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Perceived-Difference Segmentation Model for Mass Transit Marketing

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Cluster analysis was applied to the differences automobile users perceive between the attributes of mass transit and those of automobile travel. This approach generated three stable, replicable market segments whose members exhibit sharp differences in their likelihood of switching from automobiles to mass transit. One of these segments contains a large number of individuals who have a high probability of switching; this segment was identified as a priority target segment. The cluster analysis also produced readily interpretable information that can provide transit planners with a means to develop mass transit service design and advertising strategies to effect mode switching.

Since 40 percent of U.S. oil supplies are devoted to automobile gasoline, the diversion of substantial numbers of people from private automobiles to mass transit would produce substantial energy savings. (Throughout the text, "mass transit" and "transit" will refer to public bus transportation.) For this reason, mass transit has been called on to play an expanded role in government energy policy. However, to date it has proved difficult to persuade Americans to forgo the personalized comfort and convenience of private automobiles for public transit.

It is becoming clear to transportation planners that there are no universal appeals, such as cost incentives, that successfully influence a broad range of individuals to switch to mass transit. Most attempts at converting private car drivers to mass transit (1-3) have not employed a market segmentation strategy--nor have they been particularly successful.

Transportation researchers are increasingly urging transit planners to use the segmentation approach (4-11). In general, segmentation is a method of identifying groups of consumers who have similar travel values, perceptions, and needs--and thus similar reactions toward transportation system changes. Identification of these groups (market segments) makes it possible to make more effective use of mass transit resources by tailoring transit services and promotion to the specific needs of distinct market segments.

A need has recently been identified to differentiate nonusers of mass transit in terms of their potential to switch from single-occupant automobiles to mass transit (12). In this paper a market segmentation approach will be described in which nonusers of mass transit are segmented on the basis of the differences they perceive between the attributes of mass transit and those of private automobile travel. Not only does this approach identify target market segments, but it also provides detailed diagnostic marketing information about each segment that is useful in designing mass transit service and promotion strategies to induce switching behavior.

BASES FOR MARKET SEGMENTATION

Several types of variables have been used by transportation researchers as a basis for segmenting transportation markets. Each segmentation base has its advantages. As Nicolaidis, Wachs, and Golob (8) and other researchers have noted, no one basis of segmentation is best for all purposes; the research project goal should determine selection of a segmentation base.

The most basic form of segmentation is in terms of user status (current mode choice). This segmentation base is often modified to take into account the frequency with which various transportation modes are used (7).

Sociodemographic variables such as income, age, and education have also been used as a segmentation base. Because of the relative ease with which sociodemographic information is collected, this type of segmentation was one of the earliest applied to transportation. Currently, sociodemographic segmentation is probably the most common form of market segmentation in transportation planning (8,13,14).

More sophisticated market segmentations have attempted to define homogeneous groups of individuals by basing the segmentation on some aspect of the psychological process by which mode-choice decisions are made. One such approach, benefit segmentation, is based on the importance that groups of individuals place on different travel attributes. This approach is based on the assumption that individuals weight the benefits of various travel attributes differently. Several researchers have applied this type of market segmentation in transportation planning studies (8,11,15).

Each of these methods can be further modified by taking into account the constraints individuals face in making mode choices. Choice-constraint segmentation emphasizes the importance that intervening variables play in mode-choice behavior (8). For example, information that individuals do not own a car or do not live near a bus route can be used to modify the membership of segments derived from any of the previously described segmentation bases.

With one exception (16), previous market-segmentation studies have not focused on identifying target market segments that include concentrations of people who have a high potential for switching to mass transit. In most segmentation studies, the market segments responsive to mass transit improvements are typically segments that already contain significant numbers of mass transit users. The approach of this paper is to concentrate on the identification of people who are not currently using mass transit but who would do so under more favorable circumstances.

Previous research indicates that there are at least two conceptual types of potential mode switchers. Dumas and Dobson report findings that indicate that, as a result of a negative overall opinion of mass transit, some individuals do not consider mass transit a workable transportation alternative (17). These individuals are obviously low-potential mode switchers. Another type of individual is one who feels relatively indifferent about the alternatives of driving alone and mass transit. Simon's theory of "satisficing" indicates that an individual who is equally indifferent to two alternatives will not change modes until a "sufficiently attractive" alternative that has greater utility is made available (18). Therefore, despite an inertial resistance to change that favors automobiles, latent switchability is present for these individuals; as such, they may be high-potential mode switchers. These two types of switchers are, of course, extremes. Intermediate degrees of switchability are likely.

To identify groups of individuals who have different degrees of potential switchability, an alternative segmentation basis is proposed in which nonusers of mass transit are segmented on the basis of the differences they perceive between the attributes of driving alone and those of mass transit. By segmenting on the basis of perceived attribute differences, explicit consideration is given to the competitive environment in which mode-choice decisions are made. In this manner, individuals who are relatively indifferent to the choice between driving alone and mass transit (and who are thus potentially switchable) can be identified. It may be possible to overcome inertial resistance to mode switching by targeting specific transportation system changes and promotional messages to such potentially switchable people in a manner that would make mass transit "sufficiently more attractive" than driving alone, thus inducing mode switching to mass transit.

Evaluation of alternatives in terms of perceived attribute differences is not a new idea. It has been successfully used in several of the choice models (19-21). Attribute-difference calculations form the implicit behavioral basis of the logit choice model (22,23).

The effectiveness of the perceived attribute difference base for segmenting nonusers of mass transit will be tested by comparing it with segmentation of the nonuser market on the basis of sociodemographic and attribute-importance variables. Initially, the major criterion for effectiveness will be the identification of market segments that exhibit differences in the likelihood of switchability.

SEGMENTATION METHODOLOGY

The data set used in the analysis to evaluate the three segmentation bases is the Los Angeles Central Business District Commuters Survey. This survey provides sociodemographic, attribute-importance, and mode-attribute rating data. Information about the overall satisfaction of individuals who use different travel modes and the stated intentions of commuters to use different forms of mass transit is also available.

The survey was conducted on the basis of a random sample of individuals who commute daily to the central business district of Los Angeles, California. Care was taken in the sample design to ensure that commuters other than captive mass transit or automobile users were included in the survey. The survey was originally designed as a before-and-after study to assess the impact of a reserved diamond lane for high-occupancy vehicles on the Santa Monica Freeway, a major transportation facility in the survey area (2). Unfortunately, the premature end of the reserved-lane experiment substantially reduced the usefulness of the after data, and the analysis made here is based almost exclusively on the before data.

Perceived attribute-difference data were developed in the following manner. Respondents were asked to rate mass transit and driving alone on 19 attributes of travel such as comfort, convenience, and cost. A complete list of the attributes is shown in Table 1. The ratings were recorded on seven-point semantic differential scales (e.g., 1 = very good; 7 = very bad). Perceived differences in the attributes of mass transit and driving alone were estimated by subtracting each attribute rating of mass transit from the corresponding attribute rating of driving alone.

Only the attribute differences of current single-occupant automobile users will be used in the segmentation model. This approach has the added value of reducing, but not eliminating, interpretation problems resulting from halo effects (9)--the unconscious tendency of individuals to justify their current mode choice by overstating the attractiveness of the current mode on their ratings of individual travel attributes. Because only current car users are surveyed, the potential problem of confusing commuters who rate an attribute high because it is their current mode with those individuals who rate it high on a more objective basis is eliminated. Although automobile users still tend to underrate mass transit attributes, the direction and degree of bias are more tractable.

Data on 600 respondents who currently travel to work by single-occupant automobile were available from the Los Angeles Central Business District Commuters Survey. This set of 600 was randomly split into a primary sample of 400 respondents and a holdout sample of 200 respondents. The holdout sample was used for the validation of cluster, discriminant, and logit analysis results.

Demographic variables, attribute-importance variables, and perceived attribute-difference variables

Table 1. Mean-difference comparisons for current automobile users in the primary sample.

Attribute	Cluster 1 (N = 113), Drive Only	Cluster 2 (N = 152), Cost-Traffic Hassle	Cluster 3 (N = 135), Car-Bus Indifferent
Comfort	4.1	3.5	1.2
Convenience	4.9	4.9	2.0
Cost	1.0	-4.3	-2.5
Package space	4.2	3.7	2.6
Ease of use	4.7	4.1	1.4
Reliability	3.4	3.0	0.2
On time	3.1	2.6	0.5
Rush-hour travel time	2.2	1.6	0.4
Safety	0.6	-0.3	-0.9
Violence	1.8	1.4	0.3
Ease to destination after leaving vehicle	4.4	3.7	0.7
Crowding	5.2	4.9	3.2
Wait time	4.5	4.5	2.0
Relaxation	4.2	3.1	1.3
Weather exposure	4.3	3.6	2.3
Waiting in traffic	2.4	-0.3	-0.7
Flexible schedule	5.2	5.0	3.4
Extra time	4.2	4.3	2.1
Parking cost	0.1	-3.4	-1.8
Overall average difference	3.4	2.4	0.9

were each used as input to cluster analysis. The clustering procedure used, Wishart's CLUSTAN 1A program RELOC, is a convergent k-means technique that allows for a user-specified, variable number of cluster solutions (24). Such k-means cluster techniques as RELOC eliminate the problem of migration, an inherent element of hierarchical clustering techniques (25).

It is desirable that cluster solutions be stable. Stability, in this context, has two meanings. First, final cluster results produced by RELOC should not be radically different from the results produced by RELOC on the same data but with the use of different starting partitions. In other words, the clusters identified by RELOC should not be dependent on the starting point of the program. To test this aspect of stability, RELOC was run five times on the same attribute-difference data with five different sets of random initial partitions. The second aspect of stability requires that RELOC cluster results be reproducible for data generated from other surveys. Although it is not possible to test the RELOC results on other data sets, a split-sample approach was taken in which RELOC was run on both a 400-observation primary sample and a 200-observation holdout sample.

SEGMENTATION RESULTS

RELOC cluster analysis on the attribute-difference data produced 8 different cluster solutions ranging from a 10-cluster solution to a 2-cluster solution. For all five sets of random initial partitions, exactly identical clusters (i.e., identical groupings of respondents) were observed for the 3-cluster solutions. This pattern was also observed for the holdout sample; identical clusters were observed at, but not before, the 3-cluster solution. The exceptional stability of the 3-cluster solution suggests that three market segments corresponding to these segments are well-defined, natural groupings of the data.

The interpretation of the clusters in terms of attribute differences is not only stable but also meaningful. The mean values on the 19 attribute differences and the overall mean attribute difference for each cluster (Table 1) indicate that the clusters exhibit distinct differences in the degree to which mass transit is perceived as a viable alternative to driving alone.

Cluster 1 clearly represents a drive-only market segment. All of the attribute-difference values are positive; 11 of the 19 attribute-difference values are over 4.0. The average attribute difference for this segment is +3.4. Since the original attribute ratings are measured on a scale from 1 to 7, the maximum difference value can be only 6. Thus, for this segment, the dominance over mass transit by the private automobile is nearly total; the potential mode switchability of this segment must be considered to be very low.

For cluster 2 the automobile is dominant, but to a lesser extent. The average difference value is +2.4. Compared with cluster 1, cluster 2 seems much more cognizant of the superiority of mass transit on cost factors. Cluster 2 has difference values of -4.3 for the attribute of cost and -3.4 for the attribute of parking cost. Cluster 1's difference values are +1.0 for cost and +0.1 for parking cost. Another interesting difference between clusters 1 and 2 concerns the attributes of waiting in traffic, comfort, and rush-hour travel time. Although the differences between the two clusters for these attributes are not as great as the differences on the cost attributes, the pattern indicates that this segment is more cognizant of such unpleasant aspects of driving as being stuck in slow-moving or stationary freeway traffic. For these reasons, cluster 2 is labeled the cost-traffic-hassle segment. These preliminary results indicate that consumers in this market may be switchable if the concerns of cost and traffic congestion can be addressed by transportation system modifications and appropriate promotional themes.

In cluster 3, the dominance of the automobile is marginal, especially in comparison with the other two clusters. For 9 of the 19 attributes, the difference value is below +1.0; for 14 of the attributes, the difference value is less than or equal to +2.0. The average difference value over all attributes is +0.9. This cluster can be characterized as a market segment in which mass transit is considered a workable alternative to the private automobile. This cluster has been labeled the car-bus-indifferent market segment. If the consumer-choice concepts of indifference and satisficing are in force, this segment is likely to contain many high-potential switchers to mass transit. This segment should be considered a high-priority target segment.

Attribute-difference values for the three-cluster solution for the holdout sample are presented in Table 2. Although minor differences in attribute-difference values between corresponding clusters for the primary and holdout-sample cluster solutions exist, the interpretation of the clusters is essentially the same. This interpretation indicates that the market segments identified by the segmentation model are generalizable, i.e., the segments are not peculiar to one set of data. Of course, testing on totally different data sets will be required to fully substantiate the generalizability of the segmentation model.

Cluster analysis of attribute-importance and sociodemographic variables did not produce stable clusters that could be interpreted in terms of potential switchability. For both attribute-importance and sociodemographic variables, consistent cluster results across all five random initial partitions were only obtained for a two-cluster solution. As the table below indicates, the clusters based on sociodemographic variables differed little in terms of travel attitudes. The

Table 2. Mean-difference comparisons for current automobile users in the holdout sample.

Attribute	Cluster 1 (N = 39), Drive Only	Cluster 2 (N = 89), Cost-Traffic Hassle	Cluster 3 (N = 72), Car-Bus Hassle
Comfort	4.4	3.4	1.4
Convenience	5.4	4.8	1.7
Cost	1.7	-2.9	-2.7
Package space	4.6	3.9	1.8
Ease of use	4.9	4.3	1.2
Reliability	3.6	2.4	0.4
On time	4.3	2.6	0.5
Rush-hour travel time	3.9	1.3	0.3
Safety	1.1	-0.3	-1.1
Violence	2.1	1.3	-0.1
Ease to destination after leaving vehicle	4.5	4.0	1.2
Crowding	5.9	4.8	2.8
Wait time	5.2	4.0	1.7
Relaxation	3.3	3.1	1.2
Weather exposure	4.8	3.8	1.4
Waiting in traffic	4.5	-0.2	-0.6
Flexible schedule	5.5	5.3	3.1
Extra time	4.2	4.1	1.9
Parking cost	-0.5	-2.6	-1.9
Overall average difference	3.9	2.5	0.7

mean responses on stated intentions to use alternative forms of mass transit were as follows (1 = yes; 2 = no):

Alternative	Cluster 1 (N = 367)	Cluster 2 (N = 233)
Subscription bus	1.7	1.6
Reserved bus lane	1.7	1.7
Park-and-ride	1.7	1.6
Parking tax	1.8	1.8
Ramp control	1.8	1.8
Express bus	1.6	1.6
More frequent bus	1.6	1.6

The mean response on overall satisfaction with alternative modes showed virtually no difference for bus and drive alone.

The clusters do not seem to be meaningful in terms of potential switching behavior. The two-cluster solution based on attribute-importance data consists of one very small cluster (N = 51) composed of individuals who think most travel attributes are unimportant and one very large cluster (N = 549) composed of individuals who think most of the attributes are very important. The attribute-importance cluster results appear to reflect outliers or scaling anomalies. They are certainly not very useful in identifying potential switchers.

SEGMENTATION EVALUATION

On the basis of the results of the previous section, only the perceived-attribute-difference segmentation will be subjected to more rigorous evaluation. Attribute-importance and sociodemographic segmentation will not be further considered in this paper.

Nicolaidis, Wachs, and Golob (8) introduced into transportation research a set of criteria (based on ideas originally developed in marketing) to systematically evaluate the usefulness of a transportation market segmentation. The perceived-attribute-difference segmentation will be evaluated in terms of the criteria of Nicolaidis, Wachs, and Golob, as well as one additional criterion. These criteria are discussed below.

Measurability

Measurability refers to the degree to which the data required for a market segmentation model are available in forms that can be accurately measured and collected at reasonable cost. The perceived-difference segmentation model does not require new types of travel information to be collected; it can take advantage of the experience gained in collecting attitudinal data sets for previous transportation planning studies.

Substantiality

Substantiality requires that the market segments identified by a segmentation model be large enough to require separate attention. As Table 1 indicates, there are no extremes in sizes among the three segments. Each segment, including the car-bus-indifferent segment, is large enough to warrant special consideration.

Statistical Robustness

This criterion requires that market segments should be distinct, not only in the opinion of the researcher but also in terms of objective statistical tests. At present, however, strong statistical techniques for evaluating the distinctiveness of a segment are not available. Current techniques such as t- and F-tests as well as Wilk's Λ-criterion are overwhelmed by sample size; thus, these tests almost always report "highly" significant segment differences. Unfortunately, in many transportation market segmentation evaluations, these tests have been indiscriminately applied.

Although strong statistical tests are not available, in this study the distinctiveness of the market segments has been tested through the use of a holdout sample and several sets of random starting partitions. As reported previously, the market segments are extremely stable. The degree of stability is highly unusual in cluster analysis (25). On this basis the market segments can be considered distinct, statistically robust groupings of consumers.

Accessibility

Another condition for successful market segmentation noted in the marketing literature (26) but not mentioned by Nicolaidis, Wachs, and Golob (8) is accessibility. This criterion emphasizes the importance of being able to communicate with market segments. Many segmentation models define market segments in terms of relatively abstract data. Therefore, the sociodemographic characteristics of these segments must be identified to determine first to whom transit services should be directed and, next, the most appropriate media and themes for the conveyance of such informational and persuasive advertising.

To identify these characteristics, discriminant analysis was run on perceived-attribute segment membership by using sociodemographic independent variables. The specific discriminant-analysis technique used was the stepwise discriminant program P7M cited by Dixon (27). Discriminant functions were calibrated on the 400-observation primary sample and applied for classification purposes on the 200-observation holdout sample. The discriminant analysis identified very few sociodemographic variables that differentiated the market segments. The discriminant function calibrated on the primary sample was able to classify only 39 percent of the holdout-sample observations into the correct market segment, just marginally better than the chance classification rate of 33 percent.

There are three possible explanations for these

Table 3. Preference among TSM alternatives.

	Drive Only		Cost-Traffic Hassle		Car-Bus Indifferent	
Alternative	Ranked First (%)	Mean Rank	Ranked First (%)	Mean Rank	Ranked First (%)	Mean Rank
Reserved lane	14.7	3.8	13.3	4.0	15.3	4.0
Park-and-ride	11.9	3.9	14.7	3.8	7.6	4.0
Parking tax	5.5	5.7	9.3	5.3	6.1	5.5
Ramp control	5.5	4.6	2.0	5.0	1.5	5.0
Express bus	16.5	2.9	23.5	2.6	26.7	2.4
More frequent bus	23.1	3.0	14.8	3.5	28.2	2.9
Subscription bus	22.0	4.1	22.7	3.8	14.5	4.3

Table 4. Percentage of respondents who would use mass transit under different TSM alternatives.

Alternative	Drive Only	Cost-Traffic Hassle	Car-Bus Indifferent
Reserved lane	19.8	28.7	40.2
Park-and ride	21.8	33.1	44.4
Parking tax	15.5	20.7	27.1
Ramp control	17.1	12.7	33.1
Express bus	29.7	42.0	59.4
More frequent bus	34.2	29.3	51.9
Subscription bus	26.1	27.3	36.1

results. First, it may be that similar perceptions of attribute differences between mass transit and private automobiles cut across sociodemographic categories. Second, since only a limited amount of sociodemographic data was available from the Los Angeles survey data set, it may be that more extensive information is required to establish segment membership. Third, the possibility exists that standard discriminant-analysis techniques are not able to detect the sociodemographic characteristics of perceived-difference market segments. This may be a result of nonlinear relationships between sociodemographic characteristics and perceived-difference segment membership and/or interaction among sociodemographic variables. In further research, the relationship between sociodemographic characteristics and perceived-difference segment membership should be investigated by means of techniques such as logit analysis (to detect nonlinear relationships) and the Automatic Interaction Detector (to detect interactions).

Relationship with Planning of Service Options

This criterion requires that members of the same market exhibit similar reactions to changes in the features of the available transportation system alternatives. In this manner, transit planners can more effectively design transit services for individual market segments.

Data are available from the Los Angeles survey on respondents' preference ranking for seven potential transportation systems management (TSM) alternatives and the stated intentions of respondents to use mass transit under each of the alternatives. In Table 3, the perceived-difference market segments are compared in terms of the average rank for each TSM alternative and the percentage of respondents who ranked each alternative first. Strong preference is shown by the car-bus-indifferent segment toward only two alternatives--the express bus and more-frequent bus alternatives. These two alternatives were ranked first by nearly 55 percent of those in the car-bus-indifferent segment. It is somewhat surprising that the park-and-ride alternative is not rated higher by this segment.

For the other two segments, preferences are more dispersed. For the drive-only and cost-traffic-hassle segments, the top two TSM alternatives account for only about 45 percent of the respondents in each of these market segments. Compared with the car-bus-indifferent segment, both the drive-only and cost-traffic-hassle segments seem more receptive to less-standard forms of transit service, such as subscription bus service and park-and-ride lots.

Table 4 presents a comparison by market segments of the percentages of respondents who indicated they would use mass transit under each of the TSM alternatives. It is clear that more members of the car-bus-indifferent segment than of the other two segments would use mass transit under all of the seven TSM alternatives. In addition, for the express bus and more-frequent bus alternatives, 59 percent and 52 percent, respectively, of the respondents in the car-bus-indifferent segment indicated a willingness to use mass transit. For all of the market segments, these are the only cases in which a majority of the respondents of a segment indicated a willingness to switch to mass transit.

These results confirm the ability of the perceived-attribute difference segmentation model to identify market segments that include a large number of high-potential switchers to mass transit. However, despite their encouraging nature, these results should be interpreted with caution for two reasons. First, as Hartgen has shown (28), stated-intention data are subject to noncommitment bias; i.e., since they are not bound to follow through on stated intentions, survey respondents often overstate their likelihood of switching to mass transit. Second, when preference or intention data are elicited from consumers on the basis of gestalt or general questions (i.e., Would you use subscription bus service if it were offered?), it is difficult to identify the specific attributes to which consumers are reacting.

Relationship with Travel Behavior

This final criterion emphasizes the desirability of defining market segments that exhibit similar within-segment travel preferences and behavior. Ideally, this would have been tested by using the after data in the survey to compare use rates for diamond lanes and park-and-ride lots among the three perceived-attribute-difference market segments. Unfortunately, survey measurement problems and extremely low diamond-lane and park-and-ride use rates (4 percent) severely restrict the usefulness of this direct test. Given that only 4 percent of the total sample actually switched to mass transit, to compare the rates of actually switching is really not very meaningful. We note that approximately 10 percent of the car-bus-indifferent segment actually switched, while 2 percent of the cost-traffic-hassle segment and less than 1 percent of the drive-only segment did so. Because of the low criterion (4 percent) for prediction, we view the above results as consistent with our clustering hypotheses but not statistically meaningful.

The second test involves a comparison by market segment of overall satisfaction with private automobiles and mass transit (1 = extremely dissatisfied; 7 = extremely satisfied):

Segment	Mean Overall Satisfaction with Current Transit	Mean Overall Satisfaction with Single-Occupant Car Travel
Drive only	2.3	6.5
Cost-traffic hassle	2.6	5.9
Car-bus indifferent	4.0	6.1

The car-bus-indifferent segment and the cost-traffic-hassle segment are somewhat less satisfied with private automobile travel than is the drive-only segment. More interesting and significant differences are apparent for overall satisfaction with mass transit: The drive-only and cost-traffic-hassle segments experience a generally high level of dissatisfaction with mass transit, but the car-bus-indifferent segment tends to be neutral.

These results are again consistent with the original cluster-analysis results that identified a market segment of indifference--one that is likely to contain high-potential switchers to mass transit. These results are also consistent with the findings of Dumas and Dobson (17) that indicate that overall satisfaction with mass transit can be used to identify people who definitely will not switch from automobiles to mass transit.

APPLICATIONS OF THE PERCEIVED-DIFFERENCE MARKET SEGMENTATION

The perceived-difference market segmentation provides a variety of information for improved mass transit design and promotion. This information is a direct output of the original cluster analysis. In addition, the form of the output is readily interpretable to transit planners. Two general areas of application will be described: (a) service design and (b) advertising and promotion.

Service Design

The perceived-difference market segmentation addresses two design problems facing transit planners: To whom should improved mass transit service be provided, and what form and level of transit service should be provided? The perceived-difference segmentation has already identified a target market segment--the car-bus-indifferent segment--toward which improved transit service should be directed. Evidence was presented that indicated this segment is not unique to one set of data. In transit service improvement studies of specific geographic market areas, perceived-difference segmentation could be used to determine whether the size of a car-bus-indifferent segment (an indication of the maximum number of likely users) is large enough to warrant new or improved transit service. It could also be used to set priorities for alternative transit improvement projects on the basis of the sizes of the potentially switchable market segments.

In regard to service-level design problems, the perceived-difference segmentation gives information on the degree of competitiveness between mass transit and automobiles on several specific travel attributes. Thus, an analysis of the competitiveness of mass transit with automobile travel can indicate which service attributes can be maintained at their current levels and which need to be improved.

Advertising and Promotion

Although the perceived-difference segmentation has identified a target market segment, it was not possible to identify the sociodemographic characteristics of this segment. Such information would be useful in selecting specific media in which to place advertising and promotion messages. It may, of course, be the case that the car-bus-indifferent segment cuts across sociodemographic lines.

In terms of content of advertising messages, the perceived-difference market segmentation does provide specific, useful information. Lovelock (29), among others, has argued for the need to create advertising messages that emphasize the areas in which mass transit performs well in relation to automobiles and minimize the areas in which mass transit performs poorly. The cluster-analysis output for the car-bus-indifferent segment indicates which attributes of mass transit and automobiles should be stressed or de-emphasized.

As noted by Dumas and Dobson (17), the commuter's overall perception of mass transit is an important marketing consideration independent of objective service characteristics such as time and cost. Perceived-difference segmentation can aid in making decisions on advertising content because it provides information on the competitiveness of mass transit in relation to automobiles for subjective, image-related attributes such as comfort, ease of use, and schedule flexibility. Through promotional messages that appropriately address image-related attributes, it may be possible to improve the overall image of mass transit in comparison with private automobiles.

SUMMARY AND CONCLUSIONS

A market-segmentation model has been developed in which perceived differences in the attributes of mass transit and private automobile travel are used as a segmentation base. This segmentation model has identified very stable, well-defined, and highly interpretable market segments that exhibit distinct differences in travel attitudes and intended behavior. Based on an evaluation of these differences, a target market segment containing individuals who have a high potential for switching from private automobiles to mass transit has been identified. In addition, the attribute-difference values for the target market segment have suggested attributes of mass transit that should be emphasized (or de-emphasized) in service designs and promotional advertisements.

If the perceived-attribute-difference market-segmentation approach can be replicated on other data sets, transit planners are provided with a simple method for identifying high-potential switchers, and they are provided with information for developing service designs and advertising strategies to effect actual mode switching from private automobiles to mass transit.

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Acid Test of the Trade-Off Method of Attitude Measurement

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Results of a comparison of behavior predicted by a trade-off model with observed behavior under a radical change in the work environment of the employees of the New York State Department of Transportation are reported. The change, a shift from a fixed workday to a set of five alternative work schedules among which employees could choose, is analyzed. Before-and-after surveys conducted in 1977 and 1979 to test the model showed that the observed shifts by employees were within the predicted range for potential shifts. A comparison of the utilities calculated from the 1977 sample and those from the 1979 sample was inconclusive, but no major shift seems to have occurred. Although respondents in the 1977 survey rated the benefits of the alternative work-hour program higher than did those in the 1979 survey, more respondents in the 1979 survey actually prefer alternative work hours to the old fixed schedule.

Much attention has been focused on assessing the properties of conjoint attitude measurement procedures from a theoretical point of view (1-3).