

Public Attitudes Toward Transport Modes: A Summary of Two Pilot Studies

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This paper summarizes attitudinal research conducted over the past three years by a University of Maryland research team. Objectives were (a) to identify and assess the importance of attributes of an ideal transportation system by measuring consumer attitudes, and (b) to determine how satisfied these consumers are with existing systems in terms of these attributes. A distinct finding of preference for private modes was identified, although substantial variability existed among the attributes studied. An interesting trichotomous response pattern evolved when data were distributed and analyzed along demographic and trip characteristic dimensions.

•DURING the past three years, a research team at the University of Maryland has conducted two studies of consumer attitudes toward transport modes used for typical recent trips. These studies have attempted to partially fill a void existing in transportation research. Most transportation behavior research had been of the origin-destination variety (1, 2, 3), with detailed description of traveler, mode and trip purposes. Thus, much was learned about where people traveled, but the motivation for their behavior remained undisclosed.

A few studies have, however, been undertaken which have partially focused on consumer attitude measurement, thereby reflecting on consumer values relevant to transportation selection decisions (4, 5, 6, 7).

Although in most cases these efforts achieved their stated objectives, many had several limitations which precluded generalization of their results. One of the most severe was the small selected samples used. Another has been the narrowness of focus in terms of the modal, trip and/or user characteristics studied. The latter made it difficult to compare and contrast results between studies due to the different variables included in each. In some cases the method of collecting data had not been carefully constructed and/or evaluated. Finally, the designs of these studies were based on the proposition that the researchers knew which modal characteristics to study and how to define them. Usually abstract factors such as "convenience, comfort, status, congestion, flexibility, and expense" have been used as inputs in these studies. Such factors are lacking in precise definition and probably diffuse connotations for different people, making it difficult to measure them.

OBJECTIVES AND FOCUS

This paper describes two pilot studies conducted in Baltimore, Md., and Philadelphia, Pa., under contract with the Bureau of Public Roads. The primary emphasis is, however, on the Philadelphia study since the results of the Baltimore study were included in a previous paper by Hille and Martin (8). These studies attempted (a) to identify and assess the importance of attributes of an ideal transportation system by measuring consumer attitudes, and (b) to determine how satisfied these consumers are with existing systems in terms of these attributes.

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The Maryland studies have focused on the development of factor definitions empirically by subjecting a comprehensive pool of specific items reflecting particular travel characteristics to the statistical tool of factor analysis. Factors which emerge from this type of analysis are unique in that (a) they are defined by the specific items included within them which are found to be closely interrelated, (b) the extent to which such factors are independent of other factors is precisely established, and (c) probably most importantly, the definition of the factors is largely determined by the respondents as reflected by the interrelationship between their item responses, rather than by the researcher who assumes his definition is the same as the respondents. (Selectivity was, however, used in developing the comprehensive pool of items for the questionnaire.) It was thus hoped that the studies would result in progress toward a definition and classification of the attributes or factors perceived by transport users to be independent and important variables for determining their travel behavior.

Another research goal was to provide a more comprehensive coverage of significant variables affecting modal choice decisions than had previously existed. Models derived in other studies had only a modicum of success for predicting modal split decisions, probably because these decisions are more complex than they were originally thought to be. As few as two variables have been used (travel time and cost) to try to predict modal choice, and many studies included from four to six variables. Results of these studies suggest that the development of a valid prediction model for modal choice decisions depends upon the incorporation of several factors into the prediction milieu, and the sensitivity of the model to the complex interrelationships existing among factors.

The Maryland pilot studies attempted to develop an exhaustive pool of items tapping all salient attributes thought to affect modal choice decisions. Questions were incorporated to measure the importance of modal attributes as well as perceived satisfaction of respondents with public and private modes for these same attributes in the Philadelphia study. Responses to these items were related to a comprehensive set of trip purpose, demographic, and trip characteristic variables to provide a comprehensive picture of these determinants of modal choices.

The Maryland research studies also focused more heavily on determining the why of consumer behavior than had preceding transportation research. As previously stated, modal split research concentrated on what people did and their related demographic variables. The attitude instrument developed in the Maryland studies sought to determine what they did and why. The measurement approach used in this study, containing measures of both the importance of and satisfaction with modal attributes, is considered by many psychologists as the best available approach to attitude measurement. The importance of a particular attribute is a function of both the underlying strength of the human need or needs to which it is related, and its present satisfaction level. Thus, inclusion of satisfaction items with the importance items sought to clarify the extent to which the importance of an attribute is a function of its present level of satisfaction.

Finally, this research sought to provide some evidence about the reliability and usefulness of transportation attitude studies by comparing expressed attitudes with actual behavior. Information was collected about modes actually used for recent trips, and availability of these modes for such trips so that the consistency of expressed attitudes could be checked against what respondents said they actually did.

RESEARCH DESIGN

The design of the Maryland studies is reflected in ten questions for which answers were sought.

1. What are the most important trip purpose categories for which consumers have different preferences for attributes of transport modes?
2. What attributes do consumers regard as salient in typical recent trips?
3. What is the relative importance of the attributes for each trip purpose?
4. What is the perceived relative importance of the attributes in the aggregate (for all trip purposes)?
5. To what extent, and how, are demographic characteristics of respondents and trip characteristics related to the importance of trip mode attributes?

6. To what extent do consumers perceive themselves as being satisfied with the attributes of commonly used and available modes?
7. What is the relative frequency of use of existing modes for each trip purpose?
8. What is the availability of alternative modes for each trip purpose?
9. How do existing modes compare to the ideal, and to each other, in both a general sense and for each trip purpose?
10. To what extent, and how, are demographic characteristics of respondents and trip characteristics related to perceived satisfaction of trip mode attributes?

Review of relevant literature and current conceptualizations about consumer demand for transportation suggested that the characteristics of an ideal transport system, their relative importance, and consumer satisfaction with them might well differ substantially depending on the purpose of the trip being undertaken. For example, as an attribute of an ideal transport system, the importance of speed would most likely be a function of the time constraints or urgency of the trip purpose. Consequently, there was considerable theoretical support for the contention that there might not be any single "ideal system," but perhaps several "ideals," one for each significantly different trip purpose. Thus, it was considered necessary to investigate this issue in depth in the design of the study.

Question 1, concerning the identification of trip purposes, arose out of the early recognition that the importance of attributes might differ significantly as trip purposes varied. An original pool of 15 trip purposes was reduced to 4 for the Baltimore study and to 2 for the present study as a result of several pretests and the Baltimore study. Questionnaire time and space limitations also made this reduction imperative. The two remaining categories (trip to work—or school and in-town, non-work trip) were retained since they include the vast majority of in-town trips taken by transport users and were shown to have substantially different response patterns in the Baltimore study.

Question 2, which pertains to the attributes used by consumers in modal choice decisions, was essentially the heart of the Baltimore study and was studied further in Philadelphia. Thus, an effort to replicate, elaborate and extend the Baltimore results to Philadelphia was made. The original Baltimore item pool was, however, substantially reduced in number and several items were added to replace those found to be weak in the Baltimore analyses.

The justification of including Question 3 was nearly identical to that for Question 1. The significance of trip purpose for mode selection should be indicated basically by the frequency and magnitude of differences identified between the trip purposes for both studies.

Question 4 relates to the aggregative importance of the attributes across trip purposes which evolved as a primary issue in the Baltimore study. If important differences between trip purposes are small, it is feasible to think in terms of a generalized ideal transport system without need for trip purpose individuation. The Baltimore study results provided more justification for a generalized scheme than was originally expected. Philadelphia data were analyzed to determine if corroborating evidence existed.

Question 5, which analyzes the relationship of demographic and trip characteristics to the importance of the transport attributes, resulted from the recognition that responses might differ for diverse trip purposes, and also among unlike respondent categories. Results obtained in Baltimore supported this conclusion. For instance, urban residents had different response patterns than suburbanites.

The unique contributions of the Philadelphia study began with the collection of data relevant to Question 6. After the attributes were identified and their importance assessed, transport users' satisfaction with present facilities was analyzed. This information is pertinent for determining the desirability of improvements for present and future transport systems. These changes would hopefully increase consumer satisfaction and utilization of the facilities.

Questions 7 and 8 were included for the following reason: An existing problem in interpreting attitude surveys involves responses to questions that reflect actual versus predicted behavior of people. Questions 7 and 8 provide a partial internal check on this issue. For example, if a respondent states that: the attribute "self esteem" is not important for the work trip modal selection decision (Question 3); he takes the bus to work

(Question 7); he owns an automobile which sits idle while he is at work (Question 8); and he indicates the bus is lower in status satisfaction than the auto, attitudes and behavior are consistent. Although such perfect consistency could not always be expected, this type of internal check was provided in the design of this study.

The answer to Question 9 provided information about the relative merits of existing modes by evaluating consumer satisfaction levels. Comparisons of existing facilities to an "ideal" mode for each trip purpose are also facilitated.

Finally, the rationale for including Question 10 was similar to that explained for the admission of Question 5. It was thought that satisfactions of respondents might differ significantly in relation to demographic characteristics and more specific trip characteristics.

DEVELOPMENT OF THE QUESTIONNAIRE

A questionnaire consisting of three parts and a household information cover sheet was used to collect the Philadelphia data. (There were two questionnaires; the questions remained the same but their order was varied to control halo and positional ef-

TABLE 1
SELECTED CHARACTERISTICS OF SAMPLED INDIVIDUALS RESIDING WITHIN THE PHILADELPHIA SMSA (1967)
AND BALTIMORE SMSA (1966): A COMPARISON WITH 1960 CENSUS REPORTS

Category	Total Philadelphia SMSA				Total Baltimore SMSA			
	Census		Sample		Census		Sample	
	Number	Percentage ^a	Number	Percentage ^a	Number	Percentage ^a	Number	Percentage ^a
Status of Person:								
Head ^b	1,266,429	30.1	228	48.4	484,980	29.1	166	35.9
Non-Head ^c	2,939,827	69.9	243	51.6	1,183,638	70.9	296	64.1
Total	4,206,256	100.0	471	100.0	1,668,618	100.0	462	100.0
Sex:^d								
Male	1,446,358	47.9	196	41.6	567,026	48.5	162	35.1
Female	1,571,325	52.1	275	58.4	601,284	51.5	300	64.9
Total	3,017,683	100.0	471	100.0	1,168,310	100.0	462	100.0
Age:^e								
16-20 years	286,883	9.5	29	6.2	116,822	10.0	62	13.4
21-24	203,430	6.7	33	7.0	85,280	7.3	26	5.6
25-34	568,452	18.8	91	19.3	236,279	20.2	91	19.7
35-44	524,322	21.0	55	11.5	255,112	21.8	116	25.1
45-54	526,075	17.4	110	23.4	198,981	17.0	89	19.3
55-64	401,357	13.3	64	13.6	143,892	12.3	43	9.3
65½ over	397,163	13.2	55	11.7	131,944	11.3	33	7.1
Omission							2	.4
Total	3,017,683	100.0	471	100.0	1,168,310	100.0	462	100.0
Education:^f								
Less than 8 years	592,506	18.9	34	7.2	326,511	26.8	62	13.4
8 & 9	787,717	25.1	58	12.3	296,612	24.3	64	13.8
10 & 11	546,441	17.4	103	21.9	190,524	15.6	89	19.3
12	773,625	24.6	193	41.0	249,700	20.5	137	29.6
13-15	222,915	7.1	41	8.7	81,557	6.7	55	11.9
16	132,887	4.2	24	5.1	45,163	3.7	28	6.1
Over 16	82,374	2.6	9	1.9	28,638	2.3	18	3.9
Omission							9	1.9
Total	3,138,465	100.0	471	100.0	1,281,961	100.0	462	100.0
		10.6		11.2		9.9		11.1
Race:^g								
White	2,626,698	85.3	370	78.3 ^h	951,116	79.7	372 ⁱ	80.5
Non-White	450,912	14.7	101	21.7	242,638	20.3	65	14.1
Omission							25	5.4
Total	3,077,610	100.0	471	100.0	1,193,752	100.0	462	100.0

^aPercentages are rounded to the nearest tenth; therefore, in some instances, they may not total 100.0 percent.

^bIn the census and in the sample, the member reported as the head of the household by the respondent is the head of the household; however, for census tabulation only, if a married woman living with her husband is reported as the head, her husband is classified as the head.

^cNon-head includes wife, child, other relative, and non-relative reported as part of the household.

^dIncludes only those people 16 years or older.

^eIn the census data, the age classification is based on the age of the person in completed years as of April 1, 1960, as determined from the reply to a question on month and year of birth. In the sample, ages are as reported by respondents.

^fCensus figures show the number of years of school completed for all those persons of 14 years of age and over.

^gCensus figures include all those persons over 14 years of age.

^hIn the Philadelphia study, the interviewer made a determination at the time of the interview as to each person's race.

ⁱNo determination as to a person's race was made by the interviewer. If a person resided on a block of at least 65 percent one race (as determined by the 1960 Census of Population and Housing), he was classified as being of that race. Thus, the 25 omissions occurred because certain blocks were not 65 percent one race.

^{•Sources:} 1. U. S. Census of Population and Housing: 1960, Final Report PHC(1)-116 (for Philadelphia) and PHC(1)-13 (for Baltimore) Standard Statistical Areas, Tables P1, P2, H1. 2. U. S. Census of Population: 1960, Vol. 1, Part 22 (for Maryland) and Part 40 (for Pennsylvania), Characteristics of Population, Table 103.

fects.) Part A contained a set of questions designed to elicit descriptive information about the two trip purposes asked about in Parts B and C of the questionnaire, i. e., the respondent's last common or usual trip to work or school, and his last common or usual in-town, non-work trip. Part B included a set of 35 items measuring the importance of attributes contained in the items along a 7-degree Likert-type interval scale, ranging from "not at all important" to "of greatest importance." These items were designed to measure independent attribute factors, many of which were suggested by results obtained in the Baltimore study.

Part C contained a set of 33 items constructed to determine satisfaction with the Part B attributes for auto and the respondent's most likely form of public transportation for both trip purposes. The attributes included in Part B, but eliminated in Part C, were "the opportunity to drive the vehicle yourself" and "the opportunity to ride in your own vehicle." It seemed inappropriate to ask respondents to rate their satisfaction with these two attributes for public transportation. This questionnaire was designed to be self-administered, although the interviewer was available for any needed help.

SAMPLES

The selection of Baltimore and Philadelphia for study was based on several considerations. The two main reasons were: (a) both cities were within a reasonable distance of the University of Maryland which facilitated control and reduced data collection expenses; and (b) there were significant differences between the cities in terms of their transport systems, size, and demographic composition. Diversity was sought to measure the effects of such differences on consumer attitudes. For example, Baltimore's only form of public transportation is the bus, whereas Philadelphia has one of the most sophisticated public transit systems in the United States. Further, the population of Philadelphia 1960 SMSA is larger (4.4 million) than Baltimore's (1.7 million), thereby providing an indicator of attitude differences related to size of the area being studied.

The composition of the Philadelphia sample is summarized along selected social and economic characteristics in Tables 1 and 2. In addition, the tables present census data classified in the same manner as that of the Baltimore SMSA sample selected for Phase I.

The data in Table 1 concerning the age, education, sex, head/non-head of household and race composition of the sample and population are presented on an individual basis. In comparing sample data with census data for individuals, the reader is advised to proceed with caution since the sample was drawn from a universe of occupied housing units rather than a universe containing all individuals within the SMSA. Thus, it would not be expected that the proportions would be exactly identical for dissimilar universes. However, some information about the representativeness of the sample is provided with such a comparison.

Keeping that proviso in mind, the data in Table 1 indicate that the sample may be somewhat unrepresentative.

The greatest divergence appears in the distribution of the education characteristics. The sampled individuals seem to be those with higher educational attainments than the general public. Such differences may, however, be more apparent than real. The census data include individuals 14 years of age and over while the sample contains only people aged 16 and over. It is in the categories of less than 8 and 8 to 9 years of education where the sample seems to be under-represented (this contains the 14 to 15-year-old group). Further, the sample distribution is concerned only with those who participated in the study, not with every member of a family. Therefore, the selection limitations place an upward bias upon the distribution, and this is reflected in the findings of the median years completed of 11.2 for the sample compared to 10.6 in the total population.

The table also indicates that the sample may have a disproportionate number of females. That is, expected proportions would be a little closer to 50 percent females than the actual proportions of 42 percent male and 58 percent female. Special efforts were made in this phase of the study to include men in the sample since the analysis of Baltimore data showed some differences between male and female importance ratings. Comparison of proportions obtained in the two cities reveals some improvement in Philadelphia.

TABLE 2
SELECTED CHARACTERISTICS OF SAMPLED HOUSEHOLDS^a CONTAINED WITHIN THE PHILADELPHIA SMSA (1967)
AND BALTIMORE SMSA (1966): A COMPARISON WITH 1960 CENSUS REPORTS

Category	Total Philadelphia SMSA				Total Baltimore SMSA			
	Census		Sample		Census		Sample	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Ownership:								
Owned ^b	885,768	70.0	258	71.5	308,720	63.7	250	71.8
Rented ^c	380,641	30.0	100	27.7	176,260	36.3	95	27.3
Omission			3	.8			3	.9
Total	1,266,429	100.0	361	100.0	484,980	100.0	348	100.0
Income:^d								
Under \$1,000	33,790	3.1	5	1.4	15,183	3.6	2	.6
1,000- 1,999	47,239	4.3	12	3.3	20,035	4.7	11	3.2
2,000- 2,999	60,571	5.6	27	7.5	26,082	6.2	16	4.6
3,000- 3,999	84,381	7.8	21	5.8	36,296	8.6	16	4.6
4,000- 4,999	115,875	10.6	28	7.8	47,486	11.2	22	6.3
5,000- 5,999	144,753	13.3	48	13.3	56,755	13.4	48	13.8
6,000- 6,999	132,080	12.1	56	15.5	49,641	11.7	44	12.6
7,000- 9,999	260,686	24.0	77	21.3	97,893	23.1	77	22.1
10,000-14,999	145,442	13.4	64	17.7	52,159	12.3	62	17.8
15,000-24,999	46,281	4.3	18	5.0	16,011	3.8	50	14.4
25,000 and over	16,398	1.5	2	.6	5,939	1.4	0	0
Omission			3	.8			0	0
Total	1,087,496	100.0	361	100.0	423,480	100.0	348	100.0
Median income	\$6,433		\$6,700		\$6,199		\$7,440	
Number in household:^e								
1 Person	162,111	12.8	27	7.5	55,893	11.5	14	4.0
2 Persons	335,237	26.5	107	29.6	125,765	25.9	74	21.3
3 Persons	248,879	19.7	68	18.8	96,590	19.9	86	24.7
4 Persons	237,308	18.7	69	19.1	89,541	18.5	81	23.3
5 Persons and over	262,894	22.3	90	24.9	117,191	24.2	93	26.7
Total	1,266,429	100.0	361	100.0	484,980	100.0	348	100.0

^aA household consists of all the persons who occupy a housing unit.

^bIn the census data, a housing unit is owned if the owner or co-owner lives in the unit, even if it is mortgaged or not fully paid for.

^cAll other occupied units are classified as rented in the census figures.

^dIncome is given in the census data on a family basis, and in the sample data on a household basis.

^eAll persons enumerated in the 1960 Census of Population as members of the household were counted in determining the number of persons who occupied the housing unit. These persons include only lodgers, foster children, wards, and resident employees, who shared the living quarters of the household head. The same method was used in the sample.

^fSources: 1. U. S. Census of Population and Housing: 1960, Final Report PHC(1)-116 (for Philadelphia) and PHC(1)-13 (for Baltimore) Standard Statistical Areas, Tables P1, P2, H1. 2. U. S. Census of Population: 1960, Vol. 1, Part 22 (for Maryland) and Part 40 (for Pennsylvania), Characteristics of Population, Table 103.

In contrast to Table 1, the data in Table 2 are presented with household units as the base. Again, the reader is cautioned about making direct comparisons between sample characteristics and census data. It seems probable that changes would have occurred in the population during the interval between the undertaking of the 1960 Census and the gathering of the sample data.

Generally speaking, the distributions of the Philadelphia sample appear representative for the observed characteristics. The proportion of one person households may be a little lower than in the population, which probably accounts for the under-representation of the two lowest income categories in the sample.

When viewing these data it should be recognized that the chief objective of this phase of the project was to obtain a sample that included enough units of differing socio-economic characteristics to allow analysis of their questionnaire responses. That is, the primary goal was to discover if observed differences in responses to the importance and satisfaction sections of the questionnaire were partially attributable to variability in social and/or economic conditions. Thus, the precision of any generalization about the Philadelphia SMSA was an important, but clearly secondary, consideration in the overall project design. The sample is satisfactory in terms of the primary requirements. The findings of the study do point out differences in social or economic characteristics of the sample items in relation to attitude item responses.

ANALYSIS

A variety of analytical techniques were applied to the data developed for the Philadelphia study. The previously stated research questions provided the central structure

for the selection of the appropriate analytical tools. Of principal interest were the factor analyses of responses to Parts B and C (attitude sections) of the questionnaire.

Factor analysis of the Baltimore data yielded an empirically derived list of attribute factors which were subsequently labeled according to their apparent underlying dimension. The Baltimore research was concerned only with the importance of attributes to consumers; that in Philadelphia inquired into importance and satisfaction. However, this same analytic technique was used for the Philadelphia "importance" and "satisfaction" data. The factor analyses of importance items for each trip were made for the Philadelphia data in order to determine if the factors identified in Baltimore would be replicated in Philadelphia. Further, as a few new items were developed after the completion of the Baltimore research, it was necessary to determine if these items would cluster into new factors.

Simple frequency and percentage distributions, means, standard deviations, and standard errors were used in condensing and analyzing other relationships in the data.

Reliability

Various versions of the questionnaire have been subjected to test-retest reliability studies over a time span of approximately two weeks. These studies were made to insure that the instrument would elicit a stable response. Reliability is necessary if the results are to have validity and practical value. If responses are ephemeral, either because the variable being measured changes frequently or because the instrument is ambiguous, confidence in the responses and usefulness of them would be questionable.

Subjects used in these studies have been University of Maryland freshmen. Although coefficients of reliability have been obtained on an item-by-item basis, the most relevant set of coefficients are for the basic factors or attributes identified in factor analysis of item matrices. These factors are composed of from 2 to 8 items found to be highly interrelated. Table 3 gives the range and median of 6 coefficients obtained for 8 factors (and a set of miscellaneous items which did not cluster into a factor) in the most recent reliability study of the final version of the questionnaire in the Philadelphia study.

The six coefficients represent the results of relating responses to three parts of the questionnaire to each of two trip purposes. The three parts include (a) importance responses, (b) satisfaction with auto responses, and (c) satisfaction with public transport responses.

Three conclusions appear warranted. First, in light of the median coefficients, minimum levels of reliability are attained in most cases. Second, the range of coefficients suggests that some facets of the questionnaire are still not eliciting adequate levels of consistency (especially satisfaction responses to the non-work trip). Third, although these levels of reliability are acceptable for the experimental pilot studies, before the questionnaire is administered on a large scale, it should be pruned and refined again and then tested on a more realistic sample of the public than college freshmen.

TABLE 3
TEST-RETEST RELIABILITY COEFFICIENTS FOR EACH OF 9 FACTORS^a

Factor	Range of 6 Coefficients	Median Coefficient ^b
Reliability	0.42-0.91 ^c	0.75
Weather	0.18-0.84	0.69
Travel time	0.62-0.85	0.77
Cost	0.42-0.85	0.71
State of vehicle	0.49-0.89	0.73
Self-esteem	0.51-0.97	0.80
Diversions	0.42-0.92	0.81
Unfamiliarity	0.53-0.92	0.77
All other items ^d	0.62-0.91	0.77

^aN = 53 University of Maryland freshmen with a 14-day interval between administrations.

^bSince there are six coefficients, the median is the average of the third and fourth highest coefficients.

^cFor some reason, the reliability for satisfaction with factors on the non-work trip was much lower than for the other five sets of coefficients. It may be there was a mistake in the output, but it could not be found with a check.

^dItems 6, 7, 16, 17, 19, 25, 26, 27.

Validity

Although the results of these two studies do not provide any conclusive evidence about the validity of the instrument, two particular parcels of information were obtained which supports its validity. The first concerns a comparison of results obtained in Baltimore and Philadelphia. The extent to which comparable results are replicative has some bearing on the instrument's validity. Second, the Philadelphia study was designed so that it would be possible to determine the relationships between expressed respondent attitudes and modal use behavior. The congruence of expressed attitudes and respondent behavior also partially reflects validity.

Comparison of Baltimore and Philadelphia Results

Summary evidence presented in Table 4 suggests that factors emerging in both Philadelphia and Baltimore studies were quite comparable, in spite of some material differences. Difficulty is encountered in trying to assess the reasons for these differences, because they could be caused by one or more of the following circumstances. First, and most importantly, about one-third of the items in the two questionnaires were different. The least significant and most ambiguous Baltimore items were discarded to maintain a reasonable length while adding the satisfaction section to the Philadelphia questionnaire. Furthermore, several new items were added to improve the measurement of factors emerging in Baltimore and to uncover any new factors not measured by the Baltimore questionnaire. Second, it may be that Philadelphia respondents actually do perceive the factors differently from Baltimore respondents; that is, perhaps differences are a function of true attitude rather than a reflection on the validity of the questionnaire. Third, error variance in the questionnaires may be a contributing factor. Finally, differences in interpretive judgments of the factors by the researchers may be accounted for a portion of the difference. It should be remembered that the titles of the factors are purely a function of researcher judgment and a more relevant consideration for readers may be a comparison of factor item compositions and loadings from the appropriate factor analysis tables of the two studies.

Factor titles in Table 4 are presented in rank order of importance so that it is possible to determine differences between studies in factor importance as well as for the definition of the factors themselves.

Comparisons of the factor matrices for Baltimore and Philadelphia, for both work and non-work trips, show that four factors (identified as reliability, travel time, cost, and age of vehicle or state of vehicle) are defined by similar terms. Most of the other Baltimore factors merged into slightly broader or narrower factors in Philadelphia. For example, the independence of control factor (independent of anyone, control speed and direction) from the Baltimore study broadened into a self-esteem factor (independence, satisfaction of owning, pride of ownership, etc.) as a result of the inclusion of items pursuing that line in the Philadelphia questionnaire, and the Baltimore no repairs unique factor is included in the reliability dimension by the Philadelphia respondents.

It is concluded that considerable similarity exists between the dimensions identified empirically in the Baltimore and Philadelphia samples. Most differences which do exist,

TABLE 4
COMPARISON OF BALTIMORE AND PHILADELPHIA FACTORS IN ORDER OF IMPORTANCE

Work Trip		Non-Work Trip	
Baltimore	Philadelphia	Baltimore	Philadelphia
1. Repairs	1. Reliability	1. Repairs	1. Reliability
2. Reliability	2. Travel time	2. Comfort	2. Weather
3. Speed	3. Weather	3. Cost	3. Convenience
4. Cost	4. Cost	4. Speed	4. Cost
5. Independence	5. State of vehicle	5. Independence	5. Travel time
6. Traffic	6. Unfamiliarity	6. Family and friends	6. State of vehicle
7. Age of Vehicle	7. Self-esteem	7. Traffic	7. Congestion
8. Family and friends	8. Diversions	8. Age of vehicle	8. Unfamiliarity
			9. Diversions
			10. Self-esteem

can be explained by the different item content of the two questionnaires. It is anticipated that one additional modification and refinement of questionnaire items should result in the achievement of as independent and comprehensive a set of attributes as reality will permit. With regard to the latter consideration, one reason the factors do not come out entirely pure may be, because the consumers themselves do not perceive the items associated with those factors to be independent. For example, convenience and travel time may be conceptually distinct attributes, but it is obvious they are not entirely independent. To determine precisely how closely the importance of the items response patterns coincided between the two cities, a correlation analysis was made for the 21 importance items which remained the same for both questionnaires. Pearsonian coefficients were obtained between the item means. Recognizing that this procedure always overstates the magnitude of the relationship between correlated variables the relationships are still high, i.e., for trip purpose one, the correlation between the means was 0.90, and for trip purpose two it was 0.99. However, there were several interesting and significant differences between the two cities for specific trip and demographic characteristics. For example, bus riders in Baltimore showed a distinct tendency to regard reliability, convenience, comfort, and cost as more important than did auto riders. This tendency was not replicated in Philadelphia, perhaps reflecting a higher quality service in the latter city.

Attitude Compared to Reported Behavior

Attitude studies are frequently criticized as being of questionable validity, because they fail to demonstrate a linkage between attitude responses and actual behavior of respondents. Since transportation policy-makers are interested in understanding, predicting, and if possible, influencing behavior of transport users, they too should be interested in the association between attitudes and behavior of respondents in this study. Thus, expressed attitudes about the importance of, and satisfaction with, transport attributes are compared to modes reported as actually being used on a recent work or non-work trip. The reader is cautioned, however, to remember that the results are based on small subsamples and may be inaccurate. Only those respondents who reported having another mode reasonably available are included in this analysis.

Analysis of mode use and attitudes for the work trip supported the following conclusions:

1. Those who took automobile reported more satisfaction with auto than did those who took public transport.
2. Those who took public transport reported more satisfaction with public transport than did those who took auto.
3. Public transport riders report slightly more satisfaction with public transport modes than with auto for the most important reliability of destination achievement factor.
4. For two other important factors (travel time and cost), public transport users saw little difference in satisfaction between auto and public modes. However, for the important weather factor, they rated auto more satisfactory.
5. Auto users rated auto substantially more satisfactory on the self esteem, diversions, and unfamiliarity factors than did public transport riders.
6. Considering items rather than factors, the public transport group rated public modes as more satisfactory than auto on only 6 of the 33 items.

Evidence accumulated for the non-work trip suggests the following conclusions:

1. Those using automobiles report higher satisfaction with the auto than do those using public modes.
2. Those taking public transit rate auto as more satisfactory than public transit for all factors (but less than do auto users) and for all but one item.

These results suggest a modest positive linkage between expressed attitudes and reported behavior, particularly for the work trip. An issue of crucial importance for the interpretation of this evidence is how respondents perceived the question of whether a mode other than the one they used was reasonably available. If public mode users viewed it as meaning that an auto or other vehicle was possessed by the family, but not necessarily

readily available for their particular trip, then they may be more of a captive group than their surface responses would suggest. Further research about linkage is required before clear conclusions can be drawn.

FINDINGS

Remembering the previously described sampling limitations and the tentative nature of findings based on small pilot studies, the following points emerge as the most important findings of the two studies.

Trip Purpose Distinctions

Evidence indicative of the relationship between the work and non-work trip purposes for the importance section is given in Table 5. As was true in Baltimore, the main difference between them appears for the travel time factor, it being more important for the work trip. In addition, items embodied in factors labeled convenience and congestion clustered together into relatively independent dimensions for the non-work trip only. Some of the items were related quite highly to travel time items for the work trip, and are found in that work trip factor. It is concluded that differences between the item content of factors and the importance of the factors are great enough to warrant the continued distinction between work and non-work trips. However, it should be noted that 8 of the 10 factors emerged with similar item compositions for both trip purposes.

Attributes of Transport Modes

Ten factors emerged from the factor analyses, with eight of them fairly stable across both trip purposes. These dimensions closely paralleled factors identified in Baltimore considering differences in item content of the questionnaires. Factor analyses of satisfaction items also showed a similar pattern of factors, thus providing evidence of stability across both sections of the questionnaire.

It is concluded that the goal of a clearly defined exhaustive set of relatively independent and stable factors salient to modal choice decisions has not been fully attained. However, progress in that direction certainly has been made. One implication of these results is that models attempting to predict consumer behavior will probably have to include more than the 2 to 4 factors they typically incorporated if high levels of predictive validity are to be attained.

Importance of Attributes by Trip Purpose

The main differences in attribute importance between trip purposes existed for the travel time, convenience, and congestion factors. Travel time was substantially more important for the work trips than for non-work trips (Table 5). The differences in the

TABLE 5
DIFFERENCES IN PHILADELPHIA FACTORS BETWEEN
TRIP PURPOSES ARRANGED ON THE BASIS OF
RELATIVE IMPORTANCE^a

Factors	Trip Purpose	
	Work-School	Non-Work
Reliability	6.39(1)	6.34(1)
Travel time	6.14(2)	5.26(5)
Weather	5.99(3)	5.98(2)
Cost	5.50(4)	5.52(4)
State of vehicle	5.13(5)	5.10(6)
Unfamiliarity	4.62(6)	4.56(8)
Self-esteem	4.61(7)	4.25(10)
Diversions	4.01(8)	4.45(9)
Convenience	—	5.78(3)
Congestion	—	5.02(7)

Highest possible score: 7.00

^aBoth the relative and absolute importance of the dimensions identified in the factor analysis for each trip purpose are summarized. Ranks are presented in parentheses and average importance is indicated on a 7-category interval scale.

importance of convenience and congestion are clouded by the failure of these factors to emerge for both trip purposes. However, examination of factor analysis tables in the body of the report reveals that the ranking of third (3) for the convenience factor (non-work trip) coincides closely with the ranking of second (2) for the travel time factor (work trip). This is significant because the two items composing this factor ("avoid walking more than a block" and "avoid changing vehicles") fell within the travel time factor for the work trip. This evidence suggests the difference between the two trip purposes for convenience items was not large.

Other data in the body (Tables 6 and 7) support this conclusion, although both items were slightly more important relatively for the non-work trip.

The congestion items did not fall into any factors for the work trip, but they did not differ in importance significantly between trip purposes.

Finally, it should be noted that, although there were few significant relative differences in the importance of factors between trip purposes, most factors were regarded absolutely more important for the work trip. This is not unexpected, since the work trip is more compelling in requiring reliable, rapid, convenient, low cost, etc., transportation.

It is concluded, that except for travel time, there are few significant differences between the trip purposes used in this study. However, as is often true when data are condensed into a few broad categories (in this case, factors), there is a need for more intensive scrutiny of the elements in the category before a clear picture emerges.

Importance of Attributes for an Ideal System

Since differences in the relative importance of attributes between trip purposes were slight, except for the travel time factor, it is concluded that it is feasible to discuss the attributes of a generalized ideal system. The following list of factors arrayed in order of importance suggests the basic attributes of such a system.

1. Reliability of destination achievement (including elements of safety and confidence in the vehicle);
2. Convenience and comfort;
3. Travel time (but with large trip purpose differences);
4. Cost;
5. State of vehicle (with cleanliness overshadowing newness);
6. Self esteem and autonomy (with emphasis on independence rather than pride);
7. Traffic and congestion (both in and out of the vehicle); and
8. Diversions (including nature of travel companions, availability of radio, and scenery).

This list and the terminology used in defining the factors reflect the influence of results obtained in both Philadelphia and Baltimore. The similarity of findings across the two studies is striking.

Relationship of Demographic and Trip Characteristic Variables to Importance of Transport Attributes

Data pertaining to these relationships suggest that a very interesting trichotomy of response patterns may exist with regard to attitudes relating to importance of, and satisfaction with transport attributes.

The group which ranks importance attributes highly appears to be those who live in the suburbs fairly close to the CBD, have one or more autos, high income, live in single-family homes, regard out-of-town trips as being from 16 to 40 miles, use the automobile heavily for both trip purposes, and are white. Thus, they appear to be the more affluent suburbanite with middle-class American value systems emphasizing status, independence, convenience, reliability, and speed of travel.

The two other groups in the trichotomy regarded most factors as less important than the above group, but apparently for different reasons. Those residing nearest to the CBD in multiple-family housing with lower incomes and educations, owning fewer autos, and composed heavily of minority groups rated most factors as less important. This could be due to several reasons including misunderstanding of the questionnaire, reluctance to admit that things not possessed are important, less need for and emphasis on transportation, and perhaps different values and needs than those of middle-class suburbia.

The third group lives farthest from the CBD and had several characteristics similar to the first group. However, they also rated several factors as less important than the former group. Some of their response patterns suggested the hypothesis that this group has purposely chosen residences far from the center of the city to get away from the

TABLE 6
 PERCENTAGE DIFFERENCES BY ITEM OF AUTO SATISFACTION OVER PUBLIC MODES SATISFACTION FOR THE WORK TRIP

Rank by Mean Importance	Rank by Percentage Difference: Auto-Public Modes Satisfaction	Actual Percentage Difference: Auto-Public Modes Satisfaction					Item No.	Description
		0	10%	20%	30%	40%		
11 (5.83)	1	[Bar from 0 to ~45%]					26	Avoid waiting more than 5 minutes
22 (5.10)	2	[Bar from 0 to ~45%]					6	Uncrowded vehicle
9 (5.97)	3	[Bar from 0 to ~45%]					5	Protected from weather while waiting
30 (3.87)	4	[Bar from 0 to ~45%]					4	Listen to radio
23 (4.70)	5	[Bar from 0 to ~45%]					19	Package and baggage space
5 (6.14)	6	[Bar from 0 to ~45%]					12	Shortest distance
17 (5.48)	7	[Bar from 0 to ~45%]					16	Avoid walking more than a block
16 (5.52)	8	[Bar from 0 to ~45%]					14	Feel independent
33 (3.56)	9	[Bar from 0 to ~45%]					8	Take along family and friends
7 (6.10)	10	[Bar from 0 to ~45%]					17	Auto changing vehicle
19 (5.28)	11	[Bar from 0 to ~45%]					3	Cost
24 (4.70)	12	[Bar from 0 to ~45%]					31	Pride in vehicle
27 (4.50)	13	[Bar from 0 to ~45%]					23	People you like
10 (5.88)	14	[Bar from 0 to ~45%]					1	Shortest time
6 (6.13)	15	[Bar from 0 to ~45%]					24	Fast as possible
26 (4.55)	16	[Bar from 0 to ~45%]					21	Friendly people
29 (4.07)	17	[Bar from 0 to ~45%]					32	Avoid riding with strangers
13 (5.62)	18	[Bar from 0 to ~45%]					27	Comfortable
31 (3.87)	19	[Bar from 0 to ~45%]					9	Ride with people who chat
28 (4.11)	20	[Bar from 0 to ~45%]					25	Need not pay daily
2 (6.40)	21	[Bar from 0 to ~45%]					11	Arrive at intended time
14 (5.59)	22	[Bar from 0 to ~45%]					13	One-way cost of \$0.25 rather than \$0
12 (5.66)	23	[Bar from 0 to ~45%]					22	One-way cost of \$0.25 rather than \$0
15 (5.59)	24	[Bar from 0 to ~45%]					10	Clean vehicle
25 (4.66)	25	[Bar from 0 to ~45%]					20	New modern vehicle
18 (5.46)	26	[Bar from 0 to ~45%]					29	One-way cost of \$0.03 rather than \$0
20 (5.17)	27	[Bar from 0 to ~45%]					30	Avoid unfamiliar area
21 (5.14)	28	[Bar from 0 to ~45%]					7	Travel when traffic is light
8 (6.01)	29	[Bar from 0 to ~45%]					2	Vehicle unaffected by weather
3 (6.39)	30	[Bar from 0 to ~45%]					18	Safest vehicle
1 (6.49)	31	[Bar from 0 to ~45%]					28	Arrive without accident
4 (6.30)	32	[Bar from 0 to ~45%]					33	Avoid stopping for repairs
32 (3.56)	33	[Bar from 0 to ~45%]					15	Look at scenery

TABLE 7
 PERCENTAGE DIFFERENCES BY ITEM OF AUTO SATISFACTION OVER PUBLIC MODES SATISFACTION FOR THE NON-WORK TRIP

Rank by Mean Importance	Rank by Percentage Difference: Auto-Public Modes Satisfaction	Actual Percentage Difference: Auto-Public Modes Satisfaction					Item No.	Description
		0	10%	20%	30%	40%		
14 (5.40)	1	[Bar from 0 to ~45%]					26	Avoid waiting more than 5 minutes
4 (6.01)	2	[Bar from 0 to ~45%]					5	Protected from weather while waiting
33 (3.46)	3	[Bar from 0 to ~45%]					4	Listen to radio
20 (5.15)	4	[Bar from 0 to ~45%]					6	Uncrowded vehicle
15 (5.33)	5	[Bar from 0 to ~45%]					19	Package and baggage space
10 (5.58)	6	[Bar from 0 to ~45%]					16	Avoid walking more than a block
16 (5.30)	7	[Bar from 0 to ~45%]					12	Shortest distance
23 (4.82)	8	[Bar from 0 to ~45%]					1	Shortest time
28 (4.48)	9	[Bar from 0 to ~45%]					31	Pride in vehicle
17 (5.24)	10	[Bar from 0 to ~45%]					3	Cost
31 (4.04)	11	[Bar from 0 to ~45%]					32	Avoid riding with strangers
19 (5.18)	12	[Bar from 0 to ~45%]					14	Feel independent
24 (4.75)	13	[Bar from 0 to ~45%]					21	Friendly people
25 (4.67)	14	[Bar from 0 to ~45%]					23	People you like
11 (5.58)	15	[Bar from 0 to ~45%]					10	Clean vehicle
5 (5.99)	16	[Bar from 0 to ~45%]					17	Auto changing vehicle
9 (5.65)	17	[Bar from 0 to ~45%]					27	Comfortable
29 (4.15)	18	[Bar from 0 to ~45%]					9	Ride with people who chat
8 (5.67)	19	[Bar from 0 to ~45%]					11	Arrive at intended time
26 (4.65)	20	[Bar from 0 to ~45%]					8	Take along family and friends
18 (5.23)	21	[Bar from 0 to ~45%]					24	Fast as possible
32 (3.79)	22	[Bar from 0 to ~45%]					25	Need not pay daily
13 (5.53)	23	[Bar from 0 to ~45%]					29	One-way cost of \$0.03 rather than \$0
27 (4.62)	24	[Bar from 0 to ~45%]					20	New modern vehicle
12 (5.56)	25	[Bar from 0 to ~45%]					13	One-way cost of \$0.25 rather than \$0
7 (5.74)	26	[Bar from 0 to ~45%]					22	One-way cost of \$0.25 rather than \$0
21 (5.07)	27	[Bar from 0 to ~45%]					30	Avoid unfamiliar area
22 (4.89)	28	[Bar from 0 to ~45%]					7	Travel when traffic is light
1 (6.42)	29	[Bar from 0 to ~45%]					2	Vehicle unaffected by weather
6 (5.95)	30	[Bar from 0 to ~45%]					18	Safest vehicle
2 (6.34)	31	[Bar from 0 to ~45%]					33	Avoid stopping for repairs
3 (6.27)	32	[Bar from 0 to ~45%]					15	Look at scenery
30 (4.04)	33	[Bar from 0 to ~45%]					15	Look at scenery

congestion of urban living. They appear less status and ego oriented and presumably value the pastoral aesthetic environment highly. Thus, transport attributes are of importance to them only insofar as their lack interferes with the cultivation of their interests.

Satisfaction With Auto and Public Transport

If there is one startling finding emerging from this study, it would probably have to be the overwhelming preference which respondents expressed for auto over their most likely form of public transport. Tables 6 and 7 indicate that auto had a more favorable image than public transport on all 35 items in the questionnaire for both trip purposes, although the degree of favorableness varied substantially. Travel time, susceptibility to weather, self esteem and convenience-comfort were the factors for which the auto was perceived to be most satisfactory in comparison with public transport. Auto had less of an advantage for reliability, cost, state of the vehicle and diversions factors. In addition, the preferential attitude toward the auto was more pronounced for the non-work trip than for the work trip. Although part of this trend may have been due to a halo effect, it does not seem rational to attribute more than a minor portion of it to this possibility.

Comparison of Existing Modes to an Ideal

Based on previous discussions of importance and satisfaction, two conclusions are evident. First, the auto approaches the ideal much more closely than do existing public modes. The average responses for the factors along a 7-category scale ranging from "not at all satisfied" (1) to "completely satisfied" (7) were all close to "very well satisfied" (6). Congestion, cost and diversions were the factors for which the auto was perceived to be weakest in relation to the ideal. Public transport had average factor responses clustering around the "generally satisfied" category (5) with the majority between it and "somewhat satisfied" (4).

Second, it is evident that both modes are quite satisfactory with regard to the most important characteristic of an ideal mode (reliability of destination achievement), although auto also has a slight advantage for this factor. Apparently, the risk of having the vehicle break down or the fear of accidents is not great for these modes, and thus is not likely to be a crucial consideration in choosing between them on in-town trips. Whether this image also exists for out-of-town trips would be an interesting question for future research.

Relationship of Demographic and Trip Characteristic Variables to Satisfaction With Transport Attributes of Auto and Most Likely Public Mode

The trichotomous pattern found for importance responses was even more distinct for satisfaction responses. Generally, the most satisfied people were the middle-class suburbanites living fairly close to the CBD. They, of course, are the ones who possess one or more autos and find it most feasible and satisfying to use them for both trip purposes. Surprisingly, the low-income group living closest to the CBD was generally more satisfied than people living in the remote suburbs. Apparently, they have adjusted to a lack of auto in many cases and probably keep their trips short and to a minimum. The people farthest from the CBD were least satisfied, probably because their very location made traveling difficult and onerous. They tended to be relatively dissatisfied with all modes for most factors.

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