VARIATIONS IN PSYCHOLOGICAL RESPONSES TO CHARACTERISTICS OF BUS SERVICE

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This study was undertaken as a part of a Florida Department of Transportation (DOT) bus demonstration project in Clearwater, Florida. It was intended to provide psychological data as inputs to analysis and design of public transportation systems. The bus system serviced a low-density urban region in which many elderly people lived. A survey for obtaining consumer inputs was administered at home to 145 users and nonusers of the bus system. Three other variables (in addition to user status) were studied: age, sex, and health status. Large differences were found on responses to various transportation-related concerns or annoyances. Nonusers were more concerned about injury and health risks, annoyances, and long-time pressures (e.g., delays). Oldest respondents were more concerned about injury and health risks and about short-time pressures (e.g., not being able to move quickly enough). Less healthy persons also reflected this latter concern. Because of the large number of persons in the elderly (sometimes infirm) category, it was suggested that consideration of the needs and limitations of these persons is clearly advisable in the design of transportation systems.

•IDENTIFICATION and measurement of various consumer inputs are currently receiving increased attention by transportation planners. The rationale behind this growing concern stems, in part, from recognition that use of public transportation facilities depends on user preferences that are not satisfactorily measured by usual system performance variables such as travel time, cost, and departure frequency. Previous studies of the ability of public transportation modes to meet the needs of and match the physical characteristics of existing and potential riders have revealed barriers for some people (1) and the importance of measuring preferences about system characteristics by users (2).

The need for this research is intensified by the increasing emphasis on planning public transportation services that meet the needs of relatively immobile or transportation-disadvantaged groups. Such emphasis is even a matter of national policy (3):

> It is hereby declared to be the national policy that elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services; that special efforts shall be made in the planning and design of mass transportation facilities and services so that the availability to elderly and handicapped persons of mass transportation which they can effectively utilize will be assured; and that all Federal programs offering assistance in the field of mass transportation (including the programs under this Act) should contain provisions implementing this policy.

To ensure the possibility of effective use of public transportation by groups whose characteristics differ from the public at large requires that transportation planners make concerted efforts to mold the characteristics of public transportation systems

Publication of this paper sponsored by Committee on Public Transportation Planning and Development.

to fit the specialized requirements of these groups. This does not imply that the needs of the many must be disregarded in favor of those of the few. The transportation system that is responsive to eliminating as far as possible all unnecessary physical and psychological impediments to travel probably will provide improved levels of service that can be appreciated by all its patrons. An appropriate concern, therefore, of those responsible for the planning and evaluation of transportation systems should be the identification and consideration of the activity needs, economic capacity, physical capabilities, and psychological reactions of population subgroups, particularly where these needs and reactions differ considerably among the various groupings.

METHOD

Clearwater Demonstration Project

The empirical basis for this research was an attitudinal survey of actual and potential users of a 1-year bus demonstration project conducted by the Division of Mass Transit Operations, Florida DOT. This project, known as the Clearwater Bus Demonstration, served a number of small communities just outside Clearwater, Florida, from October 1970 to October 1971. Alan M. Voorhees and Associates, transportation and urban planning consultants, were retained by Florida to operate the demonstration project, and they have reported on the monitoring and analysis of project performance (4, 5, 6).

The purpose of the demonstration project was to test the feasibility of providing fixed-route, inexpensive bus service in a low-density urban area that was populated largely by middle-income retirees and that had never been served by buses. According to the 1970 census, the percentage of the 522,329 Pinellas County residents 65 years of age or older was 29.4, three times the national figure of 9.8 percent. During the planning phase of the Clearwater project, a deliberate attempt was made to locate the bus routes so they would pass through the county's retirement population.

While the bus system was in operation, a home interview survey was conducted in which a random sample of households located within 1 mile of the bus routes was studied. The age of the 1,582 members of the 641 households surveyed was 40 percent over 60, 37 percent between 20 and 60, and 23 percent under 20 years of age. Thus, it can be assumed that a sizable proportion of the target population for the Clearwater project was elderly or retired or both. Those households surveyed were predominantly of middle-class status with a median family income of $7,000 and with car ownership averaging 1.32 per dwelling unit.

In addition to the home interviews, specific users of the demonstration buses took part in an on-the-bus survey. When questioned about the mode of travel used before the demonstration bus service was provided, 40 percent of the under 20-year-old bus users said they had been previously unable to make a similar trip. This illustrates significant latent demand for transportation. Although 46 percent of the over 60 age group indicated the automobile as the previous travel mode, only 10 percent of the persons in this group had both a driver's license and an automobile. Thus, most of the elderly persons who had previously used automobile travel apparently solicited rides from relatives and friends. A latent travel demand by those over 60 was also reflected by the 28 percent that had been previously unable to make particular trips.

Procedure

The survey was developed and analyzed under the joint sponsorship of the Urban Mass Transportation Administration and the Division of Mass Transit Operations, Florida DOT. It was an attempt to identify the feelings people have about traveling by public transportation as well as how such feelings vary among different people.

The survey questionnaire was designed to focus on psychological reactions of people to bus travel. Respondents were asked to select the answer that best described their feelings about various situations that occur often in bus travel. The situations specifically dealt with health, injury, annoyance, and time pressure. These categories and the specific travel situations assessed are as follows:

1. Injury risk—boarding the bus, bus moving before the passenger is seated, having to stand or move in crowds, having to stand during the ride, experiencing a bumpy ride, sudden changes in speed, alighting from the bus, alighting before other passengers, bus stops located on wide streets, and bus stops located near fast-moving traffic.
2. Health risk—uncomfortable temperature inside bus, uncomfortable temperature differential (inside-outside), being exposed to drafts, having to stand for extended periods of time, being in close contact with other people, experiencing a bumpy ride, having to wait outside in rainy weather, having to walk too far, and being exposed to exhaust fumes.
3. Annoyance—having to walk too far, delay time waiting for a bus, experiencing a bumpy ride, sudden changes in speed, cleanliness of the bus, being in close contact with other people, being forced to transfer, and having to stand during the ride.
4. Short-duration time pressure—boarding the bus ahead of other people, getting seated before the bus starts moving, moving from a seat to the exit door, alighting from the bus before other people, and interference with other people who are moving faster than you can (or want to).
5. Long-duration time pressure—having difficulty finding the bus stop, not knowing when the bus is scheduled to arrive, having to wait for a late bus, and experiencing unexplained delays enroute.

Those respondents who used the demonstration project buses were asked to answer on the basis of their experiences riding the buses. Respondents who were not bus users were asked to answer the same questions based on what they thought the situations would be like if they were to ride. In each case, the interview was conducted in the respondent's home and lasted about 30 min.

During the interview, the respondent was given a sheet of paper that indicated the appropriate scale to be used in answering each set of questions. A four-point Likert type of scale (7) was used with each numbered point representing a statement that expressed an extent of concern. For example, a scale from 0 to 3 would represent successively increasing concerns, as follows:

1. 0—not at all concerned about the situation,
2. 1—somewhat concerned about the situation,
3. 2—moderately concerned about the situation, and
4. 3—very concerned about the situation.

The interviewer described a situation, and the person being surveyed reacted by indicating the most appropriate numbered response. Interviewers were instructed to encourage the use of numbers alone rather than the corresponding statements. This way it was hoped that the respondents would have less reluctance to express possible fears or concerns.

Survey Respondents and Interviewers

Respondents for our survey were an essentially random subset of the larger sample from the Voorhees survey. Two differences existed, however. First, some of those selected were no longer available for inclusion, and second, so that the ability to compare user with nonuser behavior could be strengthened, a higher than existing proportion of users was sampled. A total of 145 persons participated, 74 of whom were riders on the demonstration bus system and 71 who were nonusers. Of the 145 respondents, 32 were less than 20 years old, 51 were between 20 and 60, and 62 were over 60.

The survey data were collected by 12 junior college students from the Clearwater area. They had been trained for and served as interviewers in previous Voorhees research.

Study Variables and Research Design

Four main variables were studied to see what differences they accounted for in survey responses: sex (male versus female), health status (excellent versus lesser),

bus ridership status (user versus nonuser), and age (<20 versus 20 to 60 versus >60 years). The three-way division of age provided for assessment of expected nonlinearity between responses and age.

In a classic experimental design, it is desirable to assign individuals to specific conditions in random or matched fashion so that causality of variables can reasonably be determined. Unfortunately, the four variables examined in this investigation were the sort in which a person's classification was dictated by his behavior or demography. Obviously, people who voluntarily use a demonstration bus project might differ from nonriders on such characteristics as car ownership and income. Hence, the observed relationship between ridership status and other behaviors might be caused by unidentified, extraneous factors. This is a limitation characteristic of all studies that use demographic variables as quasi-independent variables. Table 1 gives some of the main relationships between the quasi-independent variables of this study and various other categories. Note that several categories relate particularly to user status and age.

We tried to identify significant sources of variation in survey responses with a multivariate analysis of variance, i.e., use of a design that permitted unequal cell frequencies and disproportionalities. [The specific analysis of variance technique that was employed (BALANOVA 5, University of Illinois) uses an unweighted means technique for estimating all sources of variance.]

One consequence of using the combination of demographic variable classifications described is that the observations on each response variable must be subdivided into 24 cells (based on a 2×2×2×3 design). Unfortunately, limitations within the data set produced an insufficient number of observations in some of the cells and precluded the use of this design. These sparsely filled cells were primarily because of the young people surveyed who were almost all in excellent health. It was found, however, that a four-way classification design to examine the effect of health on survey response was possible if a two-category age breakdown (that resulted in a 2×2×2×2 cell design) was employed. So that the effect of age under the more desirable three-way age group breakdown could be tested, a second analysis of variance was designed that omitted the health category and consisted of user status, sex, and age (a 2×2×3 cell design).

RESULTS

A summary response score for each survey participant was derived for each of the categories: injury risk, health risk, annoyance, short-duration time pressure, and long-duration time pressure. The respondent's score (from 0 to 3) was recorded for each specific situation (e.g., sudden changes in speed) in the category. These, in turn, were averaged to provide an extent of concern score (ranging from 0 to 3.0). These various scores were analyzed, and the results are shown in Figures 1, 2, and 3.

In each of the graphs, the vertical axis represents the extent of concern dimension. The vertical displacement of a given point is the group mean that represents all of the members of that particular subgroup. The specific categories of concern are represented by points along the horizontal axis of each graph. The lines connecting the plotted points have been included to aid in recognition of the response profile of each demographic group.

Variations in response level that are attributable to user status are shown in Figure 1. These results are based on the three-way (2×2×3) analysis of variance design that excluded the health status variable. For all categories of response, the nonusers expressed greater levels of concern. Significant differences (in which probability of occurrence because of chance alone is 0.05 or less) were found in the injury risk, health risk, annoyance, and long-time pressure categories. Because nonusers were asked to respond according to how they thought the situations would affect them, these results presumably indicate the presence of a bias against bus transportation.

Variations in response level that are attributable to age are shown in Figure 2. These results are also based on the three-way design excluding the effect of the health status variable. As expected, the extent of concern about injury risk, health risk, and short-time pressure situations significantly increased with age. No significant differences among age groups were found for the annoyance and long-time pressure categories, but all age groups rated them as relatively important concerns.

Table 1. Significant relations between independent and descriptive variables (probability of occurrence < 0.05).

Descriptive Variables	User (U) Versus Nonuser (NU)	Excellent (EXC) Versus Lesser (LESS) Health	<20 Years Old (LO) Versus 20 to 60 (MID) Versus >60 (HI)
Distance between home and bus stop	NU > U		
Access to car	NU > U		MID > LO and HI
Possession of driver's license	NU > U		MID > LO
Years living at current address			LO > MID; HI > MID
Size of prior town or city	U > NU		HI > LO and MID
How often a transit user there	U > NU	EXC > LESS	MID > LO; HI > LO
School grade completed	NU > U		MID > LO and HI
Ability to get around physically		EXC > LESS	LO > MID and HI; MID > HI
Persons in excellent health			LO > MID and HI; MID > HI
Persons using the bus			LO > MID; HI > MID

Figure 1. Extent of concerns as function of user status.

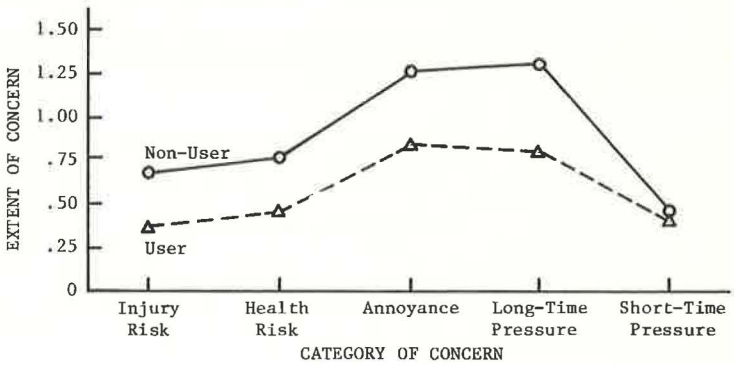


Figure 2. Extent of concerns as function of age category.

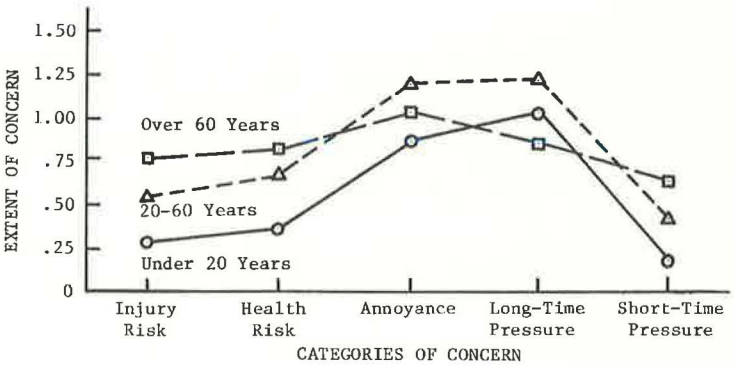
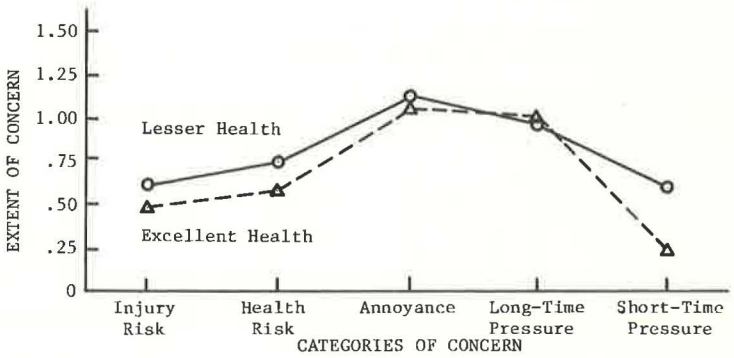


Figure 3. Extent of concerns as function of health status.



The variations in response level that are attributable to the perceived health status of the survey respondents are shown in Figure 3. These results are based on the four-way (2×2×2×2) design. The only significant difference in response level was in the short-time pressure situations, with poorer health respondents who indicated higher concern.

No significant differences in levels of concern based on sex of the respondents were found. User status and age, therefore, appear to be the two most important factors in explaining the variations in psychological response that were examined.

In addition to the main effects described above, there was a significant interaction between user status and age for the health risk concern measure. It was found that nonusers over 60 years old expressed considerably greater concern for health risk situations than did older users. This may indicate the true health status of the over-60 age group of nonusers, and it offers an additional clue as to why they chose not to use the demonstration buses.

CONCLUSIONS

This research represents a somewhat primitive attempt to provide psychological inputs to the analysis of public transportation service. The study was limited in at least two respects: (a) Budget and time constraints were responsible for the limited sample size; and (b) the Clearwater bus service was conceived as a demonstration program, and this could have led to findings atypical of bus service in general.

Nevertheless, the findings offer some useful insights and directions. The users and nonusers revealed sizable differences in many areas of concern. It would be expected (as found here) that nonusers would reflect their bias against bus riding in such areas as long waits, unexpected delays, unpredictable service, and general inconvenience. However, their concern about health and injury risks, as compared with users, is not so easily explained. There might be a need to consider public educational programs to offset this nonuser worry or bias.

The data showing the effect of age on transportation concerns appear quite important. Health and injury concerns were directly related to age: The oldest respondents were most concerned, the youngest the least. The elderly were also the most concerned about short-time pressure situations, e.g., where they could not move quickly enough to match situation requirements. Persons of poorer health in general showed this same concern. Because the elderly (and sometimes infirm) make up a major ridership group, only some of whom are currently likely to use typical bus service, their concerns strongly suggest possible equipment and systems-operation concessions. Notable among equipment considerations might be the design for safe and easy entrance and exit, adequate handholds and safety padding along all walkways and standing areas, and package and shopping cart capacity. A bus route that eliminates the need to cross fast, busy, wide avenues is an example of a system concession in the interests of wider ridership by the elderly and infirm.

The data show that people respond psychologically quite differently to various transportation equipment and systems characteristics according to their membership in relevant demographic groupings. We have tried to demonstrate that transportation service quality dimensions (which are "soft" in comparison to travel time) can be described, measured, and analyzed. Finally, we suggest that these kinds of information have considerable usefulness in the planning and evaluation of public transportation systems, which would then be more responsive to the needs of all potential consumers.

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