I didn't notice it until I got home.

DR. SHALALA: I'll check that when I get back. We had gone through and pretty much cleaned up a lot of the kinds of things like that the Department was sending out.

SPEAKER: The attachment is not actually a government form -- it's an attachment that they have stapled on the front.

DR. SHALALA: Send it to me directly. But I will do a quick runaround. Are you from Washington?

SPEAKER: No, I'm from New York City.

DR. SHALALA: We'll do a runaround and see if that is still going on. One of the things we did when we came to HUD was to look at a number of information materials that the Department puts out. In fact, we do have a lot of survey stuff going on that pretty much cleans up all of our documents. That could be an old one or one that we haven't caught, or it could be the lender himself who is adding that on top. And it certainly is against the law.

One of the joys of being in HUD came when I went to get a mortgage. They discriminated the other way. I had geared myself up and I had consulted with all of my economists on what kind of interest rate I had to pay and I consulted with the Assistant Secretary for Housing. It took five minutes to get my mortgage.

MR. LERMAN: I had a question that I really wanted to ask very much -- political question. Let us suppose that some group in the population, let's say white Jewish college professors --

DR. SHALALA: Male?

MR. LERMAN: -- that that group argues that it has been discriminated against in the mortgage market and that research had been undertaken and it has been proven to be true, but it was also proven to be true that white, Jewish, college professors, male, also had a habit of defaulting on loans and that they are in fact worse risks. --

DR. SHALALA: But it's not a conflict for us. You see, one of the things that our research on women showed was that they were good risks and that in fact some were better risks than men. When we are insuring the risk, where there is a higher percentage of risk among low-income people, obviously we are asking people to take some risk in that group. But in the wider credit issue, which has to do with basically middle-income and upper-middle-income people going into the mortgage market, where the discrimination is because of sex or because of race, we are simply saying -- and the law says -- that you can't discriminate on those grounds. The EEO person from DOT knows far more than I do on this issue. I'm not saying you are not allowed to turn people down if they as individuals have demonstrated something in their background that makes you think they can't bear the loan, one way or another. But you can't discriminate according to sex just because of the sex. That's the issue involved. And, in fact, the research has shown in a number of groups that women are much better credit risks than males in the same categories. The problem here is that you had widespread discrimination going on just because they were female, not because there was any history of defaulting.

It's the same thing I ran into at the Maxwell School -- the very distinguished school of public administration. My first week there I walked up to the chairman of my department, not the present Chairman of the Civil Service Commission -- he was not chairman of my department at the time. And the guy said to me that he wouldn't help me get a fellowship because I was a woman and women never finished their graduate

degrees. And I said where's your data and he didn't have any data. I said you can't do that -- it's against the law to do that.

MR. LERMAN: -- it's against the law and why do you need research. It seems to me irrelevant if the law states that you can't discriminate on the grounds of sex --

DR. SHALALA: We need the research to develop strategy. For us, it is in part knowing where to leverage our equal opportunity strategies. We are doing this in a number of areas in housing discrimination generally, for example. We need to know at what point the discrimination takes place and the form in which it takes place so that we can structure the Department's activities in this regard. In this case, we know that we need not only a widespread education campaign for the borrower, but we need to get to the lenders. The lenders need to be reeducated. In our wider housing discrimination work, for example, which is focused on blacks as opposed to women, we know that there are a set of things that happen to black people when they go to a real estate agent to look for a house to buy or to rent. And we are looking at those kinds of behaviors to see if there is something that we can do in terms of the Department's own EEO activities.

At the government level, it is an attempt to find strategies to be responsive to these kinds of issues.

Any other questions, abstract or otherwise? That wasn't very abstract.

MR. WACHS: We heard this morning that women are found disproportionately among public transit users and we heard from you that there is a

problem of discrimination for credit with respect to housing. I'm wondering now, the obvious connection insofar as transportation is have you investigated whether there is any similar discrimination with respect to automobile loans. Is that something that has been systematically researched?

DR. SHALALA: We have not. Transportation might have something on that. We have not. We have some scattered information on credit in general. Our focus has been on the mortgage market.

You see, there is a difference between the long term and the short term in market behavior. By market, I'm generalizing about the banks in this country -- the market is more likely to give short term than long term, and heavy discrimination has been found more in the longer term than in the shorter term market. The interest rates are so high on short-term automobile loans that they may have built in some risk and things, but I don't know specifically about that category.

I had trouble getting a car, as a matter of fact. I could get a house, but I couldn't get a car when I got to town. I had been living in New York for the last seven years and I hadn't owned a car -- had never owned a car, except when I was in graduate school. Where, like everyone else, I had a car which my parents insured. It was really in their name. So I arrived in Washington for this $50,000-a-year assistant secretary's job and went to buy a car. And I couldn't get insurance because I had no previous record of insurance. So I called the Federal Insurance -- I mean, the one advantage of being an assistant secretary,

you can call the Federal Insurance Administrator and ask about the problem. And he said that it was an area in which he was sure I would want to do research in the future, but he thought it might be easier if he just gave me the name of his agent.

MS. O'LEARY: Thank you very much, Donna.

This is probably the last time I will be in front of a microphone when I know that Sandy Rosenbloom is around and I really would like to take this opportunity to thank her publicly for all that she has done to put this conference together, the hard work. It was her idea initially and she has followed it up with lots of hard work and I think she deserves a hearty round of applause.

My final announcement is that the sessions this afternoon will begin at 2:45 P.M. Session 1 on Household Characteristics in Residential Location will be in Room 150 and Session 2, Household Responsibilities and Trip Tours will be in the Lecture Room.

Thank you all.

(Thereupon, the luncheon meeting was concluded at 2:16 P.M.)

Ellen Feingold

Director of Civil Rights

U. S. Department of Transportation

I'm Ellen Feingold. I'm the Director of Civil Rights for the Department of Transportation, and this conference is an event that gives me much joy and pleasure.

I grew up in what must now be considered the golden age and place of public transportation in the United States, Manhattan. When I was a child, there were five north-south transportation lines and two east-west transportation lines within three blocks of my house, all of them available for a nickel. When our parents wouldn't give us a nickel, we went out in the alleyways behind our houses and collected returnable bottles. Five returnable bottles got you a dime, and you could go wherever you wanted to go and back. Most of us could read and count by the time we were seven, and we had the entire city of New York at our disposal. So did adult men and women and so did the elderly. Perhaps, not the handicapped, but New York at that time was a place where general mobility was the rule, not the exception. I submit to you it's been all downhill ever since.

Our department is trying its best to recreate the joys of the thirties and the forties for public transportationusers in this country. My office is concerned with two basic transportation issues. The first is employment in the transportation industry, in government, and in the private sector. One of the things that gives me great pleasure at this meeting is to see so many of you women who are clearly non-conventional workers in the transportation area.

The other aspect of my office's business is equity in transportation services. When I arrived, there was a study that had been done by a task force appointed by Secretary Coleman, as a function of International Women's Year, to look into the ways in which our Department impacted on women. One of the things that the task force reported--no surprise to this group--was that the services paid for and provided by our Department ignored totally any particular needs that women might have and, therefore, served women poorly. When Sandi arrived on the scene, she was interested in documenting these needs. Nothing could have pleased me more than to have Sandra Rosenbloom arrive at the Department of Transportation at the time that she has.

Now, I realize that every speaker so far has asked you to applaud Sandi, but I refuse to be exempted from that, because for me, her arrival was a particular pleasure. It has been a privilege to work with her and support her efforts for this conference. Once again, let us all praise Sandi, please.

I hope all of you who are gathered here today will be developing relationships and networks that you will keep. We must begin to build a body of knowledge, a body of data which will support the efforts of the Department to provide equitable service on the basis of sex as well as on the basis of race and age and handicap.

Several people have asked me about the decision our office issued a couple of weeks ago finding that the Connecticut Department of Transportation was in non-compliance with civil rights laws in its provision of public transportation services to the minority community of Hartford. This is an issue we are looking at much more stringently now, the notion

that providing mobility is the basic mandate of a public transportation agency and that mobility must be provided equitably. Those people who are dependent for their transportation and their mobility on services that are provided with our funds, must be served equitably.

Obviously, the Department has other mandates as well. We're interested in the conservation of energy. We're interested in the reduction of congestion and the reduction of air pollution. But our first mandate is the provision of transportation services and mobility, and it is my office's responsibility to see that these are provided equitably to all people.

Somebody said to me today that one of the problems with a conference of this sort is that what we're doing here is trying to figure out ways in which the trasnportation systems can make up for the failures of other planning systems. Donna Shalala, in her wonderful presentation today about the problems of credit for women, did not follow through with the linkage to transportation issues. If women can't live wherever they choose to live, their mobility is clearly limited. If transportation services do not serve them, it is, in fact, a function of their lack of residential choice. Other elements of women's mobility constraints will come up on the course of this conference that relate in the same way.

Let me introduce to you the head table. You have already met some of the head table guests who have participated earlier today; others will be participating tonight or tomorrow, and still others are supporters of this conference although not direct participants in it. Let me start with Dr. David Rubin who is the Chief of the Urban and Regional Research Division of the Transportation Systems Center of the Department of Trans-

portation in Cambridge, Massachusetts. Dr. Rubin was a member of the Converence Steering Committee. Next to him is Dr. Steven Lerman who was the Chair of Session Two this afternoon. He is Associate Professor of Civil Engineering at MIT. Next to him is Diane Liff who is the Assistant Counsel for Litigation in the Department of Transportation. Diane is from Columbus, Ohio, where she was the General Counsel to the Ohio Public Utilities Company, and she brings to the department a wide range of information and expertise and a real commitment to the kind of work that's going on here today.

Most of you met Linda Smith at lunch. She is the Director of the Executive Secretariat of the Department of Transportation, and again, a person who has supported this Conference through all of the planning and implementation phases.

Next is Mort Downey who is the Assistant Secretary for Budget and Program of the Department of Transportation, another person with an ongoing interest in this Conference, who did not need to be persuaded that there really were some problems that women had with regard to transportation services, and that the Conference was indeed a serious effort. Next is Martin Wachs, Professor of Urban Planning at the University of California at Los Angeles, and who will chair a session tomorrow on the travel behavior of selected market segments.

And finally, Wilbur Williams, without whom I don't think the Conference would have been possible. Wilbur is from the Office of University Research of the Department of Transportation and has been a constant pillar of strength.

I don't know how much has been reported about the kinds of obstacles that one faces when asking the question: do women have different transportation needs? I'm sure all of you who are in the field have encountered the snickers and the disbelief at the idea that this is a serious field of endeavor. But I think you ought to know that at one point Senator Proxmire's staff considered awarding this Conference the Fleece of the Month Award. You are all here to bear witness that this is a serious endeavor and not a fleece of the American taxpayer. But there were people on Senator Proxmire's staff who needed to be persuaded that this was a legitimate area for research and that the issues aren't either too obvious to deserve any attention or too ridiculous to be worthy of any attention.

Our guest speaker, Adriana Gianturco, is the Director of the California Department of Transportation, CALTRANS. As chief of CALTRANS which is the state's largest department, she's responsible for directing California's efforts to plan and implement a vast network that will most efficiently move its people and goods over all of available facilities. She is responsible for 16,000 miles of highways. That number boggles the mind of those of us who come from smaller states. Her department is in charge of mass transportation, transportation planning and aeronautics. The last time I talked with Adriana she was reeling from the effort to try and deal with busways on the Los Angeles freeways, and the attempt to combine the notion of mass transit with the Californian's notion of individual freedoms on the highway.

Before Adriana went to California she was Director of the Office of State Planning in Massachusetts involved in the study of Boston's

southeast expressway. For five years before that, she was the Director of Planning and Evaluation for Action for Boston Community Development, Boston's OEO agency, and earlier still, a reporter for Time magazine where she wrote stories on both the European economy and transportation. Adriana has a vested and personal interest in transportation systems. While in Massachusetts she married a good friend of mine who still lives in Massachusetts, and I presume that they are both frequent users of the transcontinental transportation system. I give you Adriana Gianturco, the Director of CALTRANS.

The Honorable Karl Bowers, Administrator
Federal Highway Administration
U. S. Department of Transportation

DR. DAVID GENDELL: Before we get started on the Plenary Session for this afternoon, on assessing current transportation planning methodologies, we have a welcome surprise for you; Federal Highway Administrator, Karl Bowers, is showing his support for this conference. He is able to join us this afternoon, and it gives me great pleasure to welcome Mr. Bowers.

MR. BOWERS: Thank you very much. I bet some of you thought the surprise was that he was going to adjourn and let you go home. I won't take very long. I did just want to take a minute and come over and tell you how pleased we are to participate and cooperate with this first conference -- hopefully, in a number of many -- to define and emphasize the importance of women in transportation and in travel.

One of the things I found, even when I was with the State Highway Department in South Carolina, is that we sterotyped our women. We confined them to roles that didn't use their abilities to their fullest extent.

I have never taken the feminist position that I have been accused of, but I just felt like that we as an agency weren't getting the most out of our employees. When I found out when I first came to the Federal Highway Administration that we had a women's program and that we had women in travel, women in transportation, and we had a women's

coordinator and a women's counselor to make suggestions and recommendations, I became very interested in these activities. I have been very supportive of them, and I will continue to be.

One of the things that I would like to see us as an agency do, the whole transportation industry, but FHWA as an agency, is to get more women in professional and in really meaningful and supportive positions, as opposed to the ones that they have historically been confined to.

I found out when we went down to the Women's Engineering Conference in Atlanta last month, that out of 25,000, almost 26,000 engineers, Professional Engineers, only 25 are women. And that is really not enough to make any significant impact whatsoever. Women engineers are available, and so the old adage of "They're not out there, and we can't find them" is just sort of a copout. And I know, because I saw them there, and they had 400 or 500 engineering students.

We are going to set up sort of a goal for ourselves internally to try to increase our own in-house percentage of women in responsible positions, so that then when we go out and say, "Why don't you do better?" they won't be able to turn around on us and say, "Well, why haven't you done better already?"

We really are interested in this. I know that you are breaking some new ground, and I know that you are trying to come up with some suggestions, and you have had a number of influential speakers and women who are already in important places, and so I am anxious to see the results of this conference. And maybe next year, or whenever we get back

together again, we can look back and we can see what kind of progress we have made.

So I appreciate the opportunity to come over and visit with you for just a minute and wish you well. Thank you very much.

Adriana Gianturco, Director

California Department of Transportation

I'm very happy, of course, to participate in this conference. I certainly think that the subject is a very important one, and it's very clear to me that it has not received enough attention in the past. Although there hasn't been a great deal of systematic research into women's travel behavior, I think it's pretty obvious that there are in fact, a lot of distinctive features about the way women travel and their attitudes towards transportation. Obviously, these ought to be brought to the public consciousness, and particularly, ought to enter into public decision making.

Now, what I want to do in my remarks is briefly to go over some of the things that I think are important about the way women travel, or behave in general, and the factors that affect behavior. I understand you're going into all this in much greater depth with your speakers and all the research papers that are being presented. So, I would like to spend some time looking at the policy implications of these behavior patterns as I see them.

I'd like to start off by saying that I'm approaching this whole subject not from the perspective of a researcher, which I am not, but rather from the perspective of a person administering a large transportation agency, an operating agency. And from that perspective, I'd want to make a couple of points that I think need to be made right off the bat.

First of all, in my daily experience in my job I'm exposed to what I consider to be a very broad range of interest groups who have axes to

grind, who are asking for things. I'm obviously at the center of a large number of policy debates that go on in the state about what ought to be happening in transportation, and from my observations I would have to say honestly that the issue of women's travel needs is simply not an issue. And what I mean by that is, it is not part of the public agenda as are, for example, the transportation needs of the handicapped, or transportation's impact on the environment, or any one of a number of subject areas in transportation where lines have been drawn, positions have been taken, newspaper stories written, laws and regulations passed and so on. In California, anyway, and this may not be true in other states, but I suspect it is, women's travel behavior is not a subject. The problems associated with women's travel needs is not a subject where positions have been taken or proposals made or choices articulated and surfaced and argued and then actions taken.

I myself, am not aware of any organized constituent groups around women's transportation issues. In California of course, there are women's groups pushing various issues, but transportation is not one of them. And of course, in the public sector itself in our state, and again I suspect this is pretty much true for other states, the public transportation agencies, which are concerned with transportation, are themselves very heavily dominated by males. It has not been my observation that they are particularly sensitive to the needs of women, or that they think that sex makes any difference in the kinds of things that ought to be done.

I think it's quite striking what happened in Mexico City very recently

when the public agency concerned with transit there segregated the subway trains by sex. There was apparently a problem there, an issue thought to be a problem entered into the public consciousness and a solution (whether or not it was a correct one) was selected and something was done and action was taken. From the little I know about this, it seems it's producing a lot of mixed results. On the one hand, the fanny pinching is down, which is what it was supposed to handle; on the other hand, there have been some bad effects. Members of families are being split up as they get on the subway, and some members of the family are inevitably getting lost, and they don't get back together. The trains are being delayed, because the police are hauling the men off the train when they're going on the women-only trains and so on. I think we can make one observation and that is that if we do assume that women's travel needs are somehow special, or there are particular features to it that demand some kind of attention, it's not always obvious what the solution is. The solution may have some effects that are not thought of initially. Of course, that's nothing unique to this field. That's true in public policy in general; in dealing with one problem you may create another problem.

I'd like to turn now to some of the features of women's travel behavior which I think have been pretty well documented, and maybe if they haven't, I hope that one of the things that will come out of this conference is more documentation of the kinds of things that I want to mention.

I think it's pretty well accepted that women travel fewer miles and less often than men do, that they tend to work closer to home, that they have

less money to spend for transportation, because they have lower wages. On the average women get 60 percent of the pay attained by men for comparable work. Women have lower rates of auto ownership than men do, and they tend to use transit more than men do. It also seems, and there have been studies on this certainly, that women are more concerned with personal security in transportation that men are, and I don't think that this concern is limited to transit which is where it's usually brought up. I think it applies also to use of the automobile. Women are reluctant to drive in remote areas or at night, or to park far away from wherever it is they're trying to get. If they have to walk to get there, again at night, a lot of women are afraid to walk. This is something that women face that many men do not.

Women more often than men act as chauffeurs for other people, particularly for kids. At the same time, I think that women in general are probably less interested than men in being the actual driver in a car. Some of the studies that we've done seem to indicate that women are more accepting of car pooling than men are, particularly if they don't have to do the driving. They're happy to have somebody else drive.

Working women still spend more time than working men on activities associated with the household, particularly child care and shopping, and that means they tend to make a lot of those trips frequently in conjunction with work trips.

When we look at the future it seems to me that the single most important thing that's likely to affect women's travel behavior in the future is the continued trend towards more labor force participation. And, associ-

ated with that, changes in the relative roles of men and women in the household which will in turn have an effect on non-work related trips, shopping, chaffeuring the kids and so on.

I think that there are a lot of kinds of things that you can lay out along these lines; there's a lot of work to be done and more data to be collected and to be analyzed. I think, though, that the real problem is drawing some conclusions from these kinds of facts, assuming they are facts, and trying to figure out what, if anything, are the policy implications of all this. And I personally find this a very difficult thing to do. I think that the question is, should we in government be doing something different from what we're doing as a result of what we learned about this, or are these problems so intermingled with other problems that it is impossible to treat them directly? I don't know what the answer to that question is, but I think it's something we really ought to look at. I want to go through a couple of examples. I think when you try to really think about these things they become very complicated. There are so many variables involved that it is very difficult to single out a single one and say that it is the problem, and that the problem in turn demands a solution.

The trend towards more female employment raises a question, and maybe it can be answered by some kind of very clever and elegant research as to what modal split we can expect as a result of more women working. And once we have determined that, or have been able to make some kind of predictions, to try to decide what we should be doing about it if anything. The question again is, "if anything." I think that you could

assume that if more women work in higher paid jobs then those women will be making more individual auto trips. If you associate income with auto ownership and auto use, then more jobs, more money means more auto use. And it would also mean conceivably more auto use in peak hours which is the time that we have the worse congestion, of course; I think that just about everybody would agree that more peak hour congestion is something that is not publicly desirable. So, if that were the effect, we'd probably want to try to do something about it. However, it could also mean more shared riding with husbands and wives driving in the same cars, and finally it could mean more use of public transit. If there is some inclination above and beyond the inclination associated with income for women to ride transit, then more employment of women would mean more work trips by women on transit. I think that we need to develop some kind of data or models that will help us predict what the outcomes are likely to be. Then, after we've done that, we need to try to think through what do we do about it. Again, the question is, do we do anything or is the outcome acceptable?

Another example is shared riding, another policy issue entirely. I think it might be worthwhile to look at the concept of reserved lanes, something we've been very interested in in California, and how they affect women. I think that a point could probably be made that somehow reserved lanes discriminate against women. And the argument would be that working women are more likely than men to need to make stops on their way home, because they have to do shopping or pick up kids or whatever, and that therefore, it's more difficult for them to take advantage of reserved lanes, and therefore, reserved lanes discriminate

against women. I personally would disagree with the conclusion that HOV lanes discriminate against women even if we were able to demonstrate that women indeed have more trouble carpooling than men because of these other trips that they have to make. I think that everybody benefits if a certain segment of the population carpools, and so, even if women aren't carpooling, if men are, the women are better off. But I think that that subject needs to be looked at. There are probably a lot of other similar subjects that have real implications for what governmental decision makers are going to do.

Another better question is the effects that greater female participation in the labor force are likely to have on land use, and whether they are likely to be significant. And land use in turn influences the viability of different methods of transportation so it should have some effect on what we do in transportation. But again, it's very hard to try to pin down what the effects are likely to be. It seems to me that there could be two opposite effects or two logical possibilities. If the outcome of having more families with two wage earners is higher incomes, it might encourage more suburbanization, because higher income people tend to live further from their jobs.

On the other hand, the impact could be exactly the opposite if the tradeoff that people make is between the time spent in commuting and the attractiveness or whatever of the location. If you had to count the price paid by two people to live far away from a job location the net result might be that people would tend to live closer to the job. This would have effect of urban compaction which in turn would be a

better situation for providing transit. That has the spillover effect of creating networks that can be used by people on trips other than home to work, for example, teenagers, and it would relieve women of the burden of driving the kids around. I guess the point I'm trying to make here is that there's so many threads to all these things, and they connect up in so many different ways. It is very difficult to trace through what the impact of any one of these things is in terms of its final results, and what that says about public decision making.

Another subject that I think personally is an interesting one is the whole issue of using the automobile as a family taxi which, of course, has two effects. One is the burden that it places on the person that's driving the taxi, namely the housewife or the mother, and secondly maybe less obviously is from the perspective of energy use. We spend a lot of time in California worrying about the fantastic usage of energy resulting from the single occupant automobile being used on home to work trips. There's very little attention given to the fact that in a chauffeur type situation the person that's driving the car is probably driving alone for a significant portion of the trip, and that there are miles and miles driven under those circumstances not in pool situations at all.

I'd like to conclude my remarks by saying I think there is a lot of research that needs to be done in the area of women in transportation. But my problem is that I think also that the questions need to be very carefully formulated so that we don't waste a lot of time looking into things that don't make any difference, and I speak here from the point

of view of again an agency administrator. There are kinds of information that are interesting to have, but if there's nothing you can do with it, or it doesn't lead to any conclusion or any logical choices, it's academically an interesting exercise, but is unlikely to have any impact on the real world. I would prefer to see the questions formulated to be the kinds of questions such that the answers that we get will provide some kind of guidance to public decision makers.

I also think that the more information we have the better, but there is another crucial aspect of this as I mentioned before, and that is that we need some constituencies. And I don't think that it's enough to say that 51 percent of the population are women and therefore, there's a constituency there. There needs to be more specific constituencies around specific issues, and there needs to be information developed that helps those constituencies. The fact of the matter is that our government doesn't do very much unless somebody is asking it to do something. And with that I'd like to thank you and conclude my remarks.

MS. FEINGOLD: Thank you very much Adriana. We have a little time left, and I'm sure if those of you have questions, Adriana would be happy to answer them.

MR. GURIN: Can you see ways to opening up the political decision making process so that it involves more women and more of their perspectives and concerns -- bringing women's organizations into transportation?

MS GIANTURCO: I would say that in California the process is pretty notable. We've spent a lot of time beating the bushes trying to get women

to come in and give us their perspectives on all kinds of subjects, and we have not heard from women's groups. Just as a fact, we haven't. And I've heard from women's groups on other issues having to do with the form of transportation. That seems to the thing that people are most concerned about, that agencies involved in transportation should have women in affirmative kinds of things. But in terms of any kind of public demand, that particular issues that affect women be addressed, I haven't heard at all. And I think I would have if there were interests out there. I don't mean that there is no interest, but that it is not organized.

DR. RUBIN: On the same theme, are you saying that you feel there is a problem that people don't perceive? Or, is the point to determine whether there is a problem?

MS. GIANTURCO: Well, I guess both. I personally know that I don't want to sit at a bus stop late at night, if the place is not well lighted and there are a lot of other people around. But can we connect that up and say that that is a problem for women in general? Do women recognize that that is a problem and are they willing to put forth the effort to try to do something about it? Once the problem's been identified there is a way to get action on it. It could start with a newspaper writing an article on safety, and then all of a sudden people start thinking about it, and some kind of interest starts to get generated. The first thing you know there are groups demanding something. Actually, it could start in any one of a number of ways, but I haven't seen it actually come to that outcome, not in California. Again, I would be interested to know

if that's happened any place else in the country where there are groups organized.

I take it there are other organized segments of transportation; the environmental constituency is highly organized, contractors, cement mixers and developers are interested in transportation. Segments of the population are highly interested in it; the handicapped see it as something that has a major impact on their lives and they are willing to spend time which is a necessary ingredient here. I don't think that you can expect public agencies to act out although they ought to.

The way most public agencies catch on, is there is some outside party or some group that thinks there's a problem, and that's brought to the attention of government. Anyway, that's my perspective. I could be all wrong, but from my experience in government I think that's the way it's generally worked.

DR. RUBIN: The study that you alluded to earlier on, the International Women's Year had a recommendation in there which really hasn't been pursued in federal programs. I wonder in California's case whether there isn't perhaps the responsibility of the state agency to crank into local decision making an explicit review on women's travel needs when they do their local planning so that the issue becomes feasible to discuss politically with a data base. We may be perpetuating the lack of politicizing by not requiring communities in their assessments to take a look at either women's travel needs or whether women are included in making decisions.

MS. GIANTURCO: I think that's an important point.

MS. MIDDLETON: Sue Middleton; Census Bureau, Travel Survey Branch. I wanted to raise a question which I haven't heard discussed here this evening -- and that's in regard to women being allowed to occupy certain positions in the labor force that were previously reserved for men -- such as bus drivers, taxi cab drivers. In this kind of position you're exposing yourself to all sorts of dangers. I know you have a problem in California, but a few months ago a female bus driver was abducted in Washington, D. C. The only way they got D. C. to respond and even begin plannning for some sort of safety mechanisms on the bus or for the women drivers was a result of a boycott by the bus drivers, all male and female bus drivers.

MS. GIANTURCO: I can't think of any instances like that that I've heard of, although I'm sure they happen, particularly with women taxi cab drivers. I think that the point that you made in describing that situation that there was a boycott, is probably the thing that elicits some kind of action. Lots of things happen all the time, but nobody ever hears about them. Unless there's some organized way of bringing it to somebody's attention, probably nothing will be done about it.

MS. LIFF: I wanted to ask the speaker about the public policy ramifications and consequences of making some decisions for groups of travelers. I heard you say, and I think it's probably true, that in responding to the legitimate needs of a segment of the public, we may be in a situation where we would decide that the greater needs of the larger number of people in the public could not accommodate that kind of situation. That

may militate against some unique solution to the transportation problems women perceive, because the solution will either be too expensive or too inconvenient or unable to be accommodated in terms of the larger public.

MS. GIANTURCO: While I'm sure that's going to happen, we're not even at the stage where the issue is being raised so it could be costed out, and you can see what's on the other side and finally make a decision on it. Take, for example, the handicapped and the blind. If you make a bus that's better for the handicapped, the blind don't like it. So, a decision has to be made, but at least that issue is at the stage where you know that the handicapped want one thing and presumably are going to benefit from it, and the blind want something else, and you can make those kinds of decisions. But the issue has to get to the level where you identify those two needs and you know what each side wants, and then you can make the tradeoff and make a final decision. And I don't think we are there at that point with the transportation issues associated with women. I think we are in other states, but we sure aren't in California.

Lillian C. Liburdi

Associate Administrator for Policy and Program Development

Urban Mass Transportation Administration

It is a pleasure to be here, and I am doubly pleased because it is a comfortable audience to be with.

I want to start off by extending to you the Administrator of UMTA's support of this conference. Dick Page regretted deeply that he was not able to attend any of the sessions. I hope you understand; he is right now still involved in the DOT-HEW 504 hearings that are underway. These hearings are very important to us, because they mean a significant amount to the UMTA program, whatever it is that we finally determine as a result of these hearings.

And also, I think, as Ed Scott and others know from DOT, we are right on the verge of a breakthrough on our legislation. We are hopeful that it will be coming up in both houses of Congress this week. We have been negotiating and we are hopeful that we are going to have a piece of legislation that will allow us to move forward.

As suggested to you, I am a very recent appointee. I was just sworn in last Wednesday. I had, prior to that, spent about six weeks as a consultant to the Administrator, getting a little on-the-job-training so that I would understand what the Office of Policy and Program Development was about and freshen up my thinking on some things with which UMTA has been involved.

I have had only the opportunity to review briefly some of the comments that were made about the discussions over the last day and a half, and what you are looking forward to in the rest of your program. I also had the opportunity to review Mr. Butchman's remarks and some of the papers that were presented yesterday. And I have been very fortunate, I think, in having had the opportunity recently to spend some time with Sandra Rosenbloom. Sandi and I, I guess got acquainted with one another a few years ago and had the opportunity about a month and a half ago to renew that acquaintance. I think from those discussions and from what I have seen and heard about this program, that she and the Steering Committee have done an excellent job for you. I know that while she doesn't want to be recognized too frequently or too much, I think she does deserve recognition.

I hope you are not looking forward to a lot of factual information tonight, but I do want to offer you some thoughts from a newcomer's perspective to the UMTA organization, and thoughts as a woman who is concerned about your public transportation.

I want to start off with two quotes that I think are appropriate. I hope you will see, as I get into the discussion, why I think they are appropriate. One is from an old communist organization, Sources of Chinese Tradition, which advises us that "The pulse of modern life is economic," and that "The fundamental principle of economic production is individual independence." The other is by Secretary Adams -- and there is nothing meant by linking those two quotes together, other than that I think they are meaningful -- from the Statement on Transportation

Policy for a Changing America that was issued this past February. In it he said that "Federal transportation policies profoundly affect the lives and fortunes of all Americans," and that "Transportation is a fundamental, indeed an essential part of our country's economic life, of our individual lives, and of our family and social lives. It is our life stream."

Individual independence and life stream. I think those are two very interesting concepts, both related back to the economic base that they derive from. How do we, the women of this country, achieve individual independence without the necessary life stream, the transportation services that can give us the foundation to support our skills, our intelligence, our hard work and own desire to achieve whatever it is that we are desiring to achieve, whatever that objective is?

As I said a few minutes ago, I think you have had enough facts for the last day and a half. I think they are important, and I think that it is important for you to hear the results of the planning and research that has been undertaken. I am sure that you have been persuaded by the information you have received to date that there are different positions one can take on every issue and on every facet of an issue that is presented and raised for your inspection. But I think you are also persuaded -- or I hope that you are -- there is much more that we need to do. I think there is much more we need to do in planning, there is much more we need to do in research, but most of all, there is much more that we need to do -- and I am recognizing this -- in adjusting and viewing and considering the policy decisions that we make on every

level in terms of our transportation program and the implementation of that program.

I am encouraged by a conference like this. UMTA is about to have a conference in November that is sponsored by the UMTA Office of Technology and Development and Deployment which will focus on hardware-oriented research priorities. Certainly that is a perfect opportunity to feed in some of the issues and questions that might evolve from your conversations. Also, it is almost ironic that tomorrow morning I am going to be in Trenton to talk to the Commissioner of Transportation there, Lou Gambacini, who is chairing a Policy Research Conference that UMTA will be sponsoring next spring. He and I are meeting tomorrow to talk about the issues that we want that conference to focus on and the papers that we want to have written for that conference.

Hopefully tomorrow in your workshops, you will be able to develop suggestions that Sandi and the Steering Committee can communicate in a more formal way to me, so that I can buy those papers, and they will be useful to us.

I want to communicate to you that I think that the decision-makers at every level, federal, state, local, whether they are transportation program oriented directly or indirectly, may be making decisions that impact women. You and I who are the affected citizens have to be able to recognize when it is necessary to make policy corrections and what those policy corrections should achieve.

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we will go as a result of my participation in the UMTA program activities. I thought I would frame that series of thoughts by going through with you the three questions that the Report to the National Commission on the Observance of International Women's Year, which was prepared by members of the Department of Transportation, issued in 1976, raised.

The first question was, how do investments in transportation facilities impact differently on men and women? You have heard, from the Federal Highway representatives and others, the results of some of the work that we have under way in the Department assessing the impacts of our program commitments. They don't necessarily take the program impacts and relate them eventually to the policy decisions or the impacts of those decisions, but I hope we will get to that point. But we have undertaken a national study of the elderly and handicapped transportation market.

That study reveals a significant amount of information about the nature of the market. I am not going to share statistics with you, but the major market segment is elderly women. Most of the elderly are women, most of the people who are handicapped are women, most of them are less well-educated than their male counterparts, most of them have less disposable income than their male counterparts, most of them are not auto users or do not have access to autos. This specific study tells us a great deal about their needs and it will, I think, permit us to look more closely at the decisions that we are making, not only with regard to the 504 outcome, but with regard to the decisions that we are making in the Department about how we plan and administer our various program

commitments.

We are also generating factual data on our rail investments. We will generate information -- that is, for the first time -- telling UMTA where it has spent its money and what it has bought for its money. We will, I hope, be able to relate that information to demographic information that I know Dave Hartgen and others have been working on and refining. It will give us the tools to begin to make the analogies, to begin to compare, and allow us to make decisions that I hope are more reasonable and more sensitive to the needs of women as well as the other component groups of our client population.

I hope that all of that is useful, because it will help us to better plan and allocate our resources as well, since those resources are increasingly scarce.

The second question was, how can DOT help women to become more prominent in planning and policymaking positions in transportation? Well, maybe it is a stock answer, but one of those answers is by providing role models. We know that the DOT General Counsel, Linda Kamm, the UMTA Chief Counsel, Margaret Ayers , and I are all women who have been trained as professionals in our particular areas of specialty. Now, we are not all transportation professionals, but we are all becoming knowledgeable in different ways about transportation. I think we offer the opportunity for others, whether they are the operators of transportation services, the consumer of those services, or the state or local official that has to deal with us. We hope that we offer them the opportunity to see that we are committed, we are trained, and we are professional. We

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hope that we can encourage them to see that women are capable of moving into the transportation business, and are capable of making decisions that will impact significant segments of the society in a reasonable way.

We also think that an answer to the question how DOT can help women become more prominent, is by applying our EEO provisions in our grant contracts more vigorously, to help assure that our grantees, particularly transit operators, recognize and provide for the rights of women to jobs at all levels of their organization.

This year for the first time, my office and the Office of Civil Rights in UMTA have agreed to cooperate and to fund jointly a policy research program that will allow us to establish a method for evaluating how our EEO activities have impacted the grantees, what has resulted from our commitments to these grantees, and how we can adjust the way we do business if it needs to be adjusted. We hope to begin to build a recognition on everyone's part that we are very serious about what we are doing, and we are serious in terms of women as well at the other minorities that are traditionally thought of as the EEO or minority program concerns.

Also for the first time this year, the UMTA University Research and Training Program specifically provides guidance that a portion of the funding will be considered for the support of transportation research and training at minority and women's colleges and universities. While the University Program has always sought to attract more of the nation's talent into careers in public transportation, this is the first time th

we have made an explicit commitment to actively pursuing the training of women. And we are very serious about that as well, because we are working again with our Civil Rights Office to develop techniques that might be necessary to acquaint the women's schools to our method of filing application requests and how we do business in UMTA.

I brought along a propaganda piece. This is the UMTA University Research and Training Program guidance that we just published a week ago. Judy Meade, who is in the back of the room, is one of our university specialists, and she would be more than happy to take the name of anyone who is interested in receiving the program information. We very much want schools to apply. We will offer as much assistance in policy guidance as we can, to make sure that their topics are relevant and put them in the position to receive funding.

The third question in that International Women's Year document was, how can DOT assist in ensuring that women gain access to development and economic opportunities created by transportation investments? We are using this question as a strainer or a test for some of our own internal decisions and activities. I think it is important for us to look at our own decision-making in our own programs and say, "Are we sensitive enough, are we concerned enough, have we identified the right issues and the right questions to ask?"

Just as importantly, however, is our willingness to recognize, through our various program activities, the value of funding the study of women's issues in local transportation planning circumstances. A year ago someone from Tri-State came to talk with me about a terrific idea

that they had for a study. We went through the whole Tri-State process, and it looked like it was finally going to wind up under a Section 9 grant activity. Unfortunately, at the time our regional staff didn't think that that issue was as pressing a need as were some other hardware-oriented or program-oriented issues, and it got dropped out when competition became tough and when the resources became scarce.

I think as we say it, and as we say it over and over again, both at the headquarters level and at the local level, we will begin to elicit the kind of response that is appropriate at the local level. This is not just an issue that we at the federal Washington headquarters offices are concerned about, but that this is truly one that permeates to the regions and to the local official that has to make decisions about how local dollars get committed to programs, and that that they understand the impact of the decisions that they are making.

I think generally we recognize that the results of this conference will begin to produce and refine some of the existing tools, or will produce new tools that we can use to better make decisions. I think we can answer some of the questions that you have been raising and that I think Sandi will continue to raise, or that you will continue to raise to us. I think you need to recognize that you have those tools and that you also have our attention, and that is important. You have our attention now. I think what has to be done is that you have to, and we have to at the same time, follow up, push, and help to guide us as we are making program commitments, and that you have to hold the Department accountable. I think that is important because, while you may see us here and

you may see Ed Scott's representation as a clear signal that the Department is concerned about this issue -- we couldn't have funded the conference if we weren't -- but that doesn't mean that we always have the time or the staff available to commit to it. And I think the work that you are doing, the research activities that you will come forward with, will help us because it will cause us to make those commitments, and it will cause us to continue to elevate this issue and the questions that you are raising to the appropriate level of attention. And hopefully it will cause us to make better decisions, because we will have the information available upon which to base that decision.

I will make the commitment to you that I will follow up with you, in whatever forum is appropriate, in a year to tell you how we are doing, whether we are succeeding in our use of the EEO program, in our use of our internal strainer, in our use of our information that is derived through our policy and university research activities, if you also promise to come back to us and to give us the guidance that I think we need to make sure that we are paying attention to the right questions and the right objectives.

Carmen Turner

Assistant General Manager-Administration

Washington Metropolitan Area Transit Authority

Obviously I am very pleased to be here today. I think that the Department has taken a giant step forward in sponsoring this Seminar on Women's Travel Issues. This is, also, a subject that is very dear to my heart, and I see Ellen Feingold smiling. She and I have talked about this and wrestled with it for some time.

Some of you, may know that I have worked in the field of transportation for a number of years. I would say from the outset that while there has been some progress in the area of women and transportation, it has been achieved at a relatively slow pace, and I think there are several reasons for this.

From the beginning, transportation has been a male dominated industry. The glorious history of the evolution of transportation is sprinkled with mucho machismo. Historically the association of women with transportation has been at best extremely sexist.

We name ships after women, locomotives, airplanes. Many people refer to their cars by feminine names. But, most of the characters or people to which we attach great significance in the field of transportation are men - Casey Jones, Charles Lindberg, John Paul Jones. From a practical standpoint, few women ever find their way into the corporate boardrooms of the major airlines or the railroads. A survey conducted by the Urban Mass Transportation Administration a few years ago found one female general manager of a privately owned bus company. I would hazard a guess that there are probably no women serving as

executive directors of state highways departments.

In addition, the Department of Transportation, the industry and the regulatory agencies have focused primarily on systems, hardware and technology. The human factor, women or otherwise, often suffers from benign neglect or is treated as an incidental.

Moreover the transportation industry is resistant to change, particularly social change. Have you ever tried to convince an executive director of a state highway department to change the site of one of his highways? It is almost impossible, and if you then base that on what we consider the social factors it becomes even more difficult.

I think there is a reason for the resistance in the industry. You may know or be aware that WMATA has just gone through a strike and we have gone to arbitration, so I have been doing some reading in this area.

I was reading recently a publication on transit and the unions. One publication, pointed out that there are really two work forces within the transit industry. One is the old line transit manager who, essentially has come up through the ranks and really subscribes to the "pull yourself up by your bootstraps" philosophy.

The second force is a younger, frequently better educated manager whose approach to transportation has a different sense of values, has a different perspective in terms of management and a different social philosophy. I think that is important. I think that we have to begin to look at transportation with a much broader approach. We are not talking about profit out of the fare boxes, any longer.

Thus, frequently women are denied employment in transportation or transportation-related fields, particularly at the policy and decision-making levels.

Transportation services are not always comparable for women and their male counterparts. Businesses owned by women are often excluded from the economic marketplace with respect to transportation. Often, and you know I can say this with a great deal of credibility, as consumers, as users, women are either ignored or embarrassed.

In employment, I would like to look at two agencies with which I am intimately familiar. The first is the U.S. Department of Transportation, I have a great personal attachement to DOT. My comments are not meant to be critical but factual.

I went to work for UMTA in 1970 as an EEO specialist. I then became the Deputy Director of Civil Rights and worked for a short while as the Acting Director of Civil Rights for the Department.

Much of that time I was either directly or indirectly responsible for the women's program. Drawing from that experience, I can state with confidence that while DOT has demonstrated a consistent effort increasing female representation in policy and executive positions and throughout the work force, we are not there. Despite these efforts DOT has a long way to go before women achieve parity.

Today the percentage of women in the DOT work force is 17.2 percent, and of that the majority of women are concertrated in midlevel clerical and administrative jobs.

I, also, went back and picked up some figures on female employment from

the Department just to see if, in fact, I could see a trend here of at least increased female employment. Let me read them to you. In 1972, the female employment in the Department of Transportation was 17.6 percent. In 1973, it was 16.7 percent. In 1974, it was 17.4 percent; in 1975, 17.6 percent; in 1976, 16.7 percent and in 1977, 17 percent. So, if we look at those numbers we see that in spite of all the effort and attention that has been given to this program, we really have not produced the kind of results that we certainly hoped to achieve.

Last November I left DOT and accepted the job at WMATA. Ted Lutz, the general manager, assured me that this was not an EEO job.

Let me explain that. After spending about seven or eight years in affirmative action in EEO it became apparent to me, one, that after that length of time your enthusiasm wanes a little bit. You have lost more battles than you have won and it may be necessary to back off, do something different, even if you want to come back at another time and continue to pursue that career.

On the other hand, affirmative action and equal opportunity is accomplished in two arenas. The Civil Rights Offices certainly are at the forefront of change, should set the policy, the guidelines and be responsible for enforcement, but line managers make EEO affirmative action a reality. I decided that I was particularly interested in becoming a line manager and applying to my job the sensitivities that developed while working in civil rights.

So, my interest in moving from civil rights to a line management job has nothing to do with my commitment to EEO. Anyway, it was not

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long before I discovered that the Office of Personnel provides the minority and statistical input to the Office of Data Processing in the authority, and then data generates the statistical information with respect to minorities and women.

Both of these offices report to me. So, I have had an opportunity monthly, systematically to review the authority's performance in these vital areas.

Quite frankly, our performance is not particularly good.

As of August 31, 24.5 percent of our salaried employees were female; 9.3 percent of our union personnel were female, and the total female representation in the WMATA work force was approximately 12.5 percen .

Again, I think this is indicative of the industry. On the positive side, I believe the authority has taken a leadership role in the employment of women in some traditionally male occupations; in particular I refer to bus operators. In 1973, there were eight wome bus operators. Today there are 220.

In addition WMATA has had an aggressive affirmative action plan whic includes the problems associated with women for over five years. Further, in our efforts to improve our performance, we have recently created a women's program coordinator as part of our affirmative action program.

However, even with our 12.5 percent record, I would hazard a guess t at WMATA is one of the most progressive transit authorities in the coun ry. I am probably one of few if not the only assistant general manager,

female assistant general manager of a major transit authority, and I believe similar conditions exist within the airlines, the railroads and the highway departments.

Again drawing from my experience in DOT, I remember one of the people in the Office of the Secretary telling me that I had a love affair with Title 6. Title 6 provisions prohibit discrimination on the basis of race, color or national origin with respect to federally assisted programs, and most, DOT legislation now includes a Title 6-like provision which prohibits discrimination on the basis of sex.

I believe that there is a great deal that must be done in this area. I think that we have not begun to see the tip of the iceberg in assessing the impact of transportation programs on women. I am not sure at this point that we have enough empirical data to accurately articulate this problem.

This is one reason I was delighted to participate in this Conference. I think it is a giant step forward, and I congratulate the Department and the Office of University Research in moving forward.

Several years ago HUD conducted a comprehensive analysis of the impact of housing policies and programs on women which resulted in some major policy revisions within HUD. Some of you may remember the similar discussions we had during International Women's Year. Many of us in the Department participated in discussions in an effort to develop similar information as it pertained to transportation and transportation-related fields.

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We need to know, for example, to what extent transportation travel

needs of women differ from men, and I think you get to some of that in your Conference.

Another major concern goes to the extent to which the opportunity for women to compete in the marketplace exists. I am acutely aware of the debate between DOT, the industry and various interest groups concerning the definition of a minority business enterprise. Some of you may disagree with me; Ellen may disagree with me. You know, it is kind of funny to be on the other side of the coin.

I had been in the Authority a couple of months when the civil rights people came in with all the UMTA circulars, and they said, "We have got to comply with these. Do you know anything about them?" What could I say? I wrote some of them. So, it is interesting to be on the other side of the street or on the other side of the coin. As a compliance agency we have some serious concerns about the way in which we approach minority business enterprise.

At any rate, from the authority's point of view, we question the inclusion of women in the definition of minority business enterprise. We have suggested to the Department and UMTA that if the Department stands by its decision that separate goals be established for minorities and women similar to the statistical accounting procedures utilized in the affirmative action programs. This would establish reporting procedures which minimize overlap and reduce the competition among affected groups.

All too often we find ourselves, minorities, women, handicapped, elderly competing for the same limited resources. There is no doubt in my mind that women have been denied equal opportunity in con-

tracting and that we must take affirmative action to correct past disparities.

I, also, know there are bona fide, legitimate firms owned and controlled by women and that these firms are at the focal point of DOT's effort to increase participate. The record speaks for itself. Contracts to firms owned or controlled by women for transportation work are few and far between. A cursory check of all of WMATA is contracting activity produced three contracts to firms owned or controlled by women.

I am sure all this sounds rather bleak, but there are some very positive signs of change. First and foremost, women are holding their own and gaining increased respect and acceptance within transportation.

I remember well the first time I participated in an APTA workshop. I thought the moderator was going to take at least 30 minutes or more to introduce me. He explained how bright I was, how intelligent I was, how competent I was, and the introduction sounded as though I had discovered the theory of relativity or some other monumental achievement when, in fact, and this is serious, he was attempting to justify the existence of a female, a black female on the panel. It was just something that was unheard of.

Today women are present in significant numbers both in attendance and participation at APTA activities, and as an aside for those of you who may not know what APTA is, it is the American Public Transit Association.

In addition, many of the old taboos are disappearing. Women travel more frequently. Harold Williams used to say that I tracked more air miles than most airline hostesses. He was probably right.

Women are in tunnels. I don't know if many of you are familiar with the debate about women in tunnels and the fact that on construction sites it was considered bad luck for a woman to go in the tunnel, and we lived with that even in the civil rights offices until just very recently. I must say, women are allowed in at least, the WMATA tunnels.

I, also, think you will notice that there are more women in highway and highway construction as you drive throughout the country. I think it is obvious that women are in the construction industries, not in large numbers but at least in increasing numbers.

When I was Acting Director of Civil Rights of the Department, the Commandant of the Coast Guard came to see me one day. He found that he had a problem that had to be brought to the Departmental Office of Civil Rights. The problem was that a young woman had filed a complaint against the Coast Guard because she was not allowed to go to sea or to be assigned to an isolated duty station.

The file contained an opinion from almost every judge advocate general in the Coast Guard saying that it did have to be investigated and that it would have to come into the Departmental Office of Civil Rights. The Commandant was one of the most gracious men I have ever met, and what he told me was, "You really don't have to worry about this, Mrs. Turner, the Coast Guard does discriminate." He went on to give me several reasons why women should not be assigned to sea or isolated duty stations.

I reviewed the file, and then I said very casually to him that I had never seen a Coast Guard cutter, and I really did not feel competent to even respond to that.

You know how efficient the Coast Guard is. A couple of days later I was on Coast Guard I and off to Governor's Island, with the understanding that no one at Governor's Island would know what my mission was. So, here are all these various classes of ships, cutters, and buoy tenders and whatever, all tied up, waiting for this person, this woman to do a flag-rank tour of berthing facilities and heads.

Ultimately we did find that the Coast Guard discriminated, and we did say that women should go to sea and be assigned to isolated duty stations. My recommendation was 1980. Ellen Feingold came in and said, "Now," and last year women went to sea. That, in my opinion, is progress.

Now, most significant, women as managers are contributing to the development and implementation of transportation policies and programs. Over the past several years I have seen a shift from indulging and tolerating us in meetings and conferences to seeking us out and requesting our input and contributions. Someone has here, "enthusiastically incorporating our contributions." I don't know that I could say that.

Again, drawing on my own experience as a manager in a major transit authority, I must say that over the nine months that I have been at WMATA, I have participated fully in all of the decisions and actions associated with my department, much to the chagrin of many of my office directors and throughout the authority.

I have what we call a front line up front decision making job right now, and you make hard decisions. You cross your fingers, and you live with them. Where does all of this leave us?

We know that we are a long way from parity in employment, service delivery and opportunities in the marketplace. On the other hand, there are signs of progress, and those of you participating in this Conference today can certainly make major contributions to the furtherance of the participation of women in all aspects of transportation.

Thank you.

MS. SKINNER: We would entertain a couple of questions, if we have some from the audience.

INEZ SLETTA: It is a matter of clarification. On your figure of 12.5 in 1977, the number of women in DOT, how many of them are secretarial?

MRS. TURNER: The 12.5 figure is the WMATA figure. It is not the DOT. DOT's figure is 17.0 percent for 1977.

INEZ SLETTA: What is the proportion of professional versus secretarial?

MRS. TURNER: I don't have the actual figures, but I can tell you that the majority of women both in the Department and in the Authority are lumped in the midlevel administrative and clerical jobs.

In the Authority, and I don't have the total number of women employed, but I can tell you there are only two of us in senior level jobs.

MS. SAMUELSEN: I am working on a project for Mr. Scott who will be here this evening. I have a fairly recent printout with me, but it is GS-9 and above of the total number of women. So, that is a partial answer.

MRS. TURNER: But I would say your greatest concentrations are probably at 9 and 11.

MS. SAMUELSEN: I don't know.

MRS. TURNER: Wanda?

WANDA REYNA: They are below that, Carmen; they are still about the same as they were when you were there.

MRS. TURNER: That is not good. I can tell you.

WANDA REYNA: We do have more women in senior level positions. Nineteen of the appointments made out of a total of 30 appointments in Schedule C appointments, other than secretarial positions remains non-secretarial openings.

MRS. TURNER: Good.

MS. SKINNER: Other questions?

I would like to thank Carmen Turner for coming and giving us such a useful set of information as input into this Conference.

Transportation Methods, Planning Methodologies chaired by David Gendell will convene in the Lecture Room in, I am not sure how many minutes, at 2:45, which is about one-half hour from now.

We would like to reiterate that the workshop sessions that were scheduled for 8:30 this evening are rescheduled to tomorrow morning at 9 o'clock.

The Plenary Session, Defining Research Needs and Priorities will follow the workshops tomorrow morning, and please remember that the rescheduling does not mean that we have, also, canceled dinner.

We are going to have dinner, and we are going to have a dinner speaker who is Ms. Lillian Liburdi, the Associate Administrator for Planning of the Urban Mass Transportation Administration.

So, we will adjourn today after dinner, but we will go from here to the Lecture Room for the Plenary Session.

Thank you all.

VI. MISCELLANEOUS

CONFERENCE PARTICIPANTS

Conference Speakers and Dignitaries

1. Karl S. Bowers
   Administrator
   Federal Highway Administration
   U.S. Department of Transportation

2. Alan Butchman
   Deputy Secretary
   U.S. Department of Transportation

3. Mortimer L. Downey, III
   Assistant Secretary for Budget and Programs
   U.S. Department of Transportation

4. John J. Fearnsides
   Deputy Under Secretary
   U.S. Department of Transportation

5. Ellen B. Feingold
   Director, Office of Civil Rights
   U.S. Department of Transportation

6. Adriana Gianturco
   Director of Transportation
   CALTRANS

7. John S. Hassell, Jr.
   Deputy Administrator
   Federal Highway Administration
   U.S. Department of Transportation

8. Lillian C. Liburdi
   Associate Administrator
   Urban Mass Transportation Administration

9. Dianne Liff
   Assistant General Counsel for Litigation
   U.S. Department of Transportation

10. Lloyd J. Money
    Acting Director
    Transporation Programs Bureau
    Research and Special Programs Administration
    U.S. Department of Transportation

11. James Palmer
    Administrator
    Research and Special Programs Administration
    U.S. Department of Transportation

12. Courtland D. Perkins
    President, National Academy of Engineering

13. Edward W. Scott, Jr.
    Assistant Secretary for Administration
    U.S. Department of Transportation

14. Donna E. Shalala
    Assistant Secretary for Policy Development and Research
    U.S. Department of Housing and Urban Development

15. Linda Smith
    Director, Executive Secretariat
    U.S. Department of Transportation

16. Carmen Turner
    Assistant General Manager for Administration
    WMATA

Conference Attendees

1. Dorothy J. Allinger
   U.S. Department of Transportation

2. Elsie Anderson
   U.S. Department of Transportation

3. Ruth H. Asin
   U.S. Department of Transportation

4. Joseph Austin
   U.S. Department of Transportation

5. Mira Baron
   University of Pennsylvania

6. Valencia Bell
   Prairie View A&M University

7. John Betak
   University of Texas at Austin

8. Kathy Bonk
   National Commission on Working Women

9. Karen L. Borlaug
   U.S. Department of Transportation

10. Beverly Boyd
    U.S. Department of Transportation

11. Patricia A. Brown
    Capital Heights, NH

12. William F. Brown
    U.S. Department of Transportation

13. K. Anne Buchanan
    United Airlines

14. Betty Buckner
    Bureau of the Census

15. K. Patricia Burnett
    Northwestern University

16. Felice E. Busto
    U.S. Department of Transportation

17. Carolyn L. Carter
    U.S. Department of Transportation

18. Peggy Catron
    U.S. Department of Transportation

19. Rose Marie Cernin
    U.S. Department of Transportation

20. Melvyn Cheslow
    The Urban Institute

21. Deanne Chitayat
    CUNY - Graduate Center

22. Sherwood C. Chu
    U.S. Department of Transportation

23. Mary Martha Churchman
    U.S. Department of Transportation

24. Carmen C. Clark
    U.S. Department of Transportation

25. David Damm
    Massachusetts Institute of Technology

26. Paul DiNatale
    U.S. Department of Transportation

27. Rebecca Dreis
    University of California, Santa Barbara

28. Gloria G. Eiseman
    MITRE Corporation

29. Carole A. Ferguson
    U.S. Department of Transportation

30. Bonnie Fisher
    U.S. Department of Health, Education and Welfare

31. Gerald Fisher
    U.S. Department of Transportation

32. David S. Gendell
    U.S. Department of Transportation

33. Patricia E. Goeke
    West Virginia University

34. John L. Goodman, Jr.
The Urban Institute

35. Douglas Gurin
U.S. Department of Transportation

36. Susan Hanson
Middlebury College

37. John Havens
Boston College

38. Elsa Haupt
U.S. Department of Transportation, Region II

39. Harvey E. Heiges
U.S. Department of Transportation

40. Ann Hershfang
Massachusetts Port Authority

41. Patricia Hinsberg
Automotive News

42. Carolyn Hock
Johns Hopkins University

43. Martin Hunt
J.D. Power and Associates

44. Janet Kahn
American Institute for Research

45. Larry C. Kerpelman
Abt Associates

46. Alice E. Kidder
North Carolina A&T State University

47. Phillip E. Kithcart
Prairie View A&M University

48. Freada Klein
Alliance Against Sexual Coercion

49. Anne Knipper
NPSRI

50. Frank S. Koppelman
Northwestern University

51. Lidia Kostyniuk
University of Michigan

52. Paul S.T. Lee
University of Nebraska

53. Steven Lerman
Massachusetts Institute of Technology

54. Patrick Little
U.S. Department of Transportation

55. Mary Jo Long
American Trucking Associations, Inc.

56. Ann C. Macaluso
U.S. Department of Transportation

57. Janice F. Madden
University of Pennsylvania

58. Grace Malkoff
League of Women Voters

59. Arlene V. Malone
New York Department of Planning

60. Richard McGinnis
Bucknell University

61. Judy Z. Meade
U.S. Department of Transportation

62. June P. Middleton
Washington, D.C.

63. Ann Muzyka
U.S. Department of Transportation

64. Debra A. Newman
SYSTAN, Inc.

65. Katherine O'Leary
U.S. Department of Housing and Urban Development

66. Marian T. Ott
U.S. Department of Transportation

67. Robert E. Paaswell
State University of New York, Buffalo

68. Rosalind S. Paaswell
Energy Research Group

69. Philip D. Patterson
U.S. Department of Energy

70. Robert J. Ravera
U.S. Department of Transportation

71. Wilfred Recker
State University of New York, Buffalo

72. Wanda Reyna
U.S. Department of Transportation

73. Larry G. Richards
University of Virginia

74. Stuart N. Robinson
Trailways Corporation

75. Edith M. Rodano
U.S. Department of Transportation

76. Debra Kaye Rosebourgh
U.S. Department of Transportation

77. Sandra Rosenbloom
University of Texas at Austin

78. Catherine Ross
Georgia Institute of Technology

79. David Rubin
U.S. Department of Transportation

80. Jeanie Rush
U.S. Department of Transportation

81. Linda Samuelson
U.S. Department of Transportation

82. Linda Sano
U.S. Department of Transportation

83. Richard A. Schultze
Central Ohio Transit Authority

84. Lalita Sen
North Carolina A&T State University

85. Carl Shea
U.S. Department of Transportation

86. Louise E. Skinner
U.S. Department of Transportation

87. Inez Sletta
U.S. Department of Transportation

88. Marylee Smith
Mississippi R&D Center

89. Ralph Smith
The Urban Institute

90. Renee M. Smoot
U.S. Department of Transportation

91. David Spottheim
Maryland Department of State Planning

92. William M. Spreitzer
GM Research Laboratories

93. Dorsey R. Thomas
U.S. Department of Transportation

94. Mary Lynn Tischer
U.S. Department of Transportation

95. Pauline W. Tsui
Defense Mapping Agency Topographic Center

96. Alice M. Tybout
Northwestern University

97. Martin Wachs
University of California, Los Angeles

98. Richard Weiner
University of Colorado

99. Michelle J. White
New York University

100. Wilbur Williams
U.S. Department of Transportation

101. Linda Zemotel
University of Pittsburgh

AGENDA

Sunday, September 17, 1978

3:00-5:30 PM
Registration.....Entrance to Great Hall

5:30 PM
Reception.....Great Hall

Monday, September 18, 1978

8:00-8:45 AM
Registration.....Entrance to Lecture Hall

9:00 AM
Welcome.....Lecture Room
COURTLAND D. PERKINS
President
National Academy of Engineering
Keynote Address
ALAN BUTCHMAN
The Deputy Secretary
U.S. Department of Transportation

9:30 AM
Plenary Session.....Lecture Room
Demographic Trends and
Travel Issues
Chair: Sandra Rosenbloom
University of Texas at Austin
"Trends in the Movement of Women into the Labor Force"
Ralph E. Smith
The Urban Institute

"Women's Work Trips: An Empirical and Theoretical Overview"
Janice Fanning Madden
University of Pennsylvania
Michelle J. White
New York University

"Role Influence in Transportation Decision-making"
Frank S. Koppelman
Alice Tybout
David Syskowski
Northwestern University

1:00-2:30 PM
Luncheon.....The Refectory
Chair: Katherine O'Leary
U.S. Department of Housing and
Urban Development
Speaker: DONNA E. SHALALA
Assistant Secretary
Policy Development and Research
U.S. Department of Housing and
Urban Development

2:45-5:45 PM
Concurrent Sessions One and Two

Session One
HOUSEHOLD CHARACTERISTICS AND RESIDENTIAL LOCATION
Chair: Jack Goodman
The Urban Institute

"Individual Spatial Choice Behavior"
John Betak
University of Texas at Austin
E. J. Harman
Murdoch University, Western Australia

"Travel Patterns of Women and Men Based on Stage in Family Life Cycle"
Linda Zemotel
University of Pittsburgh

"Residential Location and Transportation Analysis of Married Women Workers"
Carolyn Hock
Johns Hopkins University

"Measuring the Distributional Impact of Transportation Services on Women"
Catherine Ross
Georgia Institute of Technology

Session Two
HOUSEHOLD RESPONSIBILITIES AND TRIP-TOURS
Chair: Steven Lerman
Massachusetts Institute of Technology

"Influence of Employment and Children on Intra-Household Travel Behavior"
Richard McGinnis
Bucknell University

1:00-2:30 PM
Luncheon.....The Refectory
Chair: Katherine O'Leary
U.S. Department of Housing and
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Assistant Secretary
Policy Development and Research
U.S. Department of Housing and
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Georgia Institute of Technology

Session Two
HOUSEHOLD RESPONSIBILITIES AND TRIP-TOURS
Chair: Steven Lerman
Massachusetts Institute of Technology

"Influence of Employment and Children on Intra-Household Travel Behavior"
Richard McGinnis
Bucknell University

"Impact of Women's Employment on Women's Travel Patterns"
Susan Hanson
Perry Hanson
Middlebury College

"Shopping Trips: Who Makes Them and When?"
Louise Skinner
Federal Highway Administration
Karen Borlaug
Office of University Research

"Analysis of Activity Schedules Along the Dimension of Gender"
David Damm
Massachusetts Institute of Technology

6:00 PM
Reception.....Great Hall

6:30 PM
Dinner.....The Refectory
Chair: Ellen Feingold
Office of the Secretary

Speaker: ADRIANA GIANTURCO
Director of Transportation
California Department of
Transportation

8:30 PM

Session Three
PERSONAL SECURITY AND VEHICLE CHOICE
Chair: David Rubin
Transportation Systems Center

"Perceived Safety and Security in Transportation Systems as Determined by the Gender of the Traveler"
Larry G. Richards
Ira D. Jacobson
Richard D. Pepler
University of Virginia, Charlottesville
Richard F. Bloom
Dunlap and Associates

"Gender Differences in Reaction to Vehicle Environments"
Larry G. Richards
Ira D. Jacobson
University of Virginia, Charlottesville

"Comparative Survey of Women Car Buyers"
Martin Hunt
J.D. Power and Associates

Panel Discussion: The Impact of Fear of Rape on Travel Behavior

Tuesday, September 19, 1978

9:30 AM
Concurrent Sessions Four and Five

Session Four
ATTITUDES AND TRAVEL PREFERENCES
Chair: John Havens
Boston College

"Sex Differences in Travel Preference and Decision-making"
Wilfred Recker
Harry Schuler
University of California at Irvine

"Travel Patterns and Behavior of Women in Urban Areas"
Lalita Sen
North Carolina A&T State University

"Women's Travel Behavior and Attitudes: An Empirical Analysis"
A.H. Studenmund
Occidental College and Transportation Systems Center
Larry C. Kerpelman
Abt Associates
Marian T. Ott
Transportation Systems Center

Session Five
TRAVEL BEHAVIOR OF SELECTED MARKET SEGMENTS
Chair: Martin Wachs
University of California at Los Angeles

"Transportation Problems of Low Income Women as Members of the Transportation Disadvantaged"
Alice Kidder
North Carolina A&T State University

"Women's Travel Issues: American Patterns"
Helena Lopata
Loyola University of Chicago

"A Comparison of Attitudes and Behavior Between Male and Female College Students"
Michael Spicer
Richard Weiner
University of Colorado, Colorado Springs

1:00-2:30 PM
Luncheon.....The Refectory
Chair: Louise Skinner
Federal Highway Administration
Speaker: CARMEN TURNER
Assistant General Manager—Administration, Washington Metropolitan Area Transit Authority

2:45-5:45 PM
Plenary Session.....Lecture Room
Assessments of Current Transportation Planning Methodologies
Chair: David Gendell
Federal Highway Administration

"Transportation Survey and Demand Estimation Models"
Lidia Kostyniuk
Donald Cleveland
University of Michigan, Ann Arbor

"The Transportation Planning Process"
Robert E. Paaswell
State University of New York at New York
Rosalind S. Paaswell
Energy Research Group, Buffalo

"Can Current Transportation Planning Methods Analyze Women's Travel Issues?"
David Hartgen
New York State Department of Transportation

"An Alternative Approach to Travel Demand Modelling"
K. Patricia Burnett
Northwestern University

6:00 PM
Reception.....Great Hall

6:30 PM
Dinner.....The Refectory
Chair: Karen Borlaug
Research and Special Programs
Administration
Speaker: LILLIAN LIBURDI
Associate Administrator
Urban Mass Transportation
Administration

8:30 PM
Concurrent Research Workshops

1. Projections of Social Trends and Alternative Policy Scenarios
Chair: Mary Lynn Tischer
Federal Highway Administration

2. Alternative Futures
Chair: K. Patricia Burnett
Northwestern University

3. Problem Assessment
Chair: Karen Borlaug
Research and Special Programs
Administration

4. Service and System Design Research
Chair: David Rubin
Transportation Systems Center

5. Planning Process and Methods Implications
Chair: John Havens
Boston College

Wednesday, September 20, 1978

9:30 AM-12:00 PM
Plenary Session.....Lecture Room
Determining Research Needs and Priorities
Chair: Sandra Rosenbloom
University of Texas at Austin

- Presentation of Research Workshop Reports
- Group Discussion and Synthesis of Research Recommendations

12:00 PM
Conference Adjourns

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6:30 PM

Dinner.....The Refectory

Chair: Karen Borlaug
Research and Special Programs
Administration

Speaker: LILLIAN LIBURDI
Associate Administrator
Urban Mass Transportation
Administration

8:30 PM

Concurrent Research Workshops

1. Projections of Social Trends and Alternative Policy Scenarios
   Chair: Mary Lynn Tischer
   Federal Highway Administration

2. Alternative Futures
   Chair: K. Patricia Burnett
   Northwestern University

3. Problem Assessment
   Chair: Karen Borlaug
   Research and Special Programs
   Administration

4. Service and System Design Research
   Chair: David Rubin
   Transportation Systems Center

5. Planning Process and Methods Implications
   Chair: John Havens
   Boston College

Wednesday, September 20, 1978

9:30 AM-12:00 PM

Plenary Session.....Lecture Room

Determining Research Needs and Priorities

Chair: Sandra Rosenbloom
University of Texas at Austin

- Presentation of Research Workshop Reports
- Group Discussion and Synthesis of Research Recommendations

12:00 PM

Conference Adjourns

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