tice of representing alternative shopping locations in terms of measures of size and variety (such as retail employment or floor space) alone will define underspecified choice models. The results of this research suggest directions for objective quantification of shopping-location attributes that represent other characteristics that are important in formulating perceptions of shopping locations and provides decision makers with information about present perceptions. Discrepancies between these public perceptions and management perceptions suggest directions for changes in policies that may improve public perceptions. This is particularly critical when lack of information or misinformation causes incorrectly poor perceptions and consequently low utilization. Finally, this research confirmed the potential for measuring characteristics of consumer alternatives that are not measurable by direct or engineering means. Such consumer measurements could provide a basis for extending the scope of transportation policy analysis to include consideration of improvements in subjective characteristics of transportation alternatives.

ACKNOWLEDGMENTS

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Abridgment
Instrumental and Life-Style Aspects of Urban Travel Behavior

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The travel behavior of social groups has been discussed in the literature on the basis of several conceptual approaches. The first, the logistic-operational approach, emphasizes the prediction of flows in constrained transportation networks. Thus, trip-generation models have been developed that account for the trip-making rates of various population groups, which is sometimes referred to as a category analysis of travel demand (9). The second, the spatial-activity approach, relates travel purposes to urban forms and functions. Given the various preferences of social groups in terms of their activity space within a citywide opportunity field, different population groups are presumed to have distinctive residential choices and trip patterns, so as to overcome the friction of distance caused by the spatial differentiation of urban areas (3). The third, the market-segment approach, focuses on the varying needs of special groups in society. In this approach, the travel behavior of the disadvantaged, such as the poor, the aged, or the disabled, is investigated with the aim of identifying potential ways to overcome their mobility deprivation.

This increasing interest in the travel patterns of social groups has been accompanied by a closer investigation of the behavioral aspects of travel demand. Theoretically, travel is considered as an intermediate good, for which the demand is derived from the demand for the activity performed at the trip destination. In a broader sense, this function of transportation is known as the instrumental aspect of travel, where the activity of traveling ought to be related to a set of various tangible needs or requirements of households that necessitate movements between real-world locations. The instrumental aspect of transportation has been widely used in the methodological formulation of travel research, partly because of its obvious linkage to postulates of the theory of consumer behavior (1).

It is common practice to provide an operational definition of the instrumental function of transportation by a classification of trip purposes. Three main categories of trip purposes can be defined on an increasing scale of elasticity:

1. Subsistence trips (i.e., work and business trips) are characterized by their inelasticity in terms of periodicity, time, and location;
2. Maintenance trips (i.e., those for personal affairs and shopping) have more elasticity as far as the need it-

self is concerned, but a somewhat greater flexibility in the choice of destinations, time, and periodicity; and

3. Leisure trips (those for entertainment, social, and sport purposes) are relatively the most flexible, because they are clearly related to discretionary activities (4).

More recently, an argument has been advanced that the instrumental aspect of travel patterns of social groups may be a necessary, but not a sufficient, component of a fully behavioral analysis of travel phenomena. The questions arose from two separate, but converging research efforts. The first was the attempt to formulate the basic constructs of the psychological and social factors that influence the travel behavior of households and individuals living in urban areas (5). The second was the idea that households and individuals may have established life-styles in which transportation or mobility patterns fulfill some ends in themselves. This particular question evolved partly from the inconclusive travel adjustments shown during the energy crisis in 1973-1974 (8).

In this paper, the premise is investigated that the instrumental aspects of travel should be complemented by those of another dimension that reflects the habitual behavior of individual decision makers. This dimension is sometimes labeled the preference pattern or the taste system of persons or households, but it is preferable to call it the life-style aspect. Life-styles are assumed to be shaped by recurrent behavioral responses to socioeconomic conditions, as well as to deeper personal or social attitudes, roles, or values. The specific mechanism of the behavioral response is partly reflected by consumer-behavior concepts in economics; human-development stages, role theory, and decision-making processes in psychology; and concepts of social mobility and household management in sociology.

Four life-style aspects appear to be particularly relevant, either separately or together, to individual or household travel behavior.

1. The level of economic resources available to the household and the propensity to consume—economic resources act as catalysts to travel, not only in overcoming the monetary costs of trips, but also in the increased propensity to consume goods and services at the trip destination.

2. The social engagement-disengagement continuum, which reflects the degree of involvement with people and functions in the immediate vicinity or in the urban environment in general. On one end, there are households with a very low level of engagement (or a high degree of disengagement) with the rest of the world, and on the other hand, there are households with a high involvement with their surroundings.

3. Role differentiation within the household—households with different cultural backgrounds and family sizes will have reached different forms of task allocations, according to the role of the male and female heads of household. Thus, every instrumental need listed above, particularly for nonsubsistence trips, can be performed either by any member of the household or by a specific member, depending on their habitual roles.

4. Control and awareness of time allocation, which is an element that relates to the feasibility that households can plan and order their daily routine or rhythm of life. Some households are likely to have very little control over their routines, while others have a high degree of control and may be in a position to determine whether to perform an activity out of the home or to have other people come to them.

The relation between the life-style aspects—economic resources, social engagement, role differentiation, and control over time—and the instrumental aspects—overall mobility, subsistence, maintenance, and leisure—of travel behavior can be viewed as a matrix. In each cell (i.e., for each combination of both aspects), the interaction can be scaled on a high-to-low continuum.

The main problems encountered in an empirical investigation of the relation between the life-style and the instrumental aspects of travel behavior are associated with the proper selection of the data and the research methodology. Life-style aspects should be regarded as composite and dynamic behavioral constructs, whereas the data collected in travel surveys are usually socioeconomic variables that serve as static proxies for the underlying behavorial mechanisms. Similarly, the research methodology that almost suggests itself is an in-depth household interview, preferably on a longitudinal basis. However, the amount of information required about the background, attitudes, and behavior of each household and its representativeness would probably preclude the collection of a sample that was sufficiently large for significant cross tabulations.

With the limited scope of a single study, a number of simplifying assumptions had to be made, mainly due to the available data. The life-style aspects were supplemented by socioeconomic variables, despite their inadequacy. Thus, reported household income represents economic affluence and the propensity to consume, and social engagement is reflected by age. Role differentiation is shown by focusing on travel patterns of the head of household. Finally, time control may be represented by level of education and vehicle availability. For the research methodology, an existing large cross-sectional survey, rather than a much smaller longitudinal sample, was used. The rationale was that if social groups could be differentiated even on the basis of the inadequate data and research design, a more extensive investigation would be justified.

DATA BASE

The data were collected as a follow-up of the 1972 census. The population sampled included all inhabitants aged 5 and over who had a fixed residence during the survey period in localities with 10 000 or more inhabitants or in smaller localities contiguous to metropolitan areas. The sample was conducted between November 1972 and June 1973 in 70 localities and included 55 000 households. Although only 30 percent of all households have a light vehicle at their disposal, the sample was weighted so that 50 percent of the households included had vehicles.

The methods of data collection were the standard home-interview questionnaires and cordon and screenline surveys. The enumerator visited households in the late afternoon and inquired about trips occurring between 2:00 p.m. on the preceding day and 2:00 p.m. on the day of the visit. Special attention was paid to trip information from each individual member of the household. Since the data were collected only on weekdays, the trip distributions obtained reflect only averages of weekday travel. As in most travel studies, the dependent variable is the reported trip distribution of household heads, where a trip is defined as a movement by means of a motorized vehicle from a point of origin to a destination, including walking for the purpose of reaching the point from which the journey was to start (2).

On the basis of the methodological introduction, the following specific variables were selected for the analysis.

1. Reported annual household income for households that earn salaries or wages (self-employed households were deleted because of the potential bias in their reported income) were subdivided into four groups.

2. The variable selected as a proxy for role, was head of household, who is the shaper and the mobile element of the household's mobility pattern.

3. Vehicle availability in the household refers to private passenger vehicles, commercial vehicles with a load capacity not exceeding 1 Mg (1 ton), or two-wheeled vehicles not used for carrying goods. The proportion of private automobiles was 82.4 percent, and 85 percent of all vehicles were fully owned by the households. Because 95 percent of the families with a vehicle at their disposal have only one, it was not necessary to further subdivide automobile availability by the number of vehicles.

4. Age was represented by the conventional classification of young, middle aged, and old.

5. Education was based on years of schooling.

6. Instrumental aspects were the total trips, which represent overall mobility, and subsistence trips, which include work and business trips. In some cases, maintenance and leisure trips were also included in the analysis.

By a careful selection of the subpopulation, the size of the sample was reduced to about 28 000 observations—14 277 households with automobiles and 13 487 automobileless households—covering the entire urban population of the country and having the characteristics shown below (1 I£ = $0.24 in 1973).

Characteristic	Value	Standard Deviation
With automobile		
Age, years	42.63	8.90
Income, I£	23 225	10 590
Schooling, years	13.24	3.40
Without automobile		
Age, years	44.69	11.10
Income, I£	13 785	8780
Schooling, years	9.22	3.68

INTERACTIONS OF LIFE-STYLE AND INSTRUMENTAL ASPECTS OF TRAVEL

It is commonly recognized that vehicle availability, income, and education act as positive catalysts to household travel and reinforce each other in their effects. Age, on the other hand, particularly old age, is perceived as a barrier to mobility. When travel patterns of household heads are considered (Table 1), the overall results are similar, although a number of specific interactions are noteworthy.

1. The net positive effect of income on overall mobility is higher in the group of automobileless households than in that of families with automobiles. Also,

Table 1. Average daily trips of household heads.

Age (years)	Annual Income (I£)	Automobile Availability	0 to 8 All	0 to 8 Subsistence	9 to 12 All	9 to 12 Subsistence	13 to 15 All	13 to 15 Subsistence	≥16 All	≥16 Subsistence
≤34	≤8 000	Yes	4.1	1.6	3.5	1.4	4.2	1.5	4.7	1.3
		No	2.0	0.8	2.7	1.1	2.7	1.0	3.0	1.1
	8 000 to 16 000	Yes	3.1	1.2	4.1	1.7	4.1	1.5	4.4	1.5
		No	2.2	0.9	2.7	1.2	2.8	1.0	2.7	0.9
	16 000 to 25 000	Yes	3.6	1.4	4.3	1.8	5.1	2.1	4.3	1.6
		No	2.1	0.8	3.0	1.2	3.0	1.2	2.4	0.9
	≥25 000	Yes	2.9	1.1	4.4	1.8	4.2	1.7	4.3	1.8
		No	1.7	0.8	3.4	1.5	2.4	1.0	2.8	1.0
35 to 64	≤8 000	Yes	2.8	1.1	3.6	1.4	3.8	1.6	4.2	1.7
		No	1.8	0.8	2.1	0.9	2.1	0.9	2.4	0.9
	8 000 to 16 000	Yes	3.1	1.4	3.8	1.6	4.0	1.6	4.4	2.0
		No	2.1	0.9	2.3	0.9	2.6	1.2	2.1	0.8
	16 000 to 25 000	Yes	3.1	1.3	4.1	1.8	4.4	2.0	4.1	1.7
		No	2.2	0.9	2.7	1.3	2.6	1.1	2.6	1.0
	≥25 000	Yes	3.4	1.5	4.2	1.9	4.4	2.0	4.1	1.8
		No	2.1	0.9	2.6	1.2	2.7	1.2	2.9	1.2
≥65	≤8 000	Yes	2.3	1.1	1.8	0.6	1.6	0.7	3.4	1.8
		No	1.7	0.7	2.2	0.9	2.2	0.7	1.9	0.6
	8 000 to 16 000	Yes	2.6	1.6	3.3	1.8	1.8	0.9	3.9	1.2
		No	1.8	0.7	2.3	0.9	2.1	0.7	2.5	0.9
	16 000 to 25 000	Yes	2.1	0.9	3.8	1.7	2.3	1.0	2.4	1.1
		No	2.0	0.9	2.2	0.9	2.0	0.7	1.7	1.1
	≥25 000	Yes	3.6	2.7	3.2	1.7	4.0	2.0	3.8	1.5
		No	1.6	0.8	2.6	1.2	2.8	1.1	2.7	1.2

Table 2. Quantitative relations between trip generation of household heads and selected socioeconomic variables.

Dependent Variable	Education Value	Education t-Statistic	ln Education Value	ln Education t-Statistic	ln Income Value	ln Income t-Statistic	Age Value	Age t-Statistic	ln Age Value	ln Age t-Statistic	Constant Value	Constant t-Statistic	R^2
With automobiles													
All trips	-0.315	0.062	4.570	0.760	0.179	0.057	-0.018	0.004	—	—	-4.439	1.215	0.732
Subsistence trips	-0.208	0.034	2.723	0.422	0.150	0.032	-0.036	0.016	1.453	0.648	-7.816	1.800	0.675
Maintenance and leisure trips	-0.055	0.029	0.977	0.357	—	—	—	—	-0.539	0.070	1.132	0.617	0.717
Without automobiles													
All trips	-0.083	0.043	1.306	0.407	0.197	0.046	-0.011	0.003	—	—	-1.064	0.560	0.787
Subsistence trips	-0.082	0.025	0.926	0.234	0.123	0.026	-0.003	0.001	—	—	-1.251	0.351	0.664
Maintenance and leisure trips	—	—	0.199	0.023	—	—	-0.186	0.032	—	—	0.643	0.144	0.776

the effect increases in both groups with the age of the household head.

2. Age is always a negative factor. This is probably due to the deletion of children and adolescents from the sample, thus removing the lower tail of the usual bell-shaped distribution. Similarly, when only household heads are being included, the difference between the mobility of the various age groups is modest and does not exceed 25 to 35 percent between group averages.

3. The effect of education on travel is not simply additive to that of income. In reality, at higher levels of education and income, some reduction in overall mobility and subsistence travel can be observed.

4. Subsistence trips are the predominant trip purpose, as befits the case of household heads. Education is generally negatively related to this predominance.

To determine the interaction between the life-style and the instrumental aspects of household heads, standard multivariate techniques were used (Table 2).

The quantitative relations shown in Table 2 substantiate the basic premise that three socioeconomic variables—education, income, and age—contribute independently to a large degree of the explained variance of trip generation by household heads. Furthermore, the effect of income is positive, although weak. Age is nearly always negatively related to the various instrumental aspects of travel. Education shows mixed interactions, depending on the statistical formulation of the relations.

The derivation of the elasticities of income, education, and age shown below provides an additional insight to the effects of these variables on the mobility patterns of household heads.

Independent Variable	Dependent Variable		
	Income	Education	Age
With automobiles			
All trips	0.044	0.099	−0.184
Subsistence trips	0.087	−0.020	−0.050
Maintenance and leisure trips	NS	0.284	−0.611
Without automobiles			
All trips	0.085	0.235	−0.218
Subsistence trips	0.126	0.177	−0.154
Maintenance and leisure trips	NS	0.540	−0.506

Three general observations can be made:

1. On the whole, the elasticities of the variables on instrumental aspects of travel are fairly low, with the exception of maintenance and leisure trips.

2. Automobileless families have almost consistently higher elasticities than do households with an automobile available.

3. Income elasticities are positive, but very low; age elasticity is negative, but higher; and educational elasticities, although generally positive, show an interesting exception, namely that of subsistence trips by household heads with automobiles.

Turning now to the behavioral interpretation of the findings, several inferences seem to be appropriate. First, economic resources appear to have only a small effect on either overall mobility (within the observed range) or subsistence travel, probably because of the low costs of the trips relative to their utility or to the satisfaction derived at the trip end. However, the lack of significant results about maintenance and leisure trips should be considered in the light of the availability of weekday travel data without the complementary weekend travel. Second, the engagement-disengagement continuum is reflected by the difference in the travel patterns

of young vis-à-vis elderly household heads. Young adults are the most mobile group and make more trips for nonsubsistence purposes, particularly at higher levels of education. This is the age when the basic activity space is being formed, probably through a process of search and an evaluation of the opportunity range offered by the urban environment. Old age, on the other hand, is characterized by a substantial decrease in mobility. These lower levels of mobility of the elderly can be related to both the disengagement and the activity theories of aging (6).

Control and awareness of time are represented by both education and vehicle availability. Lower educational levels are generally associated with occupations that do not permit trips during working hours, whereas higher educational levels presumably allow a greater flexibility in subsistence travel, particularly business trips. However, higher educational levels may also have an opposite effect, because of a greater awareness of time and of the need for planning the use of this scarce resource. In a more detailed analysis, it was found that the income elasticities of maintenance and leisure trips of household heads who have an automobile and belong to the group with the highest education tend to be negative. This suggests that education has a mixed interaction with mobility, positive up to a certain level and then becoming negative, when the number of trips is reduced either by better planning or by a substitution of the person who is performing the trip.

The effect of automobile availability is two-fold: On the one hand, as has been shown above, it reduces the differences among the various variables that represent life-styles. In other words, when they have an automobile available, people with less income have a trip-making behavior more similar to that of people with higher income than they would have without an automobile. The same appears to be true for education and age. This particular effect of the private automobile may be termed an equity effect, in that it overcomes basic differences in socioeconomic characteristics of the traveling population. At the same time, the apparent dissimilarity between the elasticities of automobile-owning and automobileless household heads suggests a divergent propensity to use the opportunity field offered by the urban environment. Such a dual mobility pattern has been observed in a separate study (7) and seems to be reinforced by the findings of the present analysis.

CONCLUSIONS

A comparison of socioeconomic variables and their relations to weekday travel patterns in urban areas of Israel has shown a number of noteworthy variations in the distributions that can be related to a firmer behavioral rationale. This paper attempts to link the choice mechanism to a set of habitual responses inherent in the instrumental nature of travel and in life-style aspects that presumably underlay the preference systems of various groups in society.

Even in a simple cross-sectional analysis of standard household travel surveys, it was possible to isolate several phenomena that are usually missed in the normal category analysis of trip generation: the counter effect of higher education on income in reducing mobility; the existence of a highly mobile age group, young adults, with a travel behavior opposite to that of the better known, less mobile group of the elderly; the equity effect of automobile availability; and finally, the small weight of income on the trip generation of household heads.

These results should be considered as partial and tentative, because of the limitations of the data. These

limitations include the lack of independent data on mobility, such as trip lengths or vehicle kilometers of travel by the various social groups. Also, there was no information available on pedestrian movements, which would complement the investigation of instrumental needs that can be fulfilled without making a trip at all.

A number of implications for transportation research and policy may be outlined. First, survey techniques should include specific life-style variables and be administered in panel-type longitudinal surveys, so as to obtain more direct information on travel behavior. Second, a reconsideration of the population to be investigated in such surveys is required, so that subgroups who might respond more rapidly to transportation policy measures could be identified. Finally, the relations shown in this study precede the energy crisis. In view of the high probability that travel costs will increase in the future, the likely effect of this trend on the elasticities of the various socioeconomic variables should be investigated.

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Public Attitudes Toward Transit Features and Systems

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An attitudinal survey was made in the Dallas-Fort Worth metropolitan area in 1973-1974 to obtain representative public attitudes toward a comprehensive array of urban public transit features and systems. The sample population surveyed were demographically representative of the area. The questionnaire was structured such that the reasons for some of the attitudes could be deduced. It consisted of a series of questions about transit features or operational elements and a section about whole transit systems. An unbiased, informative audiovisual presentation accompanied the administration of the questionnaire, calling attention to various human factors, aesthetics, economics, and innovations regarding public transit. The questionnaire also incorporated a provision for quantification of attitudes by adding a question about money to be invested in a transit-system feature to the usual qualitative scale of answers. The importance scales were compared to the money-investment scales by using factor analysis, regression analysis, and other techniques. The five transit systems in the questionnaire were improved bus, dual rail, other-tracked vehicle, dual mode, and demand responsive (bus). This type of research is consistent with a contemporary philosophy of system development that emphasizes user-oriented techniques as an approach to enhancing public transit usage.

The initial objects of this research were two. The first was to determine the nature and type of human design factors that the public believe are important and should be incorporated in the transportation system. The second was to determine what type of overall system people prefer. Subsequent aspects of the study involved examining the data and determining any interrelations among the various parameters. The final step was to identify the underlying factors that influence regional attitude and behavior patterns in the public's decision to ride or not to ride any public transit system. Such attitudinal information should allow transit planners to be more sensitive to the desires of the public. This study was sponsored by the Urban Mass Transportation Administration of the Department of Transportation.

The experimental design and the data analysis attempted to determine the answers to a series of propositions about attitudes toward transit in the Dallas-Fort Worth metropolitan region.

The first phase of the research was the development of an attitudinal-survey, or questionnaire, form. This required several exploratory sessions, reviews, interviews, and revisions. The next phase of the research involved the presentation of the questionnaire to a representative sample population. Regional demographic characteristics such as income, sex, age, distance to