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Transit User Information Aids: An Evaluation of Consumer Attitudes

Prepared for

U.S. Department of Transportation
Urban Mass Transportation Administration
Office of Transit Management
Washington, D.C. 20590

by

Battelle Memorial Institute,
Human Affairs Research Center
and Ilium Associates, Inc.

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These results deal with an evaluation of transit user information aids. The evaluation was part of a broader project on transit information aids, which was conducted by Ilium Associates. They surveyed information tools and dissemination techniques being used by the United States, Canadian, European, and Mexican transit systems. The product of those efforts is available in a separate report, Transit Marketing Management Handbook: Transit User Information Aids.

Members of the Ilium Associates staff were instrumental to the evaluation in assisting with the research planning, acquiring study sites and samples, and leading the evaluation discussion groups. These activities were performed by Gary H. Andersen, Michael T. Hughes, and Carolyn A. Perez.

We are grateful to the following transit system representatives who cooperated in establishing evaluation data sites: (1) In Seattle--Mr. Richard S. Page, Mr. Carle H. Salley, and Mr. Larry L. Coffman, of Seattle Metro System; (2) In Columbus--Mr. Walter H. Daggett and Mr. Thompson A. Nooner, of Central Ohio Transit Authority; (3) In Dallas--Mr. Ellis H. Watkins and Mr. Jerry Johnson, of Dallas Transit.

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INTRODUCTION

Background

In the past ten years, increasing attention has been focused on ways to increase public transit ridership in many American cities. Both local governments and relevant federal agencies have undertaken a number of projects geared toward developing and testing transit marketing and information systems which will encourage more people to ride transit; and toward assessment of those attitudinal factors which influence people's decision to ride or not to ride public transit. While one study[1] has found that information systems do not conclusively influence ridership decisions, it has, nevertheless, determined that transit information systems are a necessary, if fairly passive element, in the overall transit system. A good information system may increase the visibility and level of awareness of the transit system, thus providing people with adequate information for making a choice between riding/not riding transit.

In other words, the design of an information system, by itself, has not previously been shown to influence a person to ride transit. However, given a need or favorable attitude toward riding transit, the information system becomes vitally important in allowing people to actually carry out their behavioral intentions. Thus it becomes imperative to be able to identify the combination of elements of a transit information system that are both necessary and preferred by users and potential users as most effectively transmitting the necessary information for persons to successfully

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[1] Liff, Sally D. and Richard M. Michaels. Public Information Systems in Urban Mass Transit. Research Report from the Transportation Center, Northwestern University, Evanston, Illinois.

use a transit system. Two elements have been tested in past projects and studies on transit information systems: attitudes toward transit in general and attitudes and perceptions of how and what information about transit should be presented to the public. Unfortunately, few studies have looked at both elements and particularly at how they relate to each other. It is, therefore, the purpose of this report to determine the relationship between attitudes toward public transit in general and perceptions/preferences for certain types and levels of transit information as aids in utilizing a transit system. Additionally, attitudes have been tested before and after laboratory exercises involving assessment and use of several types of transit-user information aids to ascertain what effect, if any, exposure to and use of these aids has on people's general attitudes toward using transit.

Because of the short time frame and limited scope of the study, it has not been possible to determine whether such exposure to using transit aids affects people's actual transit behavior. Thus, like most other studies to date, it is not possible to conclude from this study the extent to which preferred types and levels of information aids actually are a determining factor in decisions to ride/not ride transit. This would require longitudinal studies on laboratory participants over time. However, this study does add to our knowledge of the relationship between attitudes toward transit and exposure to transit information aids and it provides sufficient information on preferred elements of transit user information aids for developing some initial guidelines regarding

the form and content of information aids which will meet the needs of a variety of potential and actual transit users.

Purpose

The overall purpose of the Transit User Information Project has been to identify the necessary components (both currently used and potential) of an effective transit information program which will provide the appropriate types and levels of information for persons to successfully use a transit system. A major output of this project is a handbook of transit user information aids which will provide transit operators with guidelines for developing an effective set of information aids. This handbook is based on an extensive inventory of currently used user information aids, interviews with a selected sample of transit operators, development of new potential information aids (form, design, etc.), and evaluation of existing and proposed transit user information aids through a series of laboratory group activity sessions.

The laboratory evaluation was a means of objectively studying the impacts of the alternative techniques for providing transit information. As stated in the proposal for this project, the evaluation goals are "to determine what user information aids and dissemination techniques work best to satisfy existing and potential rider needs, physical and psychological, in specific test situations considering multiple influence forces".[2] In

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[2]Ilium Associates, Inc., "Transit User Information Project", response to RFP No. DOT-UT-50001, December, 1974, p. 8.

short, the laboratory sessions have been a primary mechanism for testing how accurately information aids and techniques reflect the perceived information needs of transit users. More specific objectives of the laboratory evaluations have been to test:

1. degrees of information levels required by specific information aid types to supply necessary information;

2. the level of information and design content at which complexity and mass becomes unclear, confusing, and counterproductive to purpose;

3. importance of specific information aids and dissemination techniques and their ability to satisfy rider needs and stimulate ridership;

4. user information's ability to satisfy certain psychological, as well as physical, components of the urban transportation trip, specifically: treatment, predictability, individualization, security, and accessibility;

5. the effect that brief exposure to information aids may have on attitudes and/or propensity to ride transit.

RESEARCH METHOD

Overview

The research approach used to evaluate the transit information aids involved a series of laboratories, or group-activity sessions in three cities. The sessions were designed to present alternative kinds and specific forms of aids, and to secure the public's assessment of the value of aids in stimulating and assisting effective use of the transit system. The basic activities within the group sessions consisted of: (1) measurement of general attitudes toward transit use; (2) visual and oral presentation of information aids; (3) measurement, through questionnaire responses, of individuals' reactions to the aids and judgments of their utility; and (4) performance of a transit exercise requiring the use of aids in taking a mock local transit trip.

The laboratories were conducted with four to five groups in each of three cities. The activities were performed in a two-hour time period and in a group presentation format. There were generally fifteen to thirty people in each of the groups. Group composition varied, principally with the occupation, sex, and age of the participants. Most features of the laboratory were constant for all groups. However, later groups involved additional components of a second exercise and evaluation of dissemination methods for transit information. These tasks were substituted for general discussions, to keep within the original time period for the session.

Sample

The research was conducted with 122 people in Seattle,

Washington; 79 participants in Columbus, Ohio; and 100 people in Dallas, Texas. The total sample thus consisted of 301 people from different regions of the country. The three cities were selected for study after a detailed process of site evaluation. They are similar with respect to population and transit system characteristics. All three metropolitan areas have 1 to 1.5 million residents. Columbus has a slightly smaller bus-riding population; and Seattle has only a 6% minority population, while Columbus and Dallas minority representations are 12% and 17%; respectively. In Dallas, groups of Spanish speaking citizens were especially selected for study. In each city, the only mass transit facilities are busses. The three transit properties are considered quite progressive, and all were willing to participate in this study.

In each city, groups of participants were recruited through special-interest citizen groups, including Seattle Women's Orthopedic Guilds, university classes, senior citizens groups, a regional planning commission (Columbus), League of Women Voters, a Mexican-American Center (Dallas), and a group of bank employees. Table 1 shows the composition of the 13 groups of participants. Leaders of such groups provided 20-30 of their members for each laboratory session. Participants were paid for their two hours' work. In the case of the Women's Guilds and League of Women Voter groups, the payment fees were turned over by the individuals to the charity they sponsored. Thus, subjects were volunteers; either they as individuals or their organizations were financially rewarded for taking part in the study.

Since subjects were selected by groups, participants within a group were fairly homogeneous. However, across groups, personal characteristics, such as sex, age, education, and race

TABLE 1

Transit Aid Laboratory Groups: Their Location, Composition, and Size

Group Number[1]	Location	Composition	Size
1	Seattle	Senior Citizens	20
2	Seattle	Women's Orthopedic Guild (South)	25
3	Seattle	College Students	46
4	Seattle	Women's Orthopedic Guild (North)	30
5	Columbus	Senior Citizens	24
6	Columbus	College Students	19
7	Columbus	Regional Planning Commission	13
8	Columbus	League of Women Voters	20
9	Dallas	Senior Citizens	25
10	Dallas	League of Women Voters	12
11	Dallas	Bank Employees	17
12	Dallas	Mexican-American Center	31
13	Dallas	College Students	6

[1]Order of administration

varied. Personal characteristics of the sample are described in the results section of this report.

Measurement Instruments and Procedure

Information about the participants, their attitudes, and their reactions to transit aids was collected through a series of self-report, questionnaire-form measuring instruments administered throughout the group session. The instruments were distributed as a package to the individuals at the start of the session and collected at the end. Instructions for use of the instruments were written on the questionnaires and supplemented with oral directions from the session leader. The parts of the questionnaire, and the tasks for which they were used, are described below.

The first part of the instrument asked for personal characteristics and background of the subject: (1) age, in 10-year response intervals; (2) sex; (3) occupation, written by the subject; (4) race; Black, Asian American, Indian (Native American), Spanish Surnamed, and Caucasian; (5) education, in 7 categories ranging from elementary to graduate degree; and (6) a series of questions concerning their bus-riding activities, including the frequency and purpose of riding the bus, and reasons for their riding or not riding. This was administered following introductory statements describing the session's purpose, by the leader.

The second part of the package was a 34-item public transportation attitude survey. Items were adapted from previous surveys (e.g., Liff; Michaels, 197), or constructed by the

present research staff. Subjects were asked for their extent of agreement with statements pertaining to needs for, characteristics of, and ease of using public transit. A sample item was "Public transportation is convenient". Responses were made on five-interval Likert-type scales with options for: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. The 34-item survey was administered prior to presentation of any transit aids. Ten items from the survey were readministered at the end of the two-hour period to measure any changes in attitudes.

The third part of the session involved subjects responding in terms of perceived effectiveness, to presentation of alternative transit aids. Aids, and characteristics of them, were shown by slide presentation and described by the leader. Subjects indicated their reaction to the aids on their questionnaire.

1. Eight types of aids were rank ordered in terms of their helpfulness in using transit. The aids were: pocket schedule, telephone, bus stop information, other people at a bus stop, fold-out map, electronic route finder, bus driver, and sign on the front of a bus. The aids were simultaneously projected onto the screen and left on through the ranking task.

2. Subjects indicated the convenience of paying fares by coin, ticket, and token. Dallas subjects were asked also to rate passes in addition to these three methods of payment.

3. Different means of designating bus stops were presented, and subjects responded to the meaningfulness, understandability, identifiability, and attractiveness of: (a) alternative symbols (T, picture of bus, words "bus stop", and "bus stop" with a

regional symbol); (b) shapes (square, circle, triangle, and a special graphic shape); and (c) colors (yellow, blue, green, and red). Some responses involved rating characteristics (e.g., meaningfulness) on a five-point scale; others involved ranking the bus stop signs on, e.g., overall usefulness.

4. Bus stop signs containing differing amounts of information were presented. Subjects rated, on five-point scales, the amount (too much--not enough), meaningfulness, understandability, and overall usefulness of the information contained in the following five types of signs: (a) sign with route numbers, (b) signs with route names, (c) sign with numbers and names, (d) sign with numbers, names, and a route map, and (e) sign with numbers, names, map, and departure times.

5. The next section of the laboratory involved presentation of different kinds of transit route maps, and measuring preferences for them. Subjects were asked to indicate a preference for: (a) fold-out versus pocket-size maps, considering their legibility and convenience; (b) showing map routes by numbers in a square versus color coding; (c) detailed versus schematic maps, considering their understandability; and (d) using colors to designate class of service versus using color to designate general geographic destination. Subjects also indicated the maximum number of colors they thought could be used to designate destinations, without confusion.

6. During the next phase of the laboratory, participants engaged, individually, in a transit use exercise. They were provided with pocket schedules and route maps from the local

transit system, and an information person (project personnel) to use at their discretion, in the task of taking the bus from a given departure point to a particular destination, arriving by a given time.[3] To successfully perform the task, subjects had to correctly identify: (a) the name and number of the bus they would take; (b) their departure time, and (c) their arrival time. They reported this information on their questionnaire. Additionally, after completing the exercise, they were asked how they accomplished it. A series of questions asked: (a) which of the three aids they found most and least helpful, and why; (b) how legible, attractive, understandable, and useful the schedules and maps were; these characteristics were rated on five-point scales; and (c) whether they liked or disliked getting information from a person; whether they found that approach easier or harder than using the other aids; and why they did or did not prefer an information person.

7. The laboratory on information aids concluded with a repetition of two judgment tasks that had been performed at the outset: (a) the eight aids were re-ranked in terms of their helpfulness in using transit; and (b) ten items from the attitude survey were readministered.

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[3]The task differed for some groups. Seattle groups used a real local departure-destination task. Two of those groups also served as a pilot for a more complex task involving a hypothetical (abstract) locale and the need to transfer busses. The information person was added as an aid after the first two sessions. Reports of results will be restricted to the first task in Seattle and Columbus groups, and this exercise will include both tasks for Dallas groups. Use of information persons will be reported for the groups which had that aid available.

8. The final part of the session for the Dallas, Columbus, and last (one) Seattle groups, focused on evaluating transit information dissemination techniques. Subjects responded, using five-point rating scales, to:

a. The likelihood of using the bus more if information were available at school or work;

b. the helpfulness of providing information about the bus;

c. the frequency with which they look at mailed advertising;

d. the usefulness of getting mailed information about neighborhood bus routes;

e. the likelihood that receiving such route information would increase their riding;

f. the favorability of door-to-door information from a uniformed bus driver;

g. the helpfulness of a short course, in the schools, on using public transportation;

h. the usefulness of printing bus schedules in the newspaper;

i. their likelihood of picking up transit service flyers or handouts at banks, supermarkets, etc.; and

j. the importance, to their decision to ride, of having information close at hand.

This concluded the sessions. After any questions were answered, all participants were thanked, paid, and dismissed.

Data Analysis

Data were analyzed for the aggregate sample and for each of the cities separately. Descriptive analyses were performed on the questionnaire data to provide distributions of judgments about transit aids, relationships (correlations) between judgments,

and differences across cities and subjects. Data on participants' attitudes toward transit were factor analyzed and related to their other judgments and exercise performance.

RESULTS

Characteristics of the Sample

Participants in the laboratory activities in the three cities (Seattle, Washington; Columbus, Ohio; and Dallas, Texas) were almost evenly split between riders and non-riders of transit and were representative of highly potential riding groups. Generally, participants were distributed between both sexes, all age groups with a slight emphasis on 16-25 and over 65, various ethnic groups, had either a high school education or some college, and reflected a number of occupations, but especially students, homemakers, and retirees. Thus, while the sample does not necessarily show an accurate representation of the general population on all characteristics, it does, in large part, reflect characteristics of transit users. Sample distributions on these personal background variables are shown in Table 2.

When asked how frequently they ride the bus for various purposes, 74% of riders reported they sometimes, frequently, or always use the bus to go shopping or downtown; combining the same frequency response categories showed that 53% of riders use the bus for non-work appointments and leisure activities. Forty-four per cent of riders said the best thing about transit was its convenience; 42% cited low cost as the best transit feature. Among nonriders, 59% said they would be more willing to ride if transit were more convenient; 36% would ride more if it were

TABLE 2

Characteristics of the Sample (N=301)

I. AGE

Under 15	16-25	26-35	36-45	46-55	56-65	Over 65
2.7%	27.9%	12.5%	9.4%	9.4%	7.1%	31.0%

II. SEX

Male	Female
36%	64%

III. OCCUPATION

Retired	Student	Housewife	Professional	Managerial	Clerical	Skilled Trade	Other
25%	26%	27%	8%	2%	4%	1%	7%

IV. RACE

White	Black	Mexican-American
85%	5%	10%

V. EDUCATION

Elementary	High School	Vocational	Some College	Degree	Graduate Work	Degree
8.8%	26.9%	5.4%	31.3%	11.8%	6.7%	8.1%

VI. TRANSIT USE

Rider	Non Rider
51%	49%

faster; and 15% cited lower cost as the incentive to ride more.

Ridership was significantly related to the person's age, education, race, and residence. Ridership was more prevalent in the Seattle and Dallas samples than in Columbus. Whether people ride or do not ride did not, however, depend on their sex.

Several of the individual characteristics were interrelated in the sample, notably: (1) the Mexican-American group was young, and the Whites tended to be either very young (16-25) or senior citizens; (2) education was associated with race, with "some college" education more characteristic of Whites; (3) education also related to sex--males had "some college", females generally less or more education; (4) females were older than the males; (5) education varied with age, such that there were more uneducated older people, more college graduates in middle age brackets, and more people with "some college" who were young. Finally, (6) education, sex, and age compositions of the sample varied across cities. The Seattle groups were comprised more of (both) extreme ends of the age range, but of the mid-range of the education distribution. Education level was lowest in the Dallas sample.

Attitudes Toward Public Transportation

Attitude Favorability

Attitudes of people in the present study toward public transit were quite favorable. This conclusion is reflected in the finding that, among 34 attitude-item measures, 18 showed favorable attitudes, and only one denoted an unfavorable attitude (see Table 3). Attitude scores were considered as favorable if the sample mean fell between 1 and 2.5 on the 5-point attitude scales. Unfavorable items had means of 3.5 to 5. Item means in the intermediate range (2.6 to 3.4) were considered moderate attitudes (the scale neutral point was 3). Table 3 presents means and standard deviations for only the favorable and unfavorable attitudes. Lower means or smaller numbers (1) represent more favorable attitude scores. The single item indicating an unfavorable attitude (wanting to be independent), might connote unfavorability for stimulating transit use, but a favorable statement for the person to make about himself.

Attitude Factors

In order to reduce the data set of attitude items for further analyses of their relations to transit aid preferences and use, and to examine the attitude matrix for possible attitude dimensions or clusters, the attitude-item correlation matrix was factor analyzed. The factor analysis method used was a principal components analysis, with iterations and varimax rotation of the components to orthogonal structure.

In oversimplified terms, this procedure identifies clusters of variables (attitude items) that "go together", and the relative

TABLE 3

Mean (Average) Attitudes Toward Public Transportation: Total Sample[1]

Attitude Item	Mean	Standard Deviation
I. Favorable Attitudes (18 items)		
Necessary for cities to have good public transportation	1.36	.67
Pollution and energy-consumption could be reduced	1.70	.90
Improving public transportation should be high priority for local government	1.74	.89
In general, I support efforts to develop public transportation	1.78	.86
Will help reduce air pollution if I ride public transit	1.86	.84
Federal government policies and subsidies	1.89	1.00
Free from possibility of accident while on transit	1.92	.81
Can relax while going to destination	2.06	.88
Everyone who possibly can should use public transit	2.07	.87
If I successfully complete a transit trip, I'm likely to repeat it	2.10	.84
Public transit permits one to avoid traffic congestion	2.11	1.12
People should be willing to spend more time traveling by transit than car	2.19	1.07
I am not uneasy in fast-moving bus in traffic	2.30	1.27
It is better for children to use transit than to be driven everywhere	2.33	.99
Public transportation is convenient	2.41	1.16
Public transportation is inexpensive	2.41	1.16
Can rely on scheduled service	2.42	1.02
Public transit drivers are not discourteous	2.44	.99
II. Unfavorable Attitudes (1 item)		
I prefer to feel independent of anyone else for transportation	3.72	1.08

contribution (factor loading) of each item to that cluster or factor. The resulting factors are then geometrically rotated to achieve maximum independence (orthogonality), and to account for as much variability in the item correlations as possible. In this manner, a small number of factors can be used to describe the content of 34 attitude items, and the factors may have theoretical meaning in describing what the items in a factor have in common, and what differentiates the factors. The method described above is one of several for achieving this purpose under different conditions.

The factor analysis revealed seven factors which together accounted for 100% of the common variance in the matrix. However, the last four factors consisted of only one or two attitude items each. The first three factors, accounting for 83% of the variance, were interpreted and retained for additional analyses of attitudes. The definitions of these factors were determined by including items with loadings on the factor greater than .40 and which loaded more heavily on that factor than on any of the other six.

The structure of the resulting attitude factors is shown in Table 4. The first factor was named "Social Impacts: Political Support." It included items dealing with social and environmental impacts of transit use (reduced pollution and energy consumption, better for children, less risk of accident), and items reflecting general political support for public transit, such as: (a) improving transit being a high priority for local government; (b) federal policies encouraging transit development; and (c) personal support of efforts to develop transit systems.

Factor II reflected attitudes based on Personal Convenience of transit. Exemplary high-loading items referred to transit's

TABLE 4

Transit Attitude Factors

Attitude Item	Factor Loading
Factor I: Social Impacts; Political Support (45% variance)	
Necessary for cities to have good public transportation	.54
Pollution and energy-consumption could be reduced	.67
Everyone who possibly can should use public transit	.61
Better for children to use than to be driven everywhere	.49
Feel relatively free from possibility of accident	.52
I will help reduce air pollution by riding transit	.66
Federal policies and subsidies for transit systems	.70
People should be willing to spend more time in transit than car	.63
I support efforts to develop transit systems	.75
Improving transit should be high priority for local governments	.83
Factor II: Personal Convenience (24% variance)	
Public transportation is convenient	.62
Can avoid traffic congestion	.48
Cannot become lost in unfamiliar area	.47
Public transportation is fast	.73
Information on how to use transit is easy to get and understand	.67
Would repeat taking transit after a successful trip	.50
Easy to find where to catch a bus	.65
Can rely on scheduled service	.70
Can relax while going to destination	.51
Public transportation is inexpensive	.39
I personally prefer using transit rather than car	.46

TABLE 4 (Continued)

Attitude Item	Factor Loading
Factor III: Personal Discomforts; Use Inhibitors (15% variance)	
Public transportation is noisy	.56
Public transportation facilities are dirty	.72
I am uneasy in fast-moving bus in traffic	.50
Riding public transit takes too long	.69
Don't know which stop to get off at	.42
Public transit drivers are discourteous	.56
Prefer to ride with friends rather than general public	.61
Public transportation is uncomfortable to ride	.67
Have to wait too long to take public transportation	.48
Difficult to use transit if I'm going somewhere I have never been before.	.47

being convenient, fast, easy to use, inexpensive, and reliable. Some of the items also focused on personal comforts of avoiding traffic congestion, not getting lost, and relaxing while riding. Personal preference for using transit instead of one's car contributed to this factor.

The third factor was named Personal Discomforts and consisted of elements which might, if attitudes were unfavorable, inhibit the use of transit. This set of attitudes was defined by: poor physical properties (noisy, dirty); excessive time consumption (long waits and rides); personal discomfort (uneasy in fast-moving bus, not knowing where to get off, discourteous drivers, uncomfortable rides); and a preference for traveling with friends rather than the general public.

For further analyses of attitude relationships, participants' attitudes were defined by their standard scores on the three attitude factors, rather than scores on each of 34 items or a total score. The three factor scores were computed for each person in the sample, using a method which adds loading-weighted item scores and standardizes them in the sample.[4] These scores were then analytically related to other variables of interest. Examination of attitude interrelationships showed that (only) factors I and II were correlated with each other. More positive Personal Convenience attitudes were associated with favorable Social-Political attitudes (r = .48).

Attitude Differences Between Subjects and Cities

Attitudes, particularly those pertaining to political support

[4] H. H. Harman, Modern Factor Analysis. Chicago: University of Chicago Press, 1967.

of transit and personal conveniences, were related to the individual's sex, race, age, education, and city. Women expressed more favorable "political" and "convenience" attitudes than did men (significantly more favorable mean factor scores). Both sets of attitudes were also more favorable for Blacks than for Whites and (especially) Mexican Americans. The social-political support attitudes were more favorable in Columbus than the other two cities. These findings of more favorable attitudes toward political support of public transportation and its social impacts, however, could be interpreted two different ways: (a) people are satisfied with transit and think it should have continuing support; or (b) the attitudes reflect feelings that transit is inadequate and should be improved by governments.

Attitudes were not related to whether one does or does not ride the bus. However, among those who do ride, those who ride more frequently expressed more positive personal convenience attitudes and somewhat more negative discomfort attitudes (Table 5). Other correlations in Table 5 indicate strong relationships between convenience attitudes and both age and education and a weaker relation between age and social-political attitudes. Older people and those with less education had more favorable personal convenience attitudes ($p < .001$). The older subjects also had more positive social-political attitudes ($p < .01$). These results suggest the general implication that attitudes are more favorable for people whose characteristics are likely to make them more transit-dependent.

TABLE 5

Correlations Between Transit Attitudes
and Personal Characteristics: Age, Education, and Ridership

Characteristic	Attitude Factor[a] I: Social-Political	II: Personal Convenience	III: Personal Discomforts
Age	-.17***	-.42***	.16**
Education	-.04	.41***	.08
Ride Frequency	-.03	-.28***	.15**

***$p < .001$
**$p < .01$

[a]A negative correlation means that the higher the score on the personal characteristic the more favorable the attitude, since favorable attitudes are denoted by low score.

Attitudes Before and After the Laboratory

General attitudes toward public transportation did not change with the brief exposure to information aids experienced in the laboratory. Comparisons of the ten attitude items administered at the beginning, and readministered at the conclusion of the group session showed no differences in attitude favorability.

Preferences Among Eight Kinds of Transit Information Aids

Results of overall rankings of the helpfulness of the eight transit information aids in using public transporation are shown in Table 6. Here, and in all results presenting ranked data, smaller numbers (ranks and mean ranks) denote high preferences. That is, the highest (most preferred) rank is 1. Table 6 shows that, among the total sample of three hundred respondents, pocket schedules are clearly the most preferred aid. The mean rank of the second-ranked aid, telephone, is a full rank unit lower than that of schedules. Furthermore, "other people at the bus stop" were markedly least preferred aids. The mean rank of "other people" was 1.3 rank units below that for bus signage, the seventh-ranked aid. The mean ranks of the other six aids were about equally separated by .3 rank units. An exception to this even distribution was the "tie" for fifth and sixth place between "bus driver" and "electronic route finder".

The more and less helpful aids are not distinguished by any particular set of characteristics. Two of the top four aids (schedule and map) might be considered transportable on one's person, whereas none of the four least helpful aids have that feature. However, route finders and bus signage (less preferred) are direct visual aids, as are schedules, bus stop signs, and maps (more preferred). Aids found at a bus stop occurred in both the upper (bus stop sign information) and lower (driver, signage, other people) halves of the rank distribution. A possible distinguishing feature, if the person on the other end of the

TABLE 6

Ranked Preferences for Eight Kinds of Transit Aids in Terms of Their Overall Helpfulness to Transit Use

Transit Aid	Mean Rank	Rank Order of Mean Rank
Pocket Schedule	2.28	1
Telephone	3.29	2
Bus Stop Information	3.56	3
Fold-Out Map	3.86	4
Bus Driver	4.24	5
Electronic Route Finder	4.24	6
Sign on Front of Bus	4.55	7
Other People at Bus Stop	5.84	8

telephone line is disregarded as part of the telephone aid, is that of personal contact. Both the bus driver and other people at the stop were judged less helpful aids. These two aids, unlike the telephone, require face-to-face questioning, and are made later in the ride process. The low ranking of the electronic route finder may be due, in part, to its novelty and people's lack of familiarity with or exposure to it. The overall rank order suggests an hypothesis for further inquiry, that those aids perceived as less helpful are those from which the user can expect to receive less complete trip information.

Relationships of Aid Preferences to Personal Characteristics

Preferences among the eight aids were related to characteristics of the (potential) user. Age was significantly correlated with the rank order position of six of the aids. Older people assigned higher preference ranks to schedules, bus stop information, other people, drivers, and signage, and lower preferences to the electronic route finder. The age-preference correlations were significant at $p < .001$, except for bus stop information, where $p < .05$. Preferences also were associated with education. The mean ranks by participants with more formal education were lower, than those of the less-educated, for: drivers ($r = .29$, $p < .001$); signs on bus ($r = .28$, $p < .001$); other people ($r = .24$, $p < .001$); bus stop information ($r = .20$, $p < .001$); pocket schedules ($r = .18$, $p < .001$); and the telephone ($r = .10$, $p < .05$).

The helpfulness of four of the aids was also related to the sex of the people doing the ranking. Table 7 shows that schedules, bus drivers, and bus signs were significantly more preferred by women than men; men found the route finder a more helpful aid than did women.

TABLE 7

Sex and Ridership Differences in Mean Ranks of the Usefulness of Eight Kinds of Transit Aids

	Sex			Ridership		
Aid	Male	Female	Difference Significant[1]	Rider	Nonrider	Difference Significant
Schedule	2.56	2.12	Yes	1.95	2.63	Yes
Telephone	3.47	3.18	No	3.11	3.47	No
Bus Stop	3.74	3.46	No	3.34	3.80	No
Other People	5.96	5.77	No	5.27	6.43	Yes
Map	3.55	4.03	No	4.01	3.69	No
Route Finder	3.46	4.68	Yes	4.72	3.74	Yes
Driver	4.72	3.96	Yes	3.77	4.72	Yes
Bus Sign	5.23	4.16	Yes	4.15	4.97	Yes

[1]All significant differences are at the $p < .01$ level, except the sex difference for schedules, where $p < .05$.

There were also some notable preference differences between subjects of different races (Table 8). Where differences occurred, they were generally of the nature that Blacks differed from Whites and Mexican Americans, whose rankings were similar. Blacks tended to attribute greater helpfulness, than did the other two race samples, to schedules, telephone, bus stop information, other people at the stop (this difference was especially large), maps, and bus drivers. Preferences were higher among Whites than Mexican Americans for schedules and route finders. On the other hand, Mexican Americans considered other people at the stop more helpful than did Whites. Rankings of signs on busses were equivalent for those races.

Relationships of Preferences to Ridership

Another personal characteristic that affects judgments of the value of transit aids is whether the person normally rides the bus. Ridership differs from the other subject characteristics (age, sex, education, race), however, in that it is more a background behavioral variable than a given or inherited personal trait and is more transitory (i.e., whether one rides is more subject to change). Thus, ridership is treated here as a special case of individual differences that may affect the use of transit aids.

Ridership differences in preferences for the eight aids are presented in Table 7. Bus riders found schedules, other people at the stop, bus drivers, and frontal bus signs significantly

TABLE 8

Mean Ranks of Eight Transit Aids: By Race

Aid	Race		
	White	Black	Mexican American
Schedule	2.33	1.58	3.29
Telephone	3.42	2.50	3.17
Bus Stop Information	3.71	2.75	3.62
Other People at Stop	6.25	3.92	5.71
Map	3.93	3.17	4.17
Electronic Route Finder	4.20	4.25	4.83
Bus Driver	4.33	3.08	4.54
Bus Sign	4.74	4.67	4.62

more helpful than did nonriders. However, they considered route finders less valuable than did the nonriders.[5]

Preferences Before and After the Group Session

Rankings of the helpfulness of the aids made at the beginning and end of the laboratory were compared. There were no significant differences between the "before" and "after" mean ranks, and the overall rank order of aid preferences remained the same. There were slight but nonsignificant increases in the mean preference ranks of the telephone and bus stop information aids, and slight decreases for maps, route finders, drivers, and bus signage. The intervening brief laboratory activities had no impact on aid preferences.

Relationships of Aid Preferences to Transit Attitudes

The extent to which people viewed the aids as helpful was related to their general attitudes toward public transportation (see Table 9). The strongest relationships occurred with respect to the Personal Convenience attitude factor. People with more favorable attitudes on this dimension attributed greater helpfulness to other people, bus drivers, signs on the front of the bus, bus stop information, and schedules (all relationships at $p < .001$), and to the telephone ($p < .01$). Favorable Personal

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[5]Except for the relation of ridership to the value of the other people aid, these results closely parallel the observed sex differences. This similarity is not due to overlap between the two personal characteristics. In this sample, sex and ridership were not associated. Hence, even when relationships of these two variables to other attitudes and judgments are similar, results will be presented for both.

TABLE 9

Correlations Between Transit Attitude Factors and Perceived Helpfulness of Transit Aids

Aid	Attitude Factor I: Social-Political	II: Personal Convenience	III: Personal Discomforts
Schedule	.12**	.24***	.04
Telephone	.01	.16**	.10*
Bus Stop	.06	.24***	.12**
Other People	.09	.39***	.18***
Map	.17***	.09	.16**
Route Finder	.05	-.08	.17***
Driver	.04	.33***	.08
Bus Sign	.12**	.32***	.12**

***$p < .001$
**$p < .01$
*$p < .05$

Discomfort (Factor III) attitudes were associated with preferences for: other people and route finders ($p < .001$); maps ($p < .01$); and bus signs, bus stop information, and the telephone ($p < .05$). Positive attitudes on the Social-Political dimension correlated with higher usefulness rankings for maps ($p < .001$), and for schedules and bus signs ($p < .01$).

Preferences in the Three Cities

Helpfulness-ranking data were analyzed for comparisons of judgments made in Seattle, Columbus, and Dallas. Results showed no differences across the cities, for any of the aids. Ranking patterns were very similar, with no between-city differences exceeding half of one rank unit; and most discrepancies were on the order of .1 to .2 units.

Bus Stop Signs as an Information Aid

A large proportion of the laboratory session was devoted to obtaining judgments on various aspects of bus stop signs as transit information aids. Participants were asked to rank the identifiability, understandability, attractiveness, and usefulness of alternative shapes, colors, symbols, and combinations of information on bus stop signs.

Shapes

Overall Preferences: The special graphic shape was given a 1 ranking by 45% of the respondents on identifiability, with the square given 26% of the 1 rankings, although a significant percentage gave the lowest (4) ranking to these two choices (30% and 21% respectively). However, the means show in Table 10 that the special graphic had the highest overall ranking on identifiability with the square, circle, and triangle following in that order. When asked to rank these same shapes for their attractiveness, respondents showed somewhat different preferences (Table 10). In this case the square was ranked first, followed by the circle, triangle, and special graphic. In most cases regarding attractiveness, rankings of the shapes were fairly evenly distributed. Only in the case of the special graphic was there a clear low ranking (49% rank it 4).

Individual Differences. Both age and education are significantly related to judgments on the identifiability and attractiveness of alternative sign shapes. Age correlates negatively except in the case of alternative D--the special

TABLE 10

Rank Shapes of Bus Stop Signs

		Identifiability			Attractiveness		
		(mean)	(med)	(rank)	(mean)	(med)	(rank)
A.	(Square)	2.14	2.08	2	2.08	1.39	1
B.	(Circle)	2.33	2.46	3	2.19	2.22	2
C.	(Triangle)	2.43	2.60	4	2.29	2.40	3
D.	(Special Graphic)	2.02	1.39	1	2.69	3.44	4

TABLE 11

Rank Colors

		Identifiability			Attractiveness		
		(mean)	(med)	(rank)	(mean)	(med)	(rank)
A.	(Yellow)	2.10	1.91	2	2.16	2.03	2
B.	(Blue)	2.10	2.09	1	2.05	1.97	1
C.	(Green)	2.79	2.97	4	2.76	2.93	4
D.	(Red)	2.30	2.30	3	2.37	2.43	3

graphic shape. Thus for A, B, and C, higher rankings are given by older subjects, but for D, higher rankings are given by younger subjects, but for D, higher rankings are given by younger subjects (identifiability D = $\underline{r}$ = .34; $\underline{p}$ < .001). Also age does not correlate significantly with judgments on the attractiveness of D. Education also correlates with these judgments in a positive direction; thus less educated subjects tend to rank alternatives higher than more highly educated subjects. Education shows a particularly significant correlation with identifiability judgments for A and B ($\underline{r}$ = .18; $\underline{p}$ < .001 and $\underline{r}$ = .21; $\underline{p}$ < .001) and with the attractiveness of A ($\underline{r}$ = .15; $\underline{p}$ < .01). Finally, sex shows moderately significant correlations with judgments on identifiability of square, triangle and the graphic ($\underline{p}$ < .01; $\underline{p}$ < .05; $\underline{p}$ < .01) where males show lower rankings of shapes than do females.

Ridership does not show consistent relationships to the judgments on shapes. Ridership is correlated significantly only with judgments regarding the identifiability of the squares and the graphic (both $\underline{p}$ < .001) with riders ranking the square lower and graphic higher than nonriders. This indicates that it is the riders who have a higher preference for the special graphic while nonriders prefer more familiar shapes, particularly the square, which is commonly used for informational signs. There were no significant differences among cities in the judgments on shape.

Color

Overall Preferences: A second aspect of signage tested dealt with colors. First, subjects were asked to rank the

importance of having any special color to designate bus stops. On a scale of 1-5, a majority of the subjects indicated that a special color was moderately to quite important; 58% gave a rating of 2 to this question. Age, education, ridership, and sex all correlate significantly with this item, though none are strong correlations. These correlations are discussed below.

In the overall ranking of four colors--yellow, blue, green, and red, blue was considered overall as the most identifiable and the most attractive color for bus stop signs. Yellow is considered a close second, particularly in identifiability, then red, and finally green, which was ranked substantially lower than the rest. Thus, either blue or yellow would seem to fit the preferences of the subjects here. As in the earlier judgments on shapes, the distribution of rankings of colors is fairly even except in the case of the color green, which received significantly fewer high rankings than did any of the other colors. This is logical since there are many places which use green highway signs and since green is less likely to stand out in a residential setting. Also the preference for yellow is expected since many cities already use yellow to designate transit and general traffic information signs. The preferences for blue and red indicate that subjects are interested in seeing a different color for designating transit as these two colors are generally not widely used for street signage.

Individual Differences. Both age and education are significantly related to judgments about the importance of a specially designated color for bus signs. Age correlates significantly in a negative direction showing that the older the subject, the

higher importance placed on a specially designated color (r = -.18; p < .01), and those with less education place more importance on the special color. Age and education relate significantly only to judgments on identifiability and attractiveness for colors yellow and red (I.D. of D: Age = r = -.24; p < .001) and Education = r = .16; p < .01). Here age is inversely related to high rankings, the relation to education is positive. Thus older and less educated subjects tend to give higher rankings than do younger and more highly educated subjects.

Sex shows significant correlation to assessments of the importance of a specially designated color, with men (and nonriders) giving higher ranks than women, (p < .01 (and riders) p < .05). Sex correlates with judgments on identifiability and attractiveness for red with females giving higher rankings than males to red.

City differences did not show significant correlation to assessments of the specially designated color. As noted above nonriders ranked the importance of a special color higher than did riders. On the rankings of the four colors, riders gave higher rankings to yellow and red but lower rankings to green than nonriders and Columbus subjects gave lower rankings to green than did subjects in the other two cities.

Symbols

Overall Preferences. Subjects in the laboratories were shown slides of several different symbols that are or could be used to designate bus stops. These included (a) the words bus stop, (b) a picture of a bus, (c) a letter T and the word

transit and (d) a regional symbol and the words bus stop. They were asked first for judgments about using a standard symbol and/or words in general (Table 12). A large majority (76%) of the subjects gave a 1 or 2 rating to the meaningfulness, and (77%) to the understandability of a standard symbol on a bus sign. A less substantial majority of the subjects ranked highly the identifiability of symbol (57%, 1 or 2 rating) on bus signs. On both of these items more subjects ranked them average (24%; 15%) or low (10%; 15%). From these results, one finds that while all items were ranked above average, the distribution of rankings differed somewhat between the first and last two items. This means that while most subjects find the concept of a standard symbol very meaningful and understandable, they are less certain of the identifiability of such a symbol and of the necessity for words to accompany the symbol. Next, subjects were asked to indicate their preference between the "T-transit" symbol and the "Regional' symbol. By 3 to 1, there was a preference for the T-transit symbol (72%-24%). This preference is consistent with earlier judgments regarding standard symbols; a regional symbol would not be standard from one city to another thus reducing its usefulness to new transit users.

Finally, subjects were asked to assess the overall usefulness of the four alternative symbols (Table 13). "Bus stop" words and "bus picture" received the highest percentage of 1 and 2 rankings (62% and 58% respectively). On the other hand, the "T-transit" and the "Regional" symbols were ranked much lower, with over

TABLE 12

Judgments on Standard Symbol Attitudes

	1	2	3	4	5	
Symbol Meaningful	22%	54%	16%	2%	3%	Mean = 2.02 Median = 1.96
Symbol Understandable	23%	54%	14%	3%	3%	Mean = 2.00 Median = 1.94
Symbol Identifiable	17%	40%	24%	6%	10%	Mean = 2.15 Median = 2.24
Words Necessary	19%	38%	15%	10%	15%	Mean = 2.58 Median = 2.24

TABLE 13

Overall Usefulness of Symbols

	1	2	3	4	5	
A (Bus Stop)	36%	26%	22%	11%	0%	Mean = 1.96 Median = 1.82
B (Picture Bus)	35%	23%	19%	17%	0%	Mean = 2.06 Median = 1.90
C (T Transit)	8%	26%	25%	32%	0%	Mean = 2.66 Median = 2.80
D (Regional symbol and bus stop)	15%	18%	26%	34%	0%	Mean = 2.64 Median = 2.83

half the subjects ranking them 3 or 4 (57% and 60% respectively). Thus, there is a clear preference for either the words "bus stop" or the bus picture, although no significant preference is expressed for one over the other. These results very likely reflect the current mode of designating bus/transit stops; people usually prefer the familiar to the unfamiliar.

Individual Differences. Age was found to correlate significantly with both the judgments on standard symbols and the overall usefulness of particular symbols. This negative correlation shows, for example, that older subjects were more likely to find a standard symbol very meaningful than are younger subjects ($r = -.15$; $p < .01$), and that words are necessary to supplement a symbol ($r = -.21$; $p < .001$). In the overall assessment, age correlated significantly except on rankings of the T-transit symbol.

Education did not correlate with the judgments of standard symbols, but does correlate significantly with the overall assessment of the regional symbol ($r = .17$; $p < .01$).

Sex did not correlate with items relating to the standard symbol, but did correlate significantly or items relating to the identifiability and necessity of words ($p < .01$). Thus men were more likely to rank highly the identifiability of a standard symbol and the necessity of words with a symbol.

Ridership characteristics tended not to correlate with the items on standard symbols. Only on the questions relating to identifiability and necessity of words did ridership correlate strongly ($p < .01$). Thus nonriders were more likely to rank highly the identifiability of a standard symbol and of the

necessity of words to accompany a symbol, while riders ranked these items lower. It may be that nonriders perceived the need for more initial information to aid transit use than did riders.

There were few differences among cities regarding assessments of standard symbols. Most differences were less than .5; none exceeded 1 rank difference. However, Dallas subjects tended to rank the meaning, understandability and necessity of words slightly lower than Seattle and Columbus subjects. No significant differences existed among cities in the assessment of the four alternative symbols.

Information Elements

Overall Preferences. Subjects were also asked to rank four information elements that could be included on a bus stop sign--route number, route name, route map, and departure times. Looking at Table 14, one finds that route names and departure times (60% and 52% ranked 1 or 2) were seen as more useful elements than are the route number and route map (33% and 43% rank 1 or 2). These findings do not allow selection of one or two elements that should be safely used exclusively on bus stop signs, since the preferences do not differ greatly among all four elements. This will be discussed in depth in the next section.

Individual Differences. As in the previous tasks, age tended to be correlated significantly more than did education. Age correlated strongly with the map ($r = .21$; $p < .001$) and in this case it was a positive relationship, higher rankings being given by younger subjects. Both age and education

TABLE 14

Rank of Information Elements: Usefulness

	(Most) 1	2	3	(least) 4	
A (Route Number)	14%	19%	19%	41%	Mean = 2.72 Median = 3.02
B (Route Name)	36%	24%	25%	8%	Mean = 1.93 Median = 1.81
C (Route Map)	24%	19%	24%	27%	Mean = 2.40 Median = 2.54
D (Departure Time)	23%	29%	24%	17%	Mean = 2.22 Median = 2.20

correlated with route name and number, although age showed the stronger correlation (route number $r = -.33$; $p < .001$ and route name $r = -.13$; $p < .01$).

Sex also correlated significantly with route number, name and map ($p < .01$) but not with departure times. A negative correlation existed for the route map which indicates that females rated the usefulness of the map more highly than did males.

Like the previous two characteristics, ridership correlated significantly with route number, name and map, but not departure times with riders showing lower preference for route number and name than nonriders. In the case of the route map, these correlations were negative for ridership ($p < .05$), meaning that riders tend to rank higher the usefulness of route maps than do nonriders.

There was only one significant difference among cities regarding the information elements: Seattle subjects ranked route number lower than did subjects in Columbus and Dallas (2.3 compared to 3.2 and 2.8).

Attitude differences: Respondents with more favorable Personal Convenience attitudes gave higher rankings of usefulness to route numbers ($r = .28$, $p < .001$) and route numbers ($r = .20$, $p < .001$).

As a final step in this analysis, the subjects' rankings of the four information elements were correlated to the three attitude factors. Only the Personal Convenience factor correlated significantly and this with just route number and name as useful information elements on a bus stop sign. ($r = .28$;

$p < .001$ and $r = .20$; $p < .001$). Thus people who had more positive attitudes toward the convenience aspects of public transit were more likely to rank highly the usefulness of route numbers and names on bus stop signs than are those who did not have as positive attitudes toward the convenience of public transit.

Information Combinations

Overall Preferences. Finally, combinations of bus stop information were each rated for their amounts of information, meaningfulness, understandability, and usefulness. These combinations are: (a) route number; (b) route name; (c) route number and name; (d) route number, name and map; and (e) route number, name, map and departure times. Since the rankings on the last three characteristics were very similar, only the responses on information amount and usefulness will be discussed here (Tables 15 and 16).

Subject responses indicate that in no case did they find the amount of information in a combination "too much" (1 ranking). This is not surprising except for the last combination which included four pieces of information, some of which was quite detailed. However, these seemed to be considered as useful in using a transit system, thus were a preferred part of the bus stop sign. This would, of course.consolidate most necessary information in one place, eliminating the need for other information aids in many cases. (Consistent with the high ranking for more complex combinations, D + E received 49% and 70% for 2 and 3 rankings.) The simple or single combinations

TABLE 15

Rank of Information Combinations: Information Amount

	1	2	3	4	5		Ranking
A (Route number)	1%	4%	12%	5%	69%	Mean = 4.10 Median = 4.77	5
B (Route name)	1%	8%	17%	23%	40%	Mean = 3.57 Median = 4.05	4
C (Number and name)	1%	5%	25%	34%	18%	Mean = 3.10 Median = 3.56	3
D (Number, name, map)	4%	13%	36%	24%	8%	Mean = 2.73 Median = 3.00	2
E (Number, name, map, departure times)	5%	21%	49%	6%	2%	Mean = 2.27 Median - 2.64	1

TABLE 16

Rank of Information Combination: Usefulness

	1	2	3	4	5		Ranking
A (Route number)	5%	10%	12%	15%	42%	Mean = 3.33 Median = 3.99	5
B (Route name)	4%	12%	17%	30%	20%	Mean = 2.98 Median = 3.49	4
C (Number and name)	5%	13%	21%	31%	8%	Mean = 2.60 Median = 3.00	3
D (Number, name map)	6%	26%	29%	14%	8%	Mean = 2.39 Median = 2.52	2
E (Number, name, map, departure times)	17%	40%	21%	4%	4%	Mean = 1.96 Median = 1.97	1

received lower rankings for both information amount and usefulness. For example, route numbers alone were ranked 5 (lowest) by 69% on information amount and by 42% for usefulness. This reflects the perception by subjects that one piece of information was not enough to be of significant value in helping them use a transit system. By a substantial margin, the most complex combination is considered the most useful one (E: 57% rank 1 or 2).

Individual Differences. Correlations were analyzed only for the "usefulness" item because of the similarity among all of the items in this task.[6] Both age and education correlated significantly with judgments on usefulness except in the case of combination E, the most complex alternative. Age showed a negative and stronger correlation than did education (e.g., A: Age = $r = -.32$; $p < .001$ and Education = $r = .18$; $p < .001$). Thus the combinations tended to be ranked more highly by older people and less educated people.

Sex differences were not significant except for judgments on combinations D and E, where they had a significant negative correlation ($p < .01$). Thus females were more likely to rank highly the more complex combinations than were males.

Ridership does correlate significantly ($p < .01$) in all cases except combination E, the most complex information set. Here, riders were more likely to give high ranks to combinations on usefulness than were nonriders. This would seem to indicate that riders were more familiar with and thus favorable to the kinds of information that are necessary to aid transit use.

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[6]Further, a favorable rating of amount would be at the midpoint of the scale.

Throughout the rankings, there were some fairly consistent differences among cities. Seattle subjects generally tended to rate information combinations higher; Columbus subjects rated them moderately; and Dallas subjects rated them lowest of the three. However, these differences tended not to exceed 1.0 rank and many were within .5 rank of each other.

Effective Transit System Maps

General Conclusions

A second principal information aid investigated was that of the transit system map. Maps, described as "fold-out maps", were ranked fourth in overall usefulness among eight general types of transit aids. More detailed visual presentations of route map forms and users' responses to them were examined in the group session. Subjects were shown slide projections of, and asked to indicate their preferences for the following map alternatives: (1) large fold-out maps versus small pocket maps; (2) maps designating routes by numbers in a square versus maps designating routes with different colors; (3) detailed street and terrain maps versus schematic route maps; and (4) maps using color to designate geographical areas versus maps using color to designate classes of service.

Results showed that:

1. Pocket maps were preferred over fold-out maps (62% of the subjects preferred pocket maps; 36% preferred fold-out maps).

2. Preferences for designating routes by numbers and colors were about equal (53% versus 45%).

3. Detailed maps were preferred over schematic maps by a large majority (77% versus 21%).

4. Preferences for the use of colors as service-class and area designators did not differ (54% versus 44%).

5. If colors are used on transit information aids in general, the maximum number of different colors that can be effectively used without being confusing is four. (The median number of colors in the sample = 4.06; and the mode, with 44% of the sample choosing it, was 4).[7]

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[7]Fewer than four colors could also be detrimental. Only 12% of the subjects thought three colors could be used, and only 18% preferred five colors.

Therefore, the summary results suggest that the "ideal" transit system map would be pocket-sized but as detailed as possible and colors could be used to distinguish either classes of service or geographical areas. Route numbers could also be included to relate map-designated routes to routes appearing in schedules.

Individual and City Differences

Whether respondents were male or female, and whether they were transit riders or nonriders had little impact on their assessment of map characteristics. The only difference of note is shown in Table 17, which depicts both sex and ridership differences in preferences for ways to designate routes. Men and nonriders preferred color-coding to number-coding; women and riders preferred number-coding. These results follow from the previous conclusion that men and nonriders attributed significantly greater importance to color being used in bus-stop signs. The general importance of color is reflected in its preferred application to both signs and maps. Both the sex and rider differences in preferred route coding were significant. A greater proportion of males than females preferred color ($z = 2.97$, $p < .01$), as did a larger percentage of nonriders than riders ($z = 3.51$, $p < .01$).

Sex and ridership did not affect preferences for use of colors or types of maps. Preferences for pocket maps held for all population subgroups, though these preferences were slightly stronger for females and riders. Males were slightly (not significantly) more extreme in their preferences for detailed over schematic maps (82%-17%) than were females (75%-24%).

Racial differences in the sample were related only to preferences for designation of routes, and the number of colors that might be used on transit aids. While Blacks and Mexican Americans preferred number-coding of routes, each by about 75%-25%, the White subgroup preferred color-coding, by 52%-45% ($\chi^2 = 9.58$, $p < .01$). While 50% of Whites and Mexican Americans thought four would be the best number of colors to use on transit aids, only 25% of Blacks said four was best and 17% preferred three colors.

Subjects' transit attitudes related significantly to route designation preferences and the use of color. People with more favorable Personal Convenience attitudes preferred number-coding of routes over color coding ($r = .30$, $p < .01$), and using color to designate service-class rather than destination ($r = .10$, $p < .05$).

Preferences for different types of maps and route designation methods were strongly associated with the city in which the people lived. As shown in Table 17, Columbus residents preferred color coding of routes, while Seattle and Dallas residents chose number coding ($\chi^2 = 9.58$, $p < .01$). Additionally, while Seattle and Dallas subjects preferred pocket maps 2-to-1 over fold-out maps the Columbus group was more equally divided, with 54% choosing pocket maps ($\chi^2 = 11.17$, $p < .01$). On the other hand, Seattle differed from the other two cities in preferences for detailed versus schematic maps. While people in the latter cities preferred detailed maps 85%-15%, Seattleites preferred them only 2-to-1 ($\chi^2 = 13.43$, $p < .01$). Detailed maps, nonetheless, were the clear preference in all cities.

TABLE 17

Individual and City Differences in Preferences for Map Route Designation by Numbers and Colors

		Number Designation	Color Designation
Sex:	Male	40%	57%
	Female	60%	38%
Rider:	Rider	60%	35%
	NonRider	44%	55%
Race:	White	45%	52%
	Black	67%	25%
	Mexican American	75%	25%
City:	Seattle	52%	43%
	Columbus	38%	62%
	Dallas	64%	33%

The Use of Schedules and Maps in Transit Exercises

Preface: Criteria of Performance

Part of the laboratory was devoted to testing the effective use of aids in solving specific transit-riding problems. Two exercises were used. The concrete exercise involved determining correct route names and numbers, and correct departure and arrival times, for a direct trip between two points in the subjects' home-town. The abstract exercise was more complex with a referent system unknown to the subject (the "Troutdale line", actually constructed from the Portland, Oregon, system). This exercise included multiple route and transfer options. Maps and schedules were provided to assist in performing both exercises. In the concrete exercise, subjects were given one overall transit system map and multiple pocket schedules (one of which had to be used to succeed in the task). For the abstract exercise, the necessary schedule was provided, and subjects were given three kinds of maps to use and evaluate--a detailed map, a schematic map, and a schematic map with a legend.

The concrete task was used as an exercise in all three cities (N=297 people). The abstract exercise was added as the study progressed. Results of the abstract exercise are presented for the Dallas sample and the one Seattle group which performed it (N=129).

Multiple task performance criteria were intercorrelated within each exercise, making is possible to select a subset for

discussion here. In the concrete task, choosing the right route name and number for the bus to take were correlated (r = .59), as were determining correct departure and arrival times (r = .72). Selecting correct routes were less related to correct times. Hence, for the concrete task, two performance results will be presented, correct route name and correct departure time. Similarly, four performance criteria will be discussed for the abstract exercise, two of which can be compared with concrete exercise results. These four performance measures were: route name, transfer route, departure time (for the first leg of the trip), and trip time. The route and time criteria were correlated within themselves (median r = .74), but independent of each other (median r for routes versus times = .00).

Performance on the Exercises

Performance on the transit-riding tasks was generally not high, and it varied between the two exercises. As shown in Table 18, the most successful performance was that of correctly identifying the route in the concrete task. However, while 73% succeeded in naming the route, only 54% of the subjects chose the right departure time to reach their destination by the time specified in the problem. Performance on the different criteria in the abstract exercise was more consistent, but at a lower success-level than in the concrete task. Only 40% selected the right route, and even fewer (29%) identified the appropriate departure time. The tasks of accomplishing the transfer and knowing trip time were successfully performed by 35% and 36% of the subjects, respectively.

TABLE 18

Performance on Transit Exercises: Percent of Subjects Succeeding and Failing on Performance Measures

	Concrete Exercise (e.g. Northgate)		Abstract Exercise (Troutdale)	
Performance Measure	% Correct	% Wrong	% Correct	% Wrong
Route Name	73	27	40	60
Departure Time	54	46	29	71
Transfer Route	NA	NA	35	65
Trip Time	NA	NA	36	64

Background Factors Contributing to Successful Performance

Successful performance on the concrete task was related to several personal background factors.

1. Age was related to correct departure time ($r = -.22$, $p < .001$), but not to correct route identification ($r = -.04$). Older subjects were more successful in defining departure time. This relation also held for the abstract task ($r = -.59$). Education, however, was not related to performance.

2. Sex also influenced correct identification of departure time. Among men, 41% solved this part of the problem, while 61% of the women succeeded. For the sex-related variable of rider-ship, 60% of riders and 46% of nonriders were successful. These variables did not affect correct route naming.

3. Transit attitudes were associated with performance, again only for correct time specification. Only personal convenience attitudes related strongly to success ($r = .21$, $p < .001$). A significant, but weaker correlation also was evident for the personal discomfort attitudes ($r = .12$, $p < .05$). Performance was not associated with social-political attitudes ($r = .05$).

4. Performance differed between all three cities. In Dallas, 71% made correct departure-time judgments. However only 49% of Seattle subjects and 38% or those in Columbus were correct. Success in naming the route to take ranged from 64% to 81% across the cities.

5. Race had a slight impact on performance. A somewhat greater proportion of Whites (74%) than the other two races (58%

and 62%) correctly identified routes. However, more Blacks (67%) selected correct times than did Whites (55%) or Mexican Americans (58%).

Successful performance on the abstract task was also influenced by immediately preceding performance on the concrete task. For the 129 subjects who participated in both exercises (in the concrete-abstract order), the correlation between identifying correct departure times on the two tasks was .32 ($p < .001$). Those who got the first one right tended to get the second exercise right as well. Practice on the concrete exercise helped in performance of the abstract exercise.

Use of Aids in the Exercise

In performing the concrete task, people had three aids at their disposal. After the task, they were asked to choose the most useful (score = 1) and least useful (3) aids. Schedules were seen as the most useful aid (mean = 1.45). The information person was intermediate in usefulness (1.62), and maps were the least useful aid (2.14). In the concrete task, however, the subjects were probably familiar with the city serving as the exercise reference area.

The four evaluated characteristics of the map and schedule aids--legibility, understandability, attractiveness, and ease of use--were all highly interrelated (median $r = .72$, range = .41-.81). These characteristics more highly intecorrelated for maps (.71-.83) than for schedules (.41-.72). In the case of both aids, all four characteristics were related to their overall usefulness in

performing the exercise (schedule correlations were .52-.68; map correlations were .73-.84). Table 19 shows the means of each characteristic of the two aids. Lower means denote more favorable ratings. Ratings were on 5-point scales. Except for attractiveness, schedules were evaluated (slightly) more favorably than maps on all characteristics.

The extent to which the aids were judged useful in solving the exercise problem was related to the person's age and transit attitudes, and to how well he actually performed in the exercise. Personal convenience attitudes were significantly positively related to all three aids; that is, the more favorable the attitudes, the more useful the aids were seen to be. The usefulness of aids was not related to social-political attitudes. Favorable personal discomfort attitudes were associated with greater usefulness of the information person. Older people also considered the aids, particularly the schedule, more useful. More educated people rated the information person as less useful.

Relationships of aid usefulness to exercise performance are illustrated in Table 20. Both the schedule and map were considered more useful by people who successfully completed the exercise. However, the usefulness of the schedule was not as strongly tied to performance as was the map. Map usefulness correlated significantly with both performance criteria ($r = .20$, $p < .001$). However, schedule usefulness was not related to correctness of the route, and more weakly related to correctness of departure time ($r = .13$, $p < .05$). Thus, while maps were generally the least useful aid to solving the exercise problem, they were

TABLE 19

Ratings (Means) of Characteristics of Schedules and Maps Used in the Concrete Exercise

	Aid	
	Schedule	Map
Legibility	2.69	2.92
Understandability	3.08	3.18
Attractiveness	3.11	3.02
Ease of Using Map[1]	2.99	3.28
Overall Usefulness	2.77	3.12

[1]For the schedule, this referred to the ease of using a small map printed in the schedule.

TABLE 20

Correlations Between (Concrete) Exercise Performance and Perceived Usefulness of Three Aids in Performing the Exercise

	Usefulness of Aid		
Performance Measure	Map	Schedule	Information Person[1]
Route Name	.20***	.08	.16**
Departure Time	.20***	.13*	.26***

[1]For discussion of the role of the information person, see the next section of the report.

TABLE 21

Correlations of Aid Usefulness in the Exercise with Attitudes, Age, and Education[1]

	Aid		
	Schedule	Map	Information Person
Personal Convenience Attitudes	.23***	.16**	.14**
Personal Discomfort Attitudes	-.06	.01	.10*
Social Political Attitudes	.07	.02	.04
Age	.19***	.10*	.15***
Education	.03	.05	-.14**

Positive correlations indicate that more favorable attitudes, and higher age and education associate with greater usefulness

***p < .001
**p < .01
*p < .05

considered useful when the person successfully performed the task.

Usefulness of Maps in Performing the Abstract Exercise

Results on the use of alternative forms of maps in the abstract exercise were quite interesting (see Table 22). The schematic map including a legend was considered the most informative and most preferred vis-à-vis performing the exercise task itself. Moreover, 29 of 55 subjects responding considered the schematic map easy to use, and only 9 thought it was hard to use. In contrast, the detailed map was considered hard to use by 32 people, and only 8 thought it was easy. However, when people were asked to indicate which map would be most helpful to them in riding the bus to a new or unfamiliar destination, this pattern reversed, and the detailed map won out, by 7-to-1! These results substantiate, and clarify somewhat, the earlier result that detailed maps, generally, are preferred over schematic maps by a large majority of people. This preference may now be tied to general tasks of knowing how to generally use transit to reach a new destination in an unfamiliar locale. However, as shown by the preference for a schematic map when planning a trip on a specific route, the schematic map approach can be effective if the route is easily and carefully compressed.

TABLE 22

The Value of Three Kinds of Maps in the Abstract Exercise: Percent of Subjects Considering Maps Informative and Useful

Characteristic	Type of Map		
	Detailed	Schematic with Legend	Schematic without Legend
Most informative in doing the exercise	7	35	3
Most preferred in doing the exercise	14	27	2
Most helpful in going to a new (non-exercise) destination	35	5	1

Note. Percentages sum to less than 50%. More than half of the subjects either failed to respond or considered none of the maps best.

The Information Person as a Transit Aid

Preferences for Availability of a Person

Having a person available to provide transit information was a desirable aid. Sixty-five percent of the sample reported they like getting information from a person, while only 24% said they do not like that approach. This preference held even though the sample was equally split in their judgments of the ease of getting information from a person. While 44% felt it was easier to get information from a person than from maps or schedules, 43% thought maps and schedules were the easier ways to get information. Therefore, liking to get information from a person seems not heavily dependent on the ease of procuring information that way.

Table 23 illustrates some additional bases for preferring to have an information person. When asked to write open-ended comments about the use of an information person, participants identified 10 types of reasons for liking the information person. These reasons, along with 8 reasons given for not liking the information-person aid, are listed in Table 23. Five of the 10 reasons for liking relate directly to the ease of getting information, i.e., immediacy, directness, ease of understanding oral communication, accuracy, and general convenience. However, the most frequently mentioned reason for liking concerned the interpersonal pleasantness of the person and the social nature of the person-to-person contact. The information person was also liked because he (she) could: (a) supplement information from other aids; (b) serve as a good first introduction to the transit system; (c) provide experience and familiarity with geographic

TABLE 23

Reasons Given for Liking/Not Liking Information Person
As a Transit User Aid (Number of Mentions in Parentheses)

Like: Easier	Not Like: Not Easier
Interpersonally pleasant (11) (Considerate, polite, friendly, in good mood. receptive)	Unfriendly, condescending (1)
Immediacy, quickness of availability, feedback, reinforcement (8)	Lack of availability; takes too much time; usually too busy (4)
Can answer specific questions; directness (4)	May not fully realize riders' needs (2)
Can offer explanations, supplement other aids (4)	Not necessary if other aids available; electronic route finder better (3)
Useful as first contact with system; valuable if no other aids available, or if rider is a stranger (4)	
Ease of understanding oral communication; instructions easy to follow (4)	
Person's experience, familiarity with area, having up-to-date information (6)	Lack of familiarity with area (1)
Accuracy of information (3)	Doubt about correctness of information (3)
Generally convenient (4)	Inconvenient; not located at bus stop (2)
Can blame someone else if you fail (to reach destination on time) (1)	Do not like to ask someone for help; don't like to bother people; makes you feel stupid, ignorant; need for independence (11)

system; (c) provide experience and familiarity with geographic areas; and (d) serve as a scapegoat for one's transit-use failures.

Most of the reasons for not liking the information person were the reverse of those reasons for liking him or her (unfriendliness, lack of availability, etc.). However, the single greatest barrier to preferring an information person was more personal to the user. That is, use of an information person was viewed as a threat to one's sense of security and independence in being able to do things himself, e.g., feeling ignorant, not liking to bother others with one's problems.

Use of the Information Person in Conjunction with Other Aids

The information person was found to be a moderately helpful aid, in conjunction with schedules and maps, in performing the transit-use exercise. Among the three aids, the person was accorded intermediate helpfulness, between the most useful aid (schedule) and least useful aid (maps). Thirty-six percent of the participants considered the person the most helpful aid; 29% considered him the least helpful; and 35% cited the person as neither the most nor least useful aid. Median rank indices of helpfulness for each of the aids were: schedule = 1.45, person = 1.62, and map = 2.14, where 1 = most helpful and 3 = least helpful. Thus, the person was closer to being the most useful, than to being the least useful aid.

The relative helpfulness of an information person was related to performance on the exercise. The person was judged significantly more helpful by those subjects who performed successfully than those who failed to solve the problem. Moreover, the value of the person was greater for those who correctly identified departure

and arrival times than those who did not (r = .26 and .25, $p < .001$). The person was also more helpful for those who correctly cited route names (r = .16, $p < .01$). But the information person's helpfulness was not related to correctly identifying the route number (r = .09). By way of contrast with other aids, the helpfulness of maps was significantly ($p < .001$) related to performance on all four task criteria; and the helpfulness of schedules was associated ($p < .05$) with getting travel times right, but not with identifying routes. These results reinforce the possibility that the information person contributes to effective use of transit as a secondary aid, if we assume that specifying travel times is secondary to identifying the right route to take. Although we cannot discern the order in which persons, maps, and schedules were used, observations of the group process indicated that subjects generally went to the information person after reviewing the other aids.

It should be noted that, in the transit task used in this study, the users interacted in a face-to-face manner with an information person who was "on site", i.e., in the room with them. The more typical mode of contacting an information person, in preparing to take a "real" trip, is probably by telephone. Direct personal contact may allow personal attractiveness and mannerisms to have a greater effect on user reactions. It might also be recalled, however, that, in comparing the rankings of eight transit aids before and after the laboratory, the perceived usefulness of the telephone (and, by implication, the person

contacted) increased slightly. This may have been partly due to satisfactory experience with the information person in the laboratory exercise.

On the whole, then, the information person was: (a) liked as a transit aid; (b) used effectively and reacted to favorably in a behavioral exercise when other aids were available; and (c) ranked second, with respect to telephoning an information person, when compared with 7 other kinds of aids.

Individual Differences in Preferences for an Information Person

Preferences for information persons, and their perceived usefulness, varied for users with different personal characteristics and backgrounds. Information persons were seen as more useful in solving the transit-exercise problem by older people ($r = .15$, $p < .01$) and by those with less education ($r = .20$, $p < .001$).

Liking and finding it easy to get information from a person depended on the user's sex and transit-riding background. Table 24 shows the percentages of males and females, and riders and nonriders, who liked and did not like an information person, and who found it easier and harder to get information from a person. A significantly greater proportion of females in the sample, than males, liked the information person ($z = 2.59$, $p < .01$). This occurred in spite of the fact that significantly more men than women found it easier to get information from a person than from maps and schedules ($z = 2.81$, $p < .01$). Although equal percentages of riders (66%) and nonriders (63%) said they like an information person, a significantly greater percentage of nonriders than riders

TABLE 24

Sex and Ridership Differences in the
Value of Information Persons as Transit Aids

		Like to Get Information From Person	Don't Like to Get Information From Person	Easier to Get Information From Maps and Schedules	Not Easier to Get Information From Maps and Schedules
Sex:	Male	56%	32%	35%	56%
	Female	70%	20%	48%	38%
Ridership:	Rider	66%	18%	48%	32%
	Nonrider	63%	30%	38%	57%

said they did not like to use an information person (z = 2.26, $p < .05$). Again, however, a smaller proportion of riders than nonriders considered it easier to get information from a person than from other aids (z = 4.17, $p < .01$).

While the pattern of liking an information person but not considering him an easier information source seems contradictory, it is a consistent finding in the present data. The person while not the easiest path to information may be liked because of his availability when other mechanisms fail, or to supplement and explain information in printed aids, or to rely on if the "easier" maps and schedules are not immediately available. Such an interpretation is reflected in reasons, reported earlier, for liking an information person, and supports the notion of this aid being most appropriately conceived as a useful follow-up, rather than first-step approach to getting transit information. When used as a "first contact", the information person might serve his purpose by supplying, or directing the user to written aids he may find easier to use repeatedly.

These individual differences also suggest that information persons may be more effectively used, or at least preferred, after people make contact with the transit system and become a rider. Fewer riders than nonriders disliked the information person approach. Thus, an information person should not be considered as a potential aid for "breaking the ice" and turning nonriders into riders. An information person's role is passive and one of reacting to inquiring from the public, rather than systematically disseminating information.

Transit Information Dissemination Techniques

In the first three laboratories, group discussions were held to obtain opinions about information dissemination techniques. This procedure, however, did not yield adequate information from all subjects. Thus a series of eleven questions on "ways of getting information" were added after the review of aids section and was administered in nine of the thirteen groups.

Several proactive means of disseminating transit system information were evaluated by the participants in this activity. These techniques included: (a) making information available at schools and workplaces; (b) mailing information about neighborhood bus routes; (c) having bus drivers present information door-to-door; (d) presenting short courses, in the schools, on transit use; (e) printing schedules in the newspaper; and (f) having flyers available at local commerce facilities, such as banks and supermarkets.

In general, people reacted most favorably to questions which asked whether the availability of transit information would make them more likely to use the bus and whether providing such information is helpful and important. On a scale of 1-5, the mean responses were 1.9, 1.4, and 1.8 respectively, indicating that respondents did feel that transit information is important and would influence favorably their decision to ride the bus. (Lower means indicate more favorable responses).

Among the different methods of disseminating information, information sent in the mail was considered the most useful (mean: 1.9), and was considered to make people more likely to ride the

bus (mean = 1.8). However, subjects were not always likely to look at advertisements they receive in the mail. On a 1-5 scale ranging from usually to never, 32% reported that they usually look at mail advertisement while 43% look at such mail only sometimes. Therefore, mail advertisements may not be as useful in encouraging transit ridership as they seem since a substantial number of people do not always look at mail advertisements. Subjects were almost as favorable toward bus schedules being printed in newspapers (mean = 2.0) and indicated a clear preference for obtaining such information from a daily newspaper (61%) as opposed to a weekly community newspaper (32%). Also, subjects considered it helpful to have a short course on using public transportation taught in the schools (mean ≐ 2.1).

Subjects indicated they are only somewhat likely to pick up flyers or handouts (mean 2.3) but were not asked whether they favored this method specifically for disseminating transit information. Like the mail advertisements, flyers and handouts in stores and public places cannot be guaranteed to reach all potential users. However both methods would appear to be useful if combined with each other and other dissemination techniques.

Finally, subjects tended to be neutral or unfavorable toward door-to-door delivery of transit information (mean = 3.1). This was the least preferred of all methods presented.

Individual Differences

Age did not tend to correlate significantly with the questions about information dissemination techniques, although moderate negative correlations exist on the two items relating to

helpfulness and influence of information (-.15 and -.12; $p < .05$) and the importance of short courses (-.13; $p < .05$). In these cases, the older subjects gave higher preferences to these items than did younger subjects.

Education correlates significantly with all but two of the items--influence of information on use of the bus and preference for daily versus weekly newspaper. The correlations range from .16 ($p < .01$) to .30 ($p < .001$), indicating that more highly educated subjects were less likely than less educated subjects to find useful or influential the information aids discussed in this section.

Methods of Fare Payment

Early in the laboratory, subjects were asked to rank three commonly used methods of fare payment: coin, token, and ticket. There is a clear preference indicated for coin payment, which 59% ranked first; tokens were ranked second by 48%; and tickets were ranked third by 48% of the subjects. Thus there appears to be a substantial amount of agreement on the preferred methods of payment. This indicates that caution should be used in introducing non-monetary methods of payment, particularly without assessment of the preferences (and their underlying causes) of user groups of the particular transit system. There were few differences among cities in the ranking of methods of fare payment although Columbus subjects showed smaller distributions and more agreement on the ranks for the three items than did subjects in the other two cities. For example, 74% of the Columbus subjects gave coins a 1 rank while 46% of the Dallas and 60% of the Seattle subjects gave this same ranking. However these variations do not reflect significant differences, and these results should be interpreted cautiously. It was realized part way through the laboratories that subjects had not been given all possible alternatives from which to choose. Therefore in the laboratories in the last city (Dallas), an additional item was added which asked subjects to rank the usefulness of coins, token, ticket, and passes. The last alternative was added because different types of passes are increasingly being utilized by transit systems in this country.

Results from the added question clearly indicate a strong preference among Dallas participants for the pass, with 54% ranking it first (see Table 25). Coins and tokens are closely ranked second and third, but tickets are least preferred. All of the groups gave a 1 rank to passes more frequently than to any of the other alternatives, although senior citizens and bank employees were almost equally favorable (1 rank) to the passes and coins as methods of payment. Very few people ranked either the token or the ticket; these are not as preferred as are the pass and coin methods. These results reveal, then, that when the choice of passes is added, persons (in Dallas, at least) prefer the pass over the use of coins, but otherwise retain the same rank order as when given the original three choices (coin, token, and ticket).

TABLE 25

Methods of Fare Payment (Dallas only)

	1	2	3	4		
(Coin) A	23%	26%	18%	33%	Mean:	2.58
(Token) B	14%	24%	41%	19%	Mean:	2.59
(Ticket) C	7%	32%	23%	36%	Mean:	2.83
(Pass) D	56%	18%	16%	10%	Mean:	1.81

SUMMARY

This summary of the laboratory activities regarding transit user information aids seeks to provide the reader with a brief, general overview of the results and analyses of those laboratory sessions. A detailed discussion of the findings will be found in the analyses of each of the components of the laboratory which precede this section.

Characteristics of Sample

Participants in the laboratory activities in the three cities (Seattle, Washington; Columbus, Ohio; and Dallas, Texas) were almost evenly split between riders and non-riders of transit and were representative of highly potential riding groups. Generally, participants were distributed between both sexes, all age groups with a slight emphasis on 16-25 and over 65, various ethnic groups, had either a high school education or some college, and reflected a number of occupations, but especially students, homemakers, and retirees. Thus, while the sample does not necessarily show an accurate representation of the general population on all characteristics, it does, in large part, reflect characteristics of transit users.

Attitudes Toward Public Transit

Responses to the 34 attitude items regarding public transit were generally quite favorable. A factor analysis of these items revealed that three major attitude clusters accounted for most of the variance. These were (a) social impacts: political support, (b) personal convenience, and (c) personal discomforts. Thus most people favored governmental support of transit; and the need for

good transit systems and tended to feel that transit primarily has convenience features.

Attitudes varied with the person's age, educational background, and extent to which he/she rides the bus. Older persons showed significantly more favorable social and convenience attitudes and less favorable discomfort attitudes than younger respondents. This same trend also held for riders who use the bus more frequently. Additionally, higher education was correlated with less favorable personal convenience attitudes.

Overall, the relationships of personal characteristics to convenience attitudes were of especially strong magnitude. Attitudes differed across the three test cities with more favorable social-political attitudes in Columbus. Attitudes did not change in a post-attitude survey administered after the laboratory activities.

Preferences for Information Aids

As a first step in the actual review of transit aids, participants were asked to rank eight aids for their overall usefulness: pocket schedule, telephone, bus stop information, other people at the bus stop, fold-out map, electronic route finder, bus driver and sign on the front of the bus. The pocket schedule was clearly the preferred aid, ranked a full point above the second aid, telephone. The other aids were fairly closely ranked with the exception of other people which was markedly the least preferred aid. Preferences were not distinguished by a particular set of characteristics except possibly personal contact (bus driver, other people ranked less helpful). Age, sex and education significantly related to the rank position of some of the aids with older people,

less educated persons, and women showing higher preferences for drivers, bus signs, other people and bus stop information (except for women on latter two) than their counterparts. Blacks preferred these same aids (except bus signs) as well as schedules, telephone and maps more than did Whites and Mexican Americans. Finally, riders showed higher preferences for schedules, other people, drivers, and signs than did nonriders. There were no differences among cities and these rankings did not change at the end of the Laboratory activities when participants repeated this task. Rankings of the aids were, however, related to transit attitudes. Those with favorable Personal Convenience attitudes gave a higher rank to other people, bus drivers, frontal signs, bus stop signs, schedules and telephones. Those who showed favorable social/ political attitudes had higher preferences for maps, schedules and bus signs.

Bus Stop Signs

Laboratory participants were shown a series of slides regarding five aspects of bus stop signs--color, shapes, symbols, information elements and information combinations. Preferences for these are briefly outlined below.

Of four shapes (square, circle, triangle, special graphic), the special graphic was rated as the most identifiable followed by the square, circle and triangle. However when these same shapes were ranked for attractiveness the square was ranked first, then the circle, triangle, and the special graphic last. Older people, less educated persons, and women preferred the square, circle, and triangle shapes more and the special graphic less than

did younger, more highly educated groups and men. The use of a specially designated color for transit signage was considered important by a majority of participants, particularly to older, less educated, and female respondents. When asked to rank four colors for identifiability (yellow, blue, green and red), blue was ranked most identifiable, followed by yellow, red and green ranked last. Again older, less educated and female respondents ranked colors blue and yellow higher than their counterparts.

A majority of the laboratory participants felt that a standard transit symbol would be quite meaningful, understandable and identifiable, though they were less certain of its identifiability and of the necessity for the words "bus stop" on signs. Also they preferred the T-transit symbol over a regional symbol. In ranking the usefulness of four types of symbols (bus stop, picture, bus stop words, T-transit, and regional symbol), the symbols with a bus stop picture or words were preferred over the T-transit and regional symbols. Older persons, men and nonriders felt standard symbols were more important. Also men and nonriders ranked higher identifiability and the need for words to accompany a standard symbol.

Next, participants viewed and assessed the usefulness of four information elements: route name, route number, route map and departure times. Overall, route names and departure times were ranked more useful than route number and map, but the mean ranks of all were ranked fairly high. Younger respondents and riders preferred the map more than other groups, and older and less educated persons showed a higher preference for route name and number.

Finally, five information combinations of varying complexity were ranked by participants (a) route numbers, (b) route name, (c) route number and name, (d) route number, name and map, and (e) route number, name, map and departure times. Generally, more information was preferred to less. The bus sign with four pieces of information was not perceived as having too much information while one-element items were least preferred. Higher rankings for complex combinations were given particularly by older, less educated females and rider groups. There were some city differences with Seattle groups ranking combinations higher; Columbus groups ranking them moderately, and Dallas groups lower. However, these were moderate differences, not exceeding a 1.0 rank.

Transit System Maps

In general, the pocket map was preferred over the larger fold-out map by all subgroups, as was the detailed map over the schematic map. There were insignificant differences in preferences for (a) designating routes by number or color and (b) for using color codes to designate class of service or geographic destination. There were few differences by sex and ridership except in coding routes where males and nonriders preferred color coding. Blacks and Mexican Americans had a higher preference for number coding; Whites for color coding. There were some city differences with Columbus participants preferring color coding; Seattle and Dallas number coding. While Columbus groups were about equally divided

on pocket versus fold-out map, Seattle groups showed a strong preference for the pocket map (2-1).

Transit Exercise

The use of schedules and maps was tested through two transit exercises; one concrete and specific to the city, and one abstract. Performance generally was not high but varied between the two exercises. The most successful performance was on the identification of route in the concrete task; fewer persons correctly identified the departure time.

There was a lower but more consistent success level on the abstract exercise with less than half correctly identifying the right routes and even fewer, the correct departure time. Lowest success rate was on identifying transfer points and trip time. Older persons, women and riders were more likely to correctly identify departure times than their counterparts; but there was no correlation for education. Among the transit attitudes, the Personal Convenience cluster also was related to correct identification of times. Performance among cities differed significantly, with Dallas respondents having the highest success rate with 71%, Seattle the second with almost half, and Columbus the least (less than one-third). Finally success on the concrete exercise increased a person's likelihood of success on the abstract exercise.

Respondents were also asked to rate the different aids they used after completing the exercises. Schedules had higher ratings on the characteristic of usefulness and the map was least useful. Older persons found the schedule more useful while more highly educated persons attributed less usefulness to the information person.

Higher usefulness also was attributed to the schedule and the map by those who were successful on the exercise.

Finally in the abstract exercise, the schematic map with a legend was perceived as most useful; and the detailed map as hard to use. However, the detailed map was greatly preferred for riding the bus in going to a new, unfamiliar destination.

Information Person

Having a person available to provide transit information was considered a desirable aid by more than half of the respondents, although these persons were equally divided concerning the ease of getting information from (1) an information person; or (2) a transit map or schedule. Reasons given for liking the information person stressed more the pleasantness and the social nature of the aid than the ease of obtaining information. The information person was viewed as a moderately helpful aid (between the schedule and the map); and was ranked more helpful by those who performed the exercise successfully, especially those correctly identifying travel times. Older and less educated people viewed the information person as more helpful while females and riders liked to use the information person more than in other groups.

The information person was viewed essentially as supplemental to other aids when they fail to provide enough information. This is a more passive, responsive aid rather than one which can stimulate transit use.

Dissemination Techniques

In general, there was a favorable response to whether the dissemination of transit information would increase persons'

likelihood of using transit. Mail transit advertisements were seen as the most useful dissemination technique, but many persons reported that they did not always look at mail advertisements. Respondents were almost as favorable toward schedules printed in daily newspapers; and a short course in the schools in using public transit was considered useful. Respondents said they were only somewhat likely to pick up flyers and handouts and were neutral to negative on door-to-door delivery as a dissemination technique, thus indicating that these techniques might not be effective. In general, less educated persons found the dissemination techniques more helpful than others; there were no significant relationships with other individual characteristics or to the ranking of the eight transit aids.

Methods of Fare Payment

There was a substantial amount of agreement on the ranking of three alternative methods of payment: coins, tokens and tickets. There was a clear preference for coins over tokens; tickets were least preferred. There were few differences among cities although Columbus participants showed more agreement on the ranking than Seattle and Dallas participants.

CONCLUSIONS

Laboratory participants' attitudes toward transit were generally quite favorable. However, individual differences accounted for variation in attitudes reflecting social impacts and political support of transit, and its personal conveniences. Thus, specific system changes designed to improve attitudes should be considered in light of the population characteristics of potential users. Attitudes were favorable among both riders and nonriders. This indicates a need for caution in assuming that transit system changes will stimulate increased ridership through enhancement of attitudes. The pattern of individual differences suggests that attitudes are more favorable among those who are likely to be "transit-dependent". This attitude pattern extended to preferences for kinds of transit information aids. The elderly, the less educated, females, and riders tended to evaluate information aids and their features more favorably. Overall, pocket schedules were preferred as the most useful kind of aid, while direct contact with other people (the general public at bus stops) was considered least helpful.

The rankings and assessments of particular aids and specific characteristics of aids (e.g., color, shape) generally indicate that people prefer familiar information aids and dissemination techniques--those that are currently used or are similar to other types of information systems. Also they tend to prefer those aids which provide the most specific and accessible information regarding the use of transit (e.g., pocket schedule, telephone, and bus stop information).

However, there is substantial evidence in the findings that it would be worthwhile to develop and test some new types of aids/characteristics in transit information systems. For example, while the special graphic shape for bus stop signs was ranked lowest for attractiveness, it was ranked highest for identifiability. Some modification of such a special graphic might be developed which would not only be identifiable but also would be perceived as attractive to the public. Regarding specific characteristics of aids, preferences are highest for descriptive words and pictures, which are specific and easily understood, rather than for more abstract representations of information.

The transit exercise provided some valuable insights into the differences between preferences for aids and behavior in using them. In a mock transit-trip exercise, preferences for map types differed when participants used them. When simply judging pictures of map types, a detailed map was greatly preferred over a schematic map. In the exercise, participants found the schematic map with a legend most useful, but still preferred the detailed map (by a 7-1 margin) for riding the bus in a new setting. This seemingly contradictory finding indicates needs to: (1) pre-test the acceptability of new forms and types of aids before making significant changes in information system elements; (2) make any changes gradually; and (3) adequately educate people to use new aids.

Additional conclusions drawn from the analysis of the laboratory evaluation activities are that: (1) favorable

attitudes toward transit do not necessarily lead to actual use of transit and (2) brief exposure to transit information system components does not seem to change reported attitudes or behavioral intention to ride transit, particularly among nonriders at least as reported by participants at the end of laboratory activities.

However, transit information aids do provide essential information to transit users, some providing primary information, others serving to provide supplemental information to those primary aids. While there was a substantial amount of agreement regarding preferences for various sets of aids, there were distinct differences among some sub-population groups regarding the specific characteristics of the transit aids. These findings should provide an adequate basis for developing general guidelines for standard sets of transit user information aids, with choices among aid characteristics based on city and area differences. Another approach which might be considered would be to design aids specifically for selected target populations (i.e., groups that are potential transit riders) without making the information unusable by current riders. The latter approach particularly would require further research to ascertain what mixes of information aid types and characteristics could be designed successfully to implement such a strategy.

APPENDIX

A Glossary of Statistical Terms Used in the Report

1. Mean: The average of a set of scores; the total of the scores divided by the number of scores.

2. Median: The midpoint of a cumulative frequency distribution of scores; half the set of scores falls above the median, and half are below the median.

3. s.d.: Standard deviation of a set of scores; the square root of: the sum of the squared deviations of each score from the mean (Σ (score-mean)^2), divided by N, the number of scores. S.d. is an index of variability in a set of scores; the higher the value of s.d., the greater the variability.

4. p ; significance: An indicator of the level of confidence we can have that a result is a systematic phenomenon, not due to random chance events. A level (e.g., .001) is set for rejection of the hypothesis that there are no differences, no correlation, etc. If the statistical test shows significance beyond that level we reject the "no-effect" hypothesis with the given limits set by the level. If $p < .001$, there is less than 1 chance in a thousand that we are rejecting a true hypothesis of "no-effect", or roughly speaking, less than 1 chance in 1000 that our finding is due to chance; $p < .01$ and $p < .05$ indicate probabilities of less than 1 in 100 and 5 in 100, respectively, that the result is spurious.

5. z: A test for the significance of the difference between two proportions.

6. t: A test for the significance of the difference between means from two groups.

7. χ^2: (Chi-square): A test of association between categorical (yes/no, or A versus B versus C when these categories are not on a continuous scale) variables. E.g., is race associated with whether one does or does not do something? Test based on difference between frequencies of events observed and expected if the variables were independent.

8. r (correlation): Index of the degree of association between two variables. r can range from -1.00 to +1.00. Negative correlations indicate that high scores on one variable are predictive of low scores on the other; if the r is positive high scores go together; if $r = .00$, there is no relation between the variables.