AN EVALUATION OF PROMOTIONAL TACTICS AND UTILITY MEASUREMENT METHODS FOR PUBLIC TRANSPORTATION SYSTEMS

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AN EVALUATION OF PROMOTIONAL TACTICS AND UTILITY MEASUREMENT METHODS FOR PUBLIC TRANSPORTATION SYSTEMS

Mark Alpert
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16. Abstract

This report summarizes work in the third year of a research program that has sought to build on community-researched transportation needs and measure the impact of various marketing strategies for public transportation under carefully controlled conditions. The first part of the report focuses on the promotion of public transportation. It includes a survey of relevant communications and marketing literature, the research hypotheses that were deemed relevant, the methodology used to test alternative promotional tactics, and the results of interpretation of the findings for promotion for public transportation. The second part focuses on recent advances in methods for quantifying preference levels for various product and service features of transportation modes. Similarly, it reviews the relevant literature, presents the methodology whereby alternative measurement methods may be applied to evaluate attributes of transportation systems in the study area, and reports the findings concerning the usefulness of the methods tried as well as recommendations for transit planning and future research in the problem area.

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EXECUTIVE SUMMARY

INTRODUCTION

This is the final report of a three year effort conducted as part of a research project entitled "Transportation to Fulfill Human Needs in the Rural-Urban Environment." This report describes the culmination of the work under Topic V of that project. The report is concerned with extending the findings on determinant attributes specified in the first two years to concerns of: (1) the effects of promotional campaigns on attitudes and behavioral intentions toward public transportation, and (2) the trade-offs in attribute packages which transportation users make each time they choose a mode for a particular trip. The thrust of this work is methodological, although substantive results are presented for a particular group of transportation consumers.

PROBLEM STUDIED

In the first two years of work on Topic V detailed information was obtained regarding the attributes of transportation systems which "potential switchers" to public transportation deemed to be important in their choice of a mode. In the first year the concern was with eliciting these attributes, while in the second year, the concern was with the stability of these attributes over time. The third year of effort in this project was concerned primarily with two types of problems. First, the issue of the efficacy of alternative promotional strategies which might be adopted to entice an increase in patronage of public transportation was investigated. Two principal forms of promotional campaigns were evaluated in the third year. The first type, one-sided communication, essentially presents only the positive characteristics of a product being offered. The second type of campaign, the two-sided communication, provides both sides of the argument on the merits of choosing a particular product. In this study, the concern was with promoting the use of public transportation. To test for the possibility that the effectiveness of promotional techniques may be product specific, an additional product was added to the research design. In particular, deodorant was chosen as a second product since, along potentially relevant dimensions, consumer attitudes and perceptions are likely to be very different in nature from those toward the public transportation. To avoid any bias that brand loyalty toward established brands might create, a fictitious brand, Secure, was used in the deodorant promotional campaign. Thus, the first problem of interest in the third year of work was to determine whether different promotional techniques would have different affects on consumer attitudes and behavioral intentions toward public transportation.

The second major problem considered in the third year was the assessment of how people trade-off the various combinations of attributes that exist in different modes of transportation. More particularly, the issue is in trying to determine how much of any given attribute will be given up to obtain another level of another attribute. The specific problem was to determine the most effective method for ascertaining such trade-offs. In this study two procedures were evaluated. The first technique, a card sort procedure, was based on presenting an interviewee with a deck of cards, each card containing a listing of the attributes of a transportation mode. The respondents' task was to sort out the cards in order of preference. The cards were constructed on the basis of a multi-factor design called an orthogonal array. The second method, a matrix procedure, presented the interviewee with all the possible pairwise comparisons that could be made between all the attributes and their various levels.

To study these methodological issues, several areas within the city of Austin, Texas, were selected for enumeration of households to select possible respondents. The areas in the city were selected to maximize the possibility of obtaining interviews with people who had characteristics in common with individuals identified as "potential switchers" in Years One and Two. Furthermore, the areas were selected to minimize the possibility of tapping the captive public transportation market.

RESULTS ACHIEVED

Drawing a proportional, random sample from the areas in the city of Austin, respondents were randomly assigned to each of the procedural groups. Analysis of the demographic characteristics of the respondents indicates that there are some differences between the Year Three sample and the samples drawn in the Years One and Two. However, there are several dimensions held in common by the samples in all three years. Further analysis of the demographic characteristics of the respondents in each of the procedural groups indicates that they were randomly assigned to the procedural groups.

Analysis of the behavioral intentions toward the use of buses for trips to work or school (commuting) and for shopping or personal business, both over the short run, and "for most of your trips," indicates that neither the one-sided nor the two-sided advertisement's style was able to achieve any strong pattern of impact on peoples' behavioral intentions toward using buses. Where communication type had any effect at all, one-sided communication produced a more favorable evaluation of bus attributes advertised than did two-sided communication. For the two-sided communication there was no variable which achieved a significantly higher rating than did one-sided communication. Thus, where there was any positive effect by advertising treatment for bus transportation, it was through the use of the one-sided communication.

In contrast, the results for the deodorant advertising were almost exactly opposite of those for the bus advertising. In this instance, two-sided communication provided a far more effective device for advertising deodorant. Buying intentions were positively effected by advertising of both one-sided and two-sided format. The average intention to purchase deodorant was significantly higher for people exposed to two-sided messages than those exposed to one-sided messages. Thus, the results are almost exactly opposite of those for the bus test.

To determine if these results may have come about as a result of the character of the advertising copy, the respondents' assessments of the copy were analyzed. The results of this analysis indicate that, in fact, the overall judgment by the respondents was more favorable toward the bus advertising than for the deodorant advertising. Thus, the bus advertising was a "critical" success and a "commercial" failure.

Most important, although perhaps the most disappointing finding of this effort, is that advertising strategies for public transportation, no matter what their relative effectiveness, may have little absolute impact on patronage without corresponding and significant closing of gaps between public and private transportation, along determinant attributes of modal choice. The tested advertisements for buses, although relatively favorably received, did not generally produce significant favorable attitudes toward the features and/or use of buses in the target audiences. One-sided communication strategies seemed more effective than two-sided ones for buses (but not deodorant), and one should be extremely careful how one raises issues of drawbacks of public transportation, even when trivial ones are stated.

Evaluation of the card sort and matrix trade-off data indicates that in this study it is not possible to ascertain with any degree of certainty the relationship between the derived weights for the attributes and the raw input rank order data for the card sort respondents. On the other hand, the derived weights for the attributes are reasonably consistent with the input rank order data for the matrix respondents. Thus, it is possible to interpret the rank ordering of the attributes of the matrix respondents with some degree of surety that these weights are a meaningful representation of the part-worths of the attributes investigated. Additional analysis of the card sort and matrix data indicates that the card sort and matrix procedures are generating different rank orders and ranges for the attributes. The rank orders for the attributes in the card sort procedure are not consistent with the rank orders for similar variables found in other research. On the other hand, the rank order of the attributes derived under the matrix procedures does appear to be consistent with other research. The conclusions drawn from this form of analysis are that the card sort procedure is generating substantially different results from the matrix procedure, and the data derived from the card sort procedure do not appear to offer interpretable results. On the other hand, the results obtained from the matrix procedure may be meaningfully interpreted.

Extensive and interpretable data in the trade-off matrices for individuals and for the sample as a whole are obtained. These data are summarized in a series of curves representing the average calculated utility of each attribute for each level. These curves are fit by linear equations to obtain a straight line curve for calculating the average numerical value for each level. Using these equations it is possible to derive the equivalence trade-offs for various attributes. For example, the utility of having transportation available 6.17 days per week is the same as paying 18.3 cents per mile, and so on.

These calculated utilities are used to assess how the respondents viewed private automobile and public transportation at the time of the interview. The values for each attribute for the private automobile and for public transportation were summed respectively to obtain a total perceived utility for each mode. At the time of the interview for all respondents, the private automobile obtained a total value of 2.153, while public transportation received a total perceived utility of 1.671. Given the higher utility of the private automobile for the sample, there is no reason to expect the sample to choose public transportation. In fact, the split in the sample between the use of the private automobile and the use of public transportation is approximately eighty-five percent auto users and ten percent public transportation users, with the remainder using some other form of transportation.

The data obtained from calculating the perceived utilities for private automobile and public transportation provide guides for policy makers with respect to focal points for making changes in the modes of transportation to obtain increased patronage. There are four attributes of public transportation which clearly are viewed by the sample as being in poor shape. Policies directed toward improving the total travel time, service availability in hours per day, safety from dangerous people, and comfort will be those most likely to improve the overall utility of public transportation. More specifically, if policies are directed to achieve a total travel time of thirty minutes and to provide transportation eighteen hours per day for public transportation, a shift in the total perceived utility of public transportation would be accomplished such that, all other things held constant, public transportation would have a higher total utility than the private automobile. Assuming that people will respond rationally, if such policies were enacted, it would be expected that the utilization of public transportation would increase.

Obviously, there are several limitations to these results. However, the study has demonstrated the efficacy of a particular methodology for eliciting trade-offs in transportation attributes.

UTILIZATION OF RESULTS

The results of this research should be of value to federal, state, and local planning agencies and to research groups interested in the promotional impact of alternative advertising strategies as well as to those interested in the problem of eliciting trade-offs for transportation services to assist in policy formulation. This research represents a first step in evaluating possible methodologies which may be utilized by policy makers in promoting and increasing the use of public transportation in urban areas.

CONCLUSIONS

This report summarizes work in the third year of a research program that has sought to build on community-researched transportation needs and measure the impact of various marketing strategies for public transportation under carefully controlled conditions. The report discusses relevant literature, research methodology, findings, and recommendations concerning the following key problem areas:

(1) Does promotional activity have a significant effect on attitudes and behavioral intentions of potential users of public transportation?

(2) Does the type of promotion make a difference? Can we apply theory from communication literature to predict the differential effectiveness of one-sided versus two-sided messages regarding transit desirability?

(3) Does the number of key attributes stressed in promotional messages have any impact on these attributes and behavioral intentions?

(4) What are the relative impacts of alternative attributes stressed in promotional messages? What are the relative utility values attached to the various transportation features and levels within each feature?

The report summarizes the work that has been done to clarify these problem areas. The first part of the report focuses on the promotion of public transportation. It includes a survey of relevant communications and marketing literature, the research hypotheses that were deemed relevant, the methodology used to test alternative promotional tactics, and results of interpretation of the findings for promotion for public transportation. The second part focuses on recent advances in methods for quantifying preference levels for various products and service features of transportation modes. Similarly, it reviews the relevant literature, presents the methodology whereby alternative measurement methods may be applied to evaluate the attributes of transportation systems in the study area, and reports the findings concerning the usefulness of the methods tried as well as recommendations for transit planning and future research in the problem area.

From these results, several suggestions for future research appear to be germane. First, longitudinal studies of the effects of multi-exposure promotional campaigns on attitudes and behavioral intentions toward public transportation need to be undertaken. Second, incremental changes in the attributes having the greatest potential for altering utilities should be implemented and monitored. Third, analytical models for evaluating the political and economic viability of alternative attribute combinations for transportation systems need to be developed. Fourth, further research should be undertaken to develop a more parsimonious instrumentation for eliciting trade-off data for potential users of transportation services. Finally, work should be undertaken to reduce the computational costs of analyzing trade-off data.

In conclusion, this study has investigated alternative methodologies for promoting public transportation and for assessing the trade-offs which users of transportation services make when confronting a mode choice situation. Effective promotional techniques do exist, however, the results of the study indicate that unless there are substantial improvements in the product (public transportation) promotion will not be effective in obtaining attitudinal and behavioral changes. The trade-off analyses developed in this study provide indications of the areas where policy may be most effective in increasing the utility of public transportation services. These findings provide, at least, a first handle on some of the policy levers that may be available to decision makers confronted with choosing alternative strategies for the provision of public transportation in their communities.

PREFACE

This is the final report of a three-year effort conducted as part of a research project entitled "Transportation to Fulfill Human Needs in the Rural/Urban Environment." This report describes the culmination of the work under Topic V of that project.

The report is concerned with extending the findings on determinant attributes specified in the first two years to concerns of: (1) the effects of promotional campaigns on attitudes and behavioral intentions toward public transportation, and (2) the trade-offs in attribute packages which transportation users make each time they choose a mode for a particular trip. The thrust of this work is methodological, although substantive results are presented for a particular group of transportation consumers.

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AN EVALUATION OF PROMOTIONAL TACTICS AND UTILITY MEASUREMENT METHODS FOR PUBLIC TRANSPORTATION SYSTEMS

I. INTRODUCTION

Recent years have witnessed significantly increased emphasis on promotional activities directed towards enhancing patronage of public transportation facilities. After years of decline in the share of the transportation trip market, increasing losses and cessation or drastic curtailment of services in many areas, this renewed emphasis is a promising trend in an era marked by the specters of energy crisis and urban blight. However, too often these promotional campaigns have taken place after designing systems that "seem" to fit rider and community needs, rather than first adopting a marketing approach that would design both the system and its promotion to meet pre-researched needs of these relevant groups. What promotional effort has been expended, ex post, has either had little measureable impact on patronage, or more frequently, the impact has not been scientifically measured at all.

This report summarizes work in the third year of a research program that has sought to build upon community-researched transportation needs and measure the impact of various marketing strategies for public transportation under carefully controlled conditions. During the first two years, a medium-sized city in central Texas (Austin, population 300,000) has been chosen and surveyed as a study area for a marketing approach to transportation modification. The city is undergoing rapid growth, which will hopefully be managed through community involvement in goal-setting (Austin Goals Program) and various current planning activities. This study is part of a Department of Transportation (D.O.T.) contract with The University of Texas to study "Transportation to Fulfill Human Needs in the Rural/Urban Environment." While the nature of the community studied tends to limit generalizing specific transportation attributes and their importance, the methodology employed and types of information and measuring instruments used might prove useful for population centers both larger and smaller than Austin.

A large amount of the data and conclusions reached from the first years' research may be found in "The Marketing of Public Transportation: Method and Application" (Alpert and Davies, 1975), which was published as a research report. In this work we identified a number of transportation features which potential switchers to public transportation indicated were determinant attributes in their choice of transportation modes for various types of trip purposes. A number of other analyses were made, indicating the demographic, attitudinal, and media characteristics of potential switchers, typical community members, and a special subset of community leaders. A number of suggestions were made for improving the transportation system, as well as promoting increased patronage of public transportation. It was not clear, however, precisely how this promotion should be structured and what effect it might have. Nor was it clear how much of one transportation feature (e.g., economy) might be given up in return for an improvement in some other feature (e.g., "safety from dangerous people") even though both were among the transit features identified as determinant in preliminary research. Accordingly, this report discusses relevant literature, research methodology, findings, and recommendations concerning the following key problem areas:

(1) Does promotional activity have a significant effect on attitudes and behavioral intentions of potential users of public transportation?

(2) Does the type of promotion make a difference? Can we apply theory from communication literature to predict the differential effectiveness of one-sided versus two-sided messages regarding transit desirability?

(3) Does the number of key attributes stressed in promotional messages have any impact on these attitudes and behavioral intentions?

(4) What are the relative impacts of alternative attributes stressed in promotional messages? What are the relative utility values attached to various transportation features and levels within each feature?

This report summarizes the work that has been done toward clarifying these problem areas. The first part focuses on the promotion of public transportation. It includes a survey of relevant communications and marketing literature, the research hypotheses that were deemed relevant, the methodology used to test alternative promotional tactics, results and interpretation of the findings for promotion of public transportation. The second part focuses on recent advances in methods for quantifying preference levels for various product and service features of transportation modes. Similarly, it reviews the relevant literature, presents the methodology whereby alternative measurement methods were applied to attributes of transportation systems in the study area, and reports the findings concerning the usefulness of the methods tried as well as recommendations for transit planning and future research in the problem area.

This report begins with an overview of the research done on evaluating alternative promotional strategies for transportation marketing.

II. PROMOTIONAL STRATEGY

INTRODUCTION

While some United States cities are using marketing and promotional tools to increase market penetration and/or upgrade the image of mass transit, very little effort has been directed toward evaluating the effectiveness of alternative promotional tools. The effectiveness of a particular advertising campaign may be measured by its impact upon ridership; however, this method of evaluation emphasizes _post hoc_ assessment rather than alternative evaluation through marketing research prior to the selection of a particular marketing and promotional strategy. By using market research techniques _prior to_ the selection of a promotional strategy, the more effective advertising tactic may be implemented.

The purpose of this research is to investigate the impact of alternative message tactics upon attitudes and ridership intentions toward mass transportation. Specifically, this research focuses upon the effect of making only positive claims about the bus as opposed to "disclaiming" certain characteristics in conjunction with the positive claims. In a disclaiming situation, an advertiser makes positive statements about characteristics that are determinants of product use, but does not claim that the product performs well on certain characteristics that are not determinants of use. Previous research indicates that disclaiming may tend to increase the credibility of an advertisement.[1] Increasing credibility may then result in a more effective advertisement.

Disclaiming in an advertisement may be viewed as providing the audience (consumers) with a two-sided argument with respect to the advertised product. The advertiser would be presenting two sides since both favorable and unfavorable characteristics of the product are pointed out. Promotion performs the communication function of marketing, and the communication literature provides further insight into the nature and effects of two-sided arguments.

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[1] Settle, Robert and Linda L. Golden, "Attribution Theory and Advertiser Credibility," _Journal of Marketing Research_, Vol. 11, 1974.

ONE-SIDED AND TWO-SIDED ARGUMENTS

There appears to be no single formal definition of one-sided and two-sided arguments. Argument is a term universally employed within the literature and may be defined as simply a presentation of information with persuasive intent. Definitions of one-sided and two-sided arguments presented in the literature differ slightly in their perspective. Often the definitions are not stated explicitly, but can only be inferred from the design of the research. To exemplify the definitional variance, several definitions are listed below.

Hovland[2]

One-sided argument - argument confined to one side of an issue.

Two-sided argument - communicator takes into account both sides of an issue, but he himself is in favor of one-side.

Jones and Girard[3]

One-sided argument - communicator presents only his view.

Two-sided argument - communicator appraises his audience of arguments supporting an opposing viewpoint.

Hovland, Lumsdaine, and Sheffield[4]

One-sided argument - presents only arguments supporting the communicator's thesis.

Two-sided argument - presents arguments opposed to the communicator's thesis.

McGuire[5]

One-sided argument - argument which ignores the opposition.

Two-sided argument - argument which refutes the opposition.

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[2] Hovland, C., "Effects of the Mass Media of Communication," in Handbook of Social Psychology, Vol. 2, G. Lindzey (Ed.), Cambridge, Massachusetts: Addison-Wesley, 1954, p. 1079.

[3] Jones, E. and Gerard, H., Foundations of Social Psychology, New York: John Wiley and Sons, 1967, p. 446.

[4] Hovland, C., A. Lumsdaine and F. Sheffield, Experiments in Mass Communication: Studies in Social Psychology in World War II, Vol. 3, Princeton: Princeton University Press, 1949, p. 201.

[5] McGuire, W., "The Nature of Attitudes and Attitude Change," in Handbook of Social Psychology, Vol. 3, G. Lindzey (Ed.), Cambridge, Massachusetts: Addison-Wesley, 1954, p.210.

Several of these definitions take different perspectives. McGuire talks of refuting the opposition as two-sided communication, while others, such as Jones and Girard, speak of presenting supportive arguments for the opposition. The definitions seem to be positing similar meanings, but from somewhat different perspectives. On one hand, refuting the opposition can be viewed as supporting the original thesis while presenting both sides to an argument (see McGuire's definition).

For purposes of this research Hovland's[6] definition is used. There is very little difference in the definitions cited above with regard to one-sided arguments. However, within an advertising context, Hovland's definition of a two-sided argument appears most appropriate. An advertiser for a product will always want the audience to draw the conclusion that this "brand" or product offering is the one the consumer or target market should purchase for use. Thus, even though the advertiser may say something unfavorable about her/his brand or something favorable about the competitor, overall the advertiser will present her/his product as the one the consumer should purchase. Unlike the other definitions cited, Hovland's definition of two-sided arguments explicitly states that the communicator takes into account both sides of an issue, but *he is himself in favor of one side*. The advertiser is, indeed, in favor of one side.

One-sided and Two-sided Communications Research

In communication research, the question of one-sided or two-sided messages has been investigated in two ways. In one series of studies, the two-sided treatment has materials that simply present the other side of the question introduced along with materials from the side supporting the thesis of the message. This method of message design results in a comparision of one-sided versus two-sided message presentations. A second method of attack on the question of organization of persuasive messages concerns the refutation of opposing arguments rather than the simple mention of opposing arguments.

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[6] Hovland, C., *op. cit.*

One-sided Versus Two-sided Presentation Without Refutation

The earliest studies in this area were designed primarily to investigate the effects of two-sided presentations. In these studies, the communicator impartially presented both sides of an argument without favoring either side. The general conclusion derived from these studies is that when one is successively exposed to first one side and then the other of a controversial subject, the typical result is that the individual is left at approximately his/her initial position. This comes out most clearly in a study by Sims[7], where the same individuals were exposed to both sides of a communication on TVA. Each side alone produced a significant effect, but in combination cancellation of effects was obtained. Substantially similar results were obtained by Schanck and Goodman[8] using propaganda favoring or not favoring civil service.

In the studies by Sims and Schanck and Goodman, the communicator takes into account both sides of an issue, but reveals her/himself in favor of one side. Klapper[9] has labeled this situation that of "partial impartiality." Unlike the studies by Sims, and Schanck and Goodman, which were designed primarily to investigate the effect of only two-sided communications, the studies designed explicitly to investigate the comparative effects of one-sided versus two-sided arguments did not utilize an impartial communicator. Instead, in the two-sided situation, both sides of the issue were presented, but the communicator favored one side.

The earliest experimentation explicitly directed to the investigation of the comparative effects of one-sided and two-sided communications was conducted by Hovland, Lumsdaine and Sheffield.[10] These investigators presented communications to two experimental groups and one control group consisting of soldiers during World War II. The communications were on the topic of an early end of the war with Japan following Germany's surrender. One experimental group was given a fifteen-minute talk presenting only the arguments for

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[7] Sims, V., "Factors Influencing Attitude Toward the TVA," Journal of Abnormal Social Psychology, Vol. 33, 1938.

[8] Schanck, R. and C. Goodman, "Reactions to Propaganda on Both Sides of a Controversial Issue," Public Opinion Quarterly, Vol. 3, 1939.

[9] Klapper, J., The Effects of Mass Media, New York: Columbia University Bureau of Applied Social Research, 1949.

[10] Hovland, C., A. Lumsdaine and F. Sheffield, op. cit.

thinking that the war with Japan would be a long one (one-sided). The material presented contained much factual information stressing Japan's advantages and resources. The second experimental group was given a two-sided communication which contained an additional four minutes of information woven into the presentation stressing the United State's advantages and Japan's weaknesses.

No main effect of direct attitude change was found in this study, but there were interactions with initial favorability such that one-sided communications were more effective for those initially in favor of the conclusion and two-sided communications were more effective for those initially opposed to the conclusion. There was also a significant interaction with education such that two-sided communications were more effective with high school graduates and one-sided communications were more effective with subjects who had not graduated from high school. Later studies by Janis, Lumsdaine, and Gladstone,[11] Lumsdaine and Janis,[12] and Paulson[13] also indicated that one-sided and two-sided arguments were about equally effective over-all in producing direct attitude change.

One-sided and Two-sided Arguments with Refutation

Thistlethwaite and Kamenetzky[14] and Thistlethwaite, Kamenetsky and Schmidt[15] investigated the attitudinal effects of refutation of opposing arguments rather than simple mention of opposing arguments. For the speeches

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[11] Janis, I., A. Lumsdaine and A. Gladstone, "Effects of Preparatory Communications on Reactions to Subsequent News Events," Public Opinion Quarterly, Vol. 15, 1961.

[12] Lumsdaine, A. and L. Janis, "Resistance to 'Counterpropaganda' Produced by One-Sided and Two-Sided 'Propaganda' Presentations," Public Opinion Quarterly, Vol. 17, 1953.

[13] Paulson, S., "The Effects of Prestige of Speaker and Acknowledgement of Opposing Arguments on Audience Retention and Shift of Opinion," Speech Monographs, Vol. 21, 1954.

[14] Thistlethwaite, D. and J. Kamenetsky, "Attitude Change through Refutation and Elaboration of Audience Counterarguments," Journal of Abnormal and Social Psychology, Vol. 51, 1955.

[15] Thistlethwaite, D., J. Kamenetsky and H. Schmidt, "Factors Influencing Attitude Change through Refutative Communication," Speech Monographs, Vol. 23, 1956.

that contained refutation of opposing arguments, the organization consisted of the elaboration of a supporting argument, followed by mention of an opposing argument and then by denial of the opposing argument. In one set of speeches, the denial of the opposing argument took the form of a simple statement that the opposing argument was not true. In others, the denial was elaborated into a complete refutation.

For some of the groups tested, there were no significant differences between the speeches with refutation and those without. For others, the refutation speeches had more influence. The authors concluded that the speeches with mention and refutation of opposing arguments had the effect of strengthening opposing attitudes. They suggest that listeners apparently discounted the speeches with refutation as "phony" attempts to seem impartial.

All of these studies seem to suggest that mention of opposing arguments should be handled with caution. The only groups that seem more positively affected by two-sided messages were those initially opposed to the conclusion and those of higher educational levels. Even these groups did not make large changes in attitudes. Two-sided messages, however, do have a specific place in the communicator's organizational framework. They can serve to "immunize" receivers against contradictory information in later situations.

Inoculation-Effect of Two-sided Communications

Several experiments have indicated that two-sided communications are effective in the inoculation against counterarguments. A previously cited study by Lumsdaine and Janis[16] investigated not only the attitude change resulting from one-sided and two-sided arguments, but also the possibility of inoculation effects. The researchers asked college students to listen to one-sided and two-sided presentations of an alleged radio program regarding the production of atomic armaments by the Russians. Both the one-sided and two-sided versions produced significant changes in the desired direction. The experimenters then presented the subjects with another tape that expressed exactly the opposite view. For the subjects who had heard only the one-sided message, change toward the desired direction dropped from approximately 60

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[16] Lumsdaine, A. and L. Janis, op. cit.

percent to 2 percent, after they heard the opposite message. But the students who had heard the two-sided message had apparently been inoculated against the arguments from the opposing radio show, and the group's attitude change remained above the 60 percent mark.

This study gave rise to a series of studies by McGuire on producing resistance to persuasion by pre-exposure to a weakened form of the attacking arguments.[17] The format for all the experiments was essentially the same. There was a defense-building session followed by an attack. McGuire then determined the relative amount of resistance conferred by various types of defense inoculations by taking opinion measures after the attack.

In the first experiment[18] supportive (one-sided) and refutational (two-sided) defenses were compared. Since McGuire considers the terminology one-sided and two-sided communication "unfortunate",[19] he uses the terms supportive and refutational defenses, respectively. In the supportive defense treatment of the McGuire and Papageorgis, the subject read a cultural truism which was followed by four supporting arguments and a paragraph that spelled the arguments out. In the refutational defense the truism was followed by four arguments against the truism and then a paragraph that refuted them. Each subject received a refutational defense for one truism and a supportive defense for another truism. Two days later the subject received two messages, each attacking one of these truisms, and a third message that attacked a truism for which no prior defense had been provided. Opinion measures were taken on these three truisms after the attacking session. The subject's opinion on the fourth truism, which had neither been defended nor attacked was also measured. The results indicated that the refutational defense was more effective in inoculating against counterarguments than the supportive defense.

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[17] McGuire, W. and D. Papageorgis, "The Relative Efficacy of Various Types of Prior Belief-defense in Producing Immunity Against Persuasion," Journal of Abnormal Social Psychology, Vol. 62, 1961.

[18] Ibid.

[19] McGuire, W., op. cit.

In another study, McGuire[20] investigated the hypothesis that subjects who were mildly threatened before receiving supportive arguments would be more receptive to the supportive arguments and these arguments would confer resistance to counterarguments. This hypothesis was derived from an assumption of McGuire's theory on inoculation which contends that the ineffectiveness of the supportive defense rests on the lack of stimulation of a defensive stance. The design of this experiment varied from that of the first experiment in that the refutational defense provided counterarguments <u>different</u> from those arguments which were contained in the attack upon the cultural truism. This refutational-different defense was then followed by a supportive defense. In the refutational defense treatment of the first study, the truism was followed by four arguments against the truism and then a paragraph that refuted these <u>same</u> attacks upon the truism. The results confirmed the theory, as the resistance effect of the combination of defenses was greater than the sum of the effects of each type of defense administered separately. Thus, as occurred in the first study, a form of a two-sided argument (refutational-different defense) was more effective than a one-sided argument (supportive defense) in providing resistance to counterarguments.

While McGuire's research has tended to indicate that two-sided arguments have stronger inoculation effects than one-sided arguments for a measurement at a point in time, he reasoned that a refutational defense (two-sided argument) would also generate more persistent resistance over time. The argument here is that a refutational defense is threatening, and will cause the individual to be sensitive to any supportive information which will bolster her/his belief. Thus, we might expect that the resistance-creating effect of a refutational defense will increase as the subject gathers more and more supportive information. Conversely, the supportive defense does not threaten the subject, so it does not induce vigilance. Since there is no incentive for the subject to remember the supportive information, its resistance-creating potential tends to diminish over time.

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[20] McGuire, W., "The Effectiveness of Supportive and Refutational Defenses in Immunizing and Restoring Beliefs Against Persuasion," <u>Sociometry</u>, Vol. 24, 1961, pp. 184-197.

This prediction was confirmed[21] by comparing the resistance to attack of the refutational and supportive defense immediately after, two days after, and seven days after inoculation. The supportive defense decayed over time while the refutational defense increased after two days and decreased after seven days. This decrease presumably reflects forgetting after the subject has acquired all available supporting information following the threat.

Advertising Implications of the Research

With the exception of inoculation theory,[22] the areas investigated in the one-sided versus two-sided communication literature have not been directly researched within an advertising context. There is a fundamental difference between the communication manipulations in the one-sided versus two-sided research and advertising which limits direct generalizations from these research results to an advertising application.

The topics of the persuasive communications presented in the communication research were of a controversial nature. It is doubtful that the topic of many messages featured in an advertisement for consumer package goods could be considered controversial. However, advertisements for some non-traditional products or services such as birth control, welfare, and possibly mass transit have topics which may be considered controversial. Further, the dependent variable in the communication literature is attitude change. The objective of advertising is to influence, in the long-run, not only attitudes but ultimately behavior. However, given the demographic characteristics of the previously identified "potential switchers"[23] (relatively high level of educational attainment relative to "non-switchers") and the relative degree of controversy surrounding mass transit compared to consumer package goods, two-sided communication is a realistic promotional tool for mass transit to explore.

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[21] McGuire, W., "Persistence of the Resistance to Persuasion Induced by Various Types of Prior Belief Defenses," Journal of Abnormal Social Psychology, Vol. 64, 1962, pp. 241-248.

[22] Hunt, H., "Deception, Inoculation, Attack: Implications for Inoculation Theory, Public Policy, and Advertising Strategy," Doctoral Dissertation, Illinois: Northwestern University, 1972, p. 116.

[23] Alpert, M. and S. Davies, The Marketing of Public Transportation: Method and Application, Research Report 19, Council for Advanced Transportation Studies, The University of Texas at Austin, 1975.

III. METHOD

This study was designed to test empirically the relative impact of one-sided and two-sided messages upon purchase intentions and attitudes of "potential switchers" toward mass transportation. In so doing, this portion of Year Three's research draws heavily upon the research done in Years One and Two. In addition, this research also investigates the effects of varying the amount of information (the number of attributes) contained in the message.

SURVEY INSTRUMENT DESIGN

Presentation of both one- and two-sided experimental manipulations requires selection of both determinant and non-determinant attributes for mass transportation. In the two-sided manipulations, the product does not claim to possess the non-determinant attributes, but does claim to possess the determinant attributes. For transportation, determinant attributes are those attributes of a product which determine the consumer's modal choice.

The research conducted in Years One and Two identified determinant attributes for potential switchers. The five most determinant attributes for which the bus was rated superior to a private car were selected for use in this section of Year Three's research. These were: economy, freedom from parking problems, freedom from repairs, low energy use per passenger, and low pollution per passenger. Given a bus's perceived superiority on these features, it is likely that advertising which asserts these as advantages might be at least believable. The selection of the non-determinant attributes required additional testing, since it was necessary that the non-determinant attributes be believable both as positive claims (one-sided) and disclaimers (two-sided). The non-determinant attributes from the research of Years One and Two (e.g., "quiet ride," "ability to read") could not realistically be used for both positive and negative claims, because the image of one mode was clearly superior.

The determinancy of fifteen potentially non-determinant attributes was tested on a sample of one-hundred university students who possessed characteristics closely approximating those of potential switchers. The results indicated that the attributes colorful interior and long windows would be suitable as non-determinant attributes for both the one-sided and two-sided manipulations. These attributes were rated as relatively unimportant transportation features, for which cars and buses do not differ.

A pilot study was administered to a sample of 110 subjects whose characteristics closely approximate those of potential switchers to test alternative ways of presenting the one-sided and two-sided communication formats and placement of dependent variables. A subject received one of several experimental manipulations followed by the dependent variables tentatively selected for use in the final instrument. The order of presentation was either: (1) experimental manipulation, dependent variables, media questions, or (2) experimental manipulation, media questions, dependent variables. The message formats (experimental manipulations) tested varied in their presentation of the attributes of the bus. The attributes were listed in a column below several sentences of copy, and the bus was described in one of three ways on each of the attributes. In one treatment, the bus was given a rating of either "superior" or "inferior" on the attributes. The one-sided treatment identified the bus performance on all of the attributes as "superior". The two-sided treatment identified the bus performance on the determinant attributes as "superior" and as "inferior" on the non-determinant attributes. A second treatment followed the same general format, but replaced the adjective "superior" with "good" and "inferior" with "fair." The third treatment used check marks (✓) beside the attributes under columns labeled either "bus gives you" or "bus doesn't give you." The one-sided treatment did not contain the column "bus doesn't give you" and checked each attribute under the column labeled "bus gives you". The two-sided treatment varied in that it checked non-determinant attributes under "bus doesn't give you." The results of the pilot indicated that the use of check marks provided a slightly stronger manipulation than any of the other two treatments tested. There were no significant differences for the alternative placements of the dependent measures.

The message format pilot provided additional information which led to the addition of another product. Attitudes toward mass transit appeared to be strongly held, and may be difficult to change with a static design such as the one in this research. However, it is not clear whether the stability of the attitudes are due simply to their strength, the nature of this research design (static, print media), or to the lack of differential effectiveness between a one-sided and two-sided advertising tactic. Based upon previous research in the area of two-sided communication and probing of the subjects, it appeared that the effectiveness of the promotion may be very product specific, and in order to test this possibility, an additional product was added.

Deodorants were chosen as the second product since,on many potentially relevant dimensions,consumer attitudes and perceptions are likely to be very different in nature from those toward the bus. Unlike the bus, many people use deodorants regularly, and deodorants are a low cost consumer nondurable which do not generate (or require) as much brand ego-involvement as does the bus (viewing the bus as a "brand" of modal choice).

A sample of approximately 100 subjects were administered a questionnaire containing twenty-five attributes of deodorants selected from current advertisements and a review of previous research using deodorants.[1] The purpose of this pilot was to select five determinant attributes and two non-determinant attributes for use in the deodorant manipulations. Protection from odor, freedom from wetness, long-lasting, non-stain ingredient, and non-irritating to skin were the determinant attributes selected. The non-determinant attributes chosen were: beautiful package and five package sizes.

THE FINAL INSTRUMENT

The final instrument used an after-only design with control and contained five sections. (See Appendices I through VIII for a copy of the complete instrument for both a deodorant and a bus treatment.) The first section presented the respondent with one of twenty different experimental manipulations. The experimental manipulation was printed on heavy glossy paper and was presented on a separate page in order to simulate an advertisement situation as closely as possible. The subject was told that the following page contained part of an advertisement and to please read it carefully and completely.

The respondent could receive an advertisement for either the bus or a fictitious brand of deodorant named Secure. The fictitious brand, Secure, was used to avoid any bias that brand loyalty toward established brands might create. In addition, the respondent could receive either a one- or a two-sided communication containing either three, four, five, six or seven attributes. The

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[1] Golden, Linda L., "Consumer Reactions to Direct Brand Comparisons in Advertisements," Unpublished doctoral dissertation, University of Florida, December, 1975.

attributes were always presented in the same order, even though the number of attributes could vary. The non-determinant attributes were always the second and third attributes presented to the respondent. (See Appendices I through IV for copies of each of the experimental manipulations.)

The second section of the instrument contained five questions concerning the subject's reactions to the copy. These questions were designed to ascertain the subject's likelihood of reading the copy in a magazine, the credibility of the copy, the information provided, the usefulness of the information, and the general attitude toward the copy. Responses were elicited according to a seven-point horizontal scale with one indicating the negative extreme.

The third section of the instrument obtained information regarding the subject's media habits. Information concerning the extent and nature of the subject's use of newspapers, radio and television was elicited.

In the fourth section of the instrument, subjects were asked to indicate how likely they would be to purchase the product described in the experimental manipulation. In addition, information concerning the extent to which the subject felt the product possessed each of the seven attributes which could appear in the experimental manipulations was obtained. Subjects indicated their responses according to a seven-point horizontal scale with one representing "not at all" and seven representing "very much".

The final section of the instrument obtained demographic and personal information. Information regarding age, marital status, sex, employment status, household size, income, education, race, living situation and number of automobiles owned was collected. On the last page of the instrument, the subject had the opportunity to request a summary of the survey results.

The experimental design included two control groups, one for deodorant and one for the bus. The respective control group instruments were exactly the same as the instruments containing the experimental treatments, except that the experimental manipulations and the five questions directly regarding the experimental manipulations were deleted.

The final instrument was pre-tested for clarity of presentation on a sample of twenty subjects whose characteristics approximated those of potential switchers. Minor wording changes were made in the instrument as a result of the pre-test.

SAMPLE SELECTION AND ADMINISTRATION

The criterion for the selection of subjects for the instrument was the possession of characteristics approximating those for potential switchers. Potential switcher characteristics were identified and reconfirmed in the research conducted in Years One and Two, respectively. In general, potential switchers to mass transit tend to be relatively younger, have smaller households, are more likely to be full-time or part-time students (although 60 percent are non-students), and they are more likely to shop and work in the downtown area than are those less likely to switch to mass transit.

Distinct areas of Austin were identified which contained a relatively high proportion of individuals possessing the characteristics of potential switchers. An enumeration of households in these areas was obtained from Cole's Directory. In order to obtain a sample of 1,500 individuals, computer generated random numbers were used to identify every nth person to be included in the sample frame. Only residents, not businesses, were counted when identifying potential subjects. Further, the sample was restricted to households within one-quarter mile of a current bus route, so that intention to ride the bus could be realistically measured.

Having identified the potential respondents, interviewers then began contacting by telephone. Interviewers were to ask specifically for the person whose name appeared on their calling list. Upon contact, the interviewer first gave his or her name and then requested their assistance in a consumer attitude survey being conducted by members of the University of Texas Department of Marketing. Interviewers were carefully instructed not to mention the Department of Transportation or make any illusion to a transportation survey, since the subject may receive either a bus survey or a deodorant survey. When an individual agreed to participate in the study, he or she was told that they would receive the survey within a week. The respondent was instructed to please fill out the survey completely and return it at the earliest convenient time in the enclosed return envelope. Subjects were randomly assigned to treatments at the time of mailing. A letter of appreciation was included with the survey which contained the telephone number of the Department of Marketing so that the subject would have a contact point for any questions.

STATISTICAL ANALYSIS

The sample was drawn from areas of the city of Austin having a high proportion of persons with characteristics similar to those of potential switchers. In order to determine the similarity between Year Three's samples and the potential switchers to mass transit identified in the work of Years One and Two, the demographic data were submitted to descriptive analysis.[2] Year Three's sample contains slightly fewer females than males; the respondents are likely to be married and tend not to be students. Fifty-nine percent of the sample were between 30 and 59 years of age, the respondents tend to reside in two-person households, and seventy-nine percent of the persons interviewed had at least some college education. The large majority of the respondents were Caucasian, owned their own homes, had two or more cars and earned more than $10,000 per year in income. This is in keeping with our strategy of avoiding the captive market.

The subjects in Year Three's sample have some characteristics in common with the potential switchers identified in Years One and Two. Relevant dimensions for identification of potential switchers are: age, household size, student status and education. Like potential switchers, Year Three's subjects do tend to have small households and are relatively well educated compared to the general population. However, the potential switchers in Years One and Two tended to be slightly younger and were more frequently students than were the subjects in Year Three. Thus, Year Three's subjects have household size and education in common with previously identified potential switchers, but tend to differ slightly on other relevant dimensions.

A second preliminary analysis performed on the data was a discriminant analysis to determine if respondents assigned to alternative treatments differed significantly on demographic dimensions. Three separate analyses were run: (1) comparison of respondents assigned to one-sided or two-sided treatments, (2) comparison of respondents assigned to three, four, five, six or seven claims, and (3) comparison of respondents in each of the twenty-two

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[2] All analyses were performed with Veldman, D. J., Fortran Programming for the Behavioral Sciences, New York: Holt, Rinehart and Winston, 1967.

treatment levels (including control groups). In each of these analyses, the ten demographic questions constituted the independent variables. There were no significant differences between respondents according to demographic variables for any of the above three analyses. Thus, respondents appear to have been randomly assigned to treatments on this dimension.

A final preliminary analysis was a descriptive analysis of the sample's ridership of the bus. Ninty-nine percent of the respondents used their car for trips to shopping or personal business. Sixty-four percent of the respondents used their car for trips to work or school; however, twenty-two percent of the respondents did not respond to this question since they did not work or go to school. Only four percent of the sample used the bus at all in the last four weeks. Thus, the sample is composed of individuals who use their car as their primary mode of transportation.

Analysis of Experiments

In order to compare the effectiveness of each of the experimental manipulations (advertisement treatments) against a control group, individual t-tests were performed on each of the twenty dependent variables for the respondents receiving a bus treatment. In addition, the data from the bus instruments were submitted to two-way analysis of variance for the effects of communication type (one-sided versus two-sided) and number of claims (three, four, five, six, seven). These results are reported in Tables 1 and 2, respectively, which appear in the next section.

The data from the deodorant instruments were analyzed in similar manner. Individual t-tests were computed for each of the eight dependent variables in order to determine the relative effectiveness of each deodorant advertisement manipulation compared to the control. The data were also submitted to two-way analysis of variance for each dependent variable separately to investigate the effects of advertisement communication type (one-sided versus two-sided) and number of claims for a product such as a deodorant. Tables 3 and 4, respectively,are included in the next section and describe these results.

There were five advertisement specific dependent variables included in both bus and deodorant non-control instruments. The data from the five advertisement specific dependent variables were submitted to three-way analysis of variance for each dependent variable separately in order to investigate the relative effects of product, communication type, and number of claims. These results are presented in Table 5 of the next section.

IV. DISCUSSION

BUS ADVERTISING EXPERIMENT

The four most important dependent variables that can be used to evaluate the bus advertising treatments are the first four variables listed in Table 1. These measure the behavioral intentions towards use of buses for trips to work or school (commuting) and for shopping or personal business, both over the short run, and "for most of your trips." As can be seen in Table 2, neither the one-sided nor the two-sided advertisement style was able to achieve any strong pattern of impact on people's behavorial intentions towards using buses, which remained near the low end of the seven-point scale.

As noted in Table 2, there are ten possible comparisons made for the values of the dependent variable achieved by the various treatment levels versus the "control" group which was not exposed to any advertising (other than stimuli not manipulated in the study, which were assumed to be constant across all groups). These ten comparisons stem from the five different levels of claims, for each of the two types of communication style.

There were four significant differences observed in comparisons between behavioral intentions given by persons exposed to the varying treatments, and those in the control group. However, out of a total of forty such comparisons (4 variables x 10 levels per attribute, for both communication styles combined), one would expect four "significant" differences due to sampling fluctuations, using the .05 level for type-I error and one-tailed tests (or .10 for two-tailed tests). Furthermore, of the four that were significant three were in the positive direction, favoring increased use of buses, while one did worse, leaving a net "gain" of two favorable "shifts" in usage intentions, due to advertising influence. This is hardly a strong overall pattern of changes in ridership intentions.

It may be argued that it is unfair to expect much change in overall attitude toward riding buses, given only one exposure to a partial advertisement. This is particularly a problem, given the relatively large commitment needed to switch trip modes, and given the major perceived disadvantages of buses in terms of convenience, flexibility, safety from dangerous people, and other determinant attributes found in the prior research and not covered in this advertisement. However, it would be relevant to look at the effects of advertising treatments on

TABLE 1

DEPENDENT VARIABLES FOR BUS[a]

NUMBER	DESCRIPTION
1	How likely is it that you will use the city bus for a shopping or personal business trip during the next month?
2	How likely is it that you will use the city bus for a trip to work or school during the next month?
3	How likely would you be to use the city bus for most of your shopping or personal business trips?
4	How likely would you be to use the city bus for most of your trips to work or school?
5	Please think of your feelings about driving your car. In general, how much do you enjoy driving?
6	As an alternative to using a car, overall, how much do you think you would like riding the city bus?
7	To what extent do you feel the bus gives you freedom from repairs?
8	To what extent do you feel the bus gives you freedom from parking problems?
9	To what extent do you feel the bus has low energy use per passenger?
10	To what extent do you feel that the bus has low pollution per passenger?
11	To what extent do you feel that the bus is economical?
12	To what extent do you feel that the bus has a colorful interior?
13	To what extent do you feel that the bus has long windows?
14	To what extent do you feel that your car gives you freedom from repairs?
15	To what extent do you feel that your car gives you freedom from parking problems?
16	To what extent do you feel that you car has low energy use per passenger?
17	To what extent do you feel that your car has low pollution per passenger?
18	To what extent do you feel your car is economical?
19	To what extent do you feel that your car has colorful interior?
20	To what extent do you feel that your car has long windows?

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[a] 7 point scaling with 1="Not at all;" 7="very much"

TABLE 2

COMPARISONS (T-TESTS) FOR BUS TREATMENTS VERSUS CONTROL (SIGNIFICANT VARIABLES)

DEP. VAR. NO.	NUMBER OF CLAIMS					CONTROL "0"	NUMBER OF CLAIMS				
	ONE-SIDED						TWO-SIDED				
	3	4	5	6	7		3	4	5	6	7
1			1.27(+)[a]			1.05			1.46(+)		
2						1.37					
3						1.05	4.37(-)[b]		1.35(+)		
4						1.38					
5	5.73(-)[c]				5.67(-)	4.75					
6			3.76(+)	3.62(+)		2.54			3.50(+)		
7						4.20			5.27(+)		
8						4.55	5.58(+)				
9	4.77(-)					5.73					4.11(-)
10						4.83	3.40(-)				3.74(-)
11						5.05	4.00(-)				
12	2.95(+)	2.50(+)		2.68(+)	3.00(+)	1.74		2.56(+)			
13						3.79			2.68(-)		
14						2.37		3.39(-)			
15						2.93					
16		3.33(-)[c]				2.44		3.58(-)		3.90(-)	3.25(-)
17						3.23					
18						3.46				4.75(-)	
19						4.28					
20		4.41(-)			4.52(-)	3.42					

[a] (+) indicates dependent variable mean for treatment is more favorable to buses with $\alpha \leq .05$, 1-tailed test

[b] (-) indicates dependent variable mean for treatment is less favorable to buses with $\alpha \leq .05$, 1-tailed test

[c] Given the wording of the variables 5, 14-20, a higher treatment mean is less favorable for busines (i.e., a car is now higher than it was for control).

attitudes towards the specific bus features that were stressed in the ads, since these have been found to be bus features that might lead eventually to ridership. The thought would be that increasing favorable attitudes toward the features of buses stressed in advertisements would contribute to behavioral change, even if the immediate reaction had not changed significantly, overall.

Continuing in Table 3, and considering the changes in specific bus and car attribute ratings evoked by the advertisements, we note 27 significant effects on variables 5 through 20. Out of 150 possible comparisons, only about 15 would be expected by chance or sampling fluctuations.[1] For the one-sided advertisements, there were 13 significant differences, 6 of which were favorable to buses and 7 were not. The two-sided advertisements appear to be even less beneficial to perceptions of bus features, as 4 favorable changes were countered by 10 unfavorable ones. Even excepting the features (variables 12 and 13) that were specifically disclaimed, the ratio is 3 to 9. Specific comparisons of one-sided versus two-sided communication are more appropriately left to the analysis-of-variance (which follows) than for comparisons against control groups.

However, noting the general impact of bus advertisements as compared to a control situation where no bus ads were administered, there is not only a lack of overall pattern of positive attitude changes, but there appears to be a greater proportion of negative effects on specific bus features advertised. It may be reasonable to speculate that the effect of advertising public transportation to those who have the option of private transit and feel generally negative toward buses is to evoke less positive evaluations of bus features than are normally the case. It is possible that people may be reacting against a possible attempt to influence them to utilize this transportation mode by rating it less positively than when they are not asked to indicate a behavioral commitment to using it. Before concluding that the results of this study show advertising might be harmful to perceptions of bus features, it is necessary to

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[1] Actually, this "chance figure" should be less, since for several of the treatments, particular dependent variables were not claimed as bus features; hence one could not expect a direct effect on differences between perceptions of that feature by the test and control groups. Nevertheless, more complicated analysis of the number of changes vs. "chance" is not done since the number found exceeds even an overstated "chance" number, and more important, since the direction of changes is generally unfavorable.

TABLE 3

DETERMINANCE SCORES AND MODEL COMPARISONS FOR POTENTIAL SWITCHERS, WORK/SCHOOL

RANK	ATTRIBUTE	Z VALUE	CAR OR BUS SUPERIOR
1	Dependability	4.59[1]	car[1]
2	Low energy use per passenger	4.41[1]	bus[1]
3	Economy	3.91[1]	bus[1]
4	Low pollution per passenger	3.79[1]	bus[1]
5	Convenience	3.73[1]	car[1]
6	Flexibility	3.33[1]	car[1]
7	Freedom from repairs	2.22[1]	bus[1]
8	Freedom from accidents	2.16[1]	bus[1]
9	No parking problems	2.09[1]	bus[1]
10	Brief travel time	1.82[1]	car[1]
11	Safe from dangerous people	1.67[1]	car[1]
12	Relaxing	.41	n.s.d.
13	Ease of travel	.23	car[1]
14	Avoid traffic congestion	.01	bus[1]
15	Freedom from weather	- .08	car[1]
16	Uncrowded	- 1.25	car[1]
17	Privacy	- 1.85	car[1]
18	Ability to look at scenery	- 1.94	bus[1]
19	Ease of travel with children	- 2.02	car[1]
20	Pleasant riding surroundings	- 2.18	n.s.d.
21	Ability to read	- 2.20	bus[1]
22	Quiet ride	- 2.95	car[1]
23	Opportunity to socialize	- 3.15	car[1]
24	Smooth ride	- 3.53	car[1]
25	Can listen to radio or tape	- 3.88	car[1]
26	Fun to drive	- 4.24	car[2]
27	Socially accepted transportation	- 5.45	car[2]

[1] $p < .05$

[2] $p < .10$

Source: Alpert and Davies, p. 8

consider the relative effectiveness of communication type. Relative to the control group, one-sided ads gained about as well as they lost; two-sided advertisements contributed the greater number of unfavorable evaluations of specific features. For a systematic comparison of these two types of format, it is necessary to examine results of the analyses-of-variance which are discussed next.

ANALYSIS OF VARIANCE: BUS

Table 4 indicates the significant effects obtained in the two-way analysis-of-variance performed on the bus advertising study. For five of the twenty dependent variables, communication type was shown to have a significant main effect. In four of these, one-sided communication produced a more favorable evaluation of bus attributes advertised than did two-sided communication. As noted in Table 1, these variables involve anticipated enjoyment of riding a bus (vs. car), bus' low pollution per passenger, and the degree to which a bus has long windows and colorful interior. Since the latter two attributes were disclaimed in the two-sided treatment, it is logical that the one-sided ads, which asserted these as bus attributes, would have higher mean ratings for these features. The theory had hypothesized that since these features were not determinant attributes of modal choice, it would be better to "give up" some perceptions there in return for higher evaluations in terms of the determinant attributes that would be claimed. Unfortunately, for two-sided communication theory there was no variable for which two-sided communication achieved a significantly higher rating than did one-sided communication; also the key behavioral intention variables were not higher.

Variable 20 was higher for one-sided communication, indicating that when the bus was asserted to have long windows, people stated (possibly via reactance to the statement) that a car had longer windows than when the bus was claimed not to have long windows. This is counter-intuitive, but the four earlier dependent variable effects all show that one-sided advertising is better than two-sided. This occurred for four out of the twenty dependent variables, with only one expected due to chance (alpha = .05). Even if we subtract the one "negative effect" of one-sided communication, the net gain for one-sided would still be three attitudes, in which the bus is rated significantly higher in the one sided advertising treatment than in the two-sided advertising treatment (with sixteen non-significant differences, and one going the reverse way).

TABLE 4

ANALYSIS OF VARIANCE FOR BUS VARIABLES
(Significant Effects)

VARIABLE[a]	TREATMENT	MS[b]	DF	F	P-LEVEL	MEAN SCORES	
6	Communication Type	15.44	1	3.76	.05	3.24	One-Sided
						2.71	Two-Sided
	Error	4.10	214				
10	Communication Type	21.56	1	4.78	.03	4.63	One-Sided
						4.00	Two-Sided
	Error	4.51	210				
12	Communication Type	26.69	1	10.93	.00	2.85	One-Sided
						2.11	Two-Sided
	Error	2.44	192				
13	Communication Type	30.54	1	8.23	.00	3.91	One-Sided
						3.13	Two-Sided
	Error	3.71	195				
18	Number of Claims	10.53	4	2.98	.02	3.66	Three
						4.19	Four
						3.33	Five
						4.46	Six
						3.43	Seven
	Error	3.54	212				
20	Communication Type	18.22	1	3.85	.05	4.07	One-Sided
						3.49	Two-Sided
	Error	4.73	206				

[a] See Exhibit 1 for description of dependent variables

[b] M.S. = Error - sum - f - squares ÷ degrees of freedom for treatment

As also noted in Table 4, the impact of number of claims produced significant between group variation for only one of the twenty variables. Since this is what would be expected by chance, one cannot conclude that the number of attributes stressed in advertising, both one-sided and two-sided, affected the attitudes and behavioral intentions toward cars and buses in this study. There was also no significant interaction between number of claims and communication type, indicating that the number of claims had no significant impact on the dependent variables -- no matter which format (one-sided vs. two-sided) was used -- given the range of claims used (three to seven). For other ranges, claim-types, and product types, this might not be a valid generalization.

DEODORANT ADVERTISING EXPERIMENT

For comparison purposes and some insight into the importance of the product being advertised, consider the results for deodorant advertising obtained in a parallel experiment with respondents randomly selected from the same master list as the bus subjects (see description in earlier section).

Table 5 provides a description of the eight dependent variables that were used to measure attitudes and behavioral intentions toward the alleged new brand of deodorant, "Secure," that was advertised and studied. The first variable corresponds to the first four behavioral intentions (or riding intentions) used in the bus study. The next seven measure attitudes toward the up-to-seven features mentioned in the deodorant advertisements (analagous to the seven bus feature claims). In the absence of a clear competitive analogy to "the car," we decided not to include variables evaluating the perceptions of a substitute deodorant brand. At any rate, the impact on these eight dependent variables can be compared with eight comparable variables for the bus, as well as noting the general comparisons in percentages of significant advertising effects in the two experiments.

Table 6 provides comparative data on differences between mean values of these variables for subjects exposed to various levels of the communication treatments, each one paired against a control group that was not exposed to "Secure" advertising but rated this brand along these variables. This Table is analagous to Table 2 for bus versus control. However, in that the brand was fabricated for this experiment, comparisons with the control for this product

TABLE 5

DEPENDENT VARIABLES FOR DEODORANT[a]

NUMBER	DESCRIPTION
1	How likely is it that your next deodorant purchase would be Secure if it is available at your favorite store?
2	To what extent do you feel that Secure deodorant is non-irritating to skin?
3	To what extent do you feel that Secure deodorant is long-lasting?
4	To what extent do you feel that Secure deodorant gives you a non-stain ingredient?
5	To what extent do you feel that Secure deodorant gives you freedom from wetness?
6	To what extent do you feel Secure has five package sizes?
7	To what extent do you feel Secure has a beautiful package?
8	To what extent do you feel that Secure gives you protection from odor?

[a] 7-point scaling, with 1="Not at all . . .;" 7="Very much"

TABLE 6

COMPARISONS (T-TESTS) FOR DEODORANT TREATMENTS VERSUS CONTROL (Significant Variables)

DEP. VAR. NO.	NUMBER OF CLAIMS ONE-SIDED					CONTROL	NUMBER OF CLAIMS TWO-SIDED				
	3	4	5	6	7	"0"	3	4	5	6	7
1			2.13(+)[a]		1.95(+)	1.26		2.14(+)	2.22(+)	1.95(+)	2.14(+)
2						2.13					
3			1.50(-)[b]	2.85(+)		2.00		3.14(+)	3.19(+)	2.84(+)	3.23(+)
4				2.80(+)		1.88		3.24(+)		2.84(+)	3.45(+)
5		3.09(+)	1.50(-)	2.85(+)		1.87		4.05(+)	3.05(+)	2.84(+)	3.14(+)
6	5.65(+)	5.37(+)	5.65(+)	3.70(+)	4.05(+)	1.94					
7	4.39(+)	4.23(+)	4.41(+)	2.84(+)	3.55(+)	1.84					
8	3.61(+)	3.32(+)	3.24(+)	2.10(+)	2.95(+)	2.03	3.39(+)	4.29(+)	3.48(+)	3.42(+)	3.82(+)

[a] (+) indicates dependent variable mean for treatment is more favorable, with $\alpha \leq .05$, 1-tailed test.

[b] (-) indicates dependent variable mean for treatment is less favorable, with $\alpha \leq .05$, 1-tailed test.

are somewhat artificial. It would not be surprising to find that persons exposed to advertising for what they might assume is a new brand of deodorant would rate its features and their buying intention towards it higher than would persons who have never heard of the product, yet are asked to evaluate its features. A competing hypothesis would be that deodorant advertising in general, or the ads we made up in particular, is so negatively perceived that people will rate the product advertised more negatively than one they have never heard of.

Nevertheless, Table 6 shows a generally strong pattern of more favorable attitudes toward the advertised brand than were given by the unexposed control group. Buying intentions (variable 1), while still low, were positively affected by advertising of both one-sided and two-sided format. Of ten possible comparisons (and less than one expected by chance), six significant differences between treatment mean versus control were found. Variables 2-5 and 8 were pretested as determinant attributes of deodorant selection. Out of 50 comparisons (five variables times ten treatments per variable), 27 were significant, and all but two were in the favorable direction. The one-sided treatment had a "net gain" of seven (9-2), while the two-sided communication had 16 favorable and none the reverse.

Variables six and seven were asserted as positive claims in the one-sided approach and disclaimed in the two-sided approach, after having been pre-tested as relatively trivial choice features. Without exception, the one-sided treatment achieved significant favorable scores, and the two-sided approach was not significantly different than the control situation. These ten favorable scores give the one-sided treatments a net of 17 favorable attitudes (19-2), and the two-sided approach had 16. Both types appear to have achieved positive results vs. control, unlike the bus experiment. For comparisons between types of advertisement strategies, we shall again use the analysis-of-variance findings, which specifically compare treatments against each other rather than against a control alone.

ANALYSIS OF VARIANCE: DEODORANT

Table 7 presents the results of the two-way analysis-of-variance that was performed on the deodorant study dependent variable. Here, the results are almost directly the opposite of what was obtained in bus advertising tests.

TABLE 7

ANALYSIS OF VARIANCE FOR DEODORANT VARIABLES (Significant Variables)

VARIABLE^a	TREATMENT	MS	DF	F	P-LEVEL	MEAN SCORES	
1	Communication Type	6.38	1	6.38	.10	1.68	One-Sided
						2.03	Two-Sided
	Error	2.41	201				
3	Communication Type	13.79	1	5.22	.02	2.43	One-Sided
						2.95	Two-Sided
	Number of Claims	7.79	4	2.95	.02	2.00	Three
						2.59	Four
						3.15	Five
						2.85	Six
						2.86	Seven
	Error	2.64	198				
4	Number of Claims	9.23	4	3.35	.01	1.83	Three
						2.73	Four
						2.43	Five
						2.82	Six
						3.05	Seven
	Error	2.75	198				
5	Number of Claims	19.55	4	7.01	.00	1.67	Three
						3.57	Four
						2.96	Five
						2.85	Six
						2.82	Seven
	Error	2.79	199				

TABLE 7

(Continued)
ANALYSIS OF VARIANCE FOR DEODORANT VARIABLES

VARIABLE[a]	TREATMENT	MS	DF	F	P-LEVEL	MEAN SCORES
6	Communication Type(A)	507.15	1	119.16	.00	4.92 One-Sided
						1.81 Two-Sided
	Number of Claims(B)	11.62	4	2.73	.03	3.52 Three
						3.95 Four
						3.67 Five
						2.61 Six
						3.07 Seven
	A x B	11.10	4	2.61	.04	5.65 One-Sided, three
						5.57 One-Sided, four
						5.65 One-Sided, five
						3.70 One-Sided, six
						4.05 One-Sided, seven
						1.39 Two-Sided, three
						2.33 Two-Sided, four
						1.70 Two-Sided, five
						1.53 Two-Sided, six
						2.09 Two-Sided, seven
	Error	4.26	201			
7	Communication Type	239.11	1	71.28	.00	3.88 One-Sided
						1.74 Two-Sided
	Number of Claims	8.00	4	2.39	.05	3.04 Three
						3.19 Four
						3.05 Five
						2.11 Six
						2.66 Seven
	Error	3.15	4			

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[a] See Table 5 for description of dependent variables.

While one-sided advertising was not superior in influencing bus-riding intentions, it had a better pattern for specific attributes than did two-sided approaches. The average intention to purchase "Secure," although low in both types of advertisements, was significantly higher for people exposed to two-sided messages than those exposed to one-sided messages (alpha = .10). Further, what the two-sided deodorant messages took away in the disclaimed attributes (variables six and seven were significantly lower for two-sided messages than for one-sided ones), may have been more than compensated for in higher perceptions of long-lasting protection (variable 3).

Unlike the bus advertising study, the number of claims appeared also to be significantly related to perceptions of features of the advertised deodorant product. However, the only relevant finding would be if the number of claims were significantly related to the overall behavioral intention variable, which was not the result obtained. Impact on ratings of particular attributes is confounded by the fact that for some of the treatments involving few claims, the variable being measured may not have been presented in an advertisement for some treatments yet mentioned in others. For variable 3, for example, "long-lasting" deodorant is the fifth attribute mentioned in the sample advertising (see Appendix). It is therefore interesting to note that mean evaluation of "Secure" in terms of this trait rises dramatically when the number of claims were varied. Analysis needed to clarify this issue is beyond the scope of this report. However, it is worth noting that overall intention is not influenced by the number of claims made, nor is there an interaction with communication type (for these intention variables), given the range of 3 to 7 bus or deodorant attributes.

ATTITUDES TOWARD THE ADVERTISEMENTS THEMSELVES

In order to gain further information on the appropriateness of particular strategies for public transportation advertising, it may be useful to consider respondents' reactions to the advertisements themselves. It may be, for example, that one reason attitudes toward buses were not generally improved (vs. control) with advertising, while deodorant attitudes were, is that the bus advertisements were inferior to those for deodorant. If the advertising were at fault, and not the product, this would suggest a very different range of alternative strategies than a belief that product improvements are more critical. Further, from a standpoint of comparisons of one-sided versus two-sided communication strategies, the quality of execution of the advertisements should not vary across products in the study.

Clearly, every attempt was made to keep the advertisements realistic and comparable, subject to the restraint of having to be able to control for variations in one-sided versus two-sided format, number of claims, and the like. In addition, five standard questions by which advertisements are rated were included in the survey for all subjects who viewed sample advertisements. These are presented in Table 8. While it should be noted that consumers are not very accurate in choosing ads that will have measurable impact on them, one can usually discern a "poor ad" on the basis of these kinds of responses. Comparisons may also be useful.

Table 9 presents the results of a three-way analysis-of-variance for each advertisement-rating variable. In four of the five variables, there was a significant main effect for "product," which indicates that across all types of formats and number of claims, advertisements for "the bus" were perceived more favorably than were those for "Secure." Respondents indicated that for bus advertisements, they were significantly more likely to read all the copy, felt the ad was "truer" and contained more useful information, and that they liked the copy better than did those who were exposed to deodorant ads. It is worth noting that respondents felt bus ads to be generally truthful (mean of 5.05 on a 7-scale) -- even though they said they were more likely to purchase the deodorant brand than they were to ride a bus. The level of risk and lifestyle change of adopting a new deodorant is clearly less threatening than switching transit modes, in spite of relatively favorable attitudes toward the product advertising.

A second major finding shown in Table 9 is that communication type has a significant main effect on 3 of the 5 dependent variables, and that two-sided communication generally is perceived more favorably than one-sided communication as far as advertising ratings are concerned. Two-sided ads were rated higher in truthfulness (variable 2), information value (variable 3), and general liking for the advertisement (variable 5), across all numbers of claims and both product types. In the case of bus advertising, liking for the ad apparently did not translate into more positive results vis-a-vis the product advertised. As noted previously in Table 7, two-sided advertisements were probably more effective in

TABLE 8

ADVERTISEMENT SPECIFIC DEPENDENT VARIABLES[a]

NUMBER	DESCRIPTION
1	If you were to see the above copy in a magazine you were reading, how likely would you be to read all the copy?
2	Overall, to what extent do you feel the statements made in the copy are true?
3	How much information do you feel the copy provided?
4	How useful do you feel the information in the copy is to you?
5	In general, to what extent do you like the copy?

[a] 7-point scaling, with 1="Not at all . . .;" 7="Very Much"

TABLE 9

ANALYSIS OF VARIANCE FOR ADVERTISEMENT SPECIFIC (SIGNIFICANT) EFFECTS

VARIABLE [a]	TREATMENT	MS	DF	F	P-LEVEL	MEAN SCORES	
1	Product	68.24	1	15.37	.00	3.47	Bus
	Error	4.44	417			2.68	Deodorant
2	Product	200.30	1	75.85	.00	5.05	Bus
						3.69	Deodorant
	Communication Type	68.24	1	25.84	.00	3.97	One-Sided
						4.77	Two-Sided
	Product x Number of claims	4.01	4	1.52	.00	4.17	Bus, 3
						5.13	Bus, 4
						5.17	Bus, 5
						5.62	Bus, 6
						5.19	Bus, 7
						3.93	Deodorant, 3
						4.01	Deodorant, 4
						3.74	Deodorant, 5
						3.44	Deodorant, 6
						3.32	Deodorant, 7
	Error	2.64	416				
3	Communication Type	11.07	1	3.61	.05	3.38	One-Sided
						3.70	Two-Sided
	Number of Claims	27.39	4	8.95	.00	2.77	3
						3.20	4
						4.21	5
						3.87	6
						3.66	7
	Error	3.06	417				

TABLE 9

(continued)

ANALYSIS OF VARIANCE FOR ADVERTISEMENT SPECIFIC (SIGNIFICANT) EFFECTS

VARIABLE [a]	TREATMENT	MS	DF	F	P-LEVEL	MEAN SCORES	
4	Product	28.01	1	10.20	.00	1.99	Bus
						2.50	Deodorant
5	Product	14.77	1	5.17	.02	3.01	Bus
						2.64	Deodorant
	Communication Type	38.57	1	13.49	.00	2.52	One-Sided
						3.12	Two-Sided
	Number of Claims	11.82	4	4.12	.00	2.21	3
						2.77	4
						3.10	5
						3.11	6
						2.93	7
	Error	2.86	417				

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[a] See Table 8 for description of dependent variables.

influencing attitudes toward deodorant (where honesty is perhaps unexpected and may more easily compensate in a low-risk decision) than were one-sided advertisements.

The number of claims had impact on two of the five dependent variables. Perceived information-value of ads peaked at five claims per ad, and fell off for both more and fewer claims. Liking for the copy also appeared higher for five or six claims than for numbers greater and less. On a single-exposure basis, number of claims did not impact on key dependent variables in the products. Given these findings concerning attitudes toward the ads, it is possible that campaigns stressing a moderate number of claims may achieve more beneficial effects than those with too many or too few. More research would be needed to test this.

The only significant interaction (product x number of claims) should not be be interpreted, since at the .05 level of significance and 20 possible interactions (AB, AC, BC, ABC, for each of five variables), one would expect to have one appear significant by "chance."

SUMMARY OF ADVERTISING EXPERIMENTS

The preceding results of the analyses of the two related advertising studies may be useful in guiding advertising and product strategy for buses and other public transportation modes. The most important, although perhaps disappointing finding, is that advertising strategies for public transportation, no matter what their relative effectiveness, may have little absolute impact on patronage without corresponding and significant closing of gaps between public and private transportation, along determinant attributes of modal choice.

We have seen that advertisements for deodorant, even though not well liked as advertisements, could generate significant changes in behavioral intentions and attitudes toward product features. The tested advertisements for buses, although relatively favorably received (relative to deodorant ads), did not generally produce significant favorable attitudes toward the features and/or use of buses in the target audiences. One-sided communication strategies seemed more effective than two-sided ones for buses (but not deodorant), and one should be extremely careful how one raises issues of drawbacks of public transportation, even when trivial ones are stated. It is possible that further research, field-testing a campaign with repeated exposures to a theme such as "We know we have had some problems, but try us and see how much we have improved... Besides we have economy, freedom from parking problems..." may have good effectiveness, AS MUCH AS ADVERTISING ALONE CAN.

For the present, one cannot recommend discarding one-sided transit advertising in favor of a two-sided approach, on the basis of these findings. What little impact was obtained on transit attitudes came more through one-sided than through two-sided communication. However, one should note that behavioral intentions to use public transit were only slightly affected (in these one-exposure treatments), and changes in attributes are probably more important than effectively communicating the advantages that are generally agreed with, but are not at this time sufficient to generate much switching from private transportation to public transportation, especially for shopping and personal business trips.

This is true in spite of the above-mentioned finding that attitudes toward the bus advertisements were more favorable than were those toward deodorant advertisements. The bus advertisements (and two-sided ads as well) are in a sense a "critical success" but a commercial failure. The product needs to be improved. For insight into which attributes are most critical for change and how much change may be needed, see the following section on conjoint or trade-off measurement research and results for our study area.

V. INTRODUCTION TO TRADE-OFF ANALYSIS

This section of the research report is concerned with the same phenomenon as in the previous section, namely, what is important in determining people's choices of transportation modes. In this section, however, the question is posed in a rather different analytical manner. The concern here is with not only what is important in determining a person's choice of mode, but more specifically, how much an individual is prepared to give up of one important attribute to obtain another. This type of analytical framework leads directly to determining how much an individual will trade-off of one attribute to obtain another, as well as, what combinations of what attributes will be traded-off to obtain other combinations of the same attributes.

Such types of questioning and analytical posture have substantial policy implications. For example, if it is possible to determine what attributes or characteristics of a transportation mode will be traded-off to obtain other attributes or characteristics of a transportation mode by a particular population group, then it is possible to predict the market share of riders that will be captured by a particular mode having specified levels of attributes. Conversely, given knowledge of the trade-offs to be made between attributes, it is possible to develop design and performance requirements or standards for alternative modes of transportation. Both of these types of policy implications imply a third, namely, given knowledge of the population and transportation characteristics of a community, it may be possible to develop a strategy for obtaining a maximum utility of transportation service for several segments of the society by a mixed mode system. On the other hand, given information regarding the trade-offs acceptable to diverse segments of the community, it may be possible to provide increased information to the citizenry on the values and attitudes held by the potential users of transportation within the community. Similarly, information on acceptable trade-offs may provide a basis for developing a promotional strategy. This type of information may lead to altered community responses to transportation policies and systems.

This portion of the project, and consequently this portion of the report, explicates a methodology and theory which identifies the types of trade-offs which will be made by transportation users. Illustrative data and analyses are presented to describe the manner in which such a methodology and theory may be utilized in developing transportation policies and plans. The illustrations are drawn from data derived from a small sample of "potential switchers" to public transportation in the Austin, Texas urban area. The data and analyses for this sample verify the potential applicability of the methodology, and provide a preliminary identification of the types of trade-offs which may be made by the universe of people represented by the sample.

The remainder of this section of the report is divided into four parts. In the next chapter, a literature review is presented describing the relevant literature in the area of mode choice, conjoint analysis, and multifactor designs. This review provides the context for the study in terms of mode choice and the analytical framework utilized. The seventh chapter is concerned with the research methodology used in this study. This review discusses: (1) how the determinant attributes of transportation modes were chosen for inclusion in this study; (2) the two types of interview formats used -- a matrix and a card sort procedure; (3) the pre-test and modifications of the two basic types of instruments used in this study are discussed; and (4) the specifics of how the sample was selected, including the definition of the respondents and the areas from which the respondents were chosen is summarized. Following this, the eighth chapter presents the analysis of the results. The final chapter draws conclusions from the research and makes suggestions regarding further areas of investigations.

VI. LITERATURE REVIEW

This chapter reviews three important areas of literature relevant to the problem at hand. There is no attempt made in this review to be exhaustive regarding the three subject areas. Rather, the review is selective and illustrative of the issues of concern in each instance. The first portion of the review is concerned with the phenomenon of mode choice. This represents the fundamental core of interest of policy makers in this aspect of transportation policy. That is, policy makers are concerned with which modes of transportation will be chosen for any given purpose. Many issues have arisen regarding this particular problem, and it is toward this particular concern that the research conducted in this part of the report has been focused. The second body of literature reviewed is that surrounding conjoint analysis. This is an analytical technique which would appear to have great potential in trying to unravel many of the relationships involved in the choice of a transportation mode. The final topic of the review is concerned with a specific methodological issue called multifactor designs. Multifactor designs represent ways of developing instruments which have special statistical properties to allow for treating large numbers of factors in a parsimonious manner. The three areas reviewed provide the basis for the subsequent work undertaken on this project and reported herein.

MODE CHOICE

The extant literature on mode choice is very large. An early study focusing on the behavioral decision variables involved in urban mode choice cites over 280 references.[1] A recent bibliography dealing with modal choice and the value of passenger time cites over 500 references on mode choice

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[1] Betak, J. and C., Urban Modal Choice: A Critical Review of the Role of Behavioral Decision Variables, Research Report, The Transportation Center, Northwestern University, 1969.

alone.[2] Needless to say, it is neither necessary nor appropriate to provide an extensive review of the literature here. Rather, a brief summary of the points relevant to this study is made. For in-depth discussion of the mode choice literature, the reader is referred to the previously cited reviews or other similar reports.

Mode choice is manifest by the behavior of individuals and/or groups of individuals. This is a predominantly purposive, adaptive behavior.[3] As such, mode choice behavior represents the outcome of a complex decision process which encompasses: (1) trade-offs between system characteristics and non-system characteristics, including user requirements and attributes; (2) past decisions with respect to mode choice, origins and destinations, life style, etc., i.e., goal-directed decisions. It is the view of this study that mode choice decisions are one part of a large decision-making system in which each part of the system affects, and is affected by, the other decision components. Adopting this perspective when identifying and defining decision variables makes possible a distinction between off-system and on-system attributes. The off-system attributes include items such as user characteristics, system-environment characteristics, and so on. Clearly, some arbitrariness exists in this distinction since one of the on-system characteristics may be the off-system attributes. However, this does not appear to be a difficult distinction from the review or analysis standpoint.

On-System Attributes

Table 10 lists the on-system characteristics which have been suggested as being potentially important by the literature. Clearly, this is not an exhaustive list of attributes, however, it does represent most of the major variables that have been suggested in the mode choice literature as being potentially important. Review of this literature provides some estimation of the saliency of these characteristics.

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[2] Davies, S. and M. I. Alpert, Modal Choice and The Value of Passenger Travel Time Literature: A Selective Bibliography, Research Report 22, Council for Advanced Transportation Studies, The University of Texas at Austin, 1975.

[3] It is possible that some individuals travel and choose modes in a non-purposive manner; however, it is not likely that their numbers are significant. Furthermore, there is no known literature on the mode choices of such individuals.

TABLE 10

ON-SYSTEM ATTRIBUTES

Safety
Comfort
Convenience
Privacy
Cost
Travel Time
Service Frequency
Storage Availability

Safety. The safety of a mode for the traveler has at least two dimensions. Safety may be considered from the standpoint of the probability of being involved in an accident or from the viewpoint of the probability of becoming the victim of a crime. The traveler's concern for physical safety during a trip may be considered a passive or a threshold dimension of attitude in the modal choice decision. The traveler seems to assume that the journey will be safe; that is, safety is not explicitly considered as part of the choice mechanism.[4] However, if the traveler is querried about the importance of safety, high ratings of importance are given.[5]

In general, attitudes and perceptions of safety are not in accord with accident statistics for roads and airplanes; however, other modes do not seem to suffer this problem. Attempts to scale "dangerous-safe" routes by such qualities as travel time, speed changes, and deviation from the speed limit have met with limited success.[6]

Comfort. Comfort has been considered to be an important variable, but often has been classified as being unquantifiable. Vehicle comfort and amenity features appear to include getting a seat, satisfactory temperature, no overcrowding, little waiting, and protection from the climate.[7] The attributes which go together to make up comfort and amenity in vehicles have rather

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[4] Wachs, M., "Consumer Attitudes Toward Transit Service: An Interpretive Review," Journal of The American Institute of Planners, 42, No. 1, 1976, pp. 96-104.

[5] Alpert, M. and S. Davies, The Marketing of Public Transportation: Method and Application, Research Report 19, Council for Advanced Transportation Studies, The University of Texas at Austin, 1975; Solomon, K. M., R. J. Solomon, and J. S. Sillien, Passenger Psychological Dynamics: Sources of Information on Urban Transportation, New York: American Society of Civil Engineers, 1968.

[6] Betak, J. and C., op. cit.; Stanford Research Institute, The Value of Time for Passenger Cars: Final Report, SRI Project 5074, Stanford Research Institute, Menlo Park, California, 1967.

[7] Alpert, M. and S. Davies, op. cit.; Appleyard, D. and R. Y. Okamoto, "Environmental Criteria for Ideal Transportation Systems," in Barton-Aschman Associates Guidelines for New Systems of Urban Transportation, Vol. 2, Chicago, 1968, pp. 137-190; Gutman, R., "Urban Transporters as Human Environments," Journal of the Franklin Institute, November 1968, pp. 533-540; Department of Business Administration, University of Maryland, User Determined Attributes of Ideal Transportation Systems: An Empirical Study, College Park, Maryland, 1966; Nash, A. N. and S. J. Hille, "Public Attitudes Toward Transport Modes: Summary of Two Pilot Studies," Highway Research Record No. 233, 1968.

different saliencies in terms of mode choice. For example, protection from inclement weather, availability of package and baggage space, ability to listen to the radio, and so on, are significantly less important in modal choice than travel time, reliability, costs, avoidance of waiting, etc., for both work and non-work trips.[8] On the other hand, factors such as the presence or absence of air conditioning is considered important, and seat-assurance emerges as being only slightly less important than travel time reliability and often is as important, in modal choice decision situations, as cost differences between modes.[9] Thus, it is not reasonable to assume that a generalized dimension or variable called comfort or amenity will be of significant importance in mode choice situations, however, certain attributes of the dimension of comfort may be highly salient.

Convenience. The variable convenience is commonly cited as being important and has been found to be a highly determinant attribute in modal choice for both work/school and shopping/personal trips.[10] However, it is a variable that seems to subsume a large number of characteristics. For example, convenience appears to include such dimensions as ease of access and egress (including parking lots and availability of parking spaces), terminal times, transfer times (time and ease), service convenience (includes headway frequency and schedule alignments with user schedules), and location convenience (related to ease of access).[11] The salience of these many dimensions has only been partially ascertained. For example, walking time, which is related to location

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[8] Alpert, M. and S. Davies, op. cit.; Nash, A. M. and S. J. Hille, op. cit., Navin, F. P. and R. I. Gustafson, Attitudes Toward Public Transit: Some Comparisons, Research Publication GMR-1309, Warren, Michigan: General Motors Research Laboratories, 1973.

[9] Navin, F. P. and R. I. Gustafson, op. cit.

[10] Alpert, M. and S. Davies, op. cit.

[11] Transportation Research Institute, Carnegie-Melon University, Latent Demand for Urban Transportation: Final Report, Study D-3, Pittsburgh, Pennsylvania, 1968; Gutman, R., op. cit.; Department of Business Administration, University of Maryland, op. cit.

convenience, appears to be much more important than riding time.[12] Similarly, waiting and transfer times have been found to be important attributes of the mode choice situation.[13] Clearly, the various dimensions or attributes of convenience must be dissaggregated for appropriate analysis in determining their importance in the mode choice context.

Privacy. Behavioral scientists view the variable privacy as being very important. However, it does not seem to be a variable considered in most of the modal choice literature. Privacy represents the spatial consciousness of the individual and the extension of ones self to the transportation mode.[14] Clearly, personal privacy includes: not being pushed, pawed, stepped on, looked at, having ones activities monitored by others (particularly if seen regularly), not being forced to pay attention to the activities, sounds, or other evidence of the presence of others. Privacy may also include the wish for or need of some feeling of control or personal attachment to the mode.[15]

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[12] Henderson, C. and J. Billheimer, Manhattan Passenger Distribution Project: Effectiveness of Midtown Manhattan System Alternatives, Menlo Park: Stanford Research Institute, 1972; Lisco, T. E., The Value of Commuter's Travel Time: A Study in Urban Transportation, Ph.D. Dissertation, Department of Economics, University of Chicago, 1967; Pushkarev, B. S. and J. M. Zupan, Walking Space for Urban Centers: A Report of the Second Regional Plan. New York: Regional Plan Association, 1971; Quarmby, D. A., "Choice of Travel Mode for the Journey to Work," Journal of Transport Economics and Policy, Vol. 1, 1967, pp. 273-314.

[13] Algers, S., S. Hansen and G. Tegner, "Role of Waiting Time, Comfort, and Convenience in Modal Choice for Work Trip," Transportation Research Record No. 534, Washington, D. C.: Transportation Research Board, 1975; Brown, G. R., "Analysis of User Preferences for System Characteristics to Cause a Modal Shift," Highway Research Record No. 417, Washington, D. C.: Highway Research Board, 1972; Henderson, C. and J. Billheimer, op. cit.; Nash, A. N. and S. J. Hille, op. cit.; National Analysts, Inc., A Survey of Commuter Attitudes Toward Rapid Transit Systems, Washington, D. C.: National Capitol Transportation Agency, 1963.

[14] Betak, J. and C., op. cit.

[15] Appleyard, D. and R. Y. Okamoto, op. cit.; Bateman, J. R. and J. W. Brown, "Urban Planning, Transport, and Human Behavioral Science," Guidelines for New Systems of Urban Transportation, Vol. 2, Chicago: Barton-Aschman Associates, 1968, pp. 1-41; Beldo, L. A., "An Exploration of Human Needs as a Guide to Planning Urban Transportation," Guidelines for New Systems of Urban Transportation, Vol. 2, Chicago: Barton-Aschman Associates, 1968, pp. 43-61; Gutman, op. cit.

Although privacy is difficult to identify and measure, in one study in which individuals were querried regarding the importance of various attributes for their choice of mode for work/school and shopping/personal business trips, it was found that the generalized variable privacy was not determinant for either type of trip and the attribute "uncrowded" -- which is probably a dimension of the privacy variable -- also was not determinant for either type of trip.[16] However, the uncrowded attribute was much more important in the shopping/personal business type of trip than on the work/school trip. Of course, to accurately gauge the salience of the variable privacy, it is probably necessary to dissaggregate it into its various dimensions and scale along those attributes.

Cost. The cost variable is complex and the evidence regarding its importance is somewhat contradictory. In the broader sense of the word, we may consider cost in terms of such items as: comfort cost, convenience cost, privacy cost, noise-level cost, speed cost, congestion cost, monetary outlays, etc. However, transportation consumers apparently tend only to view monetary outlays (out-of-pocket) as costs,[17] while the effects and measures of the other costs are considered separately and are not treated in the same manner. It has been demonstrated in some cases that the cost elasticities for out-of-pocket costs are very low or negligible for various modes and trip purposes.[18]

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[16] Alpert, M. I. and S. Davies, op. cit.

[17] Lansing, J. B. and G. Hendricks, Automobile Ownership and Residential Density, Ann Arbor, Michigan: Survey Research Center, 1967; National Analysts, Detailed Findings From the Six Month Market Survey of the North Penn-Hatboro and Levittown Demonstration Programs, Southeastern Pennsylvania Transportation Compact Report No. 7, Philadelphia, Pennsylvania, 1964.

[18] Charles River Associates, Inc., An Evaluation of Free Transit Service, Report No. 125-1, Cambridge, Massachusetts, 1968; Consad Research Corporation, Transit Usage Forecasting Techniques: A Review and New Directions, Pittsburgh, Pennsylvania, 1968; Lisco, T. E., op. cit.; Moses, L. N. and H. F. Williamson, Jr., "Value of Time, Choice of Mode, and the Subsidy Issue in Urban Transportation," Journal of Political Economy, June 1963, pp. 247-264; National Analysts, Inc., 1964, op. cit.; Wallin, R. J. and P. H. Wright, "Factors Which Influence Modal Choice," Traffic Quarterly, Vol. 28, 1974, pp. 271-289.

However, it has also been shown that costs do affect patronage (i.e., perceived costs).[19]

In all probability, some of the confusion probably is due to comparisons of unlike alternatives; the consumer is not confronted with the true substitutability in transportation alternatives.[20] Furthermore, it is not clear that such generalizations regarding travel costs are operative for all population groups. For example, elderly travelers indicate that cost is of great significance in their travel choices. They frequently alter travel patterns to take advantage of reduced fares during off-peak hours.[21] Thus, the measurement of the effect of cost on modal choice must be considered in terms of more fully developed choice situations than are characteristically included in attitudinal surveys.

Travel Time. The variable travel time is complex in its composition as well as its apparent effects. At least five different measures of travel time may be considered (total travel time, terminal time at the origin, terminal time at the destination, transfer and waiting times, and total access time -- terminal transfer and waiting times). Each of these measures imply differential time distinction by the user. Intuitively, as well as evidentially, the user appears to object only to certain behaviors associated with one or two of these measures (for example, waiting or transferring). In addition to these types of travel time considerations, there is also the aspect of dependability or reliability -- i.e., arriving on time at the intended destination or departing on time from the origin.

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[19] Alpert, M. and S. Davies, op. cit.; Brown, op. cit.; Department of Business Administration, University of Maryland, op. cit.; Miller, G. K. and K. M. Goodman, The Shirley Highway Express-Bus-On-Freeway Demonstration Project: First-Year Results, Washington, D. C.: Technical Analysis Division, National Bureau of Standards, 1972; Stopher, P. R., "Predicting Travel Mode Choice for the Work Journey," Traffic Engineering and Control, January 1968, pp. 436-439.

[20] Transportation Research Institute, op. cit.

[21] Navin, F. P. and R. I. Gustafson, op. cit.

Reviewing the evidence for these various aspects of travel time, a contradictory and complex picture emerges. For example, terminal and total access times have been found to be particularly onerous.[22] On the other hand, other evidence indicates that total travel time differences are more important.[23] It has also been suggested that travel time differences are not an important factor in modal choice (convenience and frequency were more important).[24] Evidence also exists to suggest that arriving on time at an intended destination is more important than minimizing elapsed travel time in both work and non-work trips.[25] Finally, the effect of trip purpose on the importance of time is not particularly clear. Some evidence exists for time inelasticity for work or business trips and elasticity for other types cf trips. However, contrary evidence also exists (comfort and convenience being shown as more important.)[26] Thus, as concluded earlier under the discussion of convenience, it is reasonably clear that transfer, waiting, and walking time are significant perceptual choice elements in the mode choice situation, and they are independent of gross travel time, and as such, should be singled out by specific measures.[27]

Service Frequency. Mode Choice has been shown to be affected by service frequency. Increased frequency (decreased headways) increases patronage,

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[22] Henderson, C. and J. Billheimer, op. cit.; Lisco, T., op. cit; Nash, A. and S. Hille, op. cit.; National Analysts, 1963, op. cit.; National Analysts, 1964, op. cit.; Pushkarev, B. and J. Zupan, op. cit., Quarmby, D. A., op. cit.

[23] Alpert, M. and S. Davies, op. cit.; Chicago Transit Authority, Skokie Swift: The Communter's Friend, Chicago, 1968; Lansing, J. and G. Hendricks, op. cit.; Stopher, P. op. cit.

[24] Department of Business Administration, University of Maryland, op. cit.

[25] Alpert, M. and S. Davies, op. cit.; Hartgen, D. T. and G. H. Tanner, "Individual Attitudes and Family Activities: A Behavioral Model of Modal Choice," High Speed Ground Transportation Journal, Vol. 4, 1970, pp. 439-467; Nash, A. and S. Hille, op. cit.

[26] Alpert, M. and S. Davies, op. cit.; Department of Business Administration, University of Maryland, op. cit.; Systems Analysis and Research Corporation, Demand for Intercity Passenger Travel in the Washington-Boston Corridor, Boston, Systems Analysis and Research Corporation, 1963.

[27] Algers, S., S. Hansen and G. Tegner, op. cit.

although it may be more important to align vehicle schedules with passenger's schedules.[28] Where the variable service frequency is contained within the attribute of flexibility, it has been shown to be highly determinant for both work/school trips and shopping/personal business trips.[29] Thus, this variable appears to be an important one in the modal choice decision situation.

Storage Availability. There are two basic components to this variable: (1) vehicle storage or parking and (2) package storage. Each of these characteristics are related to the variable of convenience. Availability of parking is determinant for both work and non-work trips.[30] To the extent that package storage is contained within the attribute of ease of travel with packages, it is a determinant attribute in mode choice for shopping/personal business trips, but non-determinant for work/school trips.[31] The car is clearly seen as being superior to the bus or other forms of public transportation in terms of package storage. Thus, the convenience of storing parcels (including luggage for longer trips) in a private vehicle is considered to bias users toward private vehicles.[32]

Other Important Variables. In addition to the variables listed above, some other attributes have recently been determined to be important in mode choice situations for various types of trips. Two attributes which appear to be important, and clearly are related to current concerns for energy and pollution, are low energy use per passenger and low pollution per passenger. Both

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[28] Transportation Research Institute, op. cit.; Lansing, J. B. and G. Hendricks, op. cit.; National Analysts, Inc., op. cit.

[29] Alpert, M. and S. Davies, op. cit.

[30] Ibid.; Chicago Transit Authority, op. cit.; Stopher, P., op. cit.; Voorhees, A. M., G. B. Sharpe and J. T. Stegmaier, Parking as a Factor in Business Supplement: Shopping Habits and Travel Patterns, Special Report 11-B, National Research Council, Highway Research Board, Washington, D. C., 1955; Wilson, F. R., Journey to Work - Modal Split, London: MacLaren and Sons, 1967.

[31] Alpert, M. and S. Davies, op. cit.

[32] Ibid.; Appleyard, D. and R. Okamoto, op. cit.; Bateman, J. R. and J. W. Brown, op. cit.; Department of Business Administration, University of Maryland, op. cit.

of these attributes are determinant for mode choice situations for both work/school and shopping/personal business trips. The attribute of freedom from repairs is also determinant for both work/school and shopping/personal business trips.[33] Presumably, the concern for this attribute is not directly related to increased concerns over energy and pollution. It may be a dimension of convenience or dependability. In any event, these three attributes would appear to be important in a mode choice situation.

Off-System Attributes

The previous discussion has focused entirely upon the on-system characteristics presumed to be important in mode choice. In considering off-system attributes, approximately twenty variables have been considered to be related to mode choice behavior. These attributes may be divided into "user attributes" and "environment attributes." Table 11 lists the variables in their respective categories. With regard to the user attributes, it goes almost without saying that these variables are completely interrelated (at any point in time a single individual represents a composite of the user attributes) and discussing them individually is a matter of convenience. Furthermore, there are many psychological and sociological features which are not included simply because too little is known about their impact on behavior in general, let alone on modal choice behavior.

User Attributes. In reviewing the literature, it would appear that the rich do not differ from poor persons and the young do not differ from older persons in terms of their basic structure of attitudes toward on-system attributes and in the priorities they would place upon different improvements. There are, however, differences in terms of behavior and in terms of satisfaction because income, age, and location provide different groups with differing service levels and differing opportunities to obtain good service. Thus, even though attitudinal structures are similar across population groups, situational variables do intervene and influence behavior.[34]

Differences in household status do not seem to be important with respect

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[33] Alpert, M. and S. Davies, op. cit.

[34] Wachs, M., op. cit.

TABLE 11

OFF-SYSTEM ATTRIBUTES

User Attributes

Household Status
Sex
Age
Employment Status
Education
Dwelling Unit
Vehicle Ownership
Income
Number in Household
Ethnicity
Trip Purpose
Handicaps
Social Demands

Environment Attributes

Land Use Distribution
Climate
Trip Length
Local Nuisance

to weight given to the on-system variables. The weightings for certain attributes are biased by sex; women (on shopping trips) rate "no repairs" and "leaving when they want to" higher than males. Different age groups tend to place importance on different variables. For example, avoidance of repairs and weather protection become increasingly important as age increases. However, "leaving when they want to" and "getting there fast" are unimportant to the 65 and older age groups. Travel time is more important for the working age group (25-65) than for other ages. While the effect of age on travel demand is not entirely clear, it would appear that after age 65, demand decreases substantially.[35]

The attribute of employment status encompasses two variables: (1) occupation, and (2) the employed-unemployed continuum. There appears to be little distinction in the on-system variable "waiting" between full-time, part-time, and unemployed: reliability, no repairs, and travel time are equally important to all three groups. Costs are slightly more important to part-time than to full-time and unemployeds. The effects of occupation on the evaluation of on-system variables has not been well identified. It does appear that an inverse relationship exists between job status and cost, travel time, and reliability.[36]

The effect of education levels is difficult to isolate because they are closely intertwined with occupation, income, etc. However, increased education does seem to be positively associated with demand for travel and a desire for "not being crowded."[37] In terms of the dwelling unit variable, non-owners seem to demand more reliability in their transportation choice. Residents

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[35] Blood, D. M., "A Cross-Section Analysis of the Domestic Inter-City Travel Market," Ph.D. Dissertation, University of Michigan, 1963; Department of Business Administration, University of Maryland, op. cit.; Haney, D. G., The Value of Time for Passenger Cars: Further Theory and Small-Scale Behavioral Studies, Stanford Research Institute, Menlo Park, California, 1964.

[36] Blood, D. M., op. cit.; Lansing, J. B. and E. Mueller with N. Barth, Residential Location and Urban Mobility, Survey Research Center, University of Michigan, Ann Arbor, Michigan, 1964; Department of Business Administration, University of Maryland, op. cit.; Paine, F. T., et al., Consumer Conceived Attributes of Transportation: An Attitude Study, Department of Business Administration, University of Maryland, College Park, Maryland, 1967.

[37] Ibid.

close to downtown place more importance on items such as cost, travel time, protection from the weather, reliability, and avoiding walking more than a block, than do residents located farther from downtown. Where the individual is located in respect to public transportation does not seem to create any differential preference patterns for the various on-system attributes.[38]

People who do not own vehicles tend to rate the following characteristics as having higher importance than do owners: travel time, being on time, costs, and reliability. Increases in ownership are also associated with increased trip generation, although household size and income compound this effect.[39] Lower income individuals place greater importance on time for all trip purposes than do individuals with higher incomes. Middle income individuals place less importance on reliability than do either lower or upper income people. There does appear to be increased trip intensity with increased income, however, the relationship between income and trip generation is not entirely clear.[40] The number of people in the household does not seem to alter the importance of various on-system attributes. However, increased people in the household is related to increased travel demands.[41]

In the case of ethnicity, blacks tend to emphasize time, cost, protection from the weather and crowded vehicles, and reliability (non-work trips). Whites appear to select transportation modes which avoid or reduce contact with ghetto areas and residents. Differentials in travel demand between blacks and whites are probably related to income and occupation differentials (this carries over to non-white students who seem to travel less frequently and in a smaller

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[38] Lansing, J.,E. Mueller and N. Barth, op. cit.; Department of Business Administration, University of Maryland, (1966), op. cit.; Wilson, F., op. cit.

[39] Lansing, J., E. Mueller and N. Barth, op. cit.; Lansing, J. and G. Hendricks, op. cit.; Department of Business Administration, University of Maryland, (1966). op. cit.; Wilson, F., op. cit.

[40] Blood, D. op. cit.; Department of Business Administration, University of Maryland, (1966), op. cit.; Warner, S. L., Stochastic Choice of Mode in Urban Travel: A Study in Binary Choice, Evanston, Illinois: Northwestern University Press 1962.

[41] Lansing, J., E. Mueller and N. Barth, op. cit.; Department of Business Administration, University of Maryland, (1966), op. cit.

area than white students).[42]

Table 12 illustrates that trip purpose does not substantially alter the order of importance of on-system attributes. Grouping trips into the categories of work trip and non-work trip, it is observed that the ordering is similar across the two types of trips, as determined in Baltimore and Philadelphia.[43] These data suggest that travel demands and modal choice should be considered as aspects of derived demand.

The behavioral and mobility characteristics of the handicapped user have not been as systematically researched as might be hoped for in the case of modal choice. It has been suggested that the attributes of comfort, convenience (including accessibility), and information are important to the elderly and physically and/or mentally handicapped. The poor are most concerned with access, reliability, information, and to some degree, cost. The young apparently weight most heavily the convenience and information items.[44] The variable of social demand does not seem to have any relationship with the on-system attributes. This is reflected in both work/school and shopping/personal business trips where the variable has the lowest level of determinance for all attributes.[45]

Environmental Attributes. Data on the effect of environmental attributes on modal choice behavior are very limited. Apparently, land use distribution has no bearing on the importance of transportation system attributes. On the other hand, climate seems to be fairly important (protection from the weather)

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[42] Transportation Research Institute, op. cit.; Department of Business Administration, University of Maryland, 1966, op. cit.; Meyer, J. R., J. F. Kain, and M. Wohl, The Urban Transportation Problem, Cambridge, Massachusetts: Harvard University Press, 1965.

[43] Paine, F. T., et al., op. cit.

[44] Transportation Research Institute, op. cit.; Davies, S. and J. W. Carley, The Transportation Problems of the Mentally Retarded, Research Report 17, The Council for Advanced Transportation Studies, The University of Texas at Austin, 1974; Perle, E. D., "Urban Mobility Needs of the Handicapped: An Exploration," in F. Horton (Ed.) Geographic Studies of Urban Transportation and Network Analysis, Department of Geography, Northwestern University, Evanston, Illinois, 1968, pp. 20-41.

[45] Alpert, M. and S. Davies, op, cit.; Department of Business Administration, University of Maryland, (1966), op. cit.; Paine, F. T., et al., op. cit.

TABLE 12

RANK ORDER OF ON-SYSTEM ATTRIBUTES BY TRIP PURPOSE*

	WORK-TRIP		NON-WORK TRIP	
	Baltimore	Philadelphia	Baltimore	Philadelphia
1.	Repairs	Reliability	Repairs	Reliability
2.	Reliability	Travel Time	Comfort	Weather
3.	Speed	Weather	Cost	Convenience
4.	Cost	Cost	Speed	Cost
5.	Independence (control)	Vehicle Condition	Independence (control)	Travel Time
6.	Traffic (congestion)	Unfamiliarity	Traffic (congestion)	Vehicle Condition
7.	Vehicle Age	Self-Esteem	Vehicle Age	Congestion
8.	-	Diversions (scenery)	-	Unfamiliarity
9.	-	-	-	Diversions
10.	-	-	-	Self-Esteem

* F. T. Paine, et al. Consumer Conceived Attributes of Transportation: An Attitude Study. College Park, Maryland: Department of Business Administration, University of Maryland, June 1967, p. 53. Trip purpose dichotomized because further trip distinction did not substantially alter the ordering. Non-work trips include shopping-personal business, in-town social, out-of-town social. Work trips include work-school.

to users -- ranking behind "time" in importance.[46] Trip length does not seem to have any relationship to ranking of on-system attributes. The local nuisance factor is related to mode choice insofar as unpleasant surroundings deter system utilization. There is a modicum of reason to accept the notion although data are almost nonexistent.[47]

In the prediction of actual choices made by travelers, situational factors may strongly outweigh preferences in influencing daily decisions. Illustrative of this case is the evidence presented by Hartgen. In his study, he found that situational factors such as car ownership and socio-economic status accounted for 80 to 90 percent of the variance in modal choice, while attitudinal variables measuring preferences for particular modal characteristics could explain only 10 to 20 percent of the variance in modal choice. Thus, although attitudes do not vary significantly among travelers of varying socio-economic status, the ability to act in accordance with one's attitudes is governed more by the opportunities available to the individual, and these opportunities do vary with socio-economic status. Given that differences in current modal choices reflect the situational constraints in opportunities, it may be expected that as transit systems become more similar to the automobile in terms of the attitudinal dimensions described in the first section, travelers may be induced to leave their automobiles. Preliminary evidence available from ridership surveys of premium transit service unequivocally supports this view.[49]

CONJOINT ANALYSIS

Consider the following problem: An individual wishes to get from origin A to destination B for trip purpose X. Three alternative forms of transportation are available with the characteristics shown in Table 13. How will the individual rank each alternative in order of preference?

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[46] Bock, F. C., Factors Influencing Modal Trip Assignment, Report 57, National Research Council, Highway Research Board, Washington, D. C., 1968; Department of Business Administration, University of Maryland, (1966), op. cit.

[47] Appleyard, D. and R. Okamoto, op. cit.; Van Streen, C. P., "Traffic Increase Caused by Station Renovations," Railway Gazette, March 1966, pp. 242-243.

[48] Hartgen, D. T., "Attitudinal and Situational Variables Influencing Urban Mode Choice: Some Empirical Findings," Transportation, Vol 3, 1974, pp. 377-392.

[49] Crain, J. and Associates, First-Year Report: San Bernardino Freeway Express Busway Evaluation, Menlo Park, California: John Crain & Associates, 1974; Miller, G. and K. Goodman, op. cit.

TABLE 13

THREE TRANSPORTATION ALTERNATIVES

Alternative #1	Scenery, very easy to look at Moderately crowded No parking problems Moderately easy to find your way
Alternative #2	Scenery, difficult to look at Very crowded Moderately difficult to park Easy to find your way
Alternative #3	Scenery, difficult to look at Not crowded Moderately difficult to park Difficult to find your way

Consider a second problem: A planning agency wishes to evaluate the potential success of alternative forms of transportation with regard to the number of new riders which might be captured. This problem is analogous to the marketing of new products. In marketing, a procedure commonly used to evaluate new product ideas is concept testing. The rationale underlying concept testing procedures is that consumers can respond in a meaningful way to concept descriptions (whether these are in the form of verbal statements, pictorial representation or artist conceptions) and thereby provide guidelines for a "go" "no-go" decision without the cost of developing and marketing (in a test market or in a full-blown introductory campaign) the actual product. Studies of this type attempt to assess consumer's direct reaction to the concept by using intention to buy questions, or in somewhat more sophisticated studies by presenting the respondents with a choice among various concepts and competitive brands. Concepts are commonly described in terms of a unique combination of a number of product attributes along some structural, functional, psychological, social and economic dimensions. When consumers respond to a single, multi-attribute, concept description, the researcher is unable to identify to which of the various multi-attribute features the consumers respond favorably, or whether there is another combination of attributes which may lead to a more favorable consumer response.[50]

Both problems have a common structure. First, alternatives are characterized along more than a single dimension -- they are multi-attribute. Second, the individual is asked for an overall judgement about their relative value; in short, the individual is asked to order them according to some criteria. But to do this requires the individual to make complex trade-offs in a situation in which it is likely that no alternative is clearly better than another on every dimension of interest.[51]

In the past few years, new measurement techniques have been developed in the fields of mathematical psychology and psychometrics which may be applied in these situations. These procedures start out with the individual's overall

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[50] Wind, Y., S. Jolly and A. O'Conner, "Concept Testing as Input to Strategic Market Simulations," Paper presented at 58th International Conference of the American Marketing Association, Chicago, Illinois, 1975.

[51] Green, P. E. and Y. Wind, "New Way to Measure Consumers' Judgements," Harvard Business Review, July-August 1975, pp. 107-117.

or global judgements about a set of complex, multi-attribute alternatives. The techniques then decompose the respondent's overall evaluations into separate, and compatible, utility scales by which the original global judgements (or others involving new combinations of the attribute levels) can be reconstituted. The approach of particular concern here is known as conjoint measurement. Its procedures require only rank-ordered input, yet they yield interval-scaled output.[52]

The ability to decompose overall judgements into psychological components provides valuable information about the relative importance of various attributes, as well as information about the value of various levels along a single attribute. In some models, sufficient information can be provided to estimate the psychological interaction effects as well.

Conjoint Measurement

Conjoint measurement is concerned with the joint effect of two or more independent variables on the ordering of a dependent variable. For example, one's preference for various modes of transportation may depend upon the joint influence of such variables as cost, travel time, convenience, dependability, privacy, and so on. Mathematical psychologists, beginning with the paper by Luce and Tukey,[53] have developed procedures for simultaneously measuring the joint effects of two or more variables at the level of interval scales (with common unit) from rank-ordered data alone. One important special case of conjoint measurement is the additive model. This model is analogous to the absence of interaction in the analysis of variance involving two (or more) levels of two (or more) factors in a completely crossed design.[54] In the analysis of

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[52] In the case of finite data, the scale is technically an ordered metric; as the number of input values increases, however, a unique representation at the interval scale level is approached. Green, P. E. and V. R. Rao, "Conjoint Measurement for Quantifying Judgmental Data," Journal of Marketing Research, August 1971, pp. 355-363.

[53] Luce, R. D. and J. W. Tukey, "Simultaneous Conjoint Measurement: A New Type of Fundamental Measurement," Journal of Mathematical Psychology, Vol. 1, 1964, pp. 1-27.

[54] Coombs, C. H., R. M. Dawes and A. Tversky, Mathematical Psychology, An Elementary Introduction, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970.

variance procedure, one tests whether or not original cell values can be portrayed as additive combinations of row and column effects. In additive conjoint measurement, however, one asks if the cell values can be monotonically transformed so that additivity can be achieved.[55]

Since Luce and Tukey's work, mathematical psychologists have extended additive conjoint models to deal with non-additivity, partially ordered data, and any polynomial type of function. Similar to the situation for the additive model, a data matrix satisfies the (more general) polynomial model whenever it is possible to rescale each cell entry so that it is represented by a specified polynomial function of the row and column variables, and the representation preserves the rank order of the original cell entries as closely as possible.[56]

Some Fundamental Properties

Of particular concern in the type of problems illustrated above, is the derivation of an interval-scaled measurement. The first measurement theories leading to ratio- or interval-scale measurement were based on an empirical relational system that involves, in addition to an ordering of the objects, a concatenation operation of some kind.[57] Later it was shown that, given that the structure of the objects set is sufficiently enriched, an interval measurement can be obtained from an empirical relational system that involves only the ordering of objects.[58] With the development of conjoint measurement, a very general scheme for interval measurement based on ordering, provided that

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[55] Green, P. and V. Rao, op. cit.

[56] A polynomial function involves a specific combination of sums, differences, and products of its arguments. Tversky, A., "A General Theory of Polynomial Conjoint Measurement," Journal of Mathematical Psychology, Vol. 4, 1967, pp. 1-20; Young, F. W., "Polynomial Conjoint Analysis of Similarities: Definitions for a Specific Algorithm," Research No. 76, Psychometric Laboratory, University of North Carolina, 1969.

[57] Campbell, N. R., Physics: The Elements, London: Cambridge University Press, 1920.

[58] Suppes, P. and M. Winet, "An Axiomatization of Utility Based on the Notion of Utility Differences," Management Science, Vol. 1, 1955, pp. 259-270.

the contributions of two or more distinct factors are considered simultaneously, became available.[59]

The basic idea of conjoint measurement may be easily characterized. Suppose an empirically defined weak ordering, $\leq$, over a set of objects exists. Suppose further that two factors contribute to the position of an object in the ordering. (For simplicity consider other relevant factors to be constant.) Thus, if levels of the first factor are labeled A, B, C, ... (with or without subscripts) and levels of the second factor are labeled P, Q, R, ... (with or without subscripts), the objects may be labeled by pairs, (A, P), (A, Q), (B, Q), etc. If $(A, P) \leq (B, Q)$ and $(B, Q) \leq (A, P)$, then the objects (A, P) and (B, Q) are equivalent with respect to the quantity determining the order. This equivalence is denoted by $(A, P) \approx (B, Q)$.[60]

Given the above, select a particular object, (A_0, P_0), as having the zero position in the ordering, and then select another object (A_1, P_0), such that $(A_0, P_0) \leq (A_1, P_0)$, but not $(A_0, P_0) \approx (A_1, P_0)$, as having the same unit position. Then suppose that some P_1 can be found such that (A_0, P_1) is equivalent to (A_1, P_0); then a shift from A_0 to A_1 in the first factor produces the same change in the quantity being measured as the shift from P_0 to P_1 in the second factor. If the contributions of the two factors are measured in such a way as to be additive, then the difference between (A_1, P_1) and (A_0, P_0) is twice as large as the difference between (A_1, P_0) and (A_0, P_0) and between (A_0, P_1) and (A_0, P_0). If there exist some A_2 and some P_2, such that:

$$(A_0, P_2) \approx (A_1, P_1) \approx (A_2, P_0),$$

then both A_2 and P_2 produce twice the difference from (A_0, P_0) that A_1 and P_1 produce, etc. It follows that by matching changes produced by varying the level of one factor with changes produced by varying the level of the other, and by considering the contributions of the two factors as additive, one obtains a scale on each factor, with scale values summing to give a scale for the quantity being measured.[61]

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[59] Luce, R. D. and J. W. Tukey, op. cit.

[60] Krantz, D. H., "Conjoint Measurement: The Luce-Tukey Axiomatization and Some Extensions," Journal of Mathematical Psychology, Vol. 1, 1964, pp. 248-277

[61] Ibid.

Luce and Tukey give axioms which permit this construction of three scales to be carried through in detail. They prove that these are interval scales, i.e., the assignment of scale values is unique up to positive linear transformations.[62] Krantz extends the system of Luce and Tukey by separating the results based on the equivalence relation, $\approx$, defined from the weak ordering, from the results which properly involve the concept of ordering. By assuming an equivalence relation, together with the Luce-Tukey axioms specialized for it, Krantz introduces by definition a "concatenation" operation in the object set. The resulting structure is shown to be a commutative group. The order relation is then introduced, and the measurement theorems follow from standard theorems on ordered groups.[63]

This type of axiomatization in terms of the ordering of the joint effects of two factors yields an interval scale measurement of the additive type. If the composition rule is additive, one seeks real-valued utility functions for the commodities involved such that the utility of any commodity bundle equals the sum of the utilities of its components, and the order of these utilities corresponds to the individual's ordering of the commodity bundles. If, however, the contributions of some of the components, e.g., cost and convenience, are not independent, a more complicated measurement model or composition rule is required. A generalized theory of such a model is called a polynomial measurement model.

Any (partially) ordered set of data, where each datum can be regarded as the effect of treatment combinations (a, b, ...k) of the factors A, B, ...K is called a data structure, denoted by D, and each separate datum in the structure is referred to as a data element. A composition rule which represents each data element as a specified polynomial function of its components is a polynomial measurement model.

> A data structure D is said to satisfy a polynomial measurement model M whenever there exists a real-valued function f defined on D and real-valued functions f_A, f_B,...,f_K defined on the factors A, B,..., K such that, for any data element (a, b,...,k):
>
> (i) $f(a, b,\ldots,k) = M(f_A(a), f_B(b),\ldots,f_K(k))$

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[62] Luce, R. C. and J. W. Tukey, op. cit.

[63] Krantz, D. H., op. cit.

where M is a polynomial function of its arguments, that is, a specified combination of sums, differences and products of the functions f_A, $f_B, \ldots,$ f_K;

(ii) for all $x = (a, b, \ldots k)$, $x' = (a', b', \ldots, k')$,

$x >_0 x'$ implies $f(x) > f(x')$,

$x =_0 x'$ implies $f(x) = F(x')$,

where $>_0$ and $=_0$ denote the order observed in the data.[64] (1)

A data structure satisfies a polynomial measurement model M whenever it is possible to scale each of its components or treatments, such that every data element is represented as a specified polynomial of the scale value of its components, and such that the representation preserves the order of the data.[65]

A numerical data structure D_g is a data structure D together with a real valued function g defined for all x and D.

A numerical data structure D_g is said to satisfy a polynomial measurement model M whenever D satisfies M in the sense of (1) with the specific function g used in place of f.[66] (2)

When measurement models are applied to ordinal or numerical data structures, they are referred to as ordinal or numerical respectively. Clearly, whenever the data satisfy a numerical model, they also satisfy the corresponding ordinal model, but not conversely. Determining whether a given data structure satisfies a given measurement model is equivalent to determining whether the corresponding system of polynomial equations and inequalities is solvable. Thus, in (polynomial) conjoint measurement, the individual starts with an ordering of the dependent variable and investigates what properties this order should satisfy so that it can be represented numerically according to the proposed composition principal. Viewed numerically, all composition rules are

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[64] Tversky, A., op. cit.

[65] Ibid.

[66] Ibid.

equally refutable. However, when composition rules are evaluated from an ordinal viewpoint, this is no longer true.[67]

Clearly, the fundamental properties discussed above appear to be of substantial import with respect to measuring the effects of multiple attributes in the mode choice decision situation. However, it is important to ascertain how much of this potential has been realized in attempted applications of conjoint measurement ideas.

Some Operational Properties[68]

To illustrate the application of conjoint measurement, suppose a company is interested in marketing a new spot remover for carpets and upholstery. A new product has been developed by the technical staff that is designed to handle tough, stubborn spots. The firm's management is concerned about five attributes or factors that it expects will influence consumer preference: an applicator-type package design, brand name, price, a Good Housekeeping Seal of Endorsement, and a money-back guarantee.

Management is considering three package designs. These are illustrated in the upper portion of Table 14. Three brand names are being considered: K2R, Glory, and Bissell. Two of these brand names belong to competitors and are already on the market, whereas one is the company's present brand name choice for its new product. Three alternative prices are being considered: $1.19, $1.39, and $1.59. Since there are three alternatives for each of these factors, they are called three-level factors. The Good Housekeeping Seal and money-back guarantee are two-level factors, since each of these are present or not. It follows that a total of 3 x 3 x 3 x 2 x 2 = 108 alternatives would have to be tested if the researcher were to array all possible combinations of the five attributes.

Obviously, administering a consumer evaluation study of this magnitude would be prohibitive in terms of cost, as well as respondent confusion and fatigue. The researcher has alternatives, one of which is to take advantage

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[67] Krantz, D. H. and A. Tversky, "Conjoint Measurement Analysis of Composition Rules in Psychology," Psychological Review, Vol.78, No. 2, 1971, pp. 151-169.

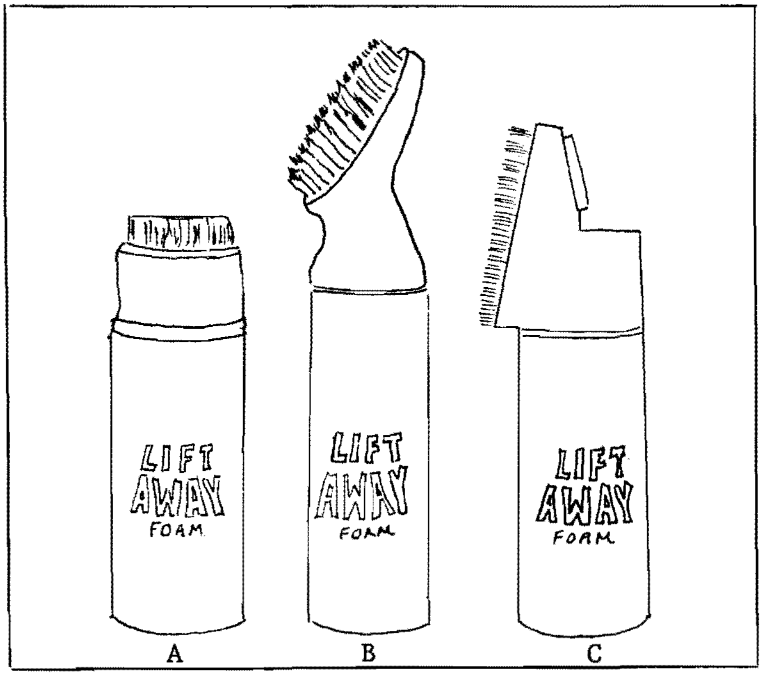
[68] Unless otherwise noted, the examples used in this section are drawn from Green and Wind, (1975), op. cit.

TABLE 14

EXPERIMENTAL DESIGN FOR CONSUMER EVALUATION OF A NEW CARPET CLEANER

(After Green & Wind, 1975)

Package Designs



Orthogonal Array

	Package Design	Brand Name	Price	Good House-keeping seal	Money-back Guarantee?	Respondent's Evaluation (Rank No.)
1	A	K2R	$1.19	No	No	13
2	A	Glory	1.39	No	Yes	11
3	A	Bissell	1.59	Yes	No	17
4	B	K2R	1.39	Yes	Yes	2
5	B	Glory	1.59	No	No	14
6	B	Bissell	1.19	No	No	3
7	C	K2R	1.59	No	Yes	12
8	C	Glory	1.19	Yes	No	7
9	C	Bissell	1.39	No	No	9
10	A	K2R	1.59	Yes	No	18
11	A	Glory	1.19	No	Yes	8
12	A	Bissell	1.39	No	No	15
13	B	K2R	1.19	No	No	4
14	B	Glory	1.39	Yes	No	6
15	B	Bissell	1.59	No	Yes	5
16	C	K2R	1.39	No	No	10
17	C	Glory	1.59	No	No	16
18	C	Bissell	1.19	Yes	Yes	1*

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*Highest Ranked

of a special experimental design, called an orthogonal array, in which the test combinations are selected so that the independent contributions of all five factors are balanced. In this way, each factor's weight is kept separate and is not confused with those of the other factors. The details of orthogonal arrays are discussed in the subsequent review section.

In the lower portion of Table 14, an illustration of an orthogonal array is given which involves only 18 of 108 possible combinations that the hypothetical company wishes to test. For the test, the researcher makes up 18 cards. An artist's sketch of the package design, A, B, or C, and the relevant details regarding each of the other four factors appear on each card. After describing the new product's functions and special features, the researcher shows the respondents each of the eighteen cards and asks them to rank the cards in order of their likelihood of purchase.

The last column of Table 14 shows one respondent's actual ranking of the eighteen cards; rank number one denotes the highest evaluated concept. It is worth noting at this point that only ranked data are obtained, and in this case only 18 (out of 108) combinations are evaluated.

Computing the Utilities. Various computer programs exist for the computation of the utility scales of each attribute.[69] These scales determine how influential each attribute is in the consumer's evaluation. Ranked data of a single respondent (or the composite ranks of a group of respondents) are entered in the program. The computer then searches for a set of scale values for each factor in the experimental design. Scale values for each level of each factor are chosen such that when added together, the total utility of each combination corresponds to the original ranks as closely as possible.

As can be seen in Figure 1, the technique obtains the utility function for each level of each factor. For example, to find the utility for the first

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[69] See for e.g., Johnson, R. M., "Pairwise Nonmetric Multidimensional Scaling," Psychometrika, Vol. 38, No. 1, 1973, pp. 11-18; Kruskal, J. B., "Analysis of Factorial Experiments by Estimating Monotone Transformations of the Data," Journal of the Royal Statistical Society, Series B, March 1965, pp. 251-263; Young, F. W., "A Model for Polynomial Conjoint Analysis Algorithms," in R. N. Shepard, A. K. Romney and S. B. Nerlove (Eds.), Multidimensional Scaling, Vol. 1, Theory, New York: Seminar Press, 1972, pp. 69-104.

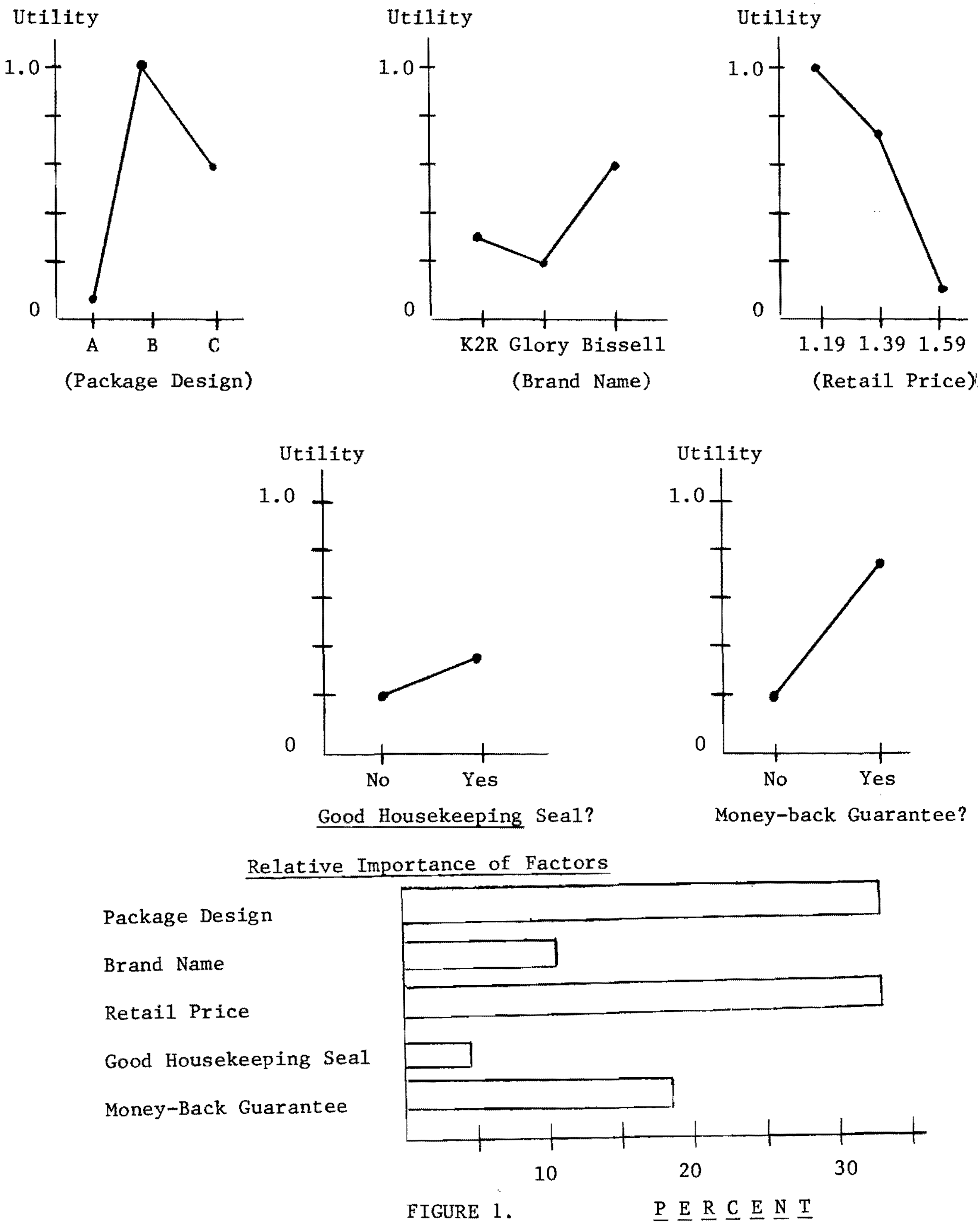

FIGURE 1.

RESULTS OF COMPUTER ANALYSIS OF EXPERIMENTAL DATA OF TABLE 5
(After Green & Wind, 1975)

TABLE 15

LEVELS OF ATTRIBUTES MEASURED IN SURVEY
(After Fiedler, 1972)

Attributes	Levels				
	28th Floor	20th Floor	12th Floor	4th Floor	
View	River View	River View	No View of River	No View of River	
Purchase Price	$46,000 $49,000	$52,000 $55,000	$59,000 $64,000	$66,000 $73,000	$74,000 $82,000
Unit Type	Plan A Plan B		Plan C Plan D		Plan E Plan F

You could have an apartment with a view. . .

And could be on the. . .	Toward the Hudson River	Away from the Hudson River
28th Floor		
20th Floor		
12th Floor		
4th Floor		

FIGURE 2. SAMPLE QUESTIONNAIRE PAGE
(After Fiedler, 1972)

combination in Table 14, we read off the utilities of each factor level in the five charts of Figure 1: U(A) = 0.1; U(K_2R) = 0.3; U($1.19) = 1.0; U(No) = 0.2; U(No) = 0.2. The sum of the five separate utilities gives us the total utility of 1.8 for the first combination. On the other hand, the utility of combination 18 is 3.1 (0.6 + 0.5 + 1.0 + 0.3 + 0.7), which is the respondent's highest evaluation of all eighteen combinations listed. From Figure 1, it may be determined that if combination 18 is modified to include package design B (in place of C), its utility is even higher. Even though this specific combination did not appear among the original 18, it is possible to obtain its utilities in this fashion, and in fact, it represents the highest possible utility available.

Importance of Attributes. If the company's marketing researchers focus attention on the package design, it can be seen from Figure 1 that design B displays the highest utility. Furthermore, all utility scales are expressed in a common unit (although their zero points are arbitrary). Consequently, it is possible to compare utility ranges from factor to factor to get some idea of their relative importance.

The lower portion of Figure 1 shows the relative size of the utility ranges expressed in histogram form. As is evident, the technique allows the determination of the importance of each attribute in relation to the others. However, it should be mentioned that the relative importance of a factor depends on the levels that are included in the design. For example, had price ranged from $1.19 to a high of $1.89, its relative importance might easily have exceeded that for package design. Obviously, this procedure is limited in the same manner as many others in that it cannot deal with alternatives which exceed the bounds of the set created by the researcher. Regardless of this limitation, the procedure does provide an indication of what factors to concentrate on in marketing a product.

The preceding example illustrates one procedure for applying conjoint measurement. This type of procedure has been utilized in several studies, as reported in Green and Wind.[70] Another procedure for conjoint measurement is essentially deriving a series of pairwise preference orders for all possible

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[70] Green, P. E. and Y. Wind, op. cit.

combinations of attributes of the item or product of concern.[71] Illustrative of this type of procedure was the application of conjoint measurement to develop a pricing structure for a new apartment complex. Table 15 lists the levels of attributes measured in the survey. Figure 2 illustrates a sample questionnaire page in the survey. In this study, the tasks given the respondents were simple. First, the respondent is asked to imagine eight possible apartments, each differing only in floor and view. If the respondent could have any of the eight, which would be the first choice? This procedure was repeated until the respondent had provided rank orders of preferences for all eight units. Using such a ranking procedure, each of the four attributes was compared to each other. In this procedure, direct examination of the trade-off data allows only two attributes to be compared at a time. Clearly, since each apartment unit is characterized by four attributes, it is desirable to compute utilities for each level of each attribute so that these may be combined to predict each respondent's choice from among various types of apartments.[72]

The computational procedure used is similar to pairwise nonmetric factor analysis.[73] A short example suffices to explain the technique. Suppose a respondent has generated ranked data as shown in Figure 3. The procedure solves for a number for each floor and one for each of the two types of views. These numbers are determined so that their products have the same (or nearly the same) rank orders as the original data. Figure 4 illustrates such a situation. As can be seen from Figure 4, these numbers have the same rank order as the original data. However, this is not always the case, since when an attribute is compared to several others, the respondent may be inconsistent in her/his preferences so that no set of numbers can be found which will fit the data perfectly.[74]

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[71] Johnson, R. W., "Trade-Off Analysis of Consumer Values," Journal of Marketing Research, May 1974, pp. 121-127.

[72] Fiedler, J. A., "Condominium Design and Pricing, A Case Study in Consumer Trade-Off Analysis," Paper presented at the Association for Consumer Research, Chicago, 1972.

[73] Johnson, R. M., (1973) op. cit.; Johnson, R. W., (1974), op. cit.

[74] Fiedler, J. A., op. cit.

	You could have an apartment with a view. . .	
And could be on the. . .	Toward the Hudson River	Away from the Hudson River
28th Floor	1	4
20th Floor	2	5
12th Floor	3	7
4th Floor	6	8

FIGURE 3.

SAMPLE QUESTIONNAIRE DATA
(After Fiedler, 1972)

		View .7	No View .3
28th Floor	.4	.28 (1)	.12 (4)
20th Floor	.3	.21 (2)	.09 (5)
12th Floor	.2	.14 (3)	.06 (7)
4th Floor	.1	.07 (6)	.03 (8)

FIGURE 4.

PAIRWISE PRODUCTS OF UTILITIES
(After Fiedler, 1972)

To determine how well the utilities fit the data, Kendall's tau, which involves a count of the pairs of ranks which are in the right order and those which are in the wrong order, is used. In the case of the preceding example, tau has a value of 1.0. A tau of 0.0 would indicate no order relationship between the predicted value and the data. Data were obtained for all the attributes listed in Table 15. These data were supplied to the utility calculating program for each respondent. Illustrative of a respondent's utilities are those results contained in Table 16. When these utilities are cross-multiplied and their products rank ordered, it is found that the respondent's data were correctly predicted for four of the six matrices. There were three pairwise errors of prediction in the remaining two matrices. A tau of .986 is shown.[75]

As with the method of conjoint measurement first described, the preceding technique has been used to evaluate or test several concepts. It should be clear from the discussions of both procedures that the application of conjoint measurement to evaluating concepts or product mixes would appear to have great potential. Both of these types of procedures are used in the research reported in later sections of this report.

MULTIFACTOR DESIGNS

As Green has pointed out, one of the problems that researchers soon encounter in applying conjoint measurement models is that evaluation problems of realistic complexity quickly generate a large number of multi-attribute profiles if a full factorial design is used.[76] Consider a design in which only five attributes are considered, each at three levels, this would result in a 3^5 design or 243 combinations. The problem of ranking (or otherwise evaluating) 243 objects is by no means easily resolved.

It seems reasonable to assume that researchers confronted with this sort

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[75] Ibid.

[76] Green, P. E., "On the Design of Choice Experiments Involving Multifactor Alternatives," Journal of Consumer Research, Vol. 1, September 1974, pp. 61-68.

TABLE 16

EXAMPLE OF A RESPONDENT'S UTILITIES
(After Fiedler, 1972)

Attribute:	Level	Utility	Attribute:	Level	Utility
Floor:	28th	.315	Price:	$52,000	.738
	20th	.311		$59,000	.217
	12th	.271		$66,000	.035
	4th	.103		$74,000	.010
River View:		.769	Unit:	Plan B	.471
No View:		.231		Plan C	.403
				Plan D	.125
				Plan E	.001
$\text{tau} = \frac{441 - 3}{444} = \frac{438}{444} =$		.986			

of problem would like to reduce the number of multifactor stimuli in the design of a choice experiment. Other questions also arise in this context, however: (1) the number of factors to vary in each set of stimuli that are presented to the respondent; (2) the number of stimuli to present in a specific set of evaluation trials; and (3) the type of utility model to apply in representing the respondent's evaluation.[77]

To illustrate the type of considerations involved, assume that the researcher wishes to develop utility functions at the individual respondent level (rather than pooled data across respondents). In addition to this, assume that the multifactor stimuli are to be rated or ranked by the respondent on some type of desirability or interest scale. The researcher may employ either metric or nonmetric methods to decompose these overall evaluations and utility scales.[78] The kinds of approaches the researcher might use may be classified in terms of the descripters listed in Table 18.

All of the questions in Table 17 are underlain by practical considerations. For example, if a main-effects only (no interactions) utility model is assumed to apply, the researcher may wish to use a highly fractionated design in which the respondent receives only a small fraction of the possible combinations. Commonly, these designs will differ, depending on whether all factors have the same number of levels or not. Similarly, the choice of the number of factors to vary in a specific round of trials or how many stimuli to present for evaluation at a single trial are also of pragmatic concern. It may be believed that a respondent is unable to deal cognitively with several factors varying simultaneously or that the respondent cannot rank more than a dozen stimuli at a single time. There will also be occasions where the number of levels within some factor is so large (12 or over) that even fractionated designs are not practical. In such cases, the researcher may utilize a procedure that estimates consumer utilities in a stage-wise fashion.[79]

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[77] Ibid.

[78] Green, P. E., "On the Analysis of Interactions in Marketing Research Data," Journal of Marketing Research, Vol. 10, November 1973, pp. 410-420.

[79] Green, P. E., (1974), op. cit.

TABLE 17

CHECKLIST FOR MULTIFACTOR DESIGNS
(After Green, 1974)

Query	Response
1. What type of model does the researcher wish to apply?	☐ a. Main effects only ☐ b. Main effects plus selected interaction effects
2. What is the nature of the levels comprising each factor?	☐ a. Each factor has the same number of levels ☐ b. Number of levels varies across factors
3. How many factors does the researcher wish to consider in each set of stimulus presentations?	☐ a. All factors ☐ b. A subset of the factors
4. How many stimuli does the researcher wish to present in any single evaluation trial?	☐ a. All stimuli ☐ b. A subset of the stimuli
5. What type of utility estimation procedure does the researcher wish to employ?	☐ a. Single-stage procedure ☐ b. Multi-stage procedure

In the following review, the questions in Table 17 are treated with regard to the topics of: (1) orthogonal arrays (symmetrical and asymmetrical); (2) incomplete block designs (balanced and partially balanced); and (3) measurement procedures for dealing with the problems of large numbers of factors or factor levels.

Orthogonal Arrays

Consider questions 1 and 2 in Table 17. The problem of designing experiments involving large numbers of factors or factor levels may be dealt with through utilizing fractional factorial designs. When using fractional factorial designs, the researcher trades off the measurement of all possible interaction effects to obtain a smaller number of replicates in which, for example, all single-factor (main) effects in two-factor interactions can still be estimated without confounding. With this class of designs, the researcher assumes that all higher-order interactions (three-factor and beyond) are negligible.[80]

One type of fractional factorial design is the Latin Square Design. This design achieves a high parsimony in number of combinations by neglecting all interaction effects. Green suggests that in many evaluation-type experiments this may be sufficiently accurate, particularly if the researcher is able to transform the original response data monotonically before estimating the models parameter values.[81] Two (orthogonal) Latin Squares may be combined to obtain a Graeco-Latin Square. Such a Graeco-Latin Square is illustrated in Figure 5 for three factors, each of three levels. It should be noted in this illustration that each pair C_iD_j appears exactly once on the table and that each C_iD_j separately appear once in each row or column.

Building on the preceding notion (illustrated by the Graeco-Latin Square), orthogonal arrays develop even more highly fractionated designs in which all main effects can be estimated on an unconfounded basis, assuming that all interactional effects can be neglected. Such arrays represent the most

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[80] Cochran, W. G. and G. M. Cox, Experimental Designs, New York: John Wiley & Sons, 1950; Fisher, R. A., "The Theory of Confounding in Factorial Experiments in Relation to Theory of Groups," Annals of Eugenics, Vol. II, 1942, pp. 341-353; Winer, B. J., Statistical Principles in Experimental Design, 2nd Edition, New York: McGraw-Hill Book Company, 1973.

[81] Green, P. E., (1973), op. cit.

		FACTOR B		
		1	2	3
FACTOR A	1	C_1D_1	C_2D_3	C_3D_2
	2	C_2D_2	C_3D_1	C_1D_3
	3	C_3D_3	C_1D_2	C_2D_1

FIGURE 5. GRAECO-LATIN SQUARE FOR THREE FACTORS, BY THREE LEVELS

parsimonious set of designs available for main-effect parameter estimation.[82]

Symmetric Versus Asymmetric Orthogonal Arrays

To explicate the notion of orthogonal arrays, assume that each factor in a factorial design has the same number of levels. If so, the design is symmetric. In general, if each factor is at the same k levels, then an orthogonal array leading to the unconfounded estimation of all main effects can be constructed if k is a prime or part of a prime.[83] Addelman has developed several basic designs for symmetrical and asymmetrical orthogonal arrays.[84] In the case of orthogonal arrays (symmetric or asymmetric), a necessary and sufficient condition that the main effects of any two factors be uncorrelated (unconfounded), is that each level of one factor occurs with each level of another factor with proportional frequencies. If the array is symmetric, each level will occur an equal number of times within each factor. Asymmetric orthogonal arrays are usually developed by collapsing levels of certain symmetric arrays, while observing the condition of proportionality. In summary then, treatment of the questions 1 and 2 from Table 17 requires the consideration of fractional factorials. The most parsimonious of such designs is the special case of orthogonal arrays (symmetric or asymmetric). These are main-effects only designs.[85]

Incomplete Block Designs

A different type of problem is addressed by questions 3 and 4 of Table 17. To illustrate, assume that the researcher has one treatment with several levels,

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[82] Green, P. E., (1974), op. cit.

[83] Addelman, S., "Orthogonal Main-Effect Plans for Asymmetrical Factorial Experiments," Technometrics, Vol. 4, 1962, pp. 21-46; Bose, R. C. and K. A. Bush, "Orthogonal Arrays of Strength Two and Three," Annals of Mathematical Statistics, Vol. 23, 1952, pp. 508-524; Plackett, R. L. and J. P. Burman, "The Design of Optimum Multi-Factorial Experiments," Biometrika, Vol. 33, 1946, pp. 305-325; Raghavarao, D., Constructions and Combinatorial Problems in Design of Experiments, New York: John Wiley & Sons, 1971.

[84] Addelman, S., op. cit.

[85] Green, P. E., (1974), op. cit.

additionally assume, for one reason or another, that the researcher is unable to give each respondent each level of the treatment in a given set of trials. Obviously, the problem is to split the treatment levels across several blocks of trials so as to achieve some type of balance.

Balanced Incomplete Block Designs. One procedure that may be utilized is the balanced incomplete block design (BIB). Given a set of v treatment levels, b blocks, k ($<$ v) items per block, r replications, and λ sets of pairs, BIB designs are characterized by the following conditions:[86]

1. Each treatment level appears (at most) once in each block.
2. Each treatment level appears in exactly r replications.
3. Each pair of treatment levels occurs at exactly λ times together.

Moreover, BIB designs satisfy the equations:

$$vr = bk \tag{3}$$

$$\lambda(v - 1) = r(k - 1) \tag{4}$$

BIB designs are available for a wide class of treatment levels and block sizes. They can be advantageously applied in conjunction with the concept of orthogonal arrays.[87]

Partially Balanced Incomplete Block Designs. If the restriction that each pair of treatment levels must appear the same number (λ) of times is relaxed, more general types of incomplete block designs may be developed. Partially balanced incomplete blocks (PBIB) with two associate classes are characterized by the conditions:[88]

1. Every treatment appears (at most) once in each block.
2. Each of v treatment levels appears in exactly r replications in b blocks of k items each.
3. Each pair of treatment levels occurs either:
   a. Exactly λ_1 times (first associates) or
   b. Exactly λ_2 times (second associates).

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[86] Ibid.

[87] Cochran, W. G. and G. M. Cox, op. cit.

[88] Clatworthy, W. H., "Partially Balanced Incomplete Block Designs with Two Associate Classes and Two Treatments Per Block," Journal of Research of the National Bureau of Standards, Vol. 54, 1955, pp. 177-190.

A large number of methods are available for constructing PBIB designs with $k \geq$ two levels per block. In the present context, the objectives of using PBIB and BIB designs are similar: to reduce the number of profile stimuli (or factors) presented at any one time, while maintaining some type of balance across presentations.[89]

Single- Versus Multi-Stage Utility Estimation Methods

The last question on the checklist involves selection of a procedure for estimating utility functions. In some instances, the researcher may have ten or twelve levels of one or more factors. Such a situation renders orthogonal arrays inappropriate. In addition, the number of levels may differ markedly from factor to factor. A three-stage procedure, as follows, may be utilized to treat this problem:[90]

1. separate estimation of each single-factor utility scale, followed by
2. presentation of an orthogonal array drawn from a 2^n factorial design made up of "end-point" utility-level descriptions, followed by
3. rescaling of single-factor utilities in accordance with the common scale unit derived from evaluations of the orthogonal array stimuli in the second stage.

The three-stage approach possesses a good deal of flexibility for dealing with a relatively large (and a not necessarily equal) number of levels within a factor. A disadvantage, of course, is that three steps are involved. Other procedures are available to carry out the multi-stage approach.[91] It is sufficient to say that the orthogonal array still plays a critical role in this general class of utility estimation procedures.

In summary, where the researcher is faced with a problem of reducing the number of possible factorial combinations (which can easily run into the thousands) to some more manageable set, orthogonal arrays and incomplete block

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[89] Green, P. E., (1974), op. cit.

[90] Green, P. E., "On the Design of Multi-Attribute Choice Experiments Involving Large Numbers of Factor Levels," Paper presented at the meetings of the Association for Consumer Research, Boston, 1973.

[91] Ibid.

designs provide a very useful way for designing multi-factor choice experiments. The concept of orthogonal arrays as a main-effects estimation design is quite general. With relatively few combinations (under 30 in most cases), the researcher can still estimate all main effects on an unconfounded basis for a dozen or more factors, each at two or three levels. The BIB and PBIB designs can be used in ways which are complimentary to orthogonal arrays. In both BIB and PBIB designs the objective is to take a single "treatment" (with a large number of levels) and present the levels in sets of blocks while maintaining various kinds of balance across levels. The utilization of these types of procedures in the context of the mode choice problems is considered later in this report.

SUMMARY

The preceding literature review was rather far-ranging in its subject and scope. As the first part indicates, the problem of mode choice has received extensive investigation. Increasing specificity is being developed regarding the attributes of importance in the mode choice situation. What has become clear is the necessity to begin to isolate the interaction or part-worths of the various attributes which go together to make up the factors which determine people's choices of modes in given situations. The procedures of conjoint measurement provide a set of tools which may be particularly applicable to achieving this kind of analysis on mode choice attributes. Given that most mode choice attributes will have multiple levels, and there are many attributes of potential concern in the mode choice situation, it is clear that some special procedures are necessary to reduce the factorial design to manageable proportions. The literature on orthogonal arrays and incomplete block designs provides such methods. The literature which was reviewed in this chapter provides the context for the research undertaken in this part of the project and reported herein.

VII. RESEARCH METHODOLOGY

Given the focus on determining the trade-offs which may be made by individuals faced with mode choice situations, and given the types of issues previously discussed, this chapter presents the research methodology used in this study. Several operational problems are addressed and the procedures adopted to treat the issues summarized. The first problem discussed is that of selecting the determinant attributes for evaluation. Following this, the interview design issue is characterized, including the pretesting and modifications of the instruments. Finally, the procedure for selecting the sample of respondents is discussed.

SELECTION OF DETERMINANT ATTRIBUTES

In the preceding chapter, a large number of on-system and off-system attributes, which are presumed to affect mode choice, were discussed. The concern here is with the selection of some of these attributes for evaluating the combinatorial rules utilized by a class of travelers. Since the focus of this research is on identifying factors which might be utilized by policy makers to improve the transportation system, the types of attributes which might be considered for evaluation must be those which have the possibility of being directly affected by policy maker's actions. A brief discussion of how a set of these possible factors were chosen for inclusion in this project follows.

Some Issues of Selection

Before discussing the attributes which have been selected, it is appropriate to discuss some of the types of issues which had to be resolved before the particular attributes could be selected. One of the implications of the previous discussion on multi-factor designs is that the number of attributes being evaluated is of some substantial importance. The problem is one in which two bounds may not be exceeded, but the appropriate middle range is ill-defined. In the first instance, large numbers of attributes will yield treatment designs which are beyond the endurance capabilities of respondents. At the other hand, too few attributes will not provide a design which portrays any of the real complexity of the decision making process. The problem with the number of attributes is compounded by the number of levels of each attribute. As pointed out earlier, in a situation where only five attributes are considered, each at three levels, a 3^5 design of 243 combinations would result. Obviously, many more than five attributes of transportation systems have been suggested as being important in mode choice. Likewise, it is quite conceivable that these attributes will have three or more possible levels each. Thus, this issue of the number of attributes and levels assumes some criticality in the selection of factors for evaluation.

Another issue is that of determining whether all the attributes to be used in the evaluation should have high salience according to prior investigations, or whether some mixture of important and unimportant factors should be selected. This problem is also twofold. In the first instance, since the apparent importance of the attributes that were described previously has been determined through rating scales with no attempt to treat the interaction between the attributes, it is unclear *a priori* how attributes with different saliencies will be traded off against each other. Furthermore, it is unclear how the saliencies will be affected by different levels of attributes, i.e., it may be possible that the high level of a nominally low salience attribute will be greater than the low level of a nominally high salience attribute. The second facet of the problem is that given the issue of the number of attributes which may be feasibly presented to a respondent, it may be more "realistic" to include a mixture of high and low salience attributes.

A final point of importance was to make the analysis in this portion of the project compatible and complimentary to the analysis contained in the promotion portion of the project. Thus, selection of the attributes had to be at least partially consistent with the attributes used in the promotional study. Keeping these issues in mind as well as the material reviewed in the second chapter, the attributes discussed in the next section were selected for inclusion in the trade-off study.

Attributes Selected

Table 18 lists the attributes which were selected for evaluation in this project. As can be seen, nine attributes were utilized. These attributes were selected from an initial list of thirteen. These thirteen were derived from the literature reviewed in the previous chapter as well as the work

TABLE 18

SELECTED ATTRIBUTES

Cost Per Mile

Fuel Use Per Passenger

Level of Pollution Per Passenger

Transportation Available __ Hours Per Day

Total Travel Time Is __ Minutes

Possibility of Encountering Dangerous People

Level of Comfort

Opportunity to Socialize

Transportation Available __ Days Per Week reported in Research Report 19.[1] With respect to the attributes used in the promotional study, three of the five determinant attributes used in that portion of this research were used in the trade-off study.

To operationalize some of the attributes considered to be important by the literature, as well as our previous research, it was necessary to redefine them in terms which could be related to observable phenomena. For example, the attributes of dependability, flexibility, and convenience were operationally defined in this study to mean "transportation available _____ hours per day" and "transportation available _____ days per week." These definitions were derived from work done in Year 2 on this project. To operationally define the attributes of economy and energy, "cost per mile" and "fuel use per passenger" were utilized. To operationalize the attribute of brief travel time, "total travel time is _____ minutes" was used. No attempt was made to provide operational definitions of comfort, dangerous people, or socializing.

Each attribute was treated as a three-level variable. In the case of "cost per mile," the levels were defined as being present cost, 15¢ less than present cost, and 15¢ more than present cost. To assist the respondents in calculating their present cost, estimates of typical current operating costs of an automobile or a bus ride were provided in the introduction. The attribute of "level of pollution per passenger" was defined as low, medium and high. The levels of "transportation available _____ days per week" were defined as Monday through Friday or five, Monday through Saturday or six, and Monday through Sunday or seven. The levels of "transportation available hours per day" were defined as twelve, eighteen, and twenty-four. "Total travel time is _____ minutes" was defined as fifteen, thirty and sixty minutes. "The possibility of encountering dangerous people" was defined as never, sometimes, and often. The attribute "level of comfort" was defined as having three levels of low, medium, and high. The attribute of "opportunity to socialize" was defined as having three levels of never, sometimes, and often. "Fuel use per passenger" had three levels of low, medium, and high.

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[1] Alpert, M. and S. Davies, The Marketing of Public Transportation: Method and Application, Research Report 19, Council for Advanced Transportation Studies, The University of Texas at Austin, 1975.

In summary, nine attributes were chosen which appear to be representative of those involved in the mode choice decision. These attributes are ones which have been found to be quite important to relatively unimportant in the mode choice literature and work done in Years One and Two of this project. Three levels for each attribute were selected, thus, giving a symmetric design from the standpoint of instrument development. Clearly, with nine attributes, with three levels each, the respondent's task is not easy. This problem is dealt with in the next section which discusses the interview designs utilized in this study.

INTERVIEW DESIGN

As recalled from Chapter VI, alternative methods for obtaining conjoint measurements exist. Since it is not clear a priori which type of method will provide the best results, or even whether comparable data will be obtained by different instruments, it was decided that at least two procedures would be evaluated in this study. The following discussion considers a matrix format and a card sort format.

Matrix or Scale Type

Given the definition and selection of the attributes and their levels, it remains to develop an instrument or instruments which will allow evaluation of the trade-offs of these attributes. The following discussion treats the development of instruments for obtaining pairwise preference rankings from respondents. To obtain all possible pairwise trade-offs for the nine attributes, thirty-six matrices are required. Thirty-six matrices, each with three levels by three levels trade-offs for each attribute, requires the respondent to make 324 rankings. Needless to say, this is a formidable task. Consequently, it is essential to develop an instrument which will make the task as easy to accomplish as is possible.

In addition to the trade-off data, the instruments must elicit information on demographics, current ridership patterns, etc. These types of questions need to be integrated with the trade-off questions. Following standard practice, the order of the questions was determined to be as follows: an introduction to the study was given, followed by warm-up questions, followed by the heart of the study (in this case, the trade-offs), followed by the demographics.[2] It was decided that as many questions as possible would be check-off type questions to facilitate administration of the instrument. Furthermore, it was determined that the instruments would be precoded as much as possible.

As mentioned previously, the primary concern in developing the instruments was to facilitate the respondent's task as much as possible. One possible way to accomplish this is to utilize illustrations or graphics in the matrix portion of the instrument, such as done in the study of the spot remover and the studies on residential preferences, and as suggested for concept testing.[3] The idea of utilizing graphics to provide visual stimuli and ease the task of preference ranking is consistent with the notion surrounding visual thinking.[4]

On the other hand, matrices without any illustrative materials may also be considered to be easier for the respondent. In this instance, the reasoning would be that these matrices would have a minimum amount of clutter on the page. Illustrative of these types of instruments are those in studies treating condominium preferences, preferences for alternative types of aircraft and aircraft services, preferences for tires, and so on.[5] Examples of the drafts

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[2] See for example: Backstrom, C. H. and G. D. Hursh, Survey Research, Evanston, Illinois: Northwestern University Press, 1963; Selltiz, C., M. Jahoda, M. Deutsch and S. W. Cook, Research Methods in Social Relations, New York: Holt, Rinehart and Winston, 1967; Young, P. V., Scientific Social Surveys and Research, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966.

[3] Green, P. E. and Y. Wind, "New Way to Measure Consumers' Judgements," Harvard Business Review, July-August 1975, pp. 107-117; Harman, E. J., "A Behavioural Analysis of the Concepts Used in Housing Choice," Ph.D. Thesis, Department of Geography, McMaster University, 1975; Knight, R. L. and M. D. Menchik, "Conjoint Preference Estimation for Residential Land Use Policy Evaluation," in R. G. Colledge and G. Rushton (eds.), Spatial Choice and Spatial Behavior, Columbus, Ohio: Ohio State University Press, 1976, pp. 135-155; Wind, Y., S. Jolly, and A. O'Conner, "Concept Testing as Input to Strategic Market Simulations," Paper presented at the 58th International Conference of the American Marketing Association, Chicago, Illinois, 1975.

[4] See for example: Arnheim, R., Visual Thinking, London: Faber & Faber, Ltd., 1969.

[5] Davidson, J. D., "Forecasting Traffic on STOL," Operational Research Quarterly, Vol. 24, No. 4, 1973, pp. 561-569; Fiedler, J. A., "Condominium Design and Pricing: A Case Study in Consumer Trade-Off Analysis," Paper presented at Association for Consumer Research, Chicago, 1972; Green, P. E. and Y. Wind, op. cit.

on the graphic and non-graphic form of the matrix instruments are shown in Appendices IX and X.[6]

Card Sort

The concern here is with developing instruments to obtain data which may be analyzed in the same manner as those data obtained in the pairwise comparisons. As suggested in the marketing literature, one possible procedure is to develop cards, or a series of cards, with descriptive statements on each card representing the various levels of the attributes of the product to be evaluated, in this case, transportation.[7] In short, the set of cards represents the various combinations or alternatives available for the respondent to evaluate or rank in terms of preferences. As pointed out earlier, and discussed by Green, one of the problems that is encountered in treating evaluation problems of realistic complexity is that of having a very large number of multi-attribute profiles.[8] In this case, where the evaluation is of nine attributes of transportation, each having three levels, a full factorial design will result in 3^9 or 19,683 combinations. Clearly, the evaluation of this many combinations is beyond the realm of possibility for the human respondent. Thus, it is necessary to develop a design which allows for the respondent to treat a representative subset of these combinations.

As discussed previously, a procedure for developing designs which reduce the number of combinations the respondent must treat is that known as orthogonal arrays. Following Addelman, Plackett and Burman, and Raghavarao, an orthogonal array is defined as follows:[9]

> A k by N matrix A with entries from a set of s (≥ 2) elements is called an orthogonal array of size N, k constraints, s levels, strength t, and index λ if any t x N submatrix of A contains all possible t x 1 column vectors with the same frequency λ. Such an array is denoted by (N,k,s,t); N is also called the number of assemblies.

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[6] The illustrations contained in Appendix IX were prepared by Ms. Carol LeGros.

[7] Green, P. E. and V. R. Rao, "Conjoint Measurement for Quantifying Judgmental Data," Journal of Marketing Research, August 1971, pp. 355-363; Green, P. E. and Y. Wind, op. cit.; Wind, Y., S. Jolly, and A. O'Conner, op. cit.

[8] Green, P. E., "On the Design of Choice Experiments Involving Multifactor Alternatives," Journal of Consumer Research, Vol. I, 1974, pp. 61-68.

[9] Addelman, S., "Orthogonal Main-Effect Plans for Asymmetrical Factorial Experiments," Technometrics, Vol. 4, No. 1, 1962, pp. 21-46; Plackett, R. L. and J. P. Burman, "The Design of Optimum Multifactorial Experiments," Biometrika, Vol. 33, 1946, pp. 305-325; Raghavarao, D., Construction and Combinatorial Problems in Design of Experiments, New York: John Wiley & Sons, 1971.

From this definition and the procedures suggested by Addelman and Raghavarao, the orthogonal matrix illustrated in Figure 6 was developed.[10] To operationalize this matrix in the card form, each 0 corresponds to the low level of the attribute, each 1 corresponds to the medium level of the attribute, and each 2 corresponds to the high level of the attribute. Considering the matrix in Figure 6, each row corresponds to an attribute and each column corresponds to a card. For example, the first row might have been assigned to the attribute "safety from dangerous people," the second row assigned to the attribute "comfort," and so on. For any given column, or card, it was possible to ascertain the level of the attribute to be assigned. This design resulted in twenty-seven cards, each card having nine statements about the attributes. The order of the attributes on any given card was randomized so that order effects would not occur in the evaluation of the alternative. An example of the type of card developed from this procedure is shown in Figure 7.

The format for the instruments for the card sort was the same as that for the matrix except that the matrix was taken out and the set of cards was used instead. Two types of card formats were developed. One type of card is that illustrated in Figure 7, while the other used phrases or a paragraph form for presenting the attributes.

PRE-TESTS

In the preceding discussion, four types of instruments were described for eliciting evaluations of the nine attributes chosen for consideration in the modal choice situation. The following material discusses the pre-test, and modifications resulting from these pre-tests, for these instruments.

Matrix or Scale Design

Three sets of pre-tests were run on the matrix instruments. In the first pre-test, approximately thirty respondents were interviewed for each instrument. In this pre-test, the element requiring significant alteration had to do with the instruction on both instruments. These were modified and a second pre-test of those instruments conducted. The second pre-test had a sample of approximately twenty respondents for each instrument. Commentary on this

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[10] Addelman, S., op. cit.; Raghavarao, D., op. cit.

0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
0	1	2	1	2	0	0	1	2	1	2	0	2	0	1	2	0	1	0	1	2	2	0	1	1	2	0
0	1	2	0	1	2	1	2	0	2	0	1	2	0	1	0	1	2	2	0	1	1	2	0	1	2	0
0	1	2	1	2	0	2	0	1	2	0	1	0	1	2	2	0	1	1	2	0	1	2	0	0	1	2
0	1	2	2	0	1	2	0	1	0	1	2	2	0	1	1	2	0	1	2	0	0	1	2	1	2	0
0	1	2	2	0	1	0	1	2	2	0	1	1	2	0	1	2	0	0	1	2	1	2	0	2	0	1
0	1	2	0	1	2	2	0	1	1	2	0	1	2	0	0	1	2	1	2	0	2	0	1	2	0	1
0	1	2	2	0	1	1	2	0	1	2	0	0	1	2	1	2	0	2	0	1	2	0	1	0	1	2
0	1	2	1	2	0	1	2	0	0	1	2	1	2	0	2	0	1	2	0	1	0	1	2	2	0	1

FIGURE 6.

ORTHOGONAL ARRAY

1. Often, there is the possibility of encountering dangerous people.
2. High fuel use per passenger.
3. High level of comfort.
4. Often, there is an opportunity to socialize.
5. Cost will be 15¢ more per mile than your current cost.
6. Transportation is available 24 hours a day.
7. High level of pollution per passenger.
8. Total travel time is 60 minutes.
9. Transportation is available 7 days per week.

FIGURE 7.

EXAMPLE CARD DEVELOPED FROM ORTHOGONAL ARRAY pre-test led to the inclusion of another example in the instructions for telling people how to do the trade-off. Following this modification, another pre-test was run with approximately thirty respondents for each instrument. The major finding from this pre-test was an indication that a combination of the graphic and non-graphic instrument might be most effective. This instrument was designed and another pre-test was run.

The issue of concern in evaluating this last pre-test was whether the type of results obtained from the combination graphic and labeled matrix would provide the same sort of results as the labeled-only format. The point being that the desire was to compare the results of the matrix procedure with the card sort procedure, and since the card sort procedure had no graphics, if a difference was found between the results of the two procedures the problem of attribution of the difference to having graphics or no graphics could provide a confound. Thus, it was necessary to determine whether there was any difference in the results being obtained between the graphic matrix and the verbal matrix. The analysis was done in terms of the utilities being derived from the two instruments and the length of interview time between the two instruments. As Figures 8 and 9 illustrate, similarities of the utilities for the two types of instruments exist. In comparing the average time for the two types of instruments, it was ascertained that the combination graphic format had a shorter time of completion for the interview. Given these results, the decision was to utilize the combination graphic and labeled instrument. The final format is illustrated in Appendix XI.

Card Sort

The card sort format underwent two pre-tests. In the first pre-test, approximately thirty respondents were interviewed. From this pre-test, it was decided to add a five card sample sort in the procedure. The second pre-test was conducted with approximately thirty respondents. From this experiment, some minor modifications were made to the instrument in terms of grammar and phrasing, and the cards with the single statements, as illustrated in Figure 7, were chosen as the final format for the card sort. (Appendix XII contains an example of the final instrument.) The basic factor underlying this choice was the respondents found it difficult to read through the paragraph form; it was more time consuming, and became more frustrating. The result was a longer interview, as well as less reliable data.

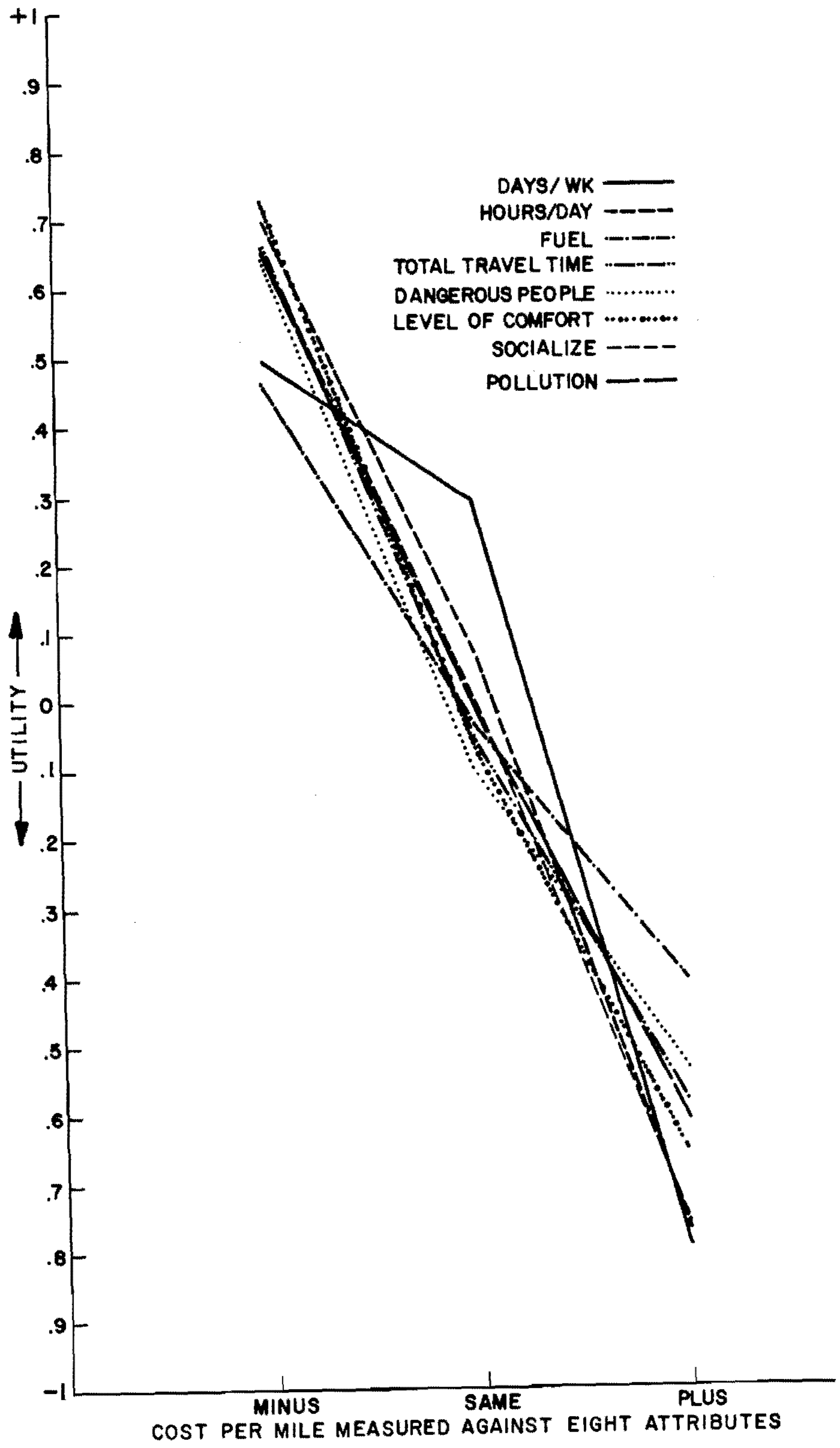

FIGURE 8. GRAPHIC INSTRUMENT

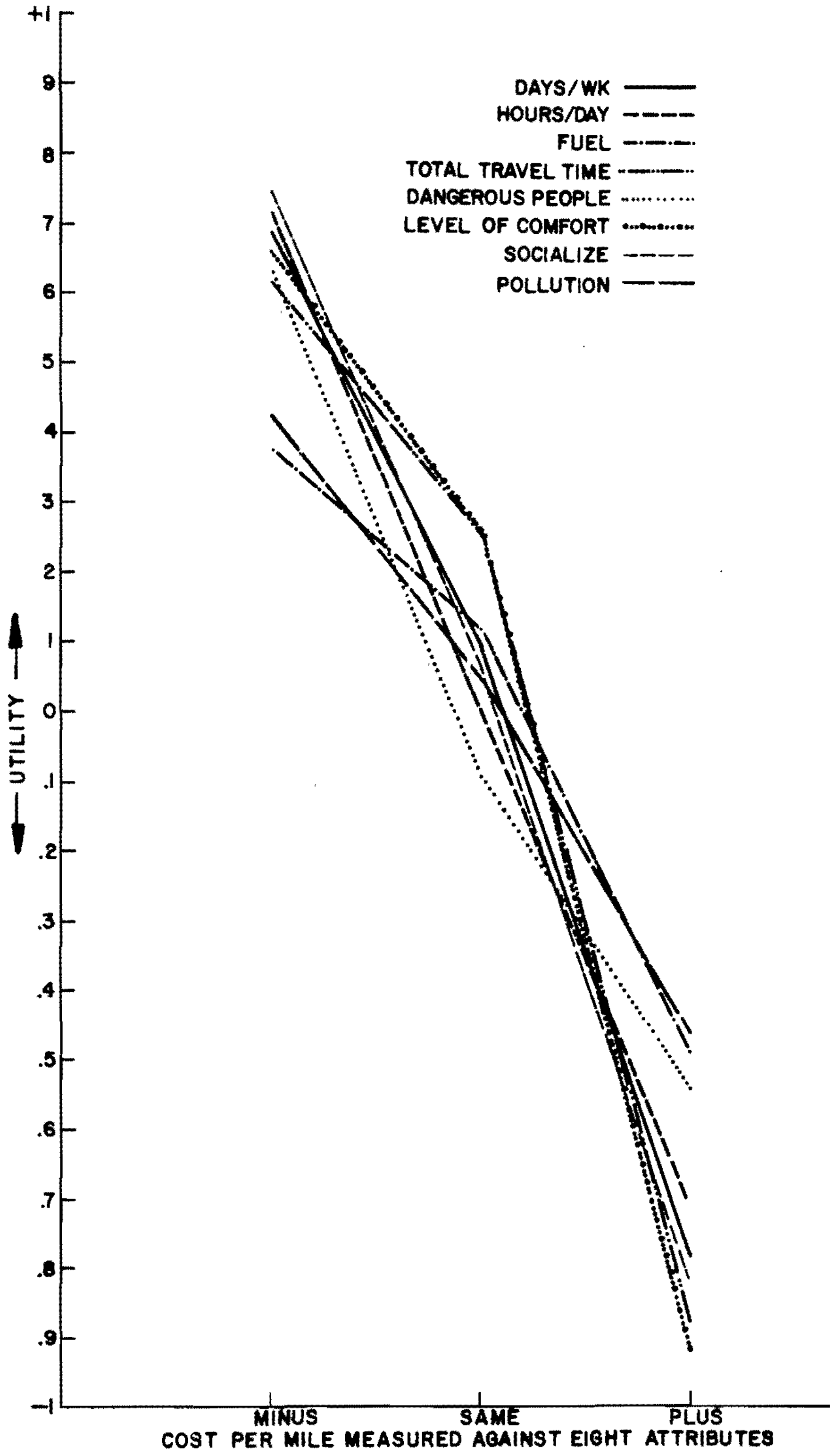

FIGURE 9. NON-GRAPHIC INSTRUMENT

SELECTION OF THE SAMPLE

In a study such as this, the character and quality of the sample of respondents assumes some significance. Three issues of concern for this study revolve around the problem of the areas, i.e., the locations the sample was to be drawn from; the respondent, i.e., the characteristics of the individuals to be interviewed; and the number of respondents, i.e., the number of respondents necessary to obtain meaningful results.

In terms of the area of the city to be utilized for the study, it was determined that several parts of Austin should be selected. However, the decision was made to avoid those areas for which a priori information indicated a substantial captive public transportation market existed. The rationale for this was that the primary focus of this study is on potential switchers to public transportation and the captive audience clearly would not provide us opportunities for analyzing these sorts of respondents. Another locational control was to select respondents residing within one-quarter mile of a bus route. This is the equivalent of three or four blocks from the bus route. The reasoning in this instance is similar to the rationale for avoiding captive transit riders; it seemed to be appropriate to try to avoid captive automobile riders as well. The quarter-of-a-mile figure is a fairly commonly accepted standard for the distance from bus routes that a person will be likely to walk, or viewed another way, this is considered to be the primary catchment area for a bus route.

With regard to the respondents, as indicated previously, the desire was to obtain individuals who had viable options (i.e., they could exercise discretion among modes). Therefore, several areas of the city were eliminated because of their traditional low income characteristics, which tended to limit the number and quality of mode choices. Additionally, the intention was to interview individuals who made consistent, regular trips. It was also decided that individuals who were primarily responsible for their own transportation would be interviewed. This was operationalized to mean individuals over the age of eighteen. Finally, it was the desire of the team to obtain as even a distribution of male and female interviewees as the previously mentioned conditions allowed.

The issue of the number of respondents revolved around two points. The first concern being that of limits on interviewing resources and the difficulty of the instruments. Each type of interview, whether card sort or matrix, required on the average about one hour to complete. Since the interviewing team was comprised of students having commitments on their time for other activities, there was clearly a limit to the number of people who could be interviewed by the team. Given these sorts of limitations, it was determined to try to obtain one hundred completed interviews - fifty for the card sort and fifty for the matrix. Reinforcing this decision to obtain a sample of that size was the task of deriving weights for the levels of each attribute. This task requires a considerable amount of computer time and individual interpretation. Consequently, obtaining as few interviews as would provide an adequate analytical base was highly desirable.

Given the preceding constraints, an enumeration of households in the selected areas was obtained from Cole's Directory. To obtain a sample of 1,500 individuals, computer generated random numbers were used to identify every nth person to be included in the sample frame. Only residents, not businesses, were counted when identifying potential subjects.

Having identified the potential respondents, letters were mailed to potential interviewees. Interviewers then began contacting these people by telephone. Interviewers were to ask specifically for the person whose name appeared on their calling list. Upon contact, the interviewer first gave his or her name and then requested their assistance in an interview on transportation. Each interviewee was informed that the study was being conducted by the Council for Advanced Transportation Studies and that their assistance was important. For those who agreed to participate, a date, time, and place was established for the interview.

SUMMARY

In this chapter, the concern has been with operationalizing the research design for investigating the types of trade-offs people make in mode choice situations. The first problem considered is that of selecting the transportation attributes to be evaluated. Nine attributes were chosen. These were drawn from the pool of items listed in the previous chapter, plus work completed in Years One and Two of this project. Three levels were specified for each attribute.

Two types of interview instruments were developed and pre-tested. One matrix format and one card-sort format were finalized for use. The matrix protocol was a combination of graphic and verbal descriptors. The card-sort instrument utilizes twenty-seven cards containing nine descriptors of the attributes.

The sample was restricted to areas of the city likely to have greater proportions of potential "switchers" to public transportation. Households with one-quarter of a mile of bus routes within the designated areas were enumerated and a sample drawn. The objective was to obtain at least fifty respondents for each type of instrument.

VIII. TRADE-OFF ANALYSIS

Two types of results are considered in this chapter. In the first case, methodological results are presented in terms of the effectiveness of the two types of instrumentation. For the second case, substantive results are presented with regard to the types of trade-offs and the utilities derived from these trade-offs for various modal attributes. Before describing these two types of results, however, it is necessary to discuss the characteristics of the sample and its relationship to the samples drawn in Years One and Two.

DESCRIPTION OF SAMPLE

The sample was drawn from areas of the city of Austin presumed to have an high proportion of persons with characteristics similar to those of potential switchers. To determine the similarity between Year Three's sample and the potential switchers to public transportation identified in the work of Years One and Two, the demographic data were submitted to descriptive analysis.[1] In general, Year Three's sample is not completely characteristic of the "potential switchers" identified in Years One and Two. There are more male respondents than female, they are more likely to be married, less likely to be students, the average income is higher, and they are generally older. Like potential switchers, Year Three's respondents do tend to have small households and are relatively well educated compared to the general population. Similarly, the number of automobiles owned by Year Three respondents averaged greater than one per household. In general, the sample for Year Three indicates that our strategy of avoiding the captive public transportation market was successful. However, the objective of obtaining respondents with with characteristics similar to potential switchers was less successfully met. The dimensions of house size, education, and automobile ownership are held in common by the two populations, but there are differences on other relevant characteristics.

These data were also analyzed to determine if respondents assigned to the two procedure groups differ significantly on demographic and other

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[1] All analyses were performed for statistics having the F distribution.

relevant dimensions. In these analyses, twenty-one questions on demographic characteristics, mode of transportation, etc. constituted the independent variables. There were no significant differences between respondents according to these variables for either group. Thus, respondents appeared to have been randomly assigned to procedural groups on these dimensions.

A final form of preliminary analysis was the development of image profiles for those respondents in each of the two procedural groups which either were predominant users of the private automobile or predominant users of public transportation. In this instance, the analysis was concerned with determining whether there are any significant differences in the images these two types of transportation users had with regard to the two modes of transportation. The assumption in this analysis is that if the respondents assigned to the two procedural groups were different, then the auto users in one group would have a different image of the private automobile than the auto users in the other group and likewise for the public transportation users. Figures 10 and 11 show that the image profiles for the two procedural groups are the same, that is, private automobile users in the card sort procedure and private automobile users in the matrix procedure have the same image of the transportation attributes of the private automobile. The same results are observed for public transportation users as well.

In summary, it is clear that the respondents assigned to the two procedural groups exhibit not only similar characteristics but also similar images of their transportation mode. Thus, while the respondents in the Year 3 sample have some differences in characteristics as compared with the potential switchers, the individual members of the Year Three sample appear to have been randomly assigned to the procedural groups. In short, this analysis would suggest that any differences in responses obtained between the two procedural groups are the results of the procedures and not a result of respondent differences.

METHODOLOGICAL RESULTS

As indicated in Chapters VI and VII, alternative methods for obtaining conjoint measurements exist. Furthermore, in this study, two types of procedures are utilized. The analysis of concern here is related to

A. Transportation Available _____ Hours/Day.

1. 12 2. 18 3. 24

B. Transportation Available _____ Days/Week.

1. 5 2. 6 3. 7

C. Total Travel Time (minutes).

1. 15 2. 30 3. 60

D. Pollution Per Passenger

1. Low 2. Medium 3. High

E. Possibility of Encountering Dangerous People

1. Never 2. Sometimes 3. Often

F. Fuel Use Per Passenger

1. Low 2. Medium 3. High

G. Level of Comfort

1. Low 2. Medium 3. High

H. Opportunity to Socialize

1. Never 2. Sometimes 3. Often

I. Cost

1. 15¢ Lower Than Your Present Cost 2. Same 3. 15¢ More Than Your Present Cost

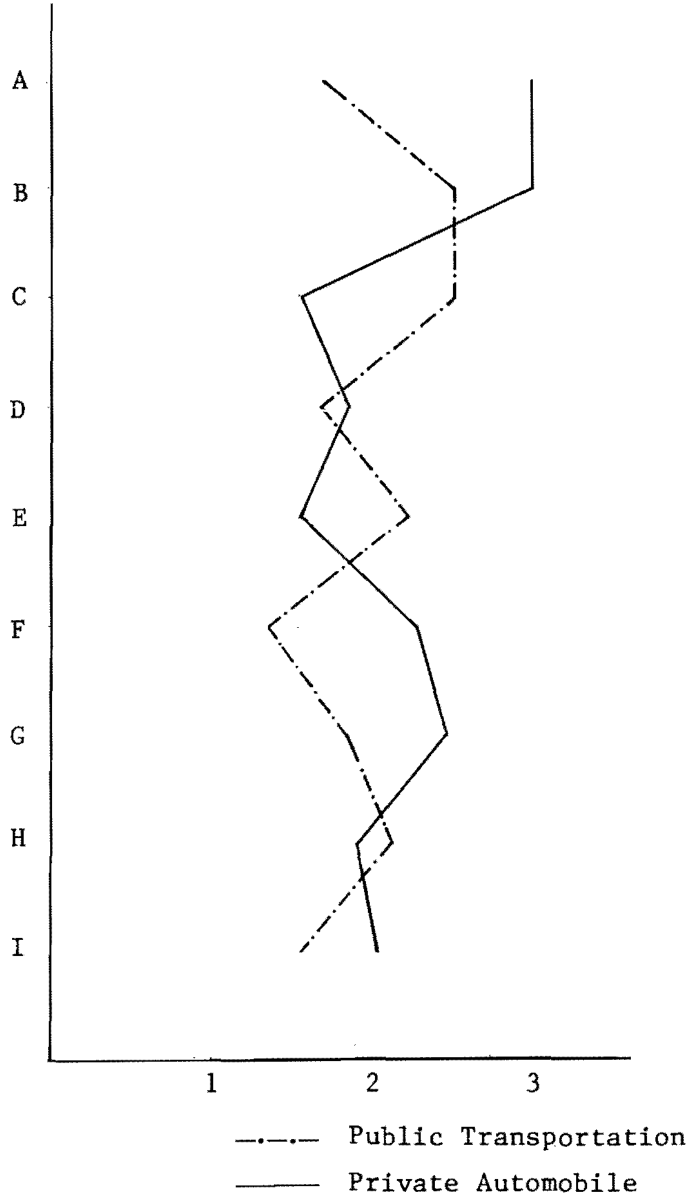

FIGURE 10. IMAGES OF TRANSPORTATION ATTRIBUTES BY CARD SORT RESPONDENTS

A. Transportation Available _____ Hours/Day.

1. 12 2. 18 3. 24

B. Transportation Available _____ Days/Week.

1. 5 2. 6 3. 7

C. Total Travel Time (minutes).

1. 15 2. 30 3. 60

D. Pollution Per Passenger

1. Low 2. Medium 3. High

E. Possibility of Encountering Dangerous People

1. Never 2. Sometimes 3. Often

F. Fuel Use Per Passenger

1. Low 2. Medium 3. High

G. Level of Comfort

1. Low 2. Medium 3. High

H. Opportunity to Socialize

1. Never 2. Sometimes 3. Often

I. Cost

1. 15¢ Lower Than Your Present Cost 2. Same 3. 15¢ More Than Your Present Cost

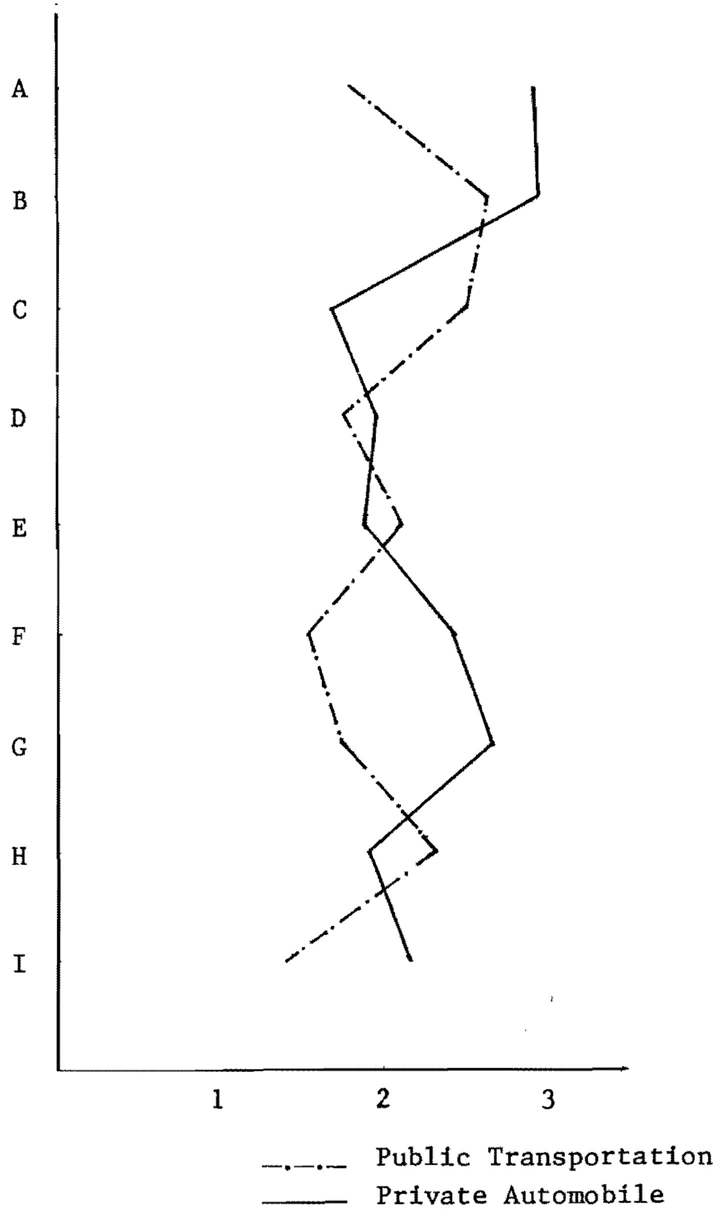

FIGURE 11. IMAGES OF TRANSPORTATION ATTRIBUTES BY MATRIX RESPONDENTS

comparing the results obtained from these two procedures. The ultimate objective of this comparison is an evaluation of the efficacy of the two procedures to yield similar results.

Recall that the procedures utilized were a card sort methodology and a matrix methodology. The card sort procedure was based on an orthogonal array design. The matrix procedure was based on pairwise trade-offs for all attributes by all levels. The first form of analysis in comparing these two procedures is to evaluate the quality of data obtained. This evaluation is first considered by examining the relationship between the input rank order of the data and the obtained rank order of the data as derived from the trade-off algorithm. The algorithm used in this study was the non-metric regression analysis developed by Johnson.[2] The lack of fit measure utilized in the pairwise procedure may be explicated in the following fashion. Consider two pairs of points, (i,j) and (k,l), for which we have input values $r_{ij} - r_{kl}$ and computed distances d_{ij} and d_{kl}. If the quantities $(r_{ij} - r_{kl})$ and $(d_{ij} - d_{kl})$ have the same sign, then the distances in that pair have the desired order relationship; if these quantities have unlike signs the order relationship desired for that pair of distances is violated. The lack of fit measure is θ, where:

$$\theta^2 = \frac{\sum\limits_{\substack{i<j \\ k<l \\ (i,j) \neq (k,l)}} \delta_{ij,kl}(d^2_{ij} - d^2_{kl})^2}{\sum\limits_{\substack{i<j \\ k<l \\ (i,j) \neq (k,l)}} (d^2_{ij} - d^2_{kl})^2}, \qquad (5)$$

and

$$\delta_{ij,kl} = \begin{cases} 1 \text{ if sign } (d_{ij} - d_{kl}) \neq \text{sign } (r_{ij} - r_{kl}) \\ 0 \text{ otherwise.} \end{cases} \qquad (6)$$

---

[2] Johnson, R. M., "Pairwise Nonmetric Multidimensional Scaling," Psychometrika, Vol. 38, No. 1, 1973, pp. 11-18.

Both the numerator and denominator of θ^2 are sums of squared differences between squared distances. For each pair of distances of quantity $(d_{ij}^2 - d_{kl}^2)^2$ is added in the numerator of θ^2 if and only if d_{ij} and d_{kl} have an order relationship contrary to the desired relationship implied by the order of r_{ij} and r_{kl}. The numerator of θ^2 can be interpreted as the sum of squared departures from monotonicity of the square of the distances. The denominator is the sum of the squared differences for all pairs of squared distances, regardless of whether each violates the desired order relationship. Since it can be shown that the denominator θ^2 is equal to a constant times the variance of the squared distances, this measure is akin to the percentage of the variation of the squared distances which is "inconsistent" with the input rank order. For pairwise, two attribute trade-offs, θ will be zero if the d_{ij} have the desired rank order, and unity of their order is perfectly reversed.[3]

Using this measure we may evaluate the goodness of fit of the data derived by the two procedures. Table 19 presents θ values for selected control groups for both the card sort and the matrix procedures. Eight categories of controls are used. In the first category θ's from all respondents were analyzed. In the second category respondents were grouped into five classes on the basis of a post-interview evaluation of their seriousness and level of effort in completing the instrument. The post-interview evaluation was done by a non-interview team using the remarks of the interviewers written on each instrument. In this second category, the first three quality levels of respondents were grouped together and their data submitted to the analysis. The remaining controls were for sex, age, and satisfaction levels, all using the first three quality levels of respondents. The satisfaction category is limited to those respondents who are very satisfied with their present mode of transportation.

As can be seen from Table 19, the θ values for the card sort respondents ranged from around .614 to approximately .42. These values contrast with those for the matrix respondents which ranged from .327 to .142. As indicated previously, as θ goes to zero the calculated distances for the d_{ij} have the

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[3] Ibid.

TABLE 19

COMPARISON OF CARD SORT Θ's AND MATRIX Θ's FOR SELECTED CONTROL GROUPS

CARD SORT	N	Θ	MATRIX	N	Θ
All Respondents	53	.58328	All Respondents[h]	60	.27709
Quality 1,2,3[a]	44	.59598	Quality 1,2,3	48	.28227
Males, Quality 1,2,3[b]	32	.41955	Males, Quality 1,2,3	34	.28769
Females, Quality 1,2,3[c]	12	.60530	Females, Quality 1,2,3	14	.24531
Age 18-29, Quality 1,2,3[d]	8	.56829	Age 18-29, Quality 1,2,3	7	.14225
Age 30-44, Quality 1,2,3[e]	11	.57312	Age 30-44, Quality 1,2,3	17	.22119
Age 45+, Quality 1,2,3[f]	25	.61434	Age 45+, Quality 1,2,3	24	.32703
Very Satisfied, Quality 1,2,3[g]	28	.61172	Very Satisfied, Quality 1,2,3	48	.26399

[a] This control is for the quality of the respondent's participation in test as determined by post interview evaluation of interviewer remarks. The intent was to divide respondents into groups according to seriousness and level of effort respondent placed on exercise. Ten iterations were performed on all groups. The lowest Θ was selected regardless of iteration. Both sexes included in this control.

[b] Male only respondents of best quality. This Θ obtained on first iteration, significantly lower than Θ's for other nine iterations.

[c] Female only respondents of best quality.

[d] Males and females ages 18-29 of best quality.

[e] Males and females ages 18-29 of best quality.

[f] Males and females ages 45 and over of best quality.

[g] Males and females very satisfied with their present form of transportation and of best quality responses.

[h] For matrix data, Θ was calculated for each matrix comparison for each respondent. Thus, 36 Θ's were calculated for each respondent. Values tabulated here represent the average Θ's for all the respondents in each group and are comparable mathematically to the Θ's obtained for the card sort data. The groupings for the matrix data are the same as for the card sort data.

desired rank order. θ's in the mid-range between 0 and 1 indicate that the distances are not consistent with the input rank order data. Thus, with regard to the θ values for the card sort respondents, it is not possible to ascertain with any degree of certainty the relationship between the derived weights for the attributes and the raw input rank order data. On the other hand, the θ's for the matrix respondents are relatively low. This indicates that the derived weights for the attributes are reasonably consistent with the input rank order data. In short, it is possible to interpret the rank ordering of the attributes of the matrix respondents with some degree of surety that these weights are a meaningful representation of the part-worths of the attributes investigated.

To further consider the issue of the validity of the results obtained in the card sort and the matrix procedures, it is appropriate to investigate whether the rank order of the attributes obtained by the two procedures are: (1) similar, and (2) reasonably consistent with the results of previous research, as reviewed in Chapter VI. These questions are considered first by comparing the range of weights obtained for each procedure, for each attribute, and the rank order of the attributes for each procedure for all of the respondents. Table 20 illustrates the results of this comparison procedure. In this analysis the range and the average weight for each level of each attribute indicates the saliance of the attributes. That is, the difference between the weights (utilities) for the high and low levels of an attribute indicate how sensitive that attribute is to level changes. A large range indicates that variation in the amount of the attribute available in a mode will significantly affect the utility of that mode in a choice situation, while conversely, a low range indicates that changes in the amount of an attribute will have only marginal effect on mode choice. The rank order of an attribute is determined by the value of the range weights, such that the highest range is first, the next highest is second, and so on.

Given this form of analysis, several features are apparent in Table 20. First, it is clear that the card sort and matrix procedures are generating different rank orders and ranges for the attributes. Second, the rank orders for the attributes in the card sort procedure are not consistent with the

TABLE 20

COMPARISION OF CARD SORT AND MATRIX RANGE OF WEIGHTS AND RANK ORDER OF ATTRIBUTES

CARD SORT			MATRIX		
ATTRIBUTE	RANK ORDER[a]	RANGE[b]	ATTRIBUTE	RANK ORDER	RANGE
Socialize	1	.96110	Dangerous People	1	1.36504
Dangerous People	2	.74372	Fuel Use	2	1.23434
Cost	3	.52651	Pollution	3	1.22783
Fuel Use	4	.36481	Total Travel Time	4	1.21041
Level of Comfort	5	.33763	Cost	5	1.06607
Total Travel Time	6	.33641	Available Days/Week	6	.94475
Available Hours/Day	7	.32424	Available Hours/Day	7	.84762
Pollution	8	.22297	Level of Comfort	8	.67045
Available Days/Week	9	.19882	Socialize	9	.50559

[a] The rank order is determined by the value of the range of weights, where the highest range is first, the next highest is second, and so on.

[b] The range gives the salience of the attribute. The value is obtained by taking the range in the average weight for each level of each attribute for all respondents. The average weight is calculated by taking all derived weights for each level of an attributed as determined through all possible trade-offs with all other attributes for all respondents. The range gives the salience of the attribute in the sense that the difference between the weights (utilities) for the high and low levels of an attribute indicates how sensitive that attribute is to level changes, i.e., large range indicates that variation in the amount of the attribute available in a mode will significantly affect the utility of that mode in a choice situation.

rank orders for similar variables found in other research.[4] On the other hand, the rank order of the attributes derived under the matrix procedure does appear to be consistent with other research. There are, of course, some differences in these rank orders from those obtained in previous work, however, some differences are to be expected given the nature of the task confronting the respondent, as well as the differences in some of the variables which have been presented to the respondents in this and other research. Thus, using data for all the respondents in each procedure respectively, Table 20 further substantiates the conclusions drawn from the analysis of the θ values, i.e., the card sort procedure is generating substantially different results from the matrix procedure and the data derived from the card sort procedure do not appear to offer interpretable results.

In summary, these data indicate that interpretation of the results obtained via the card sort procedure is likely to be fraught with difficulty and may well be meaningless. On the other hand, it appears that the results obtained from the matrix procedure may be meaningfully interpreted.

SUBSTANTIVE RESULTS

Given the findings in the preceding section, the remainder of the analysis is confined to the matrix data.

To consider the results of the matrix analysis, it is appropriate to begin by reviewing the trade-off matrices supplied by an actual respondent. This respondent happens to be a white male who was between 45 and 59 years of age and had some college or professional training. His income was $20,000 or more, he owned his own home in which there was one member under the age of 18. There were two automobiles available in the household and three members in the household. He has lived in Austin for five years and drives his car to work most of the time. The trip to work takes approximately ten minutes and is three miles in length. He was definitely satisfied with his current form of transportation.

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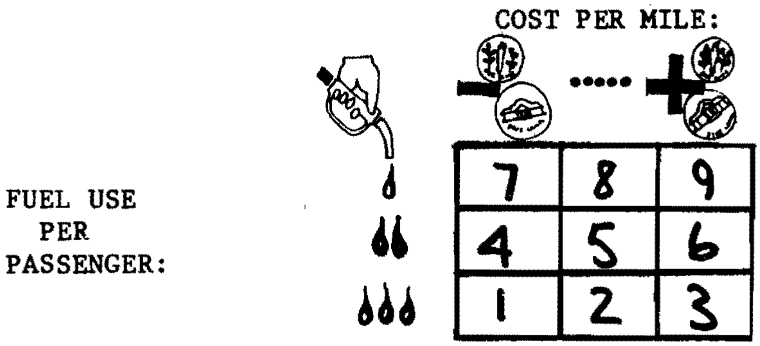
[4] cf. Chapter VI.

Figures 12 through 47 show the trade-off matrices provided by this respondent. In the first matrix, he tells us that he is really not concerned about fuel use. In fact, he would appear to prefer high fuel consumption at any cost (see Figure 12). In the second matrix we see that he is clearly preferring low pollution per passenger at any cost (see Figure 13). From the next matrix, it is clear that costs per mile are important. In this instance, he is willing to give up some of the convenience of having transportation available every day so as to save money (see Figure 14). The next figure shows that he also is very cost conscious with respect to the availability of transportation in hours per day, i.e., he will give up some convenience to save money (see Figure 15). However, the next matrix shows that while he was willing to give up the convenience of transportation seven days a week and twenty-four hours a day, he clearly prefers reduced total travel time over cost. That is, this respondent would be willing to pay higher cost per mile to have a short travel time (see Figure 16). Likewise, the next matrix tells us that the respondent will clearly pay more money to never encounter dangerous people (see Figure 17).

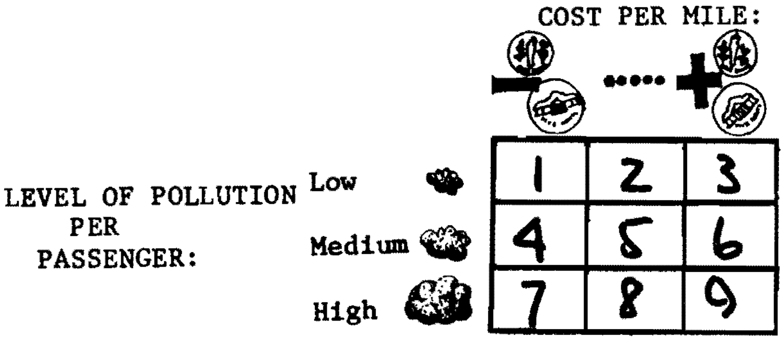
In the seventh trade-off matrix this respondent is indicating that comfort is important, however, a certain amount of comfort will be given up to save on cost. Thus, we see that the obvious preferred situation is high comfort and low cost but the next preferred option is medium comfort and low cost, while the third preferred option is high comfort at the same cost, and so on (see Figure 18). A similar pattern prevails with respect to the opportunity to socialize. That is, this respondent apparently prefers high levels of socializing but is willing to give up some of this to achieve reduced cost (see Figure 19).

Consistent with his earlier preferences, this respondent does not appear to have a great deal of concern for fuel economy as evidenced in the ninth trade-off matrix. In this case he is quite prepared to have very high fuel use to obtain transportation seven days per week (see Figure 20). The respondent is also consistent in his desire to obtain low levels of pollution in terms of having transportation available. Thus, we see in his tenth trade-off matrix that he will give up convenience in transportation being available to obtain low levels of pollution (see Figure 21). In Figure 22 he tells us that having transportation available seven days a week is more important than



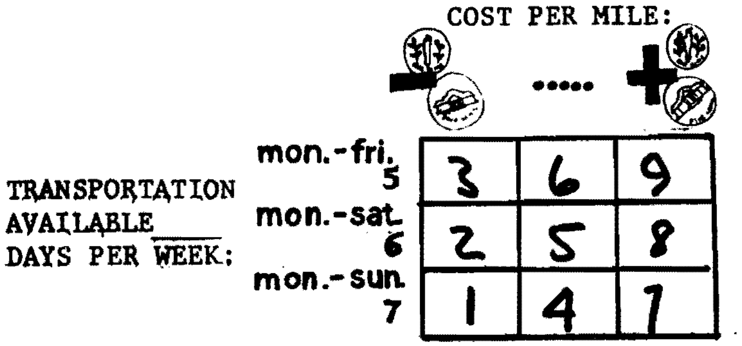
7	8	9
4	5	6
1	2	3

FIGURE 12. FIRST TRADE-OFF MATRIX: COST VERSUS FUEL USE



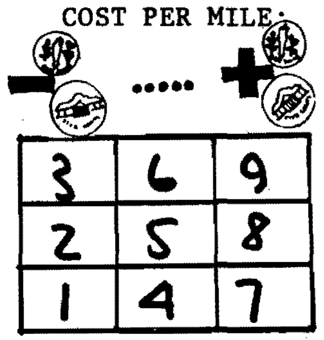
Low	1	2	3
Medium	4	5	6
High	7	8	9

FIGURE 13. SECOND TRADE-OFF MATRIX: COST VERSUS POLLUTION



mon.-fri. 5	3	6	9
mon.-sat. 6	2	5	8
mon.-sun. 7	1	4	7

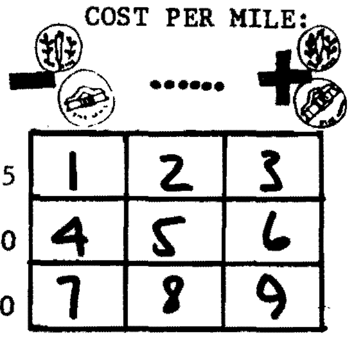
FIGURE 14. THIRD TRADE-OFF MATRIX: COST VERSUS DAYS/WEEK



TRANSPORTATION AVAILABLE_____ HOURS PER DAY:

12	3	6	9
18	2	5	8
24	1	4	7

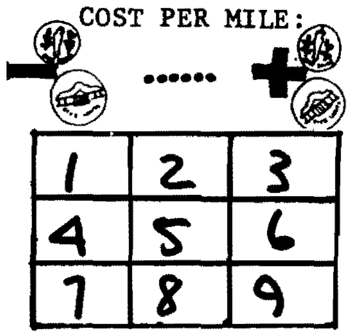
FIGURE 15. FOURTH TRADE-OFF MATRIX: COST VERSUS HOURS/DAY



TOTAL TRAVEL TIME IS_____MINUTES:

15	1	2	3
30	4	5	6
60	7	8	9

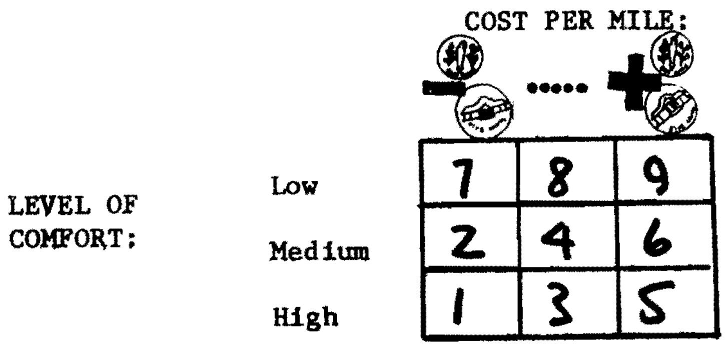
FIGURE 16. FIFTH TRADE-OFF MATRIX: COST VERSUS TOTAL TRAVEL TIME



POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE

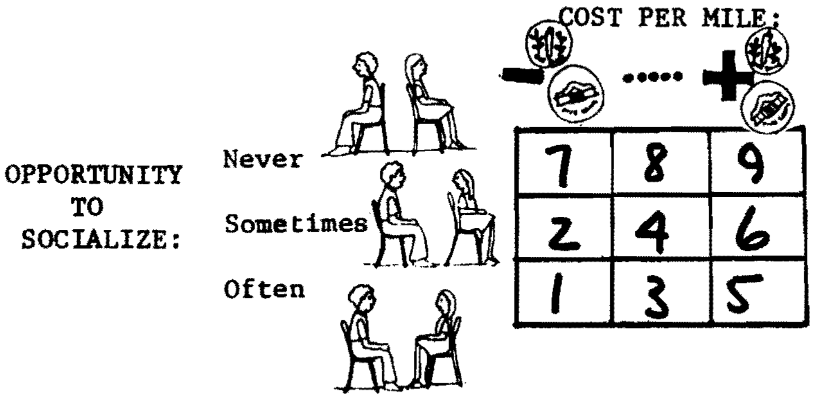
Never	1	2	3
Sometimes	4	5	6
Often	7	8	9

FIGURE 17. SIXTH TRADE-OFF MATRIX: COST VERSUS DANGEROUS PEOPLE



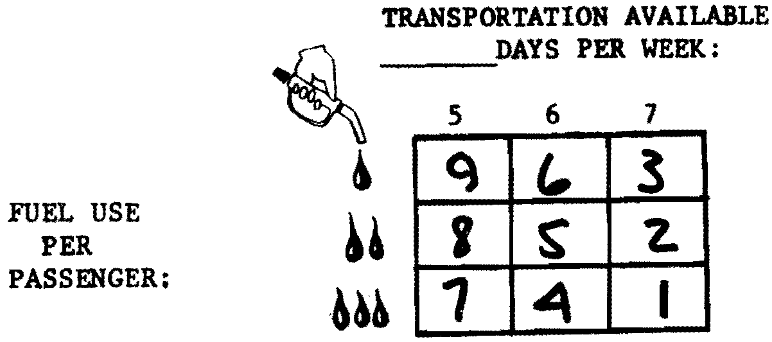
Low	7	8	9
Medium	2	4	6
High	1	3	5

FIGURE 18. SEVENTH TRADE-OFF MATRIX: COST VERSUS COMFORT



Never	7	8	9
Sometimes	2	4	6
Often	1	3	5

FIGURE 19. EIGHTH TRADE-OFF MATRIX: COST VERSUS SOCIALIZING



	5	6	7
💧	9	6	3
💧💧	8	5	2
💧💧💧	7	4	1

FIGURE 20. NINTH TRADE-OFF MATRIX: DAYS/WEEK VERSUS FUEL USE

having transportation available twenty-four, eighteen, or twelve hours per day. That is, he will give up having transportation available twenty-four hours per day to obtain transportation seven days per week. His twelfth trade-off matrix tells us again that never encountering dangerous people is highly preferred. In this instance, he will give up the availability of transportation seven days a week to avoid encountering dangerous people (see Figure 23). Total travel time again remains important in the thirteenth trade-off matrix. In this instance, we see the respondent will give up having transportation available seven days per week to obtain a total travel time of fifteen minutes (see Figure 24). In Figure 25 the respondent indicates that high comfort is more important than having transportation available seven days per week. Thus, in contrast with his concern for cost, the respondent is willing to give up some availability of transportation to obtain high levels of comfort (see Figure 25). The fifteenth trade-off matrix indicates that, while the opportunity to socialize is important, a certain amount of this will be given up to attain transportation seven days per week. However, before giving up the opportunity to socialize all together the respondent would prefer to have fewer days of transportation available (see Figure 26).

Figure 27 shows that, as before, the respondent has high concerns for a low level of pollution. He indicates that he will give up having transportation available twenty-four hours a day to obtain low levels of pollution. In fact, it is important enough such that he would prefer twelve hours of transportation to having a medium level of pollution. The seventeenth trade-off matrix again confirms that fuel use is of no great concern to this respondent. He indicates that having transportation available twenty-four hours a day is more important that reducing the use of fuel (see Figure 28).

The eighteenth trade-off matrix indicates that total travel time remains consistently important. The respondent clearly chooses total travel time of fifteen minutes over having transportation available twenty-four or eighteen hours per day (see Figure 29). Likewise, the possibility of encountering dangerous people is more important than having transportation available twenty-four hours per day. Thus, in Figure 30 we see the respondent giving up the availability of transportation to avoid encountering dangerous people. He again indicates that having high levels of comfort is more important than having transportation available twenty-four hours per day. In fact, he would

TRANSPORTATION AVAILABLE
_____ DAYS PER WEEK:

LEVEL OF POLLUTION
PER
PASSENGER:

	5	6	7
•	3	2	1
●	6	5	4
⬤	9	8	7

FIGURE 21. TENTH TRADE-OFF MATRIX: DAYS/WEEK VERSUS POLLUTION

TRANSPORTATION AVAILABLE.
______ DAYS PER WEEK:

TRANSPORTATION
AVAILABLE______
HOURS PER DAY:

	5	6	7
12	9	6	3
18	8	5	2
24	7	4	1

FIGURE 22. ELEVENTH TRADE-OFF MATRIX: DAYS/WEEK VERSUS HOURS/DAY

TRANSPORTATION AVAILABLE
_______ DAYS PER WEEK:

POSSIBILITY OF
ENCOUNTERING
DANGEROUS PEOPLE:

	5	6	7
Never	3	2	1
Sometimes	6	5	4
Often	9	8	7

FIGURE 23. TWELFTH TRADE-OFF MATRIX: DAYS/WEEK VERSUS DANGEROUS PEOPLE

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

TOTAL TRAVEL
TIME IS
______MINUTES:

	5	6	7
15	3	2	1
30	6	5	4
60	9	8	7

FIGURE 24. THIRTEENTH TRADE-OFF MATRIX: DAYS/WEEK VERSUS TOTAL TRAVEL TIME

TRANSPORTATION AVAILABLE
______DAYS PER WEEK:

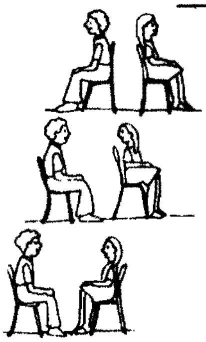
LEVEL OF
COMFORT:

	5	6	7
Low	9	8	7
Medium	6	5	4
High	3	2	1

FIGURE 25. FOURTEENTH TRADE-OFF MATRIX: DAYS/WEEK VERSUS COMFORT

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

OPPORTUNITY
TO
SOCIALIZE:



	5	6	7
	9	8	7
	6	4	2
	5	3	1

FIGURE 26. FIFTEENTH TRADE-OFF MATRIX: DAYS/WEEK VERSUS SOCIALIZING

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

LEVEL OF POLLUTION PER PASSENGER:

	12	18	24
☁	3	2	1
☁	6	5	4
☁	9	8	7

FIGURE 27. SIXTEENTH TRADE-OFF MATRIX: HOURS/DAY VERSUS POLLUTION

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

FUEL USE PER PASSENGER:

	12	18	24
💧 Low	9	6	3
💧💧 Medium	8	5	2
💧💧💧 High	7	4	1

FIGURE 28. SEVENTEENTH TRADE-OFF MATRIX: HOURS/DAY VERSUS FUEL USE

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

TOTAL TRAVEL TIME
IS _____ MINUTES:

	12	18	24
15	3	2	1
30	6	5	4
60	9	8	7

FIGURE 29. EIGHTEENTH TRADE-OFF MATRIX: HOURS/DAY VERSUS TOTAL TRAVEL TIME

prefer high levels of comfort for only twelve hours per day over medium levels of comfort for twenty-four hours per day (see Figure 31). The twenty-first trade-off matrix indicates that the respondent still considers the opportunity to socialize important. However, he is willing to give up some socializing to obtain twenty-four hours of transportation. Rather, he would prefer to have eighteen hours of transportation and maximize his opportunity to socialize (see Figure 32). In the next trade-off matrix the respondent again consistently shows concern for total travel time. However, for the first time some concern for fuel use is indicated (see Figure 33).

In Figure 34, we see the first trade-off matrix in which two previously highly salient attributes are paired. In this instance, the respondent indicates that having a low level of pollution is more important than having low total travel time. While he would clearly prefer to have low travel time and low levels of pollution, he will give up travel time to obtain low levels of pollution. The twenty-fourth trade-off matrix also shows that travel time will be sacrificed to avoid encountering dangerous people (see Figure 35). The twenty-fifth trade-off matrix indicates again that travel time will be given up to obtain high levels of comfort. Thus, while low travel time and high levels of comfort are clearly preferred, the respondent will accept thirty or sixty minutes of travel time before giving up high comfort levels (see Figure 36). In the case of the opportunity to socialize, we find that the respondent obviously prefers low travel time and high opportunity to socialize, however, he will give up a certain amount of socializing to obtain low travel time. But, never socializing is the least desirable alternative. Thus, he will give up low total travel time to obtain opportunities to socialize rather than never socializing to obtain low travel time (see Figure 37).

In Figures 38 through 41, we see that the respondent consistently ranks fuel use lower than pollution, dangerous people, comfort, and the opportunity to socialize. In short, he will willingly give up fuel economy to obtain low levels of pollution, to never encounter dangerous people, to have high levels of comfort, and to have high levels of socializing.

In the thirty-first trade-off matrix, we see that never encountering dangerous people is more salient than having low levels of pollution. That is, the respondent will accept higher levels of pollution to avoid encountering

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

		12	18	24
POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE	Never	3	2	1
	Sometimes	6	5	4
	Often	9	8	7

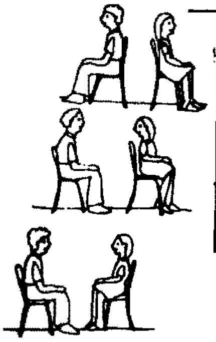
FIGURE 30. NINETEENTH TRADE-OFF MATRIX: HOURS/DAY VERSUS DANGEROUS PEOPLE

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

		12	18	24
LEVEL OF COMFORT:	Low	9	8	7
	Medium	6	5	4
	High	3	2	1

FIGURE 31. TWENTIETH TRADE-OFF MATRIX: HOURS/DAY VERSUS COMFORT

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:



	12	18	24
OPPORTUNITY TO SOCIALIZE:	9	8	7
	6	4	2
	5	3	1

FIGURE 32. TWENTY-FIRST TRADE-OFF MATRIX: HOURS/DAY VERSUS SOCIALIZING

TOTAL TRAVEL TIME IS ______ MINUTES:

FUEL USE PER PASSENGER:

	15	30	60
💧	1	4	7
💧💧	2	5	8
💧💧💧	3	6	9

FIGURE 33.
TWENTY-SECOND TRADE-OFF MATRIX: TOTAL TRAVEL TIME VERSUS FUEL USE

TOTAL TRAVEL TIME IS______. MINUTES:

LEVEL OF POLLUTION PER PASSENGER:

	15	30	60
Low	1	2	3
Medium	4	5	6
High	7	8	9

FIGURE 34.
TWENTY-THIRD TRADE-OFF MATRIX: TOTAL TRAVEL TIME VERSUS POLLUTION

TOTAL TRAVEL TIME IS ______ MINUTES:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

	15	30	60
Never	1	2	3
Sometimes	4	5	6
Often	7	8	9

FIGURE 35.
TWENTY-FOURTH TRADE-OFF MATRIX: TOTAL TRAVEL TIME VERSUS DANGEROUS PEOPLE

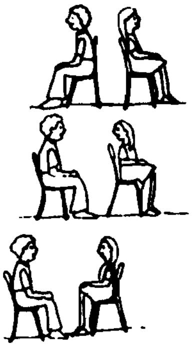
TOTAL TRAVEL TIME IS ______ MINUTES:

		15	30	60
LEVEL OF COMFORT:	**Low**	7	8	9
	Medium	4	5	6
	High	1	2	3

FIGURE 36.
TWENTY-FIFTH TRADE-OFF MATRIX: TOTAL TRAVEL TIME VERSUS COMFORT

TOTAL TRAVEL TIME IS ______ MINUTES:

OPPORTUNITY TO SOCIALIZE:



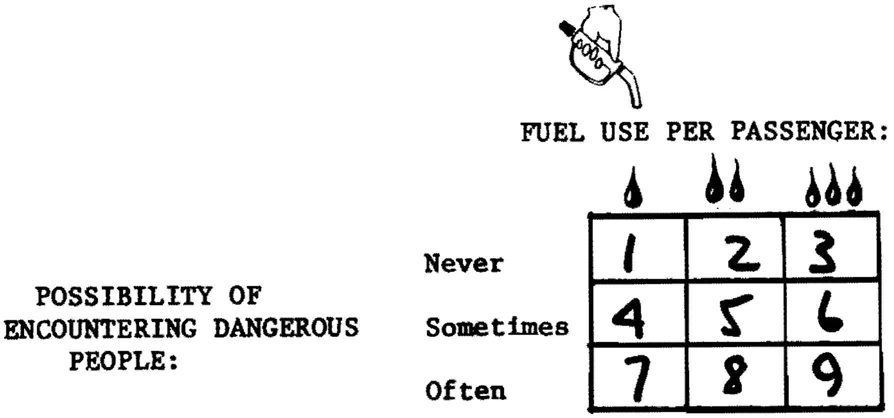
15	30	60
7	8	9
2	4	6
1	3	5

FIGURE 37.
TWENTY-SIXTH TRADE-OFF MATRIX: TOTAL TRAVEL TIME VERSUS SOCIALIZING

FUEL USE PER PASSENGER:

		💧	💧💧	💧💧💧
LEVEL OF POLLUTION PER PASSENGER:	**Low**	1	2	3
	Medium	4	5	6
	High	7	8	9

FIGURE 38.
TWENTY-SEVENTH TRADE-OFF MATRIX: FUEL USE VERSUS POLLUTION

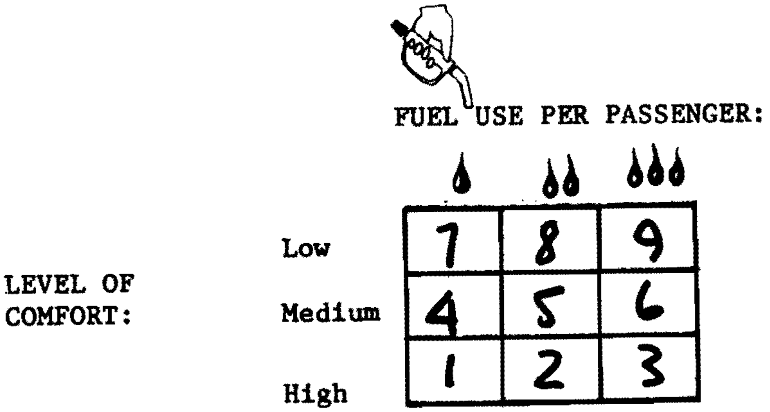


FUEL USE PER PASSENGER:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

	💧	💧💧	💧💧💧
Never	1	2	3
Sometimes	4	5	6
Often	7	8	9

FIGURE 39.
TWENTY-EIGHTH TRADE-OFF MATRIX: FUEL USE VERSUS DANGEROUS PEOPLE

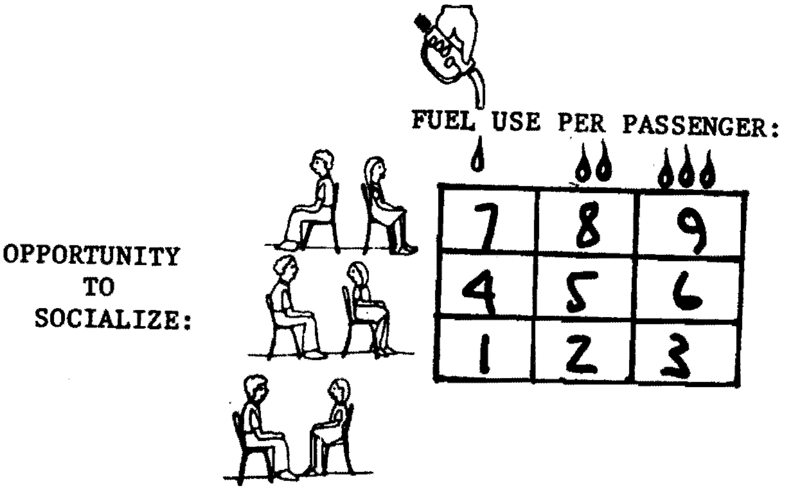


FUEL USE PER PASSENGER:

LEVEL OF COMFORT:

	💧	💧💧	💧💧💧
Low	7	8	9
Medium	4	5	6
High	1	2	3

FIGURE 40.
TWENTY-NINTH TRADE-OFF MATRIX: FUEL USE VERSUS COMFORT



FUEL USE PER PASSENGER:

OPPORTUNITY TO SOCIALIZE:

	💧	💧💧	💧💧💧
	7	8	9
	4	5	6
	1	2	3

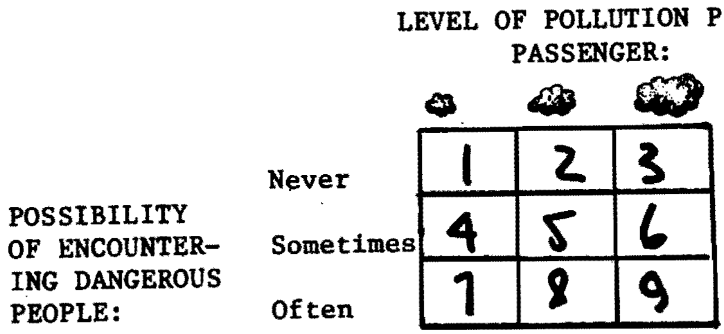
FIGURE 41.
THIRTIETH TRADE-OFF MATRIX: FUEL USE VERSUS SOCIALIZING

dangerous people (see Figure 42). On the other hand, in Figure 43 the respondent indicates that he will give up comfort to obtain low levels of pollution. In the thirty-third trade-off matrix, some rather interesting preferences appear. Obviously the opportunity to socialize and having low levels of pollution are preferred. However, some level of socializing will be given up to obtain a low level of pollution. But a medium level of pollution will be accepted before never being able to socialize. But, never being able to socialize is preferred over medium and high levels of pollution (see Figure 44).

In Figure 45, we see again that the possibility of encountering dangerous people is highly salient. Thus, comfort will be yielded to avoid encountering dangerous people. This also occurs in the thirty-fifth trade-off matrix where socializing will be yielded to avoid encountering dangerous people (see Figure 46). The thirty-sixth and final trade-off matrix shows that high levels of comfort are preferred to opportunities to socialize, but that rather than never socializing, the respondent will accept a medium level of comfort to have high socializing opportunities (see Figure 47).

These thirty-six trade-off matrices clearly yield a substantial amount of data for a single individual. The preceding, rather descriptive, analysis gives us some insight into how a single individual will treat pairs of attributes. Policymakers, however, are concerned with how groups of people will make these sort of trade-offs, since one should not make policy decisions on the basis of a single individual or observation. Figures 48 through 83 show how all the respondents in the sample whose answers were judged to be of quality one, two, or three rated these various attributes in pairs. In these figures, the sample's utilities for the given attribute level are indicated by the decimal values at the right and bottom of each matrix. The algorithm, as previously described, computes the joint additive utility for each attribute and level pair. These values are indicated in the top part of the respective cells in the matrix. The rank of the computed utility is indicated by the numbers in parentheses in each of the cells in the matrix.

For example, in Figure 48 we see that the utility for low fuel use per passenger for the sample is .66454, while the utility for fifteen cents less than the current cost per mile is .49892. The joint utility for low fuel use per passenger and fifteen cents less than current cost per mile is 1.16346.

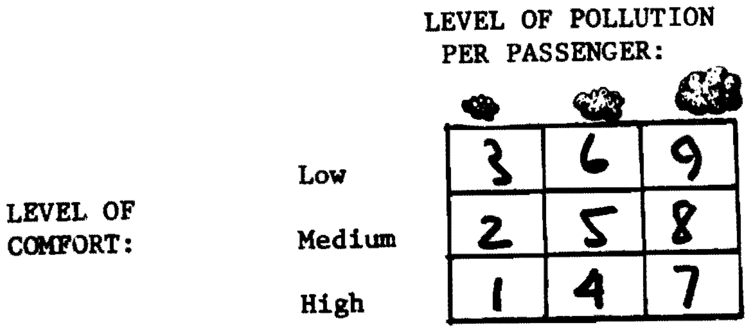


LEVEL OF POLLUTION PER PASSENGER:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

Never	1	2	3
Sometimes	4	5	6
Often	7	8	9

FIGURE 42.
THIRTY-FIRST TRADE-OFF MATRIX: POLLUTION VERSUS DANGEROUS PEOPLE

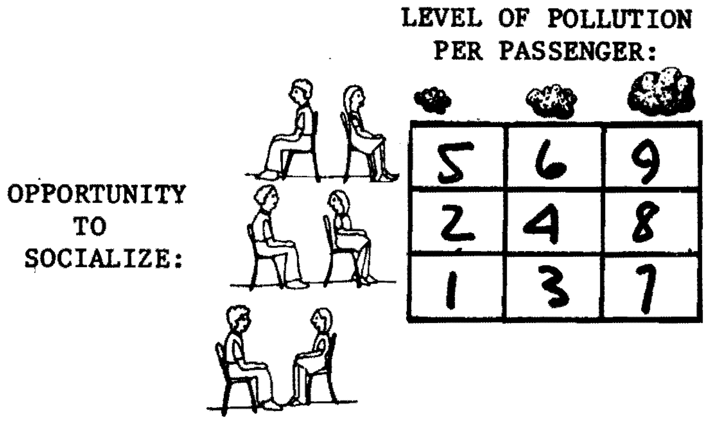


LEVEL OF POLLUTION PER PASSENGER:

LEVEL OF COMFORT:

Low	3	6	9
Medium	2	5	8
High	1	4	7

FIGURE 43.
THIRTY-SECOND TRADE-OFF MATRIX: POLLUTION VERSUS COMFORT



LEVEL OF POLLUTION PER PASSENGER:

OPPORTUNITY TO SOCIALIZE:

5	6	9
2	4	8
1	3	7

FIGURE 44.
THIRTY-THIRD TRADE-OFF MATRIX: POLLUTION VERSUS SOCIALIZING

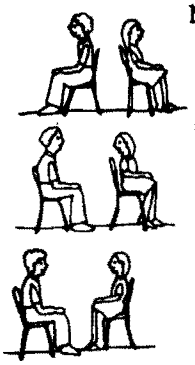
POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

		Never	Sometimes	Often
LEVEL OF COMFORT:	**Low**	3	6	9
	Medium	2	5	8
	High	1	4	7

FIGURE 45.
THIRTY-FOURTH TRADE-OFF MATRIX: DANGEROUS PEOPLE VERSUS COMFORT

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

OPPORTUNITY TO SOCIALIZE:

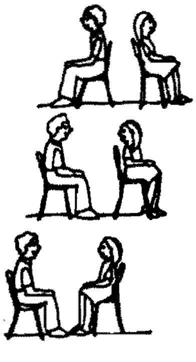


Never	Sometimes	Often
3	6	9
2	5	8
1	4	7

FIGURE 46.
THIRTY-FIFTH TRADE-OFF MATRIX: DANGEROUS PEOPLE VERSUS SOCIALIZING

LEVEL OF COMFORT:

OPPORTUNITY TO SOCIALIZE:



Low	Med.	High
9	8	7
6	4	2
5	3	1

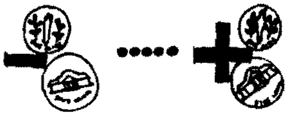
FIGURE 47.
THIRTY-SIXTH TRADE-OFF MATRIX: COMFORT VERSUS SOCIALIZING

This utility ranks number one out of the nine possible combinations for the attribute pair of fuel use and cost per mile.

Further examination of the Figure 48 indicates that the respondents are prepared to pay a little bit more to maintain low fuel use, i.e., they are willing to have the current cost per mile to obtain low fuel use. This would seem to be a reasonable preference structure. However, before they are willing to pay fifteen cents more per mile than the current cost they would prefer to have medium levels of fuel use at either a lower cost per mile or at their current cost. What we observe is that the sample is only prepared to pay fifteen cents more per mile when low fuel use per passenger will be obtained. Otherwise, the respondents will prefer to have medium or high levels of fuel use before paying fifteen cents per mile over their current cost. In Figure 49, we see a slightly different pattern. It is clear that high pollution is the least preferred attribute. That is, even at the low cost per mile, high pollution is only ranked seventh. Some rather interesting trade-offs appear in the other level pairs. For example, low pollution and low cost per mile are clearly preferred. The second level of preference is for low pollution with current cost, again, a finding which makes sense. However, cost appears to become important with the next rating, i.e., a medium level of pollution will be accepted if fifteen cents less than current cost per mile can be obtained. If, on the other hand, current costs per mile prevail, the sample indicates that they would prefer to pay fifteen cents more per mile than current cost to obtain low pollution. That is, a medium level of pollution is only acceptable if it can be obtained at a cost less than current cost per mile.

In Figures 50 and 51, the data indicate the sample population is prepared to give up a certain amount of transportation availability in days per week or hours per day to achieve lower cost per mile. If seven days per week and twenty-four hours per day service can be obtained at current cost this is an acceptable third alternative. However, the sample indicates that it would prefer to have transportation available five days per week twelve hours per day to obtain fifteen cents per mile less cost as opposed to having services available six or seven days per week at eighteen and twenty-four hours per day. Given that the frame of reference for these trade-offs was the journey to work or to school, these results are not terribly surprising.

COST PER MILE:



FUEL USE PER PASSENGER:

💧	1.16346 (1)	.79027 (2)	.18620 (5)	.66454
💧💧	.72434 (3)	.35115 (4)	-.25290 (8)	.22542
💧💧💧	-.02524 (6)	-.039843 (7)	-1.0025 (9)	-.52416
	.49892	.12573	-.47834	

FIGURE 48. SAMPLE'S UTILITIES: COST VERSUS FUEL USE

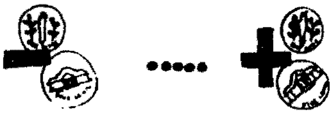
COST PER MILE:

LEVEL OF POLLUTION PER PASSENGER:

Low	1.16592 (1)	.88100 (2)	.51005 (4)	.79309
Medium	.57759 (3)	.29267 (5)	.07828 (6)	.20476
High	-.18076 (7)	-.46568 (8)	-.83663 (9)	-.55359
	.37283	.08791	-.28304	

FIGURE 49. SAMPLE'S UTILITIES: COST VERSUS POLLUTION

COST PER MILE:



TRANSPORTATION AVAILABLE _____ DAYS PER WEEK:

Mon.-Fri. 5	.43831 (4)	-.17932 (7)	-.88175 (9)	-.26797
Mon.-Sat. 6	.90351 (2)	.28588 (5)	-.41655 (8)	.19723
Mon.-Sun. 7	1.22939 (1)	.61176 (3)	-.09067 (6)	.52311
	.70628	.08865	-.61378	

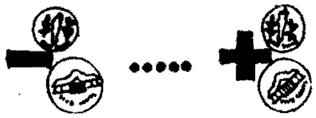
FIGURE 50. SAMPLE'S UTILITIES: COST VERSUS DAYS/WEEK

The data in Figures 52 and 53 indicate a rather similar preference structure for the attribute pairs of total travel time and cost per mile, and dangerous people and cost per mile. However, the implications of these preference structures would appear to be rather different. In Figure 52 the sample prefers low travel time at fifteen cents less than current costs and at the current cost per mile. However, the sample is prepared to give up fifteen minutes of travel time to obtain fifteen cents less than current costs per mile as its third level of preference. Yet, the sample is willing to pay fifteen cents more than current costs per mile to obtain a total travel time of fifteen minutes as its fourth preference. This suggests some possible policy options in terms of pricing and scheduling. Turning to Figure 53, we see that avoiding dangerous people is important, however, it is not important enough to pay fifteen cents more than current costs or current costs per mile. This suggests, at least in terms of cost per mile, that the possibility of encountering dangerous people is perhaps not as salient as indicated in the Year One and Year Two results. That is, the respondents are prepared to accept a certain amount of risk to avoid increasing their cost per mile.

In Figure 54 the sample indicates that it is willing to give up some comfort to obtain lower cost per mile. However, it will only begin to accept low levels of comfort at a lower cost per mile as a fifth order of preference. Thus, it is clear that a certain amount of comfort will be yielded to obtain lower cost, however, the respondents find a low level of comfort to be a relatively less desirable option. In Figure 55, some rather interesting trade-offs occur. The sample prefers to socialize occasionally at fifteen cents less per mile or at current costs per mile. They are prepared to socialize often at fifteen cents less per mile, but would be willing to never socialize at fifteen cents less per mile than to have to socialize often at current costs. Likewise, they are prepared to never socialize to obtain current costs rather than to pay fifteen cents more per mile and be able to socialize sometimes. This suggests, that the opportunity to socialize some of the time is not terribly important, at least with respect to cost per mile. This is consistent with the work in Years One and Two.

Figures 56 and 57 indicate a rather similar pattern of responses. The sample clearly prefers to have transportation available six or seven days per week in conjunction with low fuel use or low pollution. However, the

COST PER MILE:

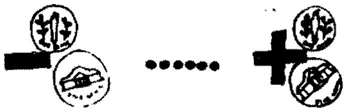


TRANSPORTATION AVAILABLE _____ HOURS PER DAY:

12	.39259 (4)	-.17169 (7)	-.85707 (9)	-.28081
18	.93969 (2)	.37541 (5)	-.30997 (8)	.26629
24	1.20356 (1)	.63928 (3)	-.04610 (6)	.53016
	.67340	.10912	-.57626	

FIGURE 51. SAMPLE'S UTILITIES: COST VERSUS HOURS/DAY

COST PER MILE:

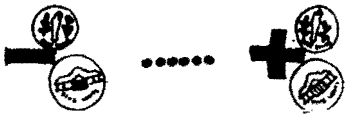


TOTAL TRAVEL TIME IS _____ MINUTES:

15	1.16504 (1)	.89008 (2)	.48951 (4)	.80208
30	.53075 (3)	.25579 (5)	-.14478 (6)	.16779
60	-.2609 (7)	-.62386 (8)	-.93643 (9)	-.62386
	.36296	.08800	-.31257	

FIGURE 52. SAMPLE'S UTILITIES: COST VERSUS TOTAL TRAVEL TIME

COST PER MILE:

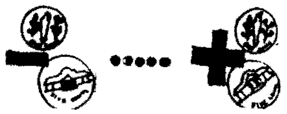


POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

Never	1.03194 (1)	.83485 (2)	.17853 (5)	.61976
Sometimes	.77095 (3)	.57386 (4)	-.08246 (6)	.35877
Often	-.10126 (7)	.29835 (8)	.95467 (9)	-.51344
	.41218	.21509	-.44123	

FIGURE 53. SAMPLE'S UTILITIES: COST VERSUS DANGEROUS PEOPLE

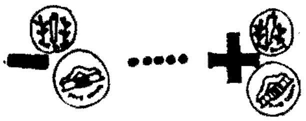
COST PER MILE:

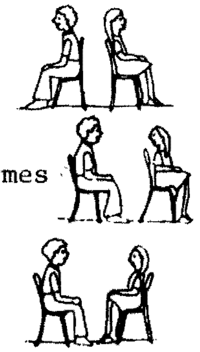


LEVEL OF COMFORT;	Low	.38809 (5)	-.04876 (6)	-.9818 (9)	-.26853
	Medium	.91832 (2)	.48147 (4)	-.45157 (8)	.26170
	High	1.07124 (1)	.63439 (3)	-.29865 (7)	.41462
		.65662	.21977	-.71327	

FIGURE 54. SAMPLE'S UTILITIES: COST VERSUS COMFORT

COST PER MILE:



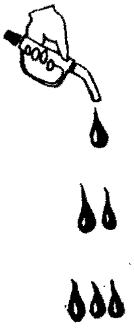


OPPORTUNITY TO SOCIALIZE:	Never	.42376 (4)	-.00622 (6)	-1.0033 (9)	-.23422
	Sometimes	1.17921 (1)	.74923 (2)	-.24785 (7)	.52123
	Often	.66322 (3)	.23324 (5)	-.76384 (8)	.00524
		.65798	.22800	-.76908	

FIGURE 55: SAMPLE'S UTILITIES: COST VERSUS SOCIALIZING

TRANSPORTATION AVAILABLE

______ DAYS PER WEEK:



	5	6	7	
FUEL USE PER PASSENGER:	.45828 (4)	.93275 (2)	1.18837 (1)	.81083
	-.18959 (6)	.28488 (5)	.5405 (3)	.16296
	-.955906 (9)	-.48459 (8)	-.22897 (7)	-.60651
	-.35255	.12192	.37754	

FIGURE 56. SAMPLE'S UTILITIES: DAYS/WEEK VERSUS FUEL USE

respondents will give up some fuel economy to obtain transportation seven days per week, as contrasted with the willingness to give up the availability of transportation to obtain low levels of pollution. In conjunction with the availability of transportation during the week, medium levels and high levels of fuel use and pollution are clearly the least preferred combinations.

In Figure 58 the availability of transportation during the week is combined with the availability of transportation during the day. In this case, we again see some rather interesting trade-offs. Obviously, the preferred combination is transportation available seven days per week twenty-four hours per day. The respondents will yield some availability of transportation during the day to obtain transportation seven days per week. However, they are willing to cut back the service to six days per week to obtain twenty-four hour per day travel as a third option. The interesting breakpoint is at the fourth choice. In this instance, the respondents would rather give up the availability of transportation during the day to obtain transportation seven days per week. Again, this suggests some areas of potential policies with respect to the provision of transportation services.

Figure 60 indicates a set of utilities which are quite consistent with what would be expected in the trade-off between the availability of transportation and the possibility of encountering dangerous people. In particular, the sample will willingly give up the availability of transportation to minimize the possibility of encountering dangerous people. In contrast, substantial sensitivity is evidenced in the trade-offs between total travel time and the availability of transportation during the week. In Figure 60, we see that the sample places higher utilities on having low total travel time in the first two preference orders. However, the respondents will accept thirty minutes of travel time to obtain seven days of transportation. The breakpoint again occurs with the fourth choice. In this case, the sample will accept the transportation five days per week to obtain the total travel time of fifteen minutes. This is clearly preferred over a total travel time of thirty minutes for six days. The total travel time of sixty minutes is obviously the least desirable combination. This finding again suggests some interesting policy possibilities with respect to scheduling and headways.

In Figure 61 it is seen that the obvious preferred combination is seven days a week with high level of comfort. The respondents, however, will give

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

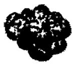
LEVEL OF POLLUTION PER PASSENGER:		5	6	7	
		.65007 (3)	.93353 (2)	1.14046 (1)	.85011
		.00115 (6)	.28461 (5)	.49154 (4)	.20119
		-.81704 (9)	-.53358 (8)	-.32665 (7)	-.61700
		-.20004	.08342	.29035	

FIGURE 57. SAMPLE'S UTILITIES: DAYS/WEEK VERSUS POLLUTION

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

TRANSPORTATION AVAILABLE ____ HOURS PER DAY:		5	6	7	
	12	-.88819 (9)	-.13287 (6)	.44802 (4)	-.25628
	18	-.36852 (8)	.3868 (5)	.96769 (2)	.26339
	24	-.14953 (7)	.60579 (3)	1.18668 (1)	.48238
		-.63191	.12341	.70430	

FIGURE 58. SAMPLE'S UTILITIES: DAYS/WEEK VERSUS HOURS/DAY

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:		5	6	7	
	Never	.59045 (3)	.95142 (2)	1.11678 (1)	.82307
	Sometimes	.01101 (6)	.37198 (5)	.53734 (4)	.24363
	Often	-.82572 (9)	-.46475 (8)	-.29939 (7)	-.59310
		-.23262	.12835	.29371	

FIGURE 59. SAMPLE'S UTILITIES: DAYS/WEEK VERSUS DANGEROUS PEOPLE

TRANSPORTATION AVAILABLE
_______ DAYS PER WEEK:

		5	6	7	
TOTAL TRAVEL TIME IS ______ MINUTES:	15	.15797 (4)	.92103 (2)	1.14812 (1)	.80744
	30	-.06763 (6)	.33543 (5)	.56252 (3)	.22184
	60	-.90674 (9)	-.50368 (8)	-.27659 (7)	-.61727
		-.28947	.11359	.34068	

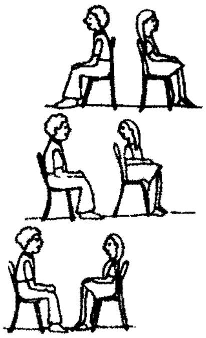
FIGURE 60. SAMPLE'S UTILITIES: DAYS/WEEK VERSUS TOTAL TRAVEL TIME

TRANSPORTATION AVAILABLE
_______ DAYS PER WEEK:

		5	6	7	
LEVEL OF COMFORT:	Low	-.99132 (9)	-.01699 (6)	.50791 (4)	-.21545
	Medium	-.51164 (8)	.46269 (5)	.98765 (2)	.26423
	High	-.45962 (7)	.51471 (3)	1.03967 (1)	.31625
		-.77587	.19846	.72342	

FIGURE 61. SAMPLE'S UTILITIES: DAYS/WEEK VERSUS COMFORT

TRANSPORTATION AVAILABLE
_______ DAYS PER WEEK:



	5	6	7	
OPPORTUNITY TO SOCIALIZE:	-.09547 (7)	.02444 (6)	.5998 (3)	-.15375
	-.48158 (8)	.49756 (4)	1.07292 (1)	.31937
	-.63958 (9)	.33956 (5)	.91492 (2)	.16137
	-.80095	.17819	.75355	

FIGURE 62. SAMPLE'S UTILITIES: DAYS/WEEK VERSUS SOCIALIZING

up some comfort to obtain seven days of transportation, i.e., they will accept a medium level of comfort to obtain seven days of transportation per week as their second option. Rather than accepting a low level of comfort, the sample will give up one day of transportation to obtain high levels of comfort. Thus, it is observed that the third preferred combination is for six days of transportation with high levels of comfort as contrasted with seven days of transportation with low comfort. It is interesting to note, however, that low comfort seven days a week is preferred over medium or low comfort six days per week. This again is consistent with the first and second order preferences, i.e., in general comfort will be yielded to obtain transportation seven days per week.

In Figure 62 it again appears that medium levels of socializing are preferred. Thus, it is observed that first preference is for a combination of seven days of transportation plus a medium level of socializing. It is also clear that the availability of transportation has more weight than socializing, in that the respondents prefer high levels of socializing and seven days of transportation or no socializing and seven days of transportation over a medium level of socializing and six days of transportation. It is also clear that at least for six or seven days of transportation no socializing is less preferred than high socializing. It would appear that if only five days of transportation are available the sample would prefer to have no socializing.

In Figure 63 the sample again shows high concern for environmental issues, i.e., it will clearly give up the availability of transportation to obtain low levels of pollution. Thus, the obvious preferred combination is twenty-four hours of transportation and low levels of pollution. However, the respondents will take eighteen hours of transportation or twelve hours of transportation to obtain low levels of pollution. This also follows for the case of medium levels of pollution. A somewhat similar finding is observed in Figure 64 with respect to fuel use. That is, the respondents obviously prefer low fuel use and twenty-four hours of transportation per day. However, they will give up some availability of transportation to obtain low fuel use. Thus, we see eighteen hours of transportation and low fuel use as the second preferred option. However, low fuel use and twelve hours per day is less preferred than having medium fuel use with twenty-four hours of transportation

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

LEVEL OF POLLUTION PER PASSENGER:

	12	18	24	
☁	.56949 (3)	1.0166 (2)	1.07995 (1)	.82730
☁☁	-.02977 (6)	.41734 (5)	.48069 (4)	.22804
☁☁☁	-.85278 (9)	-.40567 (8)	-.34232 (7)	-.59497
	-.25781	.18930	.25265	

FIGURE 63. SAMPLE'S UTILITIES: HOURS/DAY VERSUS POLLUTION

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

FUEL USE PER PASSENGER:

	12	18	24	
Low	.45878 (4)	.94285 (2)	1.17468 (1)	.79797
Medium	-.12958 (6)	.35449 (5)	.58632 (3)	.20961
High	-.89074 (9)	-.40667 (8)	-.17484 (7)	-.55155
	-.33919	.14488	.37671	

FIGURE 64. SAMPLE'S UTILITIES: HOURS/DAY VERSUS FUEL USE

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

TOTAL TRAVEL TIME IS _____ MINUTES:

	12	18	24	
15	.44359 (4)	.95779 (2)	1.11488 (1)	.78536
30	-.11121 (6)	.40299 (5)	.56008 (3)	.23056
60	-.95725 (9)	-.44305 (8)	-.28596 (7)	-.61548
	-.34177	.17243	.32952	

FIGURE 65. SAMPLE'S UTILITIES: HOURS/DAY VERSUS TOTAL TRAVEL TIME

per day. This suggests again that the availability of transportation is relatively important, but will be given up to obtain certain desired levels of environmentally beneficial attributes.

In Figure 65, it is seen that total travel time holds some salience over the availability of transportation. That is, the sample will give up some availability of transportation to obtain a minimal total travel time. However, the minimal travel time will be yielded if one must choose between twelve and twenty-four hours of available service. Thus, we see the third preferred option being for thirty minutes of total travel time with twenty-four hours of service as opposed to the fourth option of fifteen minutes of total travel time only twelve hours per day. We may contrast this finding with the results shown in Figure 66. In this case, the sample clearly will give up the availability of transportation to avoid encountering dangerous people.

Figures 67 and 68 of the sample's responses show similar preferences in the area of transportation availability and comfort or the opportunity to socialize. That is, comfort is a desired attribute, however, a certain amount of it will be given up to obtain more available transportation. Likewise, medium levels of socializing are preferred but these will be given up to obtain high levels of transportation service. In Figure 69, the environmental concern is again evident. That is, the respondents will give up some travel time to obtain low fuel use per passenger. However, before they will accept a sixty minute trip they would prefer to have medium fuel use at fifteen minutes. If their choice is between thirty and sixty minutes combined with low fuel or medium fuel use, they will then select a sixty minute low fuel use trip over a thirty minute medium fuel use trip. If, on the other hand, their choice is between sixty minutes with medium fuel use versus fifteen minutes with high fuel use, they will select the fifteen minute trip with high fuel use and so on. This environmental concern is somewhat replicated in Figure 70. In this case, a certain amount of travel time will again be yielded to obtain low levels of pollution. However, the respondents seem more sensitive to the total travel time in this pair of trade-offs than in the previous case. Thus, they seem to be more willing to accept higher pollution levels if trip time can be reduced.

TRANSPORTATION AVAILABLE
________ HOURS PER DAY:

		12	18	24	
POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:	Never	.67956 (3)	.99674 (2)	1.13306 (1)	.86794
	Sometimes	.00779 (6)	.32497 (5)	.46129 (4)	.19617
	Often	-.73867 (9)	-.29269 (8)	-.28517 (7)	-.55029
		-.18838	.12880	.26512	

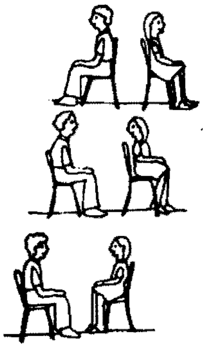
FIGURE 66. SAMPLE'S UTILITIES: HOURS/DAY VERSUS DANGEROUS PEOPLE

TRANSPORTATION AVAILABLE
________ HOURS PER DAY:

		12	18	24	
LEVEL OF COMFORT:	Low	-1.0569 (9)	-.12023 (6)	.28951 (5)	-.34532
	Medium	-.49415 (8)	.44252 (4)	.85226 (2)	.21743
	High	-.21287 (7)	.7238 (3)	1.13354 (1)	.49871
		-.71158	.22509	.63483	

FIGURE 67. SAMPLE'S UTILITIES: HOURS/DAY VERSUS COMFORT

TRANSPORTATION AVAILABLE
________ HOURS PER DAY:



	12	18	24	
OPPORTUNITY TO SOCIALIZE:	-.92521 (9)	.06882 (6)	.60855 (3)	-.12978
	-.46944 (7)	.52459 (4)	1.06432 (1)	.32599
	-.6379 (8)	.35613 (5)	.89586 (2)	.15753
	-.79543	.19860	.73833	

FIGURE 68. SAMPLE'S UTILITIES: HOURS/DAY VERSUS SOCIALIZING

TOTAL TRAVEL TIME IS ________ MINUTES:

FUEL USE PER PASSENGER:

	15	30	60	
💧	1.18203 (1)	.85735 (2)	.3507 (4)	.73613
💧💧	.64148 (3)	.31681 (5)	-.18985 (7)	.19558
💧💧💧	-.03156 (6)	.35623 (8)	-.86289 (9)	-.47746
	.44590	.12123	-.38543	

FIGURE 69. SAMPLE'S UTILITIES: TOTAL TRAVEL TIME VERSUS FUEL USE

TOTAL TRAVEL TIME IS ______ MINUTES:

LEVEL OF POLLUTION PER PASSENGER:

	15	30	60	
Low	1.11897 (1)	.8133 (2)	-.02658 (6)	.59632
Medium	.74681 (3)	.44114 (4)	-.34558 (8)	.22416
High	.1269 (5)	-.17877 (7)	-.96549 (9)	-.39575
	.52265	.21698	-.56974	

FIGURE 70. SAMPLE'S UTILITIES: TOTAL TRAVEL TIME VERSUS POLLUTION

TOTAL TRAVEL TIME IS ______ MINUTES:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

	15	30	60	
Never	1.08895 (1)	.9554 (2)	.6034 (3)	.82757
Sometimes	.45777 (4)	.32422 (5)	-.02778 (6)	.19639
Often	-.34997 (7)	-.48352 (8)	-.83552 (9)	-.61135
	.26138	.12783	-.22417	

FIGURE 71. SAMPLE'S UTILITIES: TOTAL TRAVEL TIME VERSUS DANGEROUS PEOPLE

In Figure 71, the sample again consistently will give up travel time to avoid encountering dangerous people. Figure 72 illustrates a rather interesting change from earlier preference patterns for comfort. In this case, medium levels of comfort seem to have rather more salience than in earlier trade-offs. Thus, the preferred option is for medium comfort at fifteen minutes total travel time, next is high comfort at fifteen minutes of travel time, followed by medium comfort at thirty minutes of travel time. This latter combination is preferred to low comfort levels at fifteen minutes of travel time. The overall ratings in terms of the low comfort-travel time combination suggest that a low comfort characteristic is less acceptable generally, but will be accepted for certain gains in travel time. In Figure 73, the sample treats the trade-off between travel time and opportunity to socialize as was done in earlier matrices.

Figure 74 illustrates some rather interesting trade-offs between fuel use and pollution. In this instance, the sample is having to yield on one environmentally desirable attribute to obtain another environmentally desirable attribute. Thus, after the obvious first preference of low fuel use and low pollution, we see that the respondents will accept a medium level of pollution to obtain a low level of fuel use. However, before accepting high pollution, they will accept a medium level of fuel use to first obtain a low level of pollution or next to obtain a medium level of pollution. High pollution becomes acceptable at that point where the trade-off is between high pollution and low fuel use versus high fuel use and low pollution. In that case, low fuel use wins out. After that situation, low or medium pollution levels are preferred in combination with high fuel use before high pollution will be accepted. In Figure 75, some changes are observed in the salience of the attribute of encountering dangerous people. The obvious preference is to never encounter dangerous people and to use low amounts of fuel. This is followed by a preference for never encountering dangerous people with the medium level of fuel use. However, before the sample is prepared to accept high fuel use, it will sometimes be willing to encounter dangerous people if it can obtain low fuel use. Following that rather interesting breakpoint, the pattern returns to that previously exhibited, i.e., preferring to avoid dangerous people.

TOTAL TRAVEL TIME IS
_____ MINUTES:

		15	30	60	
LEVEL OF COMFORT:	Low	.41044 (4)	-.08646 (6)	-1.03338 (9)	-.27967
	Medium	1.12554 (1)	.62864 (3)	-.31828 (7)	.43543
	High	.85838 (2)	.36148 (5)	-.58544 (8)	.16827
		.69011	.19321	-.75371	

FIGURE 72. SAMPLE'S UTILITIES: TOTAL TRAVEL TIME VERSUS COMFORT

TOTAL TRAVEL TIME IS
_____ MINUTES:

		15	30	60	
OPPORTUNITY TO SOCIALIZE:		.60400 (3)	.07621 (6)	-.97471 (9)	-.13605
		1.02285 (1)	.49506 (4)	-.55586 (7)	.28280
		.87743 (2)	.34964 (5)	-.70128 (8)	.13738
		.74005	.21226	-.83866	

FIGURE 73. SAMPLE'S UTILITIES: TOTAL TRAVEL TIME VERSUS SOCIALIZING

FUEL USE PER PASSENGER:

		💧	💧💧	💧💧💧	
LEVEL OF POLLUTION PER PASSENGER:	Low	1.17929 (1)	.70836 (3)	.10523 (6)	.59432
	Medium	.85825 (2)	.38732 (4)	-.21581 (7)	.27328
	High	.2422 (5)	-.22873 (8)	-.83186 (9)	-.34277
		.58497	.11404	-.48909	

FIGURE 74. SAMPLE'S UTILITIES: FUEL USE VERSUS POLLUTION

In Figures 76 and 77, the preference pattern begun in Figure 72 with respect to the trade-off of comfort, and the preference pattern consistently given with respect to the trade-off of socializing, are both continued. Thus, the respondents appear to have preferences for medium levels of comfort and socializing in combination with alternative fuel use levels. That is, the first preference is for low fuel use and medium comfort or medium socializing or comfort, but if they must accept a medium level of fuel use then they prefer a medium level of comfort or socializing, and so on. In Figure 78, the sample again shows concern for environmental issues. While the respondents prefer never encountering dangerous people, they will accept the possibility of encountering dangerous people sometimes if they can obtain low levels of pollution before they will accept high levels of pollution with the possibility of never encountering dangerous people. In Figure 79, the respondents clearly exhibit environmental consciousness over concern for comfort, i.e., they consistently will give up comfort to obtain low levels of pollution.

Figure 80 exhibits the same sort of pattern in trade-offs with respect to the opportunity to socialize as has been found in all previous trade-offs with this attribute. In Figure 81, the respondents indicate that while they prefer to never encounter dangerous people, they will be prepared to accept the possibility of encountering dangerous people if they can have high comfort rather than accept low comfort and never encounter dangerous people. Figure 82 exhibits the same pattern of trade-offs with respect to the opportunity to socialize vis-a-vis encountering dangerous people as has been found in the previous matrices. A somewhat different preference ordering is observed in Figure 83 with respect to the opportunity to socialize. In this instance, while medium levels of socializing are preferred first and second in combination with high or medium levels of comfort, the respondents indicate that they will accept high levels of socializing to obtain high levels or medium levels of comfort respectively for a third or fourth preference. Thus, never socializing only becomes acceptable as a fifth preference in combination with high comfort levels.

It is clear that a tremendous amount of data has been portrayed in these matrices. It is difficult to make policy on the basis of each of the separate sets of utilities for such trade-offs. Thus, it is necessary to obtain

FUEL USE PER PASSENGER:

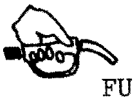
		💧	💧💧	💧💧💧	
POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:	Never	1.14754 (1)	.9043 (2)	.4964 (4)	.78959
	Sometimes	.56681 (3)	.32357 (5)	-.08433 (6)	.20886
	Often	-.19182 (7)	-.43506 (8)	-.84296 (9)	-.54977
		.35795	.11471	-.29319	

FIGURE 75. SAMPLE'S UTILITIES: FUEL USE VERSUS DANGEROUS PEOPLE

FUEL USE PER PASSENGER:

		💧	💧💧	💧💧💧	
LEVEL OF COMFORT:	Low	.59627 (3)	-.00748 (6)	-.88371 (9)	-.15252
	Medium	1.06223 (1)	.45848 (4)	-.41775 (7)	.31344
	High	.99447 (2)	.39072 (5)	-.48551 (8)	.24568
		.74879	.14504	-.73119	

FIGURE 76. SAMPLE'S UTILITIES: FUEL USE VERSUS COMFORT



FUEL USE PER PASSENGER:

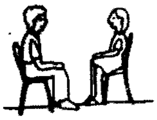
		💧	💧💧	💧💧💧	
OPPORTUNITY TO SOCIALIZE:		.53767 (3)	-.0338 (6)	-.95956 (9)	-.19686
		1.09247 (1)	.5210 (4)	-.40476 (7)	.35794
		.91069 (2)	.33922 (5)	-.58654 (8)	.17616
		.73453	.16306	-.76270	

FIGURE 77. SAMPLE'S UTILITIES: FUEL USE VERSUS SOCIALIZING

LEVEL OF POLLUTION
PER PASSENGER:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:	Never	1.15729 (1)	.87586 (2)	.48637 (4)	.78084
	Sometimes	.59864 (3)	.31721 (5)	-.07228 (6)	.22219
	Often	-.18409 (7)	-.46552 (8)	-.85501 (9)	-.56054
		.37645	.09502	-.29447	

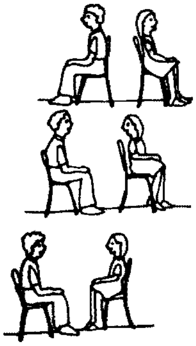
FIGURE 78. SAMPLE'S UTILITIES: POLLUTION VERSUS DANGEROUS PEOPLE

LEVEL OF POLLUTION
PER PASSENGER:

LEVEL OF COMFORT:	Low	.63821 (3)	-.10479 (6)	-.83323 (9)	-.15389
	Medium	.95766 (2)	.21466 (5)	-.51378 (8)	.16556
	High	1.18507 (1)	.44207 (4)	-.28637 (7)	.39297
		.79210	.04910	-.67934	

FIGURE 79. SAMPLE'S UTILITIES: POLLUTION VERSUS COMFORT

LEVEL OF POLLUTION
PER PASSENGER:



OPPORTUNITY TO SOCIALIZE:	.70731 (3)	.10778 (6)	-.80772 (9)	-.04965
	1.03379 (1)	.43426 (4)	-.48124 (7)	.27683
	.92056 (2)	.32106 (5)	-.59444 (8)	.16363
	.75696	.15743	-.75807	

FIGURE 80. SAMPLE'S UTILITIES: POLLUTION VERSUS SOCIALIZING

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

		Never	Sometimes	Often	
LEVEL OF COMFORT:	Low	.59602 (4)	.11599 (6)	-.80201 (9)	-.09236
	Medium	.79864 (2)	.31861 (5)	-.59939 (8)	.11026
	High	1.13818 (1)	.65815 (3)	-.25985 (7)	.44980
		.68838	.20835	-.70965	

FIGURE 81. SAMPLE'S UTILITIES: DANGEROUS PEOPLE VERSUS COMFORT

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

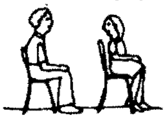
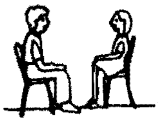
		Never	Sometimes	Often	
OPPORTUNITY TO SOCIALIZE:		.80239 (3)	-.11187 (6)	-.6326 (9)	-.04478
		1.12883 (1)	.21457 (4)	-.30616 (7)	.28166
		1.09096 (2)	.1767 (5)	-.34403 (8)	.24379
		.84717	-.06709	-.58782	

FIGURE 82. SAMPLE'S UTILITIES: DANGEROUS PEOPLE VERSUS SOCIALIZING

LEVEL OF COMFORT:

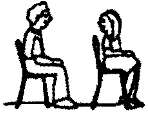
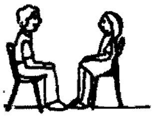
		Low	Medium	High	
OPPORTUNITY TO SOCIALIZE:		-1.09897 (9)	.07203 (6)	.27056 (5)	-.29458
		-.36514 (7)	.80586 (2)	1.00439 (1)	.43925
		-.63066 (8)	.54034 (4)	.73887 (3)	.17373
		-.80439	.36661	.56514	

FIGURE 83. SAMPLE'S UTILITIES: COMFORT VERSUS SOCIALIZING

summary measures of the utilities for various attributes by their respective levels. Figures 84 through 92 illustrate the summary utilities for each attribute by the respective levels of the attribute. In each of these figures, the solid line plots the curve of the calculated utilities for each attribute for each level. In essence, the solid line represents the average utility of the attribute for the sample for each of the respective levels. For example, in Figure 84 the cost curve is downward sloping to the right with the highest utility for the lowest cost, which is 3.3 cents per mile -- i.e., fifteen cents less than current cost, which is taken to be 18.3 cents per mile. We see that this utility has a value slightly less than .6, in fact, its calculated value is .54266. The average utility for cost per mile decreases as cost per mile increases, such that at 33.3 cents per mile, i.e., fifteen cents greater than current costs, the calculated utility is -.52345. Similar curves are seen in Figures 85 and 86 for fuel consumption per passenger. That is, the utility decreases as fuel consumption or pollution increase. In Figures 87 and 88, the curves are upward sloping to the right, i.e., as transportation availability in either days per week or hours per day increases so does the utility. In Figures 89 and 90, the curves are again downward sloping to the right, i.e., as total travel time and the possibility of encountering dangerous people increase, the utilities decrease. In Figure 91, the curve is upward sloping to the right, i.e., as levels of comfort increase so does utility. Figure 92 shows the rather more interesting curve in the sense that it is peaked at the middle values. That is, as the possibility of socializing increases from never to sometimes so does utility, however, as the possibility of increases from sometimes to often utility decreases. Each of these curves may be utilized to determine the average utility of any given level of an attribute for the sample. Thus, for policy making purposes, it is possible to go to the curve for a given attribute and determine what its utility is at any given level.

To facilitate such policy type analysis, it is possible to fit a series of linear equations to each of these curves to obtain a straight line curve for calculating the average numerical value for the level. Such curves are represented on Figues 84 through 92 by the broken line. Table 21 lists the linear equations for each attribute for deriving these curves. Illustrative of how these equations may be used is the information contained in Table 22.

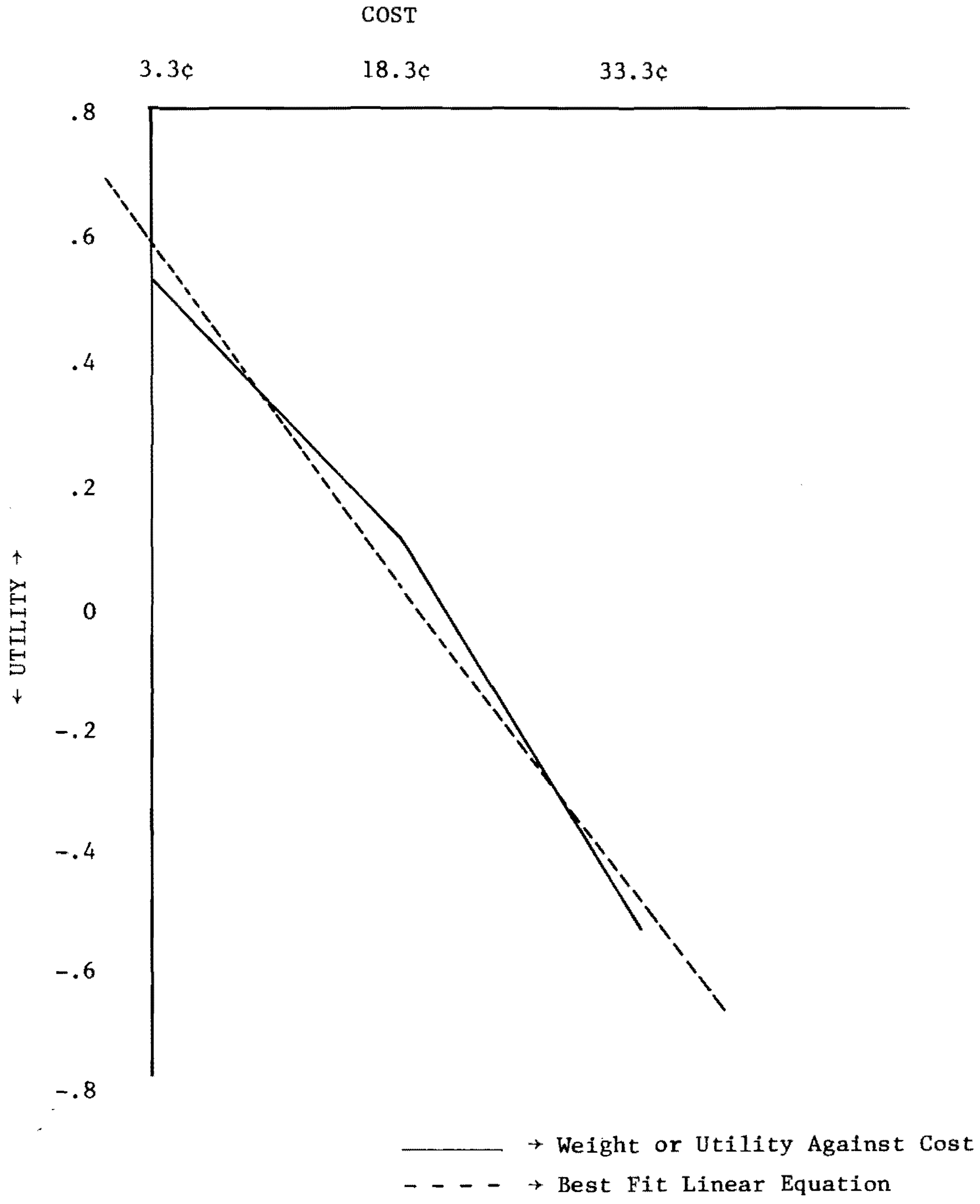


FIGURE 84. SAMPLE'S UTILITY CURVES: COST

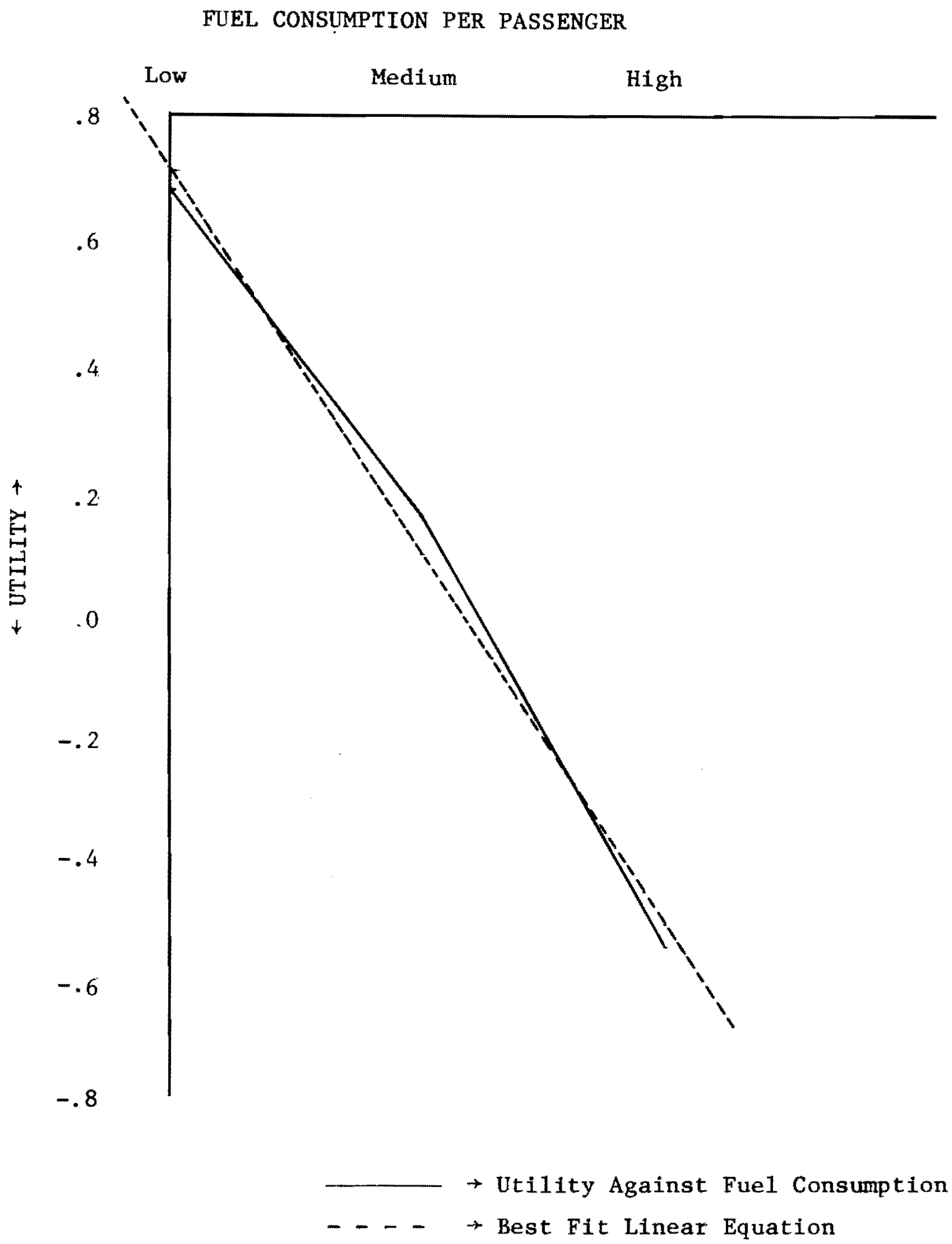


FIGURE 85. SAMPLE'S UTILITY CURVES: FUEL USE

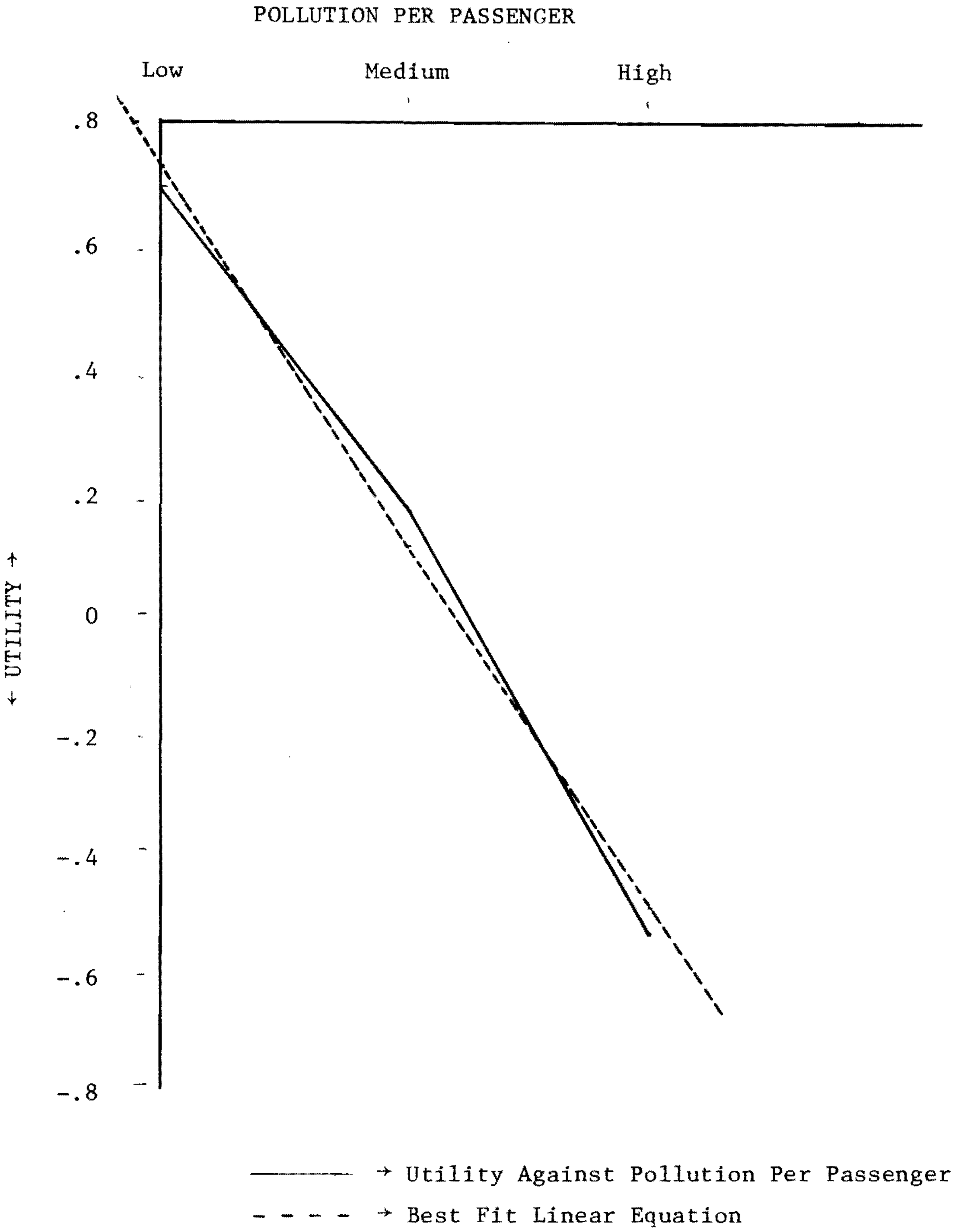


FIGURE 86. SAMPLE'S UTILITY CURVES: POLLUTION

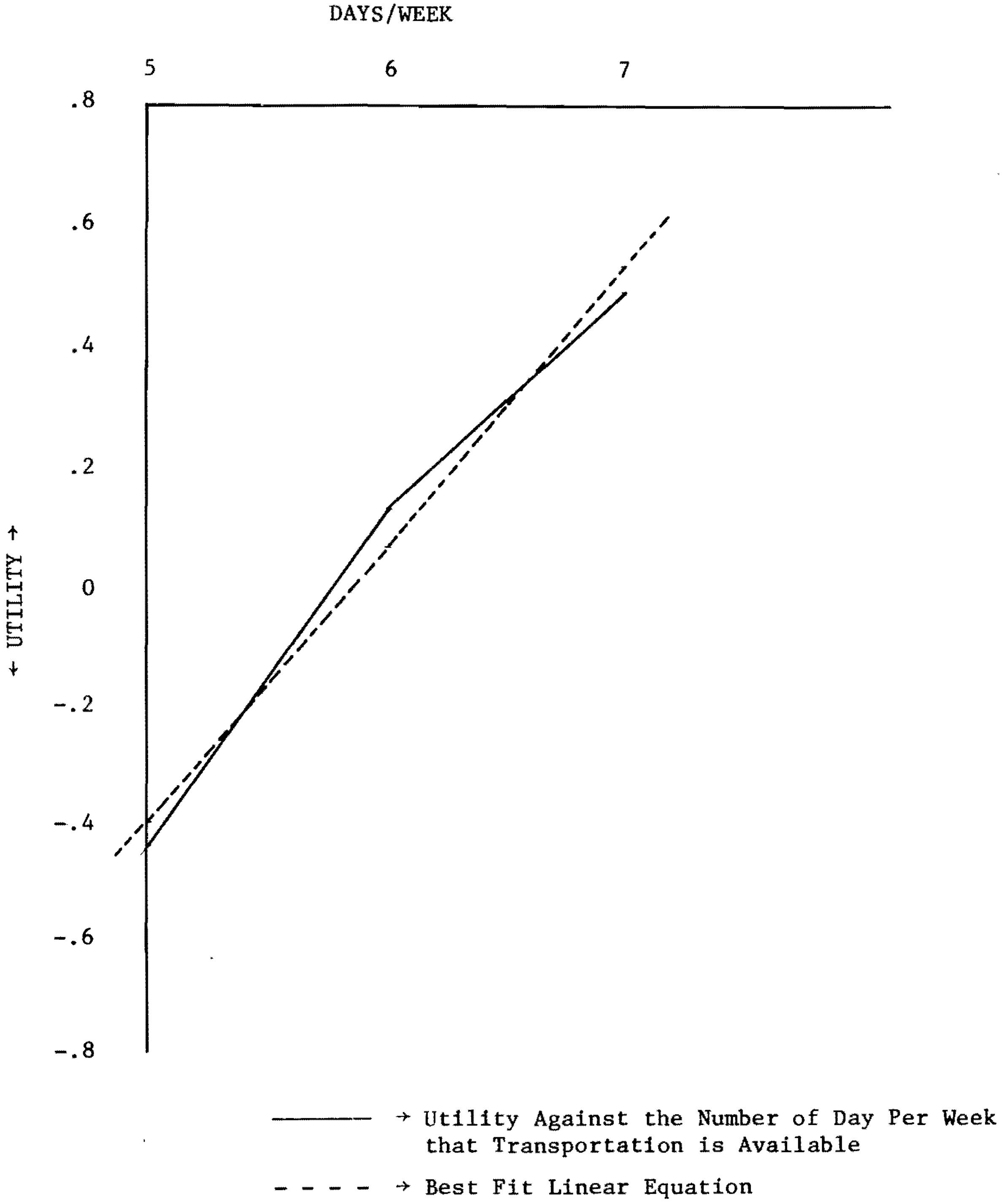


FIGURE 87. SAMPLE'S UTILITY CURVES: DAY/WEEK

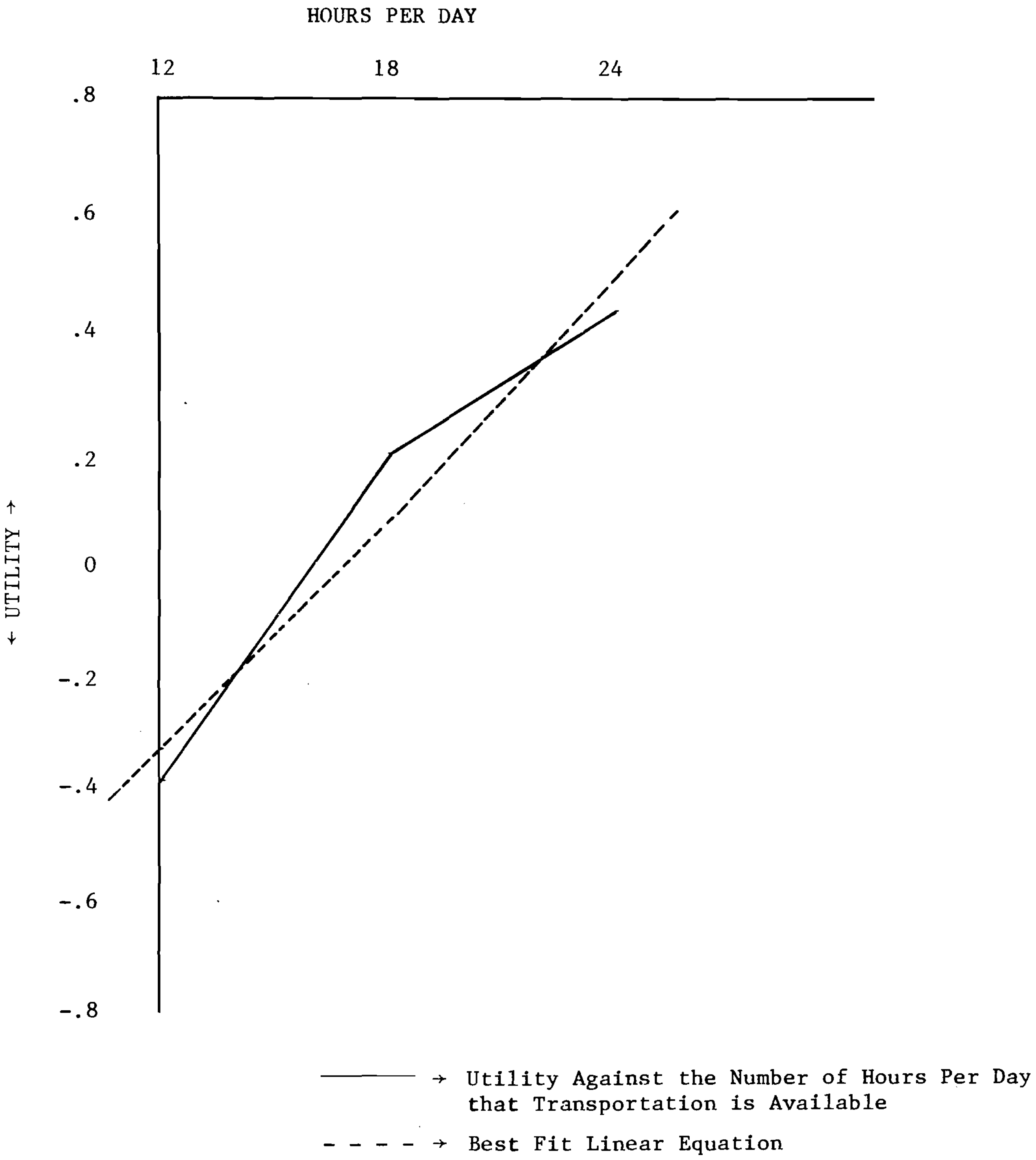


FIGURE 88. SAMPLE'S UTILITY CURVES: HOURS/DAY

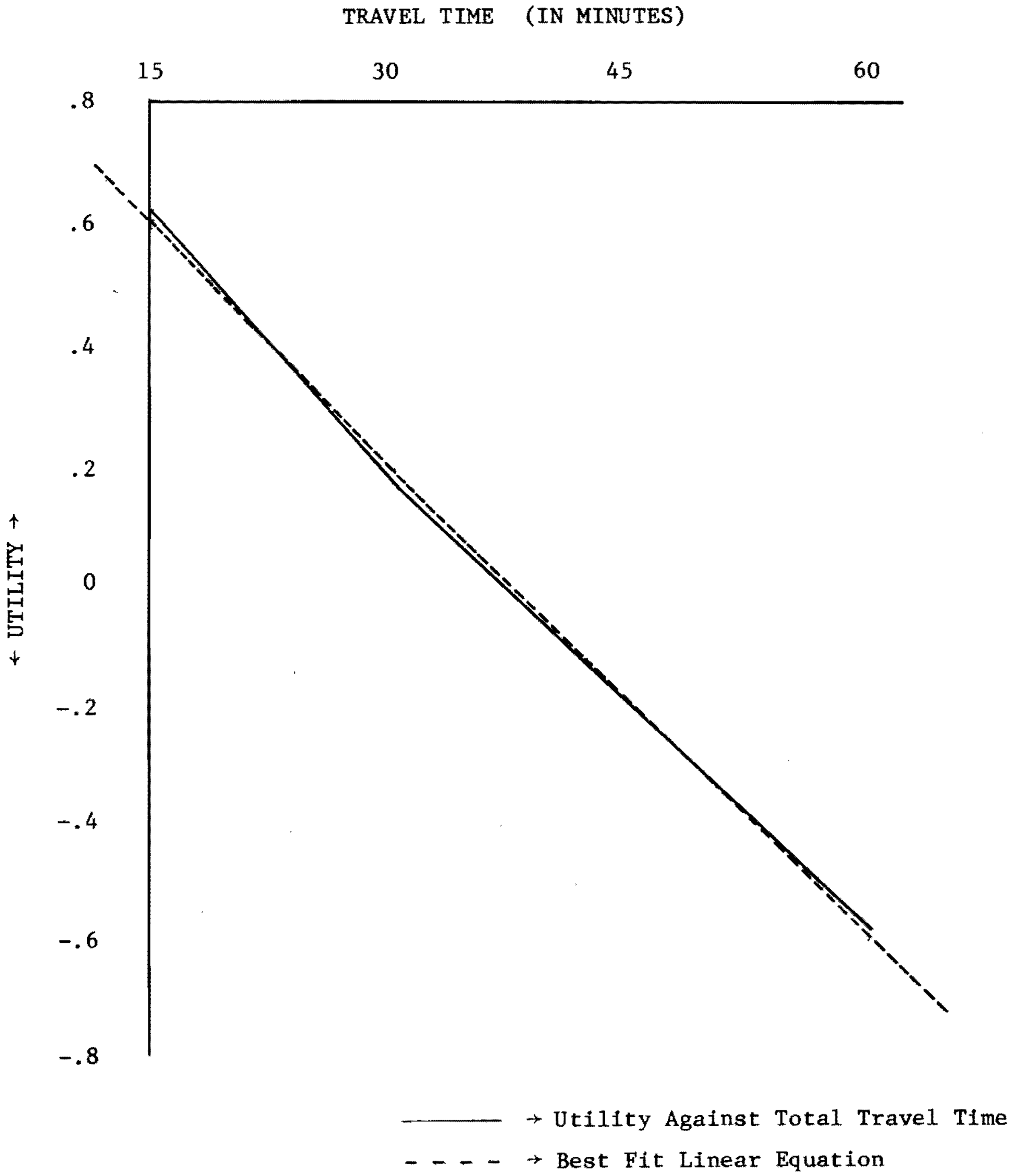


FIGURE 89. SAMPLE'S UTILITY CURVES: TOTAL TRAVEL TIME

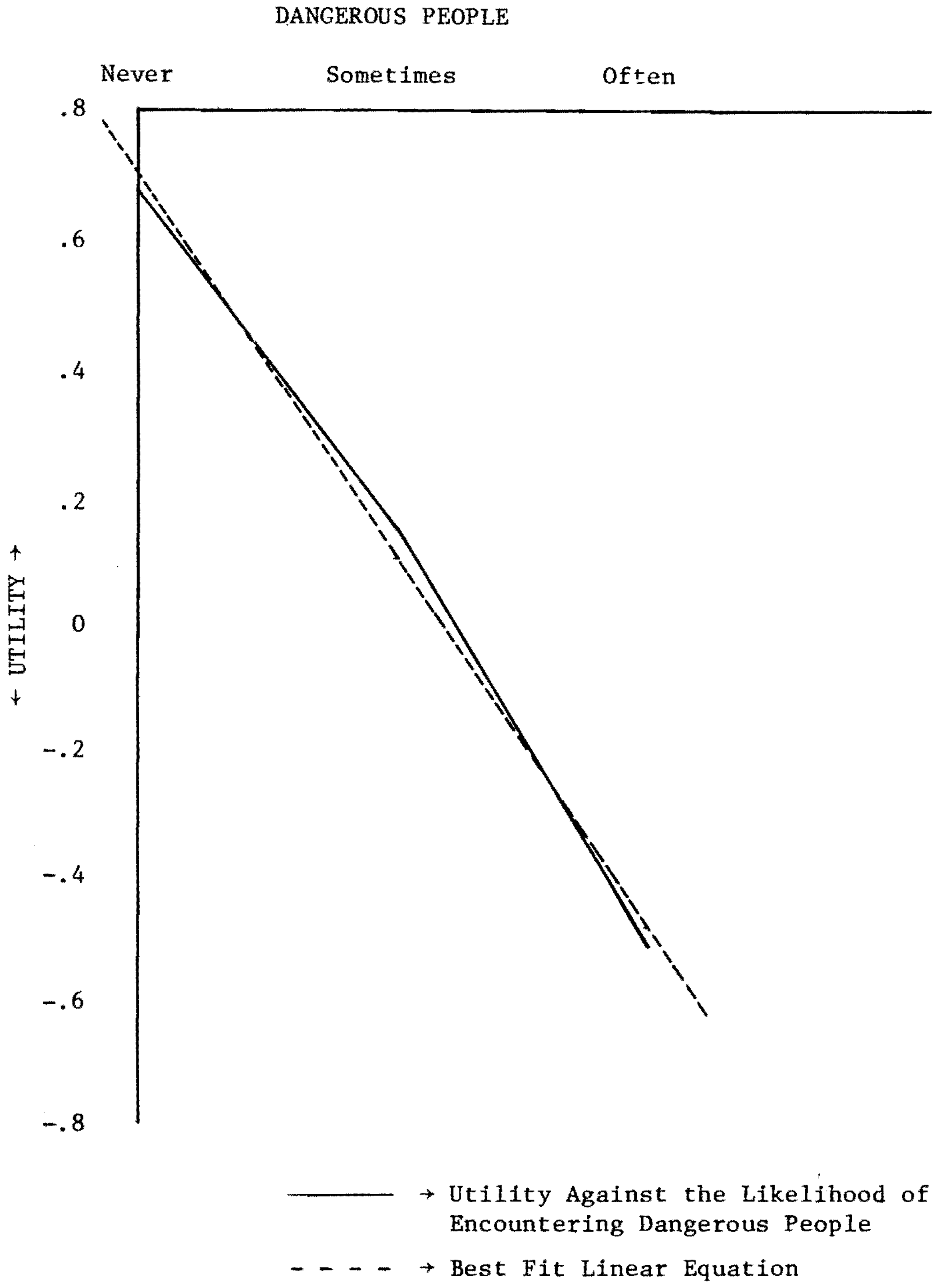


FIGURE 90. SAMPLE'S UTILITY CURVES: DANGEROUS PEOPLE

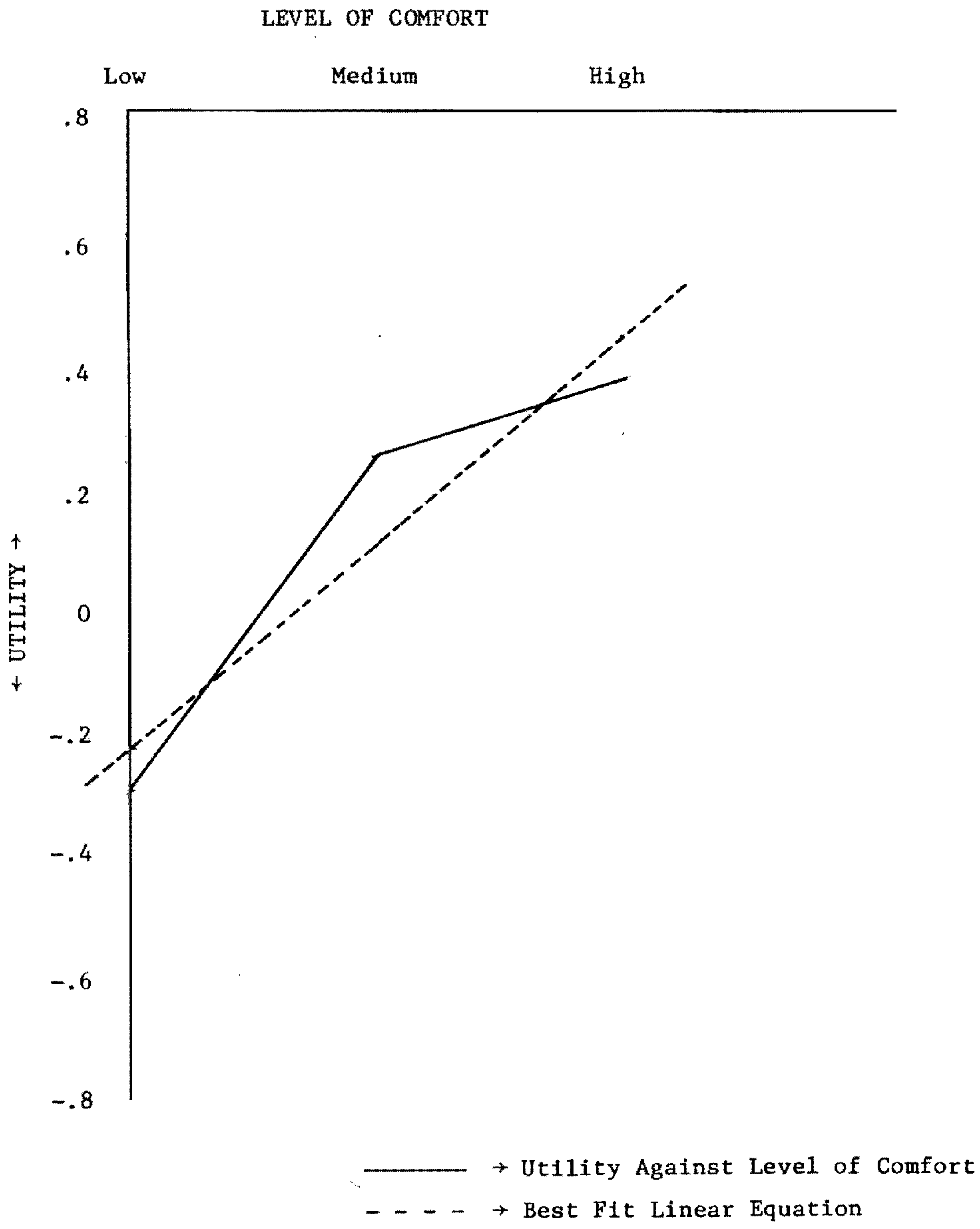


FIGURE 91. SAMPLE'S UTILITY CURVES: COMFORT

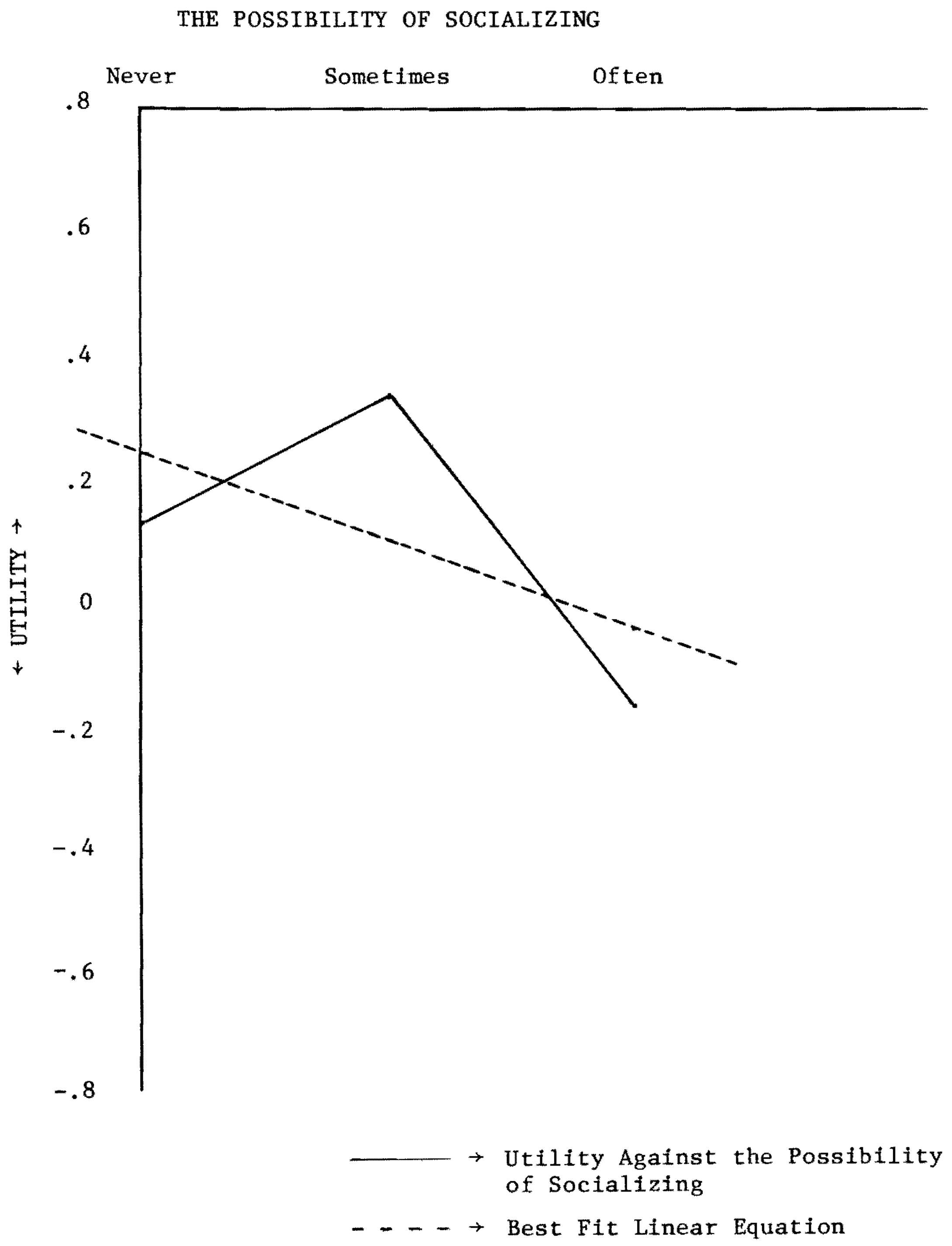


FIGURE 92. SAMPLE'S UTILITY CURVES: SOCIALIZING

In this instance, using the equations listed in Table 21, we have determined the level of each attribute which has a weight equal to the weight for 18.3 cents per mile. That is, in Table 22 it is seen that fuel use at a level of 1.92 (slightly below a medium level of fuel use), pollution at a level of 1.95 (slightly below a medium level of pollution), 6.17 days per week for transportation availability, 18.9 hours per day for transportation availability, a total travel time of 32.6 minutes, and so on are equivalent to the utility calculated for a cost of 18.3 cents per mile. In short, for the sample, the utility of having transportation available 6.17 days per week is the same as paying 18.3 cents per mile, and so on.

The preceding analyses were for the sample as a whole. They represent summary figures for all of the respondents who were of quality one, two or three in their responses in the interview. The next set of analyses are concerned with utilizing these calculated utilities to assess how the respondents viewed private automobile and public transportation at the time of the interview. Table 23 provides the basic data for this form of analysis. In Table 23 the first column lists the transportation attributes of concern in this study. The numbers correspond to the numbers assigned to each level of the attributes in the analysis. The second column presents the average weight (utility) calculated by taking all the derived weights for each level of an attribute as determined through all possible trade-offs with all other attributes for all respondents. These are the average utilities which were used to generate the curves contained in the preceding figures. The third column indicates the frequency with which all respondents in the sample stated that the private automobile is characterized by the respective level of each of the attributes. That is, this column is the numerical value counterpart of the image profile for the private automobile shown in Figure 11. The fourth column is analogous to the third column except this is for public transportation. The sixth and eighth columns contain the sums of the transformed weights for the private automobile and public transportation respectively. These are the weighted average weights, i.e., the figures in columns five and seven provide the transformed weights for each level by the frequency by which that level was chosen. Columns six and eight represent the sums of those transformed figures.

TABLE 21. LIST OF ATTRIBUTES, LEVELS AND LINEAR EQUATIONS $y = a + bx$

y = Weights
x = Numerical Value for Levels
a = y intercept
b = Slope

ATTRIBUTES	LEVELS	EQUATIONS
Cost	3.3¢ 18.3¢ 33.3¢	$y = .70512 - .03554\ x$ $x = \frac{y - (.70512)}{- .03554}$
Fuel	$\begin{array}{c} L \\ M \\ H \end{array} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	$y = 1.3313 - .61717\ x$ $x = \frac{y - (1.3313)}{- .61717}$
Pollution	$\begin{array}{c} L \\ M \\ H \end{array} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	$y = 1.34381 - .61392\ x$ $x = \frac{y - (1.34381)}{- .61392}$
Days/Week	5 6 7	$y = -2.76759 + .47238\ x$ $x = \frac{y - (-2.76759)}{.47238}$
Hrs./Day	12 18 24	$y = -1.18696 + .07064\ x$ $x = \frac{y - (-1.18696)}{.07064}$
Total Travel Time	15 30 60	$y = 1.01447 - .02670\ x$ $x = \frac{y - (1.01447)}{- .0267}$
Possibility of Meeting Dangerous People	$\begin{array}{c} N \\ S \\ O \end{array} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	$y = 1.30957 - .59881\ x$ $x = \frac{y - (1.30957)}{- .59881}$
Comfort	$\begin{array}{c} L \\ M \\ H \end{array} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	$y = -.55070 + .33523\ x$ $x = \frac{y - (-.55070)}{.33523}$
Opportunity to Socialize	$\begin{array}{c} N \\ S \\ O \end{array} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	$y = .42232 - .15328\ x$ $\frac{y - (.42232)}{- .15328}$

TABLE 22. TABLE OF ATTRIBUTES INDICATING LEVEL WHICH HAS EQUAL WEIGHT AS 18.3¢ COST (.14528)

Cost	18.3¢	(15.8¢)	← Amount calculated using linear equation
Fuel	1.92	$\begin{array}{c} L \\ M \\ H \end{array}\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	← 1.92
Pollution	1.95	$\begin{array}{c} L \\ M \\ H \end{array}\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	← 1.95
Days/Week	6.17 Days		
Hrs./Day	18.9 Hrs.		
Total Travel Time	32.6 Mins.		
Possibility of Meeting Dangerous People	1.94	$\begin{array}{c} N \\ S \\ O \end{array}\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	← 1.94
Comfort	2.08	$\begin{array}{c} L \\ M \\ H \end{array}\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	← 2.08
Opportunity to Socialize	1.81	$\begin{array}{c} N \\ S \\ O \end{array}\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$	← 1.81

TABLE 23. WEIGHTED AVERAGE WEIGHTS FOR MATRIX RESPONDENTS

ATTRIBUTE		AVG. WEIGHT [a]	PRIV. AUTO. FREQ [b]	PUB. TRANS. FREQ [c]		T [d]		T [e]
COST	1.	.54266	6.3	75.0	.034		.407	
	2.	.14528	70.8	10.4	.103		.015	
	3.	-.52345	22.9	14.6	-.120	.017	-.076	.346
FUEL USE	4.	.67946	6.3	58.3	.043		.396	
	5.	.16630	47.9	25.0	.079		.042	
	6.	-.55448	45.8	16.7	-.254	-.132	-.093	.345
POLLUTION	7.	.69833	27.1	35.4	.189		.247	
	8.	.17912	54.2	56.3	.097		.101	
	9.	-.52950	18.8	8.3	-.100	.186	-.044	.304
DAYS/WK	10.	-.44392	0.0	4.2	0		-.019	
	11.	.14307	4.2	35.4	.006		.051	
	12.	.50083	95.8	60.4	.479	.485	.303	.335
HRS./DAY	13.	-.39641	0.0	35.4	0		-.140	
	14.	.19860	6.3	52.1	.013		.103	
	15.	.45121	93.8	12.5	.423	.436	.056	.019
TOTAL TRAVEL TIME	16.	.63187	39.6	2.1	.250		.013	
	17.	.18646	54.2	50.0	.101		.093	
	18.	-.57854	6.3	47.9	-.036	.315	-.277	-.171

TABLE 23. (CONTINUED)

ATTRIBUTE		AVG. WEIGHT [a]	PRIV. AUTO. FREQ [b]	PUB. TRANS. FREQ [c]		T [d]		T [e]
POSS. OF ENCOUNTERING DANGEROUS PEOPLE	19.	.78054	20.8	0.0	.162		0	
	20.	.19591	70.8	89.6	.139		.176	
	21.	-.58450	8.3	10.4	-.049	.252	-.061	.115
LEVEL OF COMFORT	22.	-.28902	2.1	33.3	-.006		-.096	
	23.	.26683	33.3	60.4	.089		.161	
	24.	.38143	64.6	6.3	.246	.329	.024	.089
OPPORTUNITY TO SOCIALIZE	25.	-.15496	14.6	0.0	-.023		0	
	26.	.35063	79.2	68.8	.278		.241	
	27.	.15235	6.3	31.3	.010	.265	.048	.289

[a] Average weight calculated by taking all derived weights for each level of an attribute as determined through all possible trade-offs with all other attributes for all respondents.

[b] Frequency with which all respondents stated that private automobile is characterized by the respective levels of each attribute.

[c] Frequency with which all respondents stated that public transportation is characterized by the respective levels of each attribute.

[d] Sums of transformed weights for private automobile, i.e., weighted average weights.

[e] Sums of transformed weights for public transportation, i.e., weighted average weights.

These data are rank ordered in Table 24 for both private automobile and public transportation. This table indicates the order of the attributes for both private automobile and public transportation in terms of how the respondents felt about them at the time of the interview. In short, Table 24 indicates that for the private automobile the respondents rated it highest in availability of transportation in the days per week, next highest in availability of transportation hours per day, and so on. This is contrasted with how the respondents felt about public transportation which they rated as having the highest order in terms of cost, then fuel, then availability in days per week, and so on. Summing each of these values for each attribute for the private automobile and for public transportation respectively, a total perceived utility for each mode is obtained. The private automobile, at the time of the interview for all the respondents, obtained a total value of 2.153, while public transportation received a total perceived utility of 1.671.

If it is assumed that the sample responds rationally, i.e., chooses the preferred mode of transportation, then the data in Table 24 would indicate that there should be no reason to expect public transportation to be chosen by the respondents in the sample since the private automobile is clearly perceived to have the highest overall utility. In fact, the split in the sample between the use of the private automobile and the use of public transportation is approximately eighty-five percent auto users and ten percent public transportation users, with the remainder using some other form of transportation. To account for the difference between what would be expected of the sample on the basis of the data contained in Table 24 and what is observed in the sample's choice behavior, two factors may be posited. First, the data in Table 24 are average data for the whole sample. Thus, it is conceivable that some individuals would have utilities for the private auto which would be less than for the public transportation mode. Those individuals being few in number would only act to dampen the sample's total perceived utility for the private auto vis-a-vis public transportation. Thus, the individuals choosing public transportation may, in fact, have total perceived utilities for public transportation and private automobiles which are different from those obtained from the sample as a whole. To perform the type of analysis necessary to determine if this is the case for the

TABLE 24. PERCEIVED UTILITY: MATRIX RANKS

PRIVATE AUTOMOBILE

1.	Days/Week	.485
2.	Hours/Day	.436
3.	Comfort	.329
4.	Total Travel Time	.315
5.	Opportunity to Socialize	.265
6.	Possibility of Encountering Dangerous People	.252
7.	Pollution	.186
8.	Cost	.017
9.	Fuel	- .132
	TOTAL PERCEIVED UTILITY	2.153

PUBLIC TRANSPORTATION

1.	Cost	.346
2.	Fuel	.345
3.	Days/Week	.335
4.	Pollution	.304
5.	Opportunity to Socialize	.289
6.	Possibility of Encountering Dangerous People	.115
7.	Comfort	.089
8.	Hours/Day	.019
9.	Total Travel Time	- .171
	TOTAL PERCEIVED UTILITY	1.671

sample requires modification of the algorithm used in this study. This is beyond the scope of this project. Another factor which could account for the difference between the expected and observed behavior is that people do not always choose the preferred option all the time. Thus, sometimes some of the respondents will use public transportation. This type of behavior could be accounted for by developing probabilistic formulations to express the likelihood that any given individual or proportion of the sample would behave in a non-optimal or non-preferred fashion. Again, the development of such formulations is beyond the scope of this project.

Putting aside the preceding caveats, and retaining the assumption of rational, optimizing behavior, Tables 25 and 26 provide guides to policy makers with respect to focal points for making changes in the modes of transportation to obtain increased patronage. These tables utilize the data from the preceding tables to determine which attributes, at the time of the interview, were the farthest from their maximum possible utility. For example, in Table 25 the weighted utility for cost is .017. The maximum possible utility for cost is .543. The distance that .017 is from .543 is .526. This raw value gives some indication of whether this attribute might be responsive to policy changes. However, since the weighted utilities and the maximum possible utilities are not comparable between attributes, it is necessary to normalize these data to facilitate comparisons. This is done by taking the ratio of the distance to the range for the utilities for each attribute. Thus, again using Table 25, we see that the distance that the weighted utility for cost is away from its maximum possible utility is .526, the range between the maximum possible and the minimum possible utility for cost is 1.066, the ratio of these values converts into percentage of 49.3 percent.

To illustrate how the raw distance value may be an inappropriate measure for policy purposes, consider the attribute of safety from dangerous people in Table 25. For this attribute it is observed that the weighted utility is .252, the maximum possible utility is .781, and the distance between these two values is .529. This value is obviously higher than the value or distance obtained for the attribute of cost. On the basis of this column one might assume that more effort might be directed toward improving on the attribute of safety from dangerous people. However, if the range is taken into account for each of the attributes, it is then observed that safety from dangerous

TABLE 25. DISTANCE BETWEEN WEIGHTED UTILITIES (WEIGHTED BY THE % OF RESPONDENTS WHO FELT THAT LEVEL WAS MOST APPROPRIATE) AND THE HIGHEST LEVEL (BY UTILITY) MULTIPLIED BY 100% FOR PRIVATE AUTOMOBILE

	WEIGHTED UTILITIES	MAX. POSSIBLE	* DIST.	RANGE	* DIST./RANGE
Cost	.017	.543	.526	1.066	49.3%
Fuel	-.132	.679	.811	1.234	65.7%
Pollution	.186	.698	.512	1.228	41.7%
Days/Week	.485	.501	.016	.945	1.7%
Hrs./Day	.436	.451	.015	.848	1.8%
Total Travel Time	.315	.632	.317	1.210	26.2%
Possibility of Encountering Dangerous People	.252	.781	.529	1.365	38.8%
Comfort	.329	.381	.052	.670	7.8%
Opportunity to Socialize	.265	.351	.086	.506	17.0%

people has a value of 38.8 percent as contrasted with a value of 49.3 percent for the cost attribute. In short, at the time of the interview, for the private automobile the cost attribute was in worse shape than the attribute of safety from dangerous people as far as the respondents were concerned.

In Table 25, three attributes stand out as being relatively undesirable in terms of their current characteristics, namely, cost, fuel, and pollution. Two other attributes, total travel time and safety from dangerous people, are also in relatively poor shape. From the policy perspective, these would then be attributes which might yield highest returns in the sense of trying to increase patronage of the private automobile. On the other hand, if the policy were to try to dissuade people from utilizing the automobiles, the attributes showing the lowest values in Table 25 might be the most appropriate ones from a policy intervention standpoint. That is, attributes such as transportation available days per week and hours per day are clearly seen as being in very good shape by the sample. Since one would desire to lower the overall utility to the automobile, policies toward altering the availability of the automobile in days per week or hours per day would have the greatest impact on lowering the total utility of the automobile. It seems unlikely, however, that public decision makers would consider such policies as possible or desirable. Thus, it may be more appropriate to evaluate public transportation in regard to attributes most susceptible to policy intervention.

The same form of analysis pertains to Table 26 with respect to public transportation. In this instance, there are four attributes which clearly are viewed by the sample as being in poor shape. Policies directed toward improving the total travel time, service availability in hours per day, safety from dangerous people, and comfort will be those most likely to improve the overall utility of public transportation. More specifically, if policies are directed to shift the utility for total travel time from -.171 to .186 (to a total travel time of thirty minutes), and to shift the utility of availability of transportation for hours per day from .019 to .198 (to eighteen hours of transportation available per day), a shift in the total perceived utility for public transportation from 1.671 to 2.229 would be accomplished. Again, assuming that the respondents behave rationally and choose the most preferred alternative, and that the characteristics of the

TABLE 26. DISTANCE BETWEEN WEIGHTED UTILITIES (WEIGHTED BY THE % OF RESPONDENTS WHO FELT THAT LEVEL WAS MOST APPROPRIATE) AND THE HIGHEST LEVEL (BY UTILITY) MULTIPLIED BY 100%, FOR PUBLIC TRANSPORTATION

	WEIGHTED UTILITIES	MAX. POSSIBLE	DIST.	RANGE	DIST./RANGE
Cost	.346	.543	.197	1.066	18.5%
Fuel	.345	.679	.334	1.234	27.1%
Pollution	.304	.698	.394	1.228	32.1%
Days/Week	.335	.501	.166	.945	17.6%
Hrs./Day	.019	.451	.432	.848	50.9%
Total Travel Time	-.171	.632	.803	1.210	66.4%
Possibility of Encountering Dangerous People	.115	.781	.666	1.365	48.8%
Comfort	.089	.381	.292	.670	43.6%
Opportunity to Socialize	.289	.351	.062	.506	12.3%

automobile are not altered, then public transportation would have a perceived total utility higher than the private automobile. If the appropriate promotional techniques, as discussed in the first part of this report, are utilized to apprise the respondents of the alteration in the transportation system, and accounting for a certain amount of lag or inertia in choice behavior, an increasing utilization of public transportation would be expected for respondents having characteristics in common with the sample.

Clearly, this type of analysis does not, and cannot, indicate whether the policy options having the greatest potential for altering choice behavior are feasible politically or economically. Furthermore, this type of analysis cannot indicate which combinations of the changes in the transportation attributes would yield the most cost-effective option. However, the data obtained from these analyses do indicate the utilities for the various levels of the attributes. The sort of analyses indicated in Tables 25 and 26 provide the input into the next level of analysis for determining the optimal package of transportation attributes to obtain the desired mix of mode usage. This latter form of analysis is well beyond the scope of this project. It would appear, however, that a possible formulation of such analyses would be of the linear programming type, in which some optimum level of split of mode choices between public and private transportation would be obtained. This optimum level should most probably be characterized as a maximum utility for the overall population or population segments, subject to the constraints of fiscal, political, and system limitations.

SUMMARY

Two types of results are considered in this chapter. Methodological results are presented in terms of the effectiveness of the two types of instrumentation used in this part of the project. Substantive results are presented with regard to the types of trade-offs and the utilities derived from these trade-offs for various modal attributes. Prior to describing these results, the characteristics of the sample and its relationship to the samples drawn in Years One and Two are briefly summarized.

In general, Year Three's sample is not completely characteristic of the "potential switchers" identified in Years One and Two. The dimensions of household size, education, and automobile ownership are held in common by the two populations, but there are differences on other relevant characteristics. For example, in Year Three there are more male respondents than female, they are more likely to be married, less likely to be students, the average income is higher, and they are generally older than was the case for the populations in Years One and Two. It is clear, however, that the strategy of avoiding the captive public transportation market in obtaining a sample for Year Three was successful.

The data were also analysed to determine if respondents assigned to the two procedural groups differed significantly on demographic and other relevant dimensions. There were no significant differences between respondents. In short, respondents appear to have been randomly assigned to procedural groups with regard to their demographic characteristics, etc.

Investigation of the image profiles for the respondents in each of the two procedural groups indicates that the same profiles were held for the two groups, i.e., private automobile users in the card sort procedure and private automobile users in the matrix procedure have the same image of the transportation attributes of the private automobile. Likewise, public transportation users in the two procedural groups have the same images of the transportation attributes of public transportation.

Thus, the respondents in the Year Three sample have some differences in characteristics as compared with potential switchers for Years One and Two. However, they do hold some dimensions in common with the potential switchers, and, they appear to have been randomly assigned to the procedural groups utilized in this project.

Methodologically, utilizing the theta values for the goodness of fit test for the data for the two procedural groups, and assessing the rank order of the attributes obtained by the two procedures, it is clear that the card sort and matrix procedures are generating quite different theta values, rank orders, and ranges for the attributes. In summary, the data indicate that interpretation of the results obtained by the card sort procedure is likely to be fraught with difficulty and may well be meaningless. On the other hand, it appears that the results obtained from the matrix procedure may be meaningfully interpreted. Given this situation, the substantive results from the matrix data only are presented.

Considering the substantive results, the data for a single individual are first discussed to illustrate the types of results that may be obtained from these matrix analyses. The respondent selected in this instance happens to be a white male between the age of 45 and 59 years, with some college or professional training. He makes $20,000 or more per year, he owns his home in which there was one member under the age of 18. It is a three member household having two automobiles available. He has lived in Austin for five years and drives his car to work most of the time. Finally, the trip to work takes approximately ten minutes and is three miles in length, and he is definitely satisfied with his current form of transportation.

This respondent provided a tremendous amount of data. These detailed data do provide some consistent patterns for analysis for this individual. For example, it appears that the respondent consistently evidences little concern for fuel economy. Illustrative of this, is the willingness to have very high fuel use to obtain transportation seven days per week. Another area in which the respondent is consistent is in his desire to obtain low levels of pollution. Thus, it is observed that he will give up convenience of transportation to obtain low levels of pollution, he will also accept medium to high levels of total travel time to obtain low levels of pollution, and so on.

The thirty-six trade-off matrices for this single individual clearly yield a substantial amount of data. These data are also quite interpretable, and this respondent appears to provide quite consistent choices in the trade-offs of the various attributes, by the respective levels. However, since policy makers are concerned with how groups of people are making these sorts of trade-offs, data for all the respondents in the sample whose answers were judged to be adequate in quality, were submitted to the algorithm to compute the joint additive utility for each attribute in each level pair. Similar to the single individual, the sample provided very detailed information for which consistent patterns are observable. In addition, some of the tradeup-off matrices suggest possible points for policy intervention that might affect mode choice.

Across most pairwise trade-offs, the sample indicated that it would generally accept lower amounts of such desirable attributes as the availability of transportation and higher amounts of undesirable attributes such as cost per mile to obtain low levels of pollution. While the situation is not quite as strong in terms of low levels of fuel use, there is, neverless, a generally consistent pattern across the various pairwise trade-offs which suggest that low fuel use is relatively important and other less desirable attributes will be accepted in greater quantities to obtain this environmentally beneficial attribute. In some other pairwise trade-offs, potential policy intervention strategies are implied. For example, low total travel time is shown to be highly desirable. This is true to the extent that the sample will accept the provision of transportation for only five days per week to obtain a total travel time of only fifteen minutes. At the same time, the respondents show that they are prepared to accept six days of service per week to obtain twenty-four hour per day travel. Thus, if scheduling and headways were arranged to provide total travel time of fifteen minutes, twenty-four hours per day, six days per week and at a cost of fifteen cents more per mile than current cost, it would appear that this would be an attractive transportation alternative for the sample.

However, it is again necessary to remember that these trade-offs are for pairwise comparisons and more adequate summary measures of the utilities for the various attributes are required. These are obtained through a series of curves which may be used to determine the average utility of any given level of an attribute for the sample. To facilitate policy analyses, each of these curves is fit with a linear equation to obtain a straight line curve for calculating the average numerical value for the level of each attribute. From these equations, it is possible to determine the equivalence relationships between the levels of all the attributes for the sample. For example, the utility for the attribute of 18.3 cents per mile is the same as the utility for transportation available 6.17 days per week, 18.9 hours per day, and a total travel time of 32.6 minutes. Such equivalences may be determined for all levels of all attributes. Thus, from these curves and linear equations it is possible to ascertain the shifts and utilities which may be expected with shifts in the levels of the attributes.

Using these calculated utilities, the respondents' assessment of the private automotile and public transportation at the time of the interview is specified in terms of the range of attributes presented to them. At this point in time, the private automobile obtained a total utility of 2.153, while public transportation received a total value of 1.671. Assuming that the sample responds in a rational fashion, i.e., chooses a preferred mode of transportation, then there should be no reason to expect public transportation to be chosen by the respondents in the sample since the private automobile is clearly perceived to have the highest overall utility. At the time of the interview, the split in the sample between the use of the private automobile and the use of public transportaton was approximately eighty-five percent auto users and ten percent public transportation users, with the remainder using some other form of transportation. Thus, the sample's choice behavior appears to conform fairly closely to what would be expected of them on the basis of the utilities calculated from their pairwise trade-offs of the various transportation attributes.

Again utilizing these utility curves for the attributes investigated, there are four attributes of public transportation which the sample viewed as being in poor shape. Policies directed toward improving the total travel time, service availability in hours per day, safety from dangerous people, and comfort will be those most likely to improve the overall utility of public transportation, as indicated by the sample's responses at the time of the interview. Specifically, if policies are directed to shift the utility for total travel time from -.171 to .186 (to a total travel time of thirty minutes), and to shift the utility of the availability of transportation for hours per day from .019 to .198 (to eighteen hours of transportation available per day), a shift in the total perceived utility for public transportation from 1.671 to 2.229 would be accomplished. Assuming that the respondents behave rationally and that all other things remain equal, then public transportation would have a perceived total utility higher than the private automobile. Again in these conditions, and given appropriate information to potential users of public transportation, an increased utilization of public transportation would be expected for individuals having characteristics in common with the sample.

However, at least the following caveats are required with respect to this analysis. It is not possible to determine whether the policy options having the greatest potential for altering choice behavior are feasible politically or economically through the type of analysis undertaken in this project.

Furthermore, this type of analysis cannot indicate which combinations of the changes in the transportation attributes would yield the most cost-effective option. The forms of analysis required for assessing these feasibilities are beyond the scope of this project. Finally, only a limited number of attributes have been evaluated in this analysis. No direct information is available on how other attributes would affect trade-offs and perceived utility.

IX. CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

This report summarizes work in the third year of a research program that has sought to build on community-researched transportation needs and measure the impact of various marketing strategies for public transportation under carefully controlled conditions. The report discusses relevant literature, research methodology, findings, and recommendations concerning the following key problem areas:

(1) Does promotional activity have a significant effect on attitudes and behavioral intentions of potential users of public transportation?

(2) Does the type of promotion make a difference? Can we apply theory from communication literature to predict the differential effectiveness of one-sided versus two-sided messages regarding transit desirability?

(3) Does the number of key attributes stressed in promotional messages have any impact on these attitudes and behavioral intentions?

(4) What are the relative impacts of alternate attributes stressed in promotional messages? What are the relative utility values attached to the various transportation features and levels within each feature?

The report summarizes the work that has been done to clarify these problem areas. The first part of the report focuses on the promotion of public transportation. It includes a survey of relevant communications and marketing literature, the research hypotheses that were deemed relevant, the methodology used to test alternative promotional tactics, and results of interpretation of the findings for promotion for public transportation. The second part focuses on recent advances and methods for quantifying preference levels for various product and service features of transportation modes. Similarly, it reviews the relevant literature, presents the methodology whereby alternative measurement methods may be applied to evaluate attributes of transportation systems in the study area, and reports the findings concerning the usefulness of the methods tried as well as recommendations for transit planning and future research in the problem area.

CONCLUSIONS

Promotional Study

To empirically test the relative impact of one-sided and two-sided messages upon purchase intentions and attitudes of "potential switchers" toward mass transportation, an instrument was developed using an after-only design control. This instrument contained five sections. The first section presented the respondent with one of twenty different experimental manipulations. The experimental manipulation was printed on heavy glossy paper and was presented on a separate page to simulate an advertisement situation as closely as possible. The respondent was told that the following page contained part of an advertisement and to please read it carefully and completely.

The respondent could receive an advertisement for either the bus or a fictitious brand of deodorant named Secure. The fictitious brand was used to avoid any bias that brand loyalty toward established brands might create. In addition, the respondent could receive either a one-sided or a two-sided communication containing either three, four, five, six, or seven attributes. The attributes could vary. The non-determinant attributes were always the second and third attributes to be presented to the respondent.

The second section of the instrument contained five questions concerning the respondent's reactions to the copy. These questions were designed to ascertain the respondent's likelihood of reading the copy in a magazine, the credibility of the copy, the information provided, the usefulness of the information, and the general attitude toward the copy. Responses were listed according to a 7-point horizontal scale.

The third section of the instrument obtained information regarding the respondent's media habits. In the fourth section of the instrument, respondents were asked to indicate how likely they would be to purchase the product described in the experimental manipulation. The final section of the instrument obtained demographic and personal information.

The experimental design included two control groups, one for deodorant and one for the bus. The respective control group instruments were exactly the same as the instruments containing the experimental treatments, except that the experimental manipulations and the five questions directly regarding the experimental manipulations were deleted.

A sample was drawn from areas of the city of Austin having a high proportion of persons with characteristics similar to those of potential switchers. Comparison of the Year Three sample with the potential switchers identified in the work of Years One and Two indicates that the Year Three sample contains slightly fewer females than males; the respondents are more likely to be married and tend not to be students. Fifty-nine percent of the sample was between 30 and 59 years of age, the respondents tend to reside in two-person households, and seventy-nine percent of the persons interviewed had at least some college education. The large majority of the respondents were Caucasion, owned their own homes, had two or more cars, and earned more than $10,000 per year in income. This sample is in keeping with the strategy of avoiding the captive market.

The respondents in Year Three's sample have some characteristics in common with the potential switchers identified in Years One and Two. Like potential switchers, Year Three's respondents do tend to have small households and are relatively well educated compared to the general population. However, the potential switchers in Years One and Two tended to be slightly younger and were more frequently students than were the respondents in Year Three. Thus, Year Three's respondents have household size and education in common with previously identified potential switchers, but do tend to differ slightly on other relevant dimensions.

A second preliminary analysis performed on the data was a discriminant analysis to determine if respondents assigned to alternative treatments differed significantly on demographic dimensions. There were no significant differences between respondents according to demographic variables for any analyses. Thus, respondents appeared to have been randomly assigned to treatments on demographic dimensions. A final preliminary analysis was a descriptive analysis of the sample's ridership of the bus. Only four percent of the sample used the bus at all in the last four weeks. Thus, the sample is composed of individuals who use their car as their primary mode of transportation.

To compare the effectiveness of each of the experimental manipulations (advertisement treatments) against a control group, individual t-tests were performed on each of the twenty dependent variables for the respondents receiving a bus treatment. In addition, the data from the bus instrument were submitted to two-way analysis of variance for the effects of communication type (one-sided versus two-sided) and number of claims (three, four, five, six, seven). The data from the deodorant instruments were analyzed in a similar manner. There were five advertisement specific dependent variables in both bus and deodorant non-control instruments. The data from the five advertisement specific dependent variables were submitted to three-way analysis of variance for each dependent variable separately to investigate the relative effects of product, communication type, and number of claims.

The measures of the behavioral intentions towards use of buses for trips to work or school (commuting) and for shopping or personal business, both over the short run and "for most of your trips," indicate that neither the one-sided nor the two-sided advertisement style was able to achieve any strong pattern of impact on peoples' behavioral intentions toward using buses. Relative to the control group, one-sided ads gained about as well as they lost; two-sided advertisements contribute the greater number of unfavorable evaluations of specific features. The two-way analysis-of-variance performed on the bus advertising study indicates that for five of the twenty dependent variables, communication type has a significant main effect. In four of these, one-sided communication produces a more favorable evaluation of bus attributes advertised than does two-sided communication. There was no variable for which two-sided communication achieved a significantly higher rating than did one-sided communication. In addition, the key behavioral intention variables were not higher.

For comparison purposes and some insight into the importance of the product being advertised, the results for the deodorant advertising obtained in a parallel experiment, with respondents randomly selected from the same master list as the bus respondents, may be considered. Comparative data on differences between mean values of eight dependent variables used to measure attitudes and behavioral intentions toward the alleged new brand deodorant show a generally strong pattern of more favorable attitudes toward the advertised brand than were given by the unexposed control group. Buying intentions, while still low, were positively affected by advertising of both one-sided and two-sided format. The results of the two-way analysis-of-variance performed on the deodorant study dependent variable are almost directly opposite of what was obtained in the bus advertising test. While one-sided advertising was not superior in influencing bus-riding intentions, it had a better pattern for specific attributes than did two-sided approaches. The average intention to purchase "Secure," although low in both types of advertisements, was significantly higher for people exposed to two-sided messages than those exposed to one-sided messages. Further, what the two-sided deodorant messages took away in the disclaimed attributes may have been more than compensated for in higher perceptions of long-lasting protection.

Unlike the bus advertising study, the number of claims appeared also to be significantly related to perceptions of features of the advertised deodorant product. It is interesting to note that mean evaluation of "Secure" in terms of the trait "long-lasting" rises dramatically when the number of claims was varied. However, the overall intention is not influenced by the number of claims made, nor is there an interaction with communication type for the range of three to seven bus or deodorant attributes.

To consider the respondents' reaction to the advertisements themselves, a three-way analysis-of-variance for each advertisement-rating variable indicates that across all types of formats and number of claims, advertisements for "the bus" were perceived more favorably than were those for "Secure." Respondents indicated that for bus advertisements, they were significantly more likely to read all the copy, felt the ad was "truer" and contained more useful information, and that they liked the copy better than did those who were exposed to deodorant ads. It is worth noting that the respondents felt bus ads to be generally truthful even though they said they were more likely to purchase the deodorant brand than to ride a bus. The level of risk and lifestyle change required by adopting a new deodorant is clearly less threatening than switching transit modes, in spite of relatively favorable attitudes toward the product advertisement.

A second major finding is that communication type has a significant main effect on the dependent variables, and that two-sided communication generally is perceived more favorably than one-sided communication as far as advertising ratings are concerned. Two-sided ads were rated higher in truthfulness, information value, and general liking for the advertisement, across numbers of claims and both product types. In the case of bus advertising, liking for the ad apparently did not translate into more positive results vis-a-vis the product advertised.

The most important, although perhaps disappointing finding, is that advertising strategies for public transportation, no matter what their relative effectiveness, may have little absolute impact on patronage without corresponding and significant closing of gaps between public and private transportation, along determinant attributes of modal choice. The advertisements for deodorant, even though not well liked as advertisements, could generate significant changes in behavioral intentions and attitudes toward product features. The test of advertisements for buses, although relatively favorably received, did not generally produce significant favorable attitudes toward the features and/or use of buses in the target audiences. One-sided communication strategies seem more effective than two-sided ones for buses (but not deodorant), and one should be extremely careful how one raises issues of drawbacks of public transportation, even when trivial ones are stated.

On the basis of these findings, it cannot be recommended that one-sided transit advertising be discarded in favor of two-sided approaches. What little impact was obtained on transit attitudes came more through one-sided than through two-sided communication. However, one should note the behavioral intentions to use public transportation were only slightly affected, and changes in attributes are probably more important than effectively communicating the advantages that are generally agreed with, but are not at this time sufficient to generate much switching from private transportation to public transportation, especially for shopping and personal business trips.

This is true in spite of the findings that attitudes toward the bus advertisements were more favorable than were those toward deodorant advertisements. The bus advertisements are in a sense a "critical success" but a "commercial" failure. The product needs to be improved.

Trade-Off Study

To identify some of the potential areas of improvement in public transportation, the results of the trade-off analyses may be considered. In the trade-off study nine attributes were selected for investigation. Each attribute was treated as a three-level variable. The attributes chosen appear to be representative of those involved in the mode choice decision. These attributes are ones which have been found to have been quite important to relatively unimportant in the mode choice literature and work done in the previous two years of this project. The three levels for each attribute selected yield a symmetric design from the standpoint of instrument development. Since it was not clear a priori which type of alternative method for conjoint measurement would provide the best results, or even whether comparable data would be obtained by different instruments, it was decided that at least two procedures would be evaluated in this study. The first procedure considered was concerned with obtaining pairwise preference rankings from respondents. To obtain all possible pairwise trade-offs for the nine attributes, thirty-six matrices are required. Thirty-six matrices, each with three levels by three levels trade-offs for each attribute, requires the respondent to make 324 rankings. To ease the respondents' task as much as possible in using such an instrument, graphic and verbal descriptions were attached to the matrices.

The second type of instrument developed was a set of cards with descriptive statements on each card representing the various levels of the attributes of transportation to be evaluated. The set of cards represents the various combinations or alternatives available for the respondent to evaluate or rank in terms of preferences. In this case, where the evaluation is of nine attributes of transportation, each having three levels, a full factorial design will result in 3^9 or 19,683 combinations of attributes. Clearly, the evaluation of this many combinations is beyond the realm of possibility for the human respondent. Thus, an orthogonal matrix was developed to achieve the most parsimonious set of cards possible to represent these combinations. This design resulted in twenty-seven cards, each card having nine statements about the attributes. The order of the attributes on any given card was randomized so that order effects would not occur in the evaluation of the alternative.

These two tests of instruments were taken to a sample of Austin residents drawn in precisely the same manner as discussed for the promotional study. Respondents were randomly assigned to the two procedural groups. Descriptive analysis of the individuals in the two groups indicate that no significant differences exist between respondents. Thus, any differences in responses obtained between the two procedural groups may be considered to be the results of the procedures and not a result of respondent differences.

To evalute the goodness-of-fit of the data derived by the two procedures, the measure of theta was used. The theta values for the card sort respondents indicate that it is not possible to ascertain with any degree of certainty the relationship between the derived weights for the attributes and the raw input rank order data. On the other hand, the thetas for the matrix respondents indicate that the derived weights for the attributes are reasonably consistent with the input rank order data. In short, it is possible to interpret the rank ordering of the attributes of the matrix respondents with some degree of surety that these weights are a meaningful representation of the part-worths of the attributes investigated.

To further consider the issue of the validity of the result obtained from the card sort and the matrix procedures, the rank order of the attributes obtained in the two procedures were evaluated. It is clear that the card sort and matrix procedures are generating different rank orders and ranges for the attributes. Furthermore, the rank orders for the attributes in the card sort procedure are not consistent with the rank orders for similar variables found in other research. On the other hand, the rank order of the attributes derived under the matrix procedure do appear to be consistent with other research. Thus, these analyses indicate that the card sort procedure is generating substantially different results for the matrix procedure and the data derived from the card sort procedure do not appear to offer interpretable results.

Unfortunately, no hard data are available to facilitate determining underlying factors in the differences between the two procedures. However, anecdotal evidence indicates that respondents using the card sort procedure were apparently experiencing information overload. Even though the card sort procedure was based on an orthogonal array to reduce the number of possible combinations to a most parsimonious form, there was still apparently too much to deal with for the respondents. While the orthogonal array did not provide useful results in this study, it may be possible that a staged orthogonal design would yield meaningful and interpretable results. Unfortunately, such a design was not feasible in the context of this study.

Analysis of the matrix data, both for an individual and for the sample as a whole, yields a tremendous amount of information. Consistent and interpretable trade-offs are evidenced. A series of linear equations were fit to these data to obtain summary measures. Using these measures, the level of each attribute which has a weight equal to the weight for 18.3 cents per mile has been determined. Thus, for the sample, the utility of having transportation available 6.17 days per week is the same as paying 18.3 cents per mile, and so on. Using these summary measures, in conjunction with normalized distance measures for weighted utilities, four attributes of the nine considered for public transportation are indicated by the sample to be in undesirable condition. Policies directed toward improving the total travel time, service availability in hours per day, safety from dangerous people, and comfort will be those most likely to improve the overall utility of public transportation for the sample. If policies were directed to improve the utility for these attributes, and assuming that the respondents behave rationally and choose the most preferred alternative, and that the characteristics of the automobile are not altered, then public transportation would have a perceived total utility higher than a private automobile. Assuming that one-sided promotional techniques are the most effective for dealing with public transportation, a promotional campaign to inform individuals like those in the sample about the improvements in the public transportation system should yield an increasing utilization of public transportation.

Limitations on the type of analysis performed in this study are in assessing whether the policy options having the greatest potential for altering choice behavior are feasible politically or economically. Furthermore, these types of analyses cannot indicate which combinations of the changes in the transportation attributes would yield the most cost-effective option. Also, no information was obtained for attributes outside the range presented in this study. Thus, analyses beyond the scope of this project must be undertaken to fully utilize the results reported herein.

RECOMMENDATIONS FOR FUTURE RESEARCH

From the preceding results, several suggestions for future research appear germane. First, longitudinal studies of the effects of multi-exposure promotional campaigns on attitudes and behavioral intentions toward public transportation need to be undertaken. Such studies should be conducted in conjunction with modifications of transportation attributes -- as suggested by the trade-off studies. Controls for such a study should be at least for market segments, change versus non-change, one-sided versus two-sided arguments, transportation versus a non-transportation product, and media. To assess long-term stability in promotional impacts, the study should run for a minimum of two years.

Second, incremental changes in the attributes having the greatest potential for altering utilities should be implemented and monitored. In addition to being coordinated with the promotional study first suggested, pre- and post-test interviews should be conducted to assess the utilities for the attributes to be modified. Obviously, a longitudinal study is required to make such assessments. Again, a minimum of two years should be allocated to investigate long-term stability or trends in the utilities and trade-offs for the attributes to be modified.

Third, analytical models for evaluating the political and economic viability of alternative attribute combinations for transportation systems need to be developed. Such models should be developed to utilize data generated by the methodologies evaluated in this report. It would seem likely that some form of linear programming models might be the most appropriate type of analysis to investigate. In terms of the two previously suggested research areas, it is recommended that at least first approximations of the economic models be developed before the longitudinal studies are initiated. This will allow for the simultaneous evaluation of these models during the promotional and trade-off analysis.

Finally, in conjunction with the recommended study of incremental changes, further development should be undertaken of more parsimonious instrumentation for eliciting trade-off data from potential users of transportation services. The instrumentation should be developed to minimize respondent time investment. Work should also be undertaken to reduce the computational costs of analyzing trade-off data. This requires making the algorithms more efficient plus extending their capabilities.

In conclusion, this study has investigated alternative methodologies for promoting public transportation and for assessing the trade-offs which users of transportation services make when confronting a mode choice situation. Effective promotional techniques do exist, however, the results of the study indicate that unless there are substantial improvements in the product (public transportation) promotion will not be effective in obtaining attitudinal and behavior changes. The trade-off analyses developed in this study provide indications of the areas where policy may be most effective in increasing the utility of public transportation services. These findings provide at least a first handle on some of the policy levers that may be available to decision makers confronted with choosing alternative strategies for the provision of public transportation in their communities.

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BIOGRAPHICAL SKETCHES

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Mark I. Alpert, Professor of Marketing, joined the faculty of the Graduate School of Business at the University of Texas in 1968. He received his educational training at Massachusetts Institute of Technology (S.B., 1964) and the University of Southern California (M.B.A., 1965; M.S., 1967; D.B.A., 1968).

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APPENDICES

CONTENTS

APPENDIX I

ONE-SIDED DEODORANT TREATMENTS

A lot of people are switching to Secure deodorant these days. And for good reason. We have many advantages. Let us tell you what Secure can offer.

	Secure Gives You
Protection from odor	✓
Beautiful package	✓
Five package sizes	✓

Find out for yourself what Secure can give you!

(This copy printed on glossy paper)

A lot of people are switching to Secure deodorant these days. And for good reason. We have many advantages. Let us tell you what Secure can offer.

	Secure Gives You
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Beautiful package	✓
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Freedom from wetness	✓

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Freedom from wetness	✓
Long-lasting	✓

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Non-stain ingredient	✓

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	Secure Gives You
Protection from odor	✓
Beautiful package	✓
Five package sizes	✓
Freedom from wetness	✓
Long-lasting	✓
Non-stain ingredient	✓
Non-irritating to skin	✓

Find out for yourself what Secure can give you!

(This copy printed on glossy paper)

APPENDIX II

TWO-SIDED DEODORANT TREATMENTS

A lot of people are switching to Secure deodorant these days. And for good reason. Although we're not perfect, we have many advantages. Let us tell you what Secure can and can't offer.

	Secure Gives You	Secure Doesn't Give You
Protection from odor	✓	
Beautiful package		✓
Five package sizes		✓

Find out for yourself what Secure can give you!

(This copy printed on glossy paper)

A lot of people are switching to Secure deodorant these days. And for good reason. Although we're not perfect, we have many advantages. Let us tell you what Secure can and can't offer.

	Secure Gives You	Secure Doesn't Give You
Protection from odor	✓	
Beautiful package		✓
Five package sizes		✓
Freedom from wetness	✓	

Find out for yourself what Secure can give you!

(This copy printed on glossy paper)

A lot of people are switching to Secure deodorant these days. And for good reason. Although we're not perfect, we have many advantages. Let us tell you what Secure can and can't offer.

	Secure Gives You	Secure Doesn't Give You
Protection from odor	✓	
Beautiful package		✓
Five package sizes		✓
Freedom from wetness	✓	
Long-lasting	✓	

Find out for yourself what Secure can give you!

(This copy printed on glossy paper)

A lot of people are switching to Secure deodorant these days. And for good reason. Although we're not perfect, we have many advantages. Let us tell you what Secure can and can't offer.

	Secure Gives You	Secure Doesn't Give You
Protection from odor	✓	
Beautiful package		✓
Five package sizes		✓
Freedom from wetness	✓	
Long-lasting	✓	
Non-stain ingredient	✓	

Find out for yourself what Secure can give you!

(This copy printed on glossy paper)

A lot of people are switching to Secure deodorant these days. And for good reason. Although we're not perfect, we have many advantages. Let us tell you what Secure can and can't offer.

	Secure Gives You	Secure Doesn't Give You
Protection from odor	✓	
Beautiful package		✓
Five package sizes		✓
Freedom from wetness	✓	
Long-lasting	✓	
Non-stain ingredient	✓	
Non-irritating to skin	✓	

Find out for yourself what Secure can give you!

(This copy printed on glossy paper)

APPENDIX III

ONE-SIDED BUS TREATMENTS

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. And, we have many advantages. Let us tell you what the bus can offer.

	Bus Gives You
Economy	✓
Colorful interior	✓
Long windows	✓

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. And, we have many advantages. Let us tell you what the bus can offer.

	Bus Gives You
Economy	✓
Colorful interior	✓
Long windows	✓
Freedom from parking problems	✓

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

A lot or people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. And, we have many advantages. Let us tell you what the bus can offer.

	Bus Gives You
Economy	✓
Colorful interior	✓
Long windows	✓
Freedom from parking problems	✓
Freedom from repairs	✓

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. And, we have many advantages. Let us tell you what the bus can offer.

	<u>Bus Gives You</u>
Economy	✓
Colorful interior	✓
Long windows	✓
Freedom from parking problems	✓
Freedom from repairs	✓
Low energy use per passenger	✓

Find out for yourself what the bus can give <u>you</u>!

(This copy printed on glossy paper)

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. And, we have many advantages. Let us tell you what the bus can offer.

	Bus Gives You
Economy	✓
Colorful interior	✓
Long windows	✓
Freedom from parking problems	✓
Freedom from repairs	✓
Low energy use per passenger	✓
Low pollution per passenger	✓

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

APPENDIX IV

TWO-SIDED BUS TREATMENTS

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. Although we're not perfect, we have many advantages. Let us tell you what the bus can and can't offer.

	Bus Gives You	Bus Doesn't Give You
Economy	✓	
Colorful interior		✓
Long windows		✓

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. Although we're not perfect, we have many advantages. Let us tell you what the bus can and can't offer.

	Bus Gives You	Bus Doesn't Give You
Economy	✓	
Colorful interior		✓
Long windows		✓
Freedom from parking problems	✓	

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. Although we're not perfect, we have many advantages. Let us tell you what the bus can and can't offer.

	Bus Gives You	Bus Doesn't Give You
Economy	✓	
Colorful interior		✓
Long windows		✓
Freedom from parking problems	✓	
Freedom from repairs	✓	

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. Although we're not perfect, we have many advantages. Let us tell you what the bus can and can't offer.

	Bus Gives You	Bus Doesn't Give You
Economy	✓	
Colorful interior		✓
Long windows		✓
Freedom from parking problems	✓	
Freedom from repairs	✓	
Low energy use per passenger	✓	

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

APPENDIX V

EXAMPLE OF COMPLETE INSTRUMENT FOR BUS

117241

CONSUMER ATTITUDE SURVEY

Please answer each question in the survey. We are interested only in your opinions, so please respond as honestly as possible. There are no right or wrong answers. Your responses are strictly confidential.

Thank you for your cooperation.

On the following page is part of an advertisement. Please read it carefully and completely.

A lot of people are switching to the Austin city bus these days. Whether you're going to work, shopping, or just visiting, the bus will take you there. And, we have many advantages. Let us tell you what the bus can offer.

	Bus Gives You
Economy	✓
Colorful interior	✓
Long windows	✓
Freedom from parking problems	✓
Freedom from repairs	✓
Low energy use per passenger	✓
Low pollution per passenger	✓

Find out for yourself what the bus can give you!

(This copy printed on glossy paper)

Please answer the following questions on the basis of your reactions to the part of an advertisement you just read. Circle the number which best describes your feelings.

1. If you were to see the above copy in a magazine you were reading how likely would you be to read all the copy?

Not at all likely 1 2 3 4 5 6 7 Very likely

2. Overall, to what extent do you feel the statements made in the copy are true?

Not at all true 1 2 3 4 5 6 7 Very true

3. How much information do you feel the copy provided?

No information 1 2 3 4 5 6 7 Very much information

4. How useful do you feel the information in the copy is to you?

Not at all useful 1 2 3 4 5 6 7 Very useful

5. In general, to what extent did you like the copy?

Not at all 1 2 3 4 5 6 7 Very much

We would like to find out about some of the ways you spend your time. Please check the blank which is most appropriate for you.

1. How much time, on the average, do you spend a day reading the newspaper?

_____Don't read the newspaper (1)
_____1-30 minutes (2)
_____31-60 minutes (3)

2. Which newspaper(s) do you normally read at least 3 times per week?

_____None (1)
_____AUSTIN AMERICAN STATESMAN (2)
_____Spanish language newspaper (3)
_____THE DAILY TEXAN (4)
_____Other________________________ (5) (Please list)

3. What sections of the newspaper do you usually read? Please check your 4 favorites.

_____None (1)
_____General news (1st section) (2)
_____Comics (3)
_____Entertainment (4)
_____Women's Section (5)
_____Ann Landers or Dear Abby (6)
_____Sports (7)
_____Advertisements (8)
_____Business section (9)
_____Want Ads (10)
_____Other (Please list)________________________ (11)
____

4. How much time, on the average, do you usually spend a day listening to the radio?

_____Don't listen at all (1)
_____1-60 minutes (2)
_____1-3 hours (3)
_____Over 3 hours (4)

5. What programs do you usually listen to? Please check your 4 favorites.

_____None (1)
_____News (2)
_____Variety (3)
_____Sports (4)
_____"Top-40" music (5)
_____Classical music (6)
_____Talk-shows (7)
_____Country-western music (8)
_____"Easy-listening" (9)
_____Other (Please list)______________________ (10)
____

6. Please check the time(s) when you usually listen to the radio.

_____None (1)
_____7-9 a.m. (2)
_____9 a.m. to noon (3)
_____Noon to 4 p.m. (4)
_____4-6 p.m. (5)
_____6-10 p.m. (6)
_____10 p.m. on (7)

7. How much time, do you usually spend a <u>day</u> watching television?

_____None (1)
_____1-60 minutes (2)
_____1-3 hours (3)
_____Over 3 hours (4)

8. What television programs do you usually watch? Please check your 4 favorites.

_____None (1)
_____Variety (2)
_____Sports (3)
_____Children's (4)
_____Plays (5)
_____News (6)
_____Talk Shows (7)
_____Movies (8)
_____Soap operas (9)
_____Educational (10)
_____Game Shows (11)
_____Westerns (12)
_____Comedies (13)
_____Police/Detective (14)
_____Other (15)
____
____

9. Please check the time(s) when you usually watch television.

_____None (1)
_____7-9 a.m. (2)
_____9 a.m. to noon (3)
_____Noon to 4 p.m. (4)
_____4-6 p.m. (5)
_____6-10 p.m. (6)
_____10 p.m. and/or later (7)

10. What clubs or organizations do you belong to and attend at least once a month?

_____None (1)
_____PTA (2)
_____Neighborhood groups (3)
_____Church organizations (4)
_____Athletic team (5)
_____Political groups (6)
_____Card group (7)
_____Other (Please list)_______________ (8)
____

Now, we would appreciate your answering the following questions concerning transportation around Austin.

11. Please check the ONE form of transportation you use most frequently for shopping or personal business trips.

_____Your car (1)
_____Walking (2)
_____Car Pool (3)
_____Bicycle (4)
_____City bus (5)
_____Motorcycle (6)
_____UT shuttle bus (7)
_____Other (8)

12. Please check the ONE form of transportation you use most frequently for going to work or school.

_____Don't work or go to school (1)
_____City bus (2)
_____Walking (3)
_____Your car (4)
_____UT Shuttle bus (5)
_____Bicycle (6)
_____Car pool (7)
_____Motorcycle (8)
_____Other (9)

13. How often in the last 4 weeks have you ridden the Austin city bus?

_____None
(1)

_____1 to 2 round trips
(2)

_____3 to 4 round trips
(3)

_____5 or more round trips
(4)

Please circle your responses to the questions below.

14. How likely is it that you will use the city bus for a shopping or personal business trip during the next month?

Not at all likely 1 2 3 4 5 6 7 Very likely

15. How likely is it that you will use the city bus for a trip to work or school during the next month?

Not at all likely 1 2 3 4 5 6 7 Very likely

16. How likely would you be to use the city bus for most of your shopping or personal business trips?

Not at all likely 1 2 3 4 5 6 7 Very likely

17. How likely would you be to use the city bus for most of your trips to work or school? (If you do not work or go to school leave blank).

Not at all likely 1 2 3 4 5 6 7 Very likely

18. Please think of your feelings about driving your car. In general, how much do you enjoy driving? (Leave blank if you do not drive a car).

Not at all 1 2 3 4 5 6 7 Very much

19. As an alternative to using a car, overall, how much do you think you would like riding the city bus?

Not at all 1 2 3 4 5 6 7 Very much

20. To what extent do you feel the bus gives you freedom from repairs?

Not at all 1 2 3 4 5 6 7 Very much

21. To what extent do you feel the bus gives you freedom from parking problems?

Not at all 1 2 3 4 5 6 7 Very much

22. To what extent do you feel that the bus has low energy use per passenger?

Not at all 1 2 3 4 5 6 7 Very much

23. To what extent do you feel that the bus has low pollution per passenger?

Not at all 1 2 3 4 5 6 7 Very much

24. To what extent do you feel that the bus is economical?

Not at all 1 2 3 4 5 6 7 Very much

25. To what extent do you feel that the bus has colorful interior?

Not at all 1 2 3 4 5 6 7 Very much

26. To what extent do you feel that the bus has long windows?

Not at all 1 2 3 4 5 6 7 Very much

27. To what extent do you feel that your car gives you freedom from repairs?

Not at all 1 2 3 4 5 6 7 Very much

28. To what extent do you feel that your car gives you freedom from parking problems?

Not at all 1 2 3 4 5 6 7 Very much

29. To what extent do you feel that your car has low energy use per passenger?

Not at all 1 2 3 4 5 6 7 Very much

30. To what extent do you feel that your car has low pollution per passenger?

Not at all 1 2 3 4 5 6 7 Very much

31. To what extent do you feel your car is economical?

Not at all 1 2 3 4 5 6 7 Very much

32. To what extent do you feel that your car has colorful interior?

Not at all 1 2 3 4 5 6 7 Very much

33. To what extent do you feel that your car has long windows?

Not at all 1 2 3 4 5 6 7 Very much

Finally, we would appreciate some information about you. All information in this survey is completely confidential. Please check the blank which best describes you.

34. What is your sex?
_____Male (1)
_____Female (2)

35. What is your marital status?
_____Single (1)
_____Married (2)
_____Other (3)

36. Are you a student?
_____Not a student (1)
_____Full time student (2)

37. What is your approximate age?
_____Less than 21 years (1)
_____21-29 years (2)
_____30-44 years (3)
_____45-59 years (4)
_____60 years or older (5)

38. How many people live in your household in Austin?
_____One (1)
_____Two (2)
_____Three (3)
_____Four (4)
_____Five or more (5)

39. What is the highest level of education you have attained?
_____Junior High or less (1)
_____High School graduate (3)
_____Some High School (2)
_____Some college/professional training (4)
_____College graduate or higher (5)

40. Which category best describes your total family income for 1975? (If you are a student, indicate only the combined total of your and your spouse's income.)

_____ Less than $5,000 (1)
_____ $10,000 to $14,999 (3)
_____ $20,000 or more (5)
_____ $5,000 - $9,999 (2)
_____ $15,000 to $19,999 (4)

41. What is your ethnic background?

_____ Mexican-American (1)
_____ Black (2)
_____ White (3)
_____ Other (4)

42. Do you?

_____ Own home (1)
_____ Rent house (2)
_____ Rent apartment (3)
_____ Other (4)

43. How many automobiles are in your household?

_____ None (1)
_____ One (2)
_____ Two (3)
_____ Three or more (4)

Would you like a summary of the survey results?

_____ Yes (1)
_____ No (2)

If yes, please fill in the blanks below so we can mail you a summary of the results.

Name ______________________________

Address ______________________________

____

____

THANK YOU VERY MUCH FOR YOUR COOPERATION!

APPENDIX VI

EXAMPLE OF COMPLETE INSTRUMENT FOR DEODORANT

CONSUMER ATTITUDE SURVEY

Please answer each question in the survey. We are interested only in your opinions, so please respond as honestly as possible. There are no right or wrong answers. Your responses are strictly confidential.

Thank you for your cooperation.

On the following page is part of an advertisement. Please read it carefully and completely.

A lot of people are switching to Secure deodorant these days. And for good reason. Although we're not perfect, we have many advantages. Let us tell you what Secure can and can't offer.

	Secure Gives You	Secure Doesn't Give You
Protection from odor	✓	
Beautiful package		✓
Five package sizes		✓
Freedom from wetness	✓	
Long-lasting	✓	
Non-stain ingredient	✓	
Non-irritating to skin	✓	

Find out for yourself what Secure can give you!

(This copy printed on glossy paper)

Please answer the following questions on the basis of your reactions to the part of an advertisement you just read. Circle the number which best describes your feelings.

1. If you were to see the above copy in a magazine you were reading how likely would you be to read all the copy?

Not at all likely 1 2 3 4 5 6 7 Very likely

2. Overall, to what extent do you feel the statements made in the copy are true?

Not at all true 1 2 3 4 5 6 7 Very true

3. How much information do you feel the copy provided?

No information 1 2 3 4 5 6 7 Very much information

4. How useful do you feel the information in the copy is to you?

Not at all useful 1 2 3 4 5 6 7 Very useful

5. In general, to what extent did you like the copy?

Not at all 1 2 3 4 5 6 7 Very much

We would like to find out about some of the ways you spend your time. Please check the blank which is most appropriate for you.

1. How much time, on the average, do you spend a day reading the newspaper?

_____Don't read the newspaper (1)
_____1-30 minutes (2)
_____31-60 minutes (3)

2. Which newspaper(s) do you normally read at least 3 times per week?

_____None (1)
_____AUSTIN AMERICAN STATESMAN (2)
_____Spanish language newspaper (3)
_____THE DAILY TEXAN (4)
_____Other__________________________ (5) (Please list)

3. What sections of the newspaper do you usually read? Please check your 4 favorites.

_____None (1)
_____General news (1st section) (2)
_____Comics (3)
_____Entertainment (4)
_____Women's Section (5)
_____Ann Landers or Dear Abby (6)
_____Sports (7)
_____Advertisements (8)
_____Business section (9)
_____Want Ads (10)
_____Other (Please list)__________________________ (11)
____

4. How much time, on the average, do you usually spend a <u>day</u> listening to the radio?

_____Don't listen at all (1)
_____1-60 minutes (2)
_____1-3 hours (3)
_____Over 3 hours (4)

5. What programs do you usually listen to? Please check your 4 favorites.

_____ None (1)
_____ News (2)
_____ Variety (3)
_____ Sports (4)
_____ "Top-40" music (5)
_____ Classical music (6)
_____ Talk-shows (7)
_____ Country-western music (8)
_____ "Easy-listening" (9)
_____ Other (Please list) (10) ______________________
____

6. Please check the time(s) when you usually listen to the radio.

_____ None (1)
_____ 7-9 a.m. (2)
_____ 9 a.m. to noon (3)
_____ Noon to 4 p.m. (4)
_____ 4-6 p.m. (5)
_____ 6-10 p.m. (6)
_____ 10 p.m. on (7)

7. How much time, do you usually spend a <u>day</u> watching television?

_____ None (1)
_____ 1-60 minutes (2)
_____ 1-3 hours (3)
_____ Over 3 hours (4)

8. What television programs do you usually watch? Please check your 4 favorites.

_____ None (1)
_____ Variety (2)
_____ Sports (3)
_____ Children's (4)
_____ Plays (5)
_____ News (6)
_____ Talk Shows (7)
_____ Movies (8)
_____ Soap operas (9)
_____ Educational (10)
_____ Game Shows (11)
_____ Westerns (12)
_____ Comedies (13)
_____ Police/Detective (14)
_____ Other (15)
____
____

9. Please check the time(s) when you usually watch television.

_____None (1)

_____7-9 a.m. (2)

_____9 a.m. to noon (3)

_____Noon to 4 p.m. (4)

_____4-6 p.m. (5)

_____6-10 p.m. (6)

_____10 p.m. and/or later (7)

10. What clubs or organizations do you belong to and attend at least once a month?

_____None (1)

_____PTA (2)

_____Neighborhood groups (3)

_____Church organizations (4)

_____Athletic team (5)

_____Political groups (6)

_____Card group (7)

_____Other (Please list)_______________ (8)

____

Please circle your responses to the questions below.

11. How likely is it that your next deodorant purchase would be Secure if it is available at your favorite store?

Not at all likely 1 2 3 4 5 6 7 Very likely

12. To what extent do you feel that Secure deodorant is non-irritating to skin?

Not at all 1 2 3 4 5 6 7 Very much

13. To what extent do you feel that Secure deodorant is long-lasting?

Not at all 1 2 3 4 5 6 7 Very much

14. To what extent do you feel that Secure deodorant gives you a non-stain ingredient?

Not at all 1 2 3 4 5 6 7 Very much

15. To what extent do you feel that Secure deodorant gives you freedom from wetness?

Not at all 1 2 3 4 5 6 7 Very much

16. To what extent do you feel that Secure deodorant has five package sizes?

Not at all 1 2 3 4 5 6 7 Very much

17. To what extent do you feel that Secure deodorant has a beautiful package?

Not at all 1 2 3 4 5 6 7 Very much

18. To what extent do you feel that Secure deodorant gives you protection from odor?

Not at all 1 2 3 4 5 6 7 Very much

Finally, we would appreciate some information about you. All information in this survey is completely confidential. Please check the blank which best describes you.

19. What is your sex? _____Male _____Female
(1) (2)

20. What is your marital status? _____Single _____Married _____Other
(1) (2) (3)

21. Are you a student? _____Not a student _____Full time student
(1) (2)

22. What is your approximate age? _____Less than 21 years _____21-29 years
(1) (2)

_____30-44 years _____45-59 years _____60 years or older
(3) (4) (5)

23 How many people live in your household in Austin? _____One _____Two
(1) (2)

_____Three _____Four _____Five or more
(3) (4) (5)

15. To what extent do you feel that Secure deodorant gives you freedom from wetness?

Not at all 1 2 3 4 5 6 7 Very much

16. To what extent do you feel that Secure deodorant has five package sizes?

Not at all 1 2 3 4 5 6 7 Very much

17. To what extent do you feel that Secure deodorant has a beautiful package?

Not at all 1 2 3 4 5 6 7 Very much

18. To what extent do you feel that Secure deodorant gives you protection from odor?

Not at all 1 2 3 4 5 6 7 Very much

Finally, we would appreciate some information about you. All information in this survey is completely confidential. Please check the blank which best describes you.

19. What is your sex? _____(1) Male _____(2) Female

20. What is your marital status? _____(1) Single _____(2) Married _____(3) Other

21. Are you a student? _____(1) Not a student _____(2) Full time student

22. What is your approximate age? _____(1) Less than 21 years _____(2) 21-29 years

_____(3) 30-44 years _____(4) 45-59 years _____(5) 60 years or older

23 How many people live in your household in Austin? _____(1) One _____(2) Two

_____(3) Three _____(4) Four _____(5) Five or more

24. What is the highest level of education you have attained?

_____Junior High or less (1)
_____High School graduate (3)

_____Some High School (2)
_____Some college/professional training (4)

_____College graduate or higher (5)

25. Which category best describes your total family income for 1975? (If you are a student, indicate only the combined total of your and your spouse's income.)

_____Less than $5,000 (1)
_____$10,000 to $14,999 (3)
_____$20,000 or more (5)

_____$5,000 - $9,999 (2)
_____$15,000 to $19,999 (4)

26. What is your ethnic background?

_____Mexican-American (1)
_____Black (2)
_____White (3)
_____Other (4)

27. Do you?

_____Own home (1)
_____Rent house (2)
_____Rent apartment (3)
_____Other (4)

28. How many automobiles are in your household?

_____None (1)
_____One (2)
_____Two (3)
_____Three or more (4)

Would you like a summary of the survey results?

_____Yes (1)   _____No (2)

If yes, please fill in the blanks below so we can mail you a summary of the results.

Name_______________________________

Address_______________________________

____

____

THANK YOU VERY MUCH FOR YOUR COOPERATION!

APPENDIX VII

DEODORANT CONTROL

CONSUMER ATTITUDE SURVEY

Please answer each question in the survey. We are interested only in your opinions, so please respond as honestly as possible. There are no right or wrong answers. Your responses are strictly confidential.

Thank you for your cooperation.

We would like to find out about some of the ways you spend your time. Please check the blank which is most appropriate for you.

1. How much time, on the average, do you spend a day reading the newspaper?

_____ Don't read the newspaper (1)
_____ 1-30 minutes (2)
_____ 31-60 minutes (3)

2. Which newspaper(s) do you normally read at least 3 times per week?

_____ None (1)
_____ AUSTIN AMERICAN STATESMAN (2)
_____ Spanish language newspaper (3)
_____ THE DAILY TEXAN (4)
_____ Other _______________________ (5) (Please list)

3. What sections of the newspaper do you usually read? Please check your 4 favorites.

_____ None (1)
_____ General news (1st section) (2)
_____ Comics (3)
_____ Entertainment (4)
_____ Women's Section (5)
_____ Ann Landers or Dear Abby (6)
_____ Sports (7)
_____ Advertisements (8)
_____ Business section (9)
_____ Want Ads (10)
_____ Other (Please list) _______________________ (11)
____

4. How much time, on the average, do you usually spend a <u>day</u> listening to the radio?

_____ Don't listen at all (1)
_____ 1-60 minutes (2)
_____ 1-3 hours (3)
_____ Over 3 hours (4)

5. What programs do you usually listen to? Please check your 4 favorites.

_____None (1)
_____News (2)
_____Variety (3)
_____Sports (4)
_____"Top-40" music (5)
_____Classical music (6)
_____Talk-shows (7)
_____Country-western music (8)
_____"Easy-listening" (9)
_____Other (Please list)____________________ (10)
____

6. Please check the time(s) when you usually listen to the radio.

_____None (1)
_____7-9 a.m. (2)
_____9 a.m. to noon (3)
_____Noon to 4 p.m. (4)
_____4-6 p.m. (5)
_____6-10 p.m. (6)
_____10 p.m. on (7)

7. How much time, do you usually spend a <u>day</u> watching television?

_____None (1)
_____1-60 minutes (2)
_____1-3 hours (3)
_____Over 3 hours (4)

8. What television programs do you usually watch? Please check your 4 favorites.

_____None (1)
_____Variety (2)
_____Sports (3)
_____Children's (4)
_____Plays (5)
_____News (6)
_____Talk Shows (7)
_____Movies (8)
_____Soap operas (9)
_____Educational (10)
_____Game Shows (11)
_____Westerns (12)
_____Comedies (13)
_____Police/Detective (14)
_____Other (15)
____
____

9. Please check the time(s) when you usually watch television.

_____None (1)
_____7-9 a.m. (2)
_____9 a.m. to noon (3)
_____Noon to 4 p.m. (4)
_____4-6 p.m. (5)
_____6-10 p.m. (6)
_____10 p.m. and/or later (7)

10. What clubs or organizations do you belong to and attend at least once a month?

_____None (1)
_____PTA (2)
_____Neighborhood groups (3)
_____Church organizations (4)
_____Athletic team (5)
_____Political groups (6)
_____Card group (7)
_____Other (Please list)_______________ (8)
____

Now, we would appreciate your answering the following questions concerning transportation around Austin.

11. Please check the ONE form of transportation you use most frequently for shopping or personal business trips.

_____Your car (1)
_____Walking (2)
_____Car Pool (3)
_____Bicycle (4)
_____City bus (5)
_____Motorcycle (6)
_____UT shuttle bus (7)
_____Other (8)

12. Please check the ONE form of transportation you use most frequently for going to work or school.

_____Don't work or go to school (1)
_____City bus (2)
_____Walking (3)
_____Your car (4)
_____UT Shuttle bus (5)
_____Bicycle (6)
_____Car pool (7)
_____Motorcycle (8)
_____Other (9)

13. How often in the last 4 weeks have you ridden the Austin city bus?

_____None (1)

_____1 to 2 round trips (2)

_____3 to 4 round trips (3)

_____5 or more round trips (4)

Please circle your responses to the questions below.

14. How likely is it that you will use the city bus for a shopping or personal business trip during the next month?

Not at all likely 1 2 3 4 5 6 7 Very likely

15. How likely is it that you will use the city bus for a trip to work or school during the next month?

Not at all likely 1 2 3 4 5 6 7 Very likely

16. How likely would you be to use the city bus for most of your shopping or personal business trips?

Not at all likely 1 2 3 4 5 6 7 Very likely

17. How likely would you be to use the city bus for most of your trips to work or school? (If you do not work or go to school leave blank).

Not at all likely 1 2 3 4 5 6 7 Very likely

18. Please think of your feelings about driving your car. In general, how much do you enjoy driving? (Leave blank if you do not drive a car).

Not at all 1 2 3 4 5 6 7 Very much

19. As an alternative to using a car, overall, how much do you think you would like riding the city bus?

Not at all 1 2 3 4 5 6 7 Very much

20. To what extent do you feel the bus gives you freedom from repairs?

Not at all 1 2 3 4 5 6 7 Very much

21. To what extent do you feel the bus gives you freedom from parking problems?

Not at all 1 2 3 4 5 6 7 Very much

22. To what extent do you feel that the bus has low energy use per passenger?

Not at all 1 2 3 4 5 6 7 Very much

23. To what extent do you feel that the bus has low pollution per passenger?

Not at all 1 2 3 4 5 6 7 Very much

24. To what extent do you feel that the bus is economical?

Not at all 1 2 3 4 5 6 7 Very much

25. To what extent do you feel that the bus has colorful interior?

Not at all 1 2 3 4 5 6 7 Very much

26. To what extent do you feel that the bus has long windows?

Not at all 1 2 3 4 5 6 7 Very much

27. To what extent do you feel that your car gives you freedom from repairs?

Not at all 1 2 3 4 5 6 7 Very much

28. To what extent do you feel that your car gives you freedom from parking problems?

Not at all 1 2 3 4 5 6 7 Very much

29. To what extent do you feel that your car has low energy use per passenger?

Not at all 1 2 3 4 5 6 7 Very much

30. To what extent do you feel that your car has low pollution per passenger?

Not at all 1 2 3 4 5 6 7 Very much

31. To what extent do you feel your car is economical?

Not at all 1 2 3 4 5 6 7 Very much

32. To what extent do you feel that your car has colorful interior?

Not at all 1 2 3 4 5 6 7 Very much

33. To what extent do you feel that your car has long windows?

Not at all 1 2 3 4 5 6 7 Very much

Finally, we would appreciate some information about you. All information in this survey is completely confidential. Please check the blank which best describes you.

34. What is your sex?

_____Male (1)
_____Female (2)

35. What is your marital status?

_____Single (1)
_____Married (2)
_____Other (3)

36. Are you a student?

_____Not a student (1)
_____Full time student (2)

37. What is your approximate age?

_____Less than 21 years (1)
_____21-29 years (2)
_____30-44 years (3)
_____45-59 years (4)
_____60 years or older (5)

38. How many people live in your household in Austin?

_____One (1)
_____Two (2)
_____Three (3)
_____Four (4)
_____Five or more (5)

39. What is the highest level of education you have attained?

_____Junior High or less (1)
_____Some High School (2)
_____High School graduate (3)
_____Some college/professional training (4)
_____College graduate or higher (5)

40. Which category best describes your total family income for 1975? (If you are a student, indicate <u>only</u> the combined total of your and your spouse's income.)

_____Less than $5,000 (1)
_____$5,000 - $9,999 (2)
_____$10,000 to $14,999 (3)
_____$15,000 to $19,999 (4)
_____$20,000 or more (5)

41. What is your ethnic background?

_____Mexican-American (1)
_____Black (2)
_____White (3)
_____Other (4)

42. Do you?

_____Own home (1)
_____Rent house (2)
_____Rent apartment (3)
_____Other (4)

43. How many automobiles are in your household?

_____None (1)
_____One (2)
_____Two (3)
_____Three or more (4)

Would you like a summary of the survey results?

_____Yes (1)
_____No (2)

If yes, please fill in the blanks below so we can mail you a summary of the results.

Name______________________________

Address______________________________

____

____

THANK YOU VERY MUCH FOR YOUR COOPERATION!

APPENDIX VIII

BUS CONTROL

CONSUMER ATTITUDE SURVEY

Please answer each question in the survey. We are interested only in your opinions, so please respond as honestly as possible. There are no right or wrong answers. Your responses are strictly confidential.

Thank you for your cooperation.

We would like to find out about some of the ways you spend your time. Please check the blank which is most appropriate for you.

1. How much time, on the average, do you spend a day reading the newspaper?

_____Don't read the newspaper (1)
_____1-30 minutes (2)
_____31-60 minutes (3)

2. Which newspaper(s) do you normally read at least 3 times per week?

_____None (1)
_____AUSTIN AMERICAN STATESMAN (2)
_____Spanish language newspaper (3)
_____THE DAILY TEXAN (4)
_____Other_____________________ (5) (Please list)

3. What sections of the newspaper do you usually read? Please check your 4 favorites.

_____None (1)
_____General news (1st section) (2)
_____Comics (3)
_____Entertainment (4)
_____Women's Section (5)
_____Ann Landers or Dear Abby (6)
_____Sports (7)
_____Advertisements (8)
_____Business section (9)
_____Want Ads (10)
_____Other (Please list)_____________________ (11)
____

4. How much time, on the average, do you usually spend a <u>day</u> listening to the radio?

_____Don't listen at all (1)
_____1-60 minutes (2)
_____1-3 hours (3)
_____Over 3 hours (4)

5. What programs do you usually listen to? Please check your 4 favorites.

_____None (1)
_____News (2)
_____Variety (3)
_____Sports (4)
_____"Top-40" music (5)
_____Classical music (6)
_____Talk-shows (7)
_____Country-western music (8)
_____"Easy-listening" (9)
_____Other (Please list)____________________ (10)
____

6. Please check the time(s) when you usually listen to the radio.

_____None (1)
_____7-9 a.m. (2)
_____9 a.m. to noon (3)
_____Noon to 4 p.m. (4)
_____4-6 p.m. (5)
_____6-10 p.m. (6)
_____10 p.m. on (7)

7. How much time, do you usually spend a <u>day</u> watching television?

_____None (1)
_____1-60 minutes (2)
_____1-3 hours (3)
_____Over 3 hours (4)

8. What television programs do you usually watch? Please check your 4 favorites.

_____None (1)
_____Variety (2)
_____Sports (3)
_____Children's (4)
_____Plays (5)
_____News (6)
_____Talk Shows (7)
_____Movies (8)
_____Soap operas (9)
_____Educational (10)
_____Game Shows (11)
_____Westerns (12)
_____Comedies (13)
_____Police/Detective (14)
_____Other (15)
____
____

9. Please check the time(s) when you usually watch television.

_____ (1) None
_____ (2) 7-9 a.m.
_____ (3) 9 a.m. to noon
_____ (4) Noon to 4 p.m.
_____ (5) 4-6 p.m.
_____ (6) 6-10 p.m.
_____ (7) 10 p.m. and/or later

10. What clubs or organizations do you belong to and attend at least once a month?

_____ (1) None
_____ (2) PTA
_____ (3) Neighborhood groups
_____ (4) Church organizations
_____ (5) Athletic team
_____ (6) Political groups
_____ (7) Card group
_____ (8) Other (Please list)_______________
____

Please circle your responses to the questions below.

11. How likely is it that your next deodorant purchase would be Secure if it is available at your favorite store?

Not at all likely 1 2 3 4 5 6 7 Very likely

12. To what extent do you feel that Secure deodorant is non-irritating to skin?

Not at all 1 2 3 4 5 6 7 Very much

13. To what extent do you feel that Secure deodorant is long-lasting?

Not at all 1 2 3 4 5 6 7 Very much

14. To what extent do you feel that Secure deodorant gives you a non-stain ingredient?

Not at all 1 2 3 4 5 6 7 Very much

15. To what extent do you feel that Secure deodorant gives you freedom from wetness?

Not at all 1 2 3 4 5 6 7 Very much

16. To what extent do you feel that Secure deodorant has five package sizes?

Not at all 1 2 3 4 5 6 7 Very much

17. To what extent do you feel that Secure deodorant has a beautiful package?

Not at all 1 2 3 4 5 6 7 Very much

18. To what extent do you feel that Secure deodorant gives you protection from odor?

Not at all 1 2 3 4 5 6 7 Very much

Finally, we would appreciate some information about you. All information in this survey is completely confidential. Please check the blank which best describes you.

19. What is your sex? ____Male (1) ____Female (2)

20. What is your marital status? ____Single (1) ____Married (2) ____Other (3)

21. Are you a student? ____Not a student (1) ____Full time student (2)

22. What is your approximate age? ____Less than 21 years (1) ____21-29 years (2)

____30-44 years (3) ____45-59 years (4) ____60 years or older (5)

23 How many people live in your household in Austin? ____One (1) ____Two (2)

____Three (3) ____Four (4) ____Five or more (5)

24. What is the highest level of education you have attained?

_____Junior High or less
(1)

_____Some High School
(2)

_____High School graduate
(3)

_____Some college/professional training
(4)

_____College graduate or higher
(5)

25. Which category best describes your total family income for 1975? (If you are a student, indicate <u>only</u> the combined total of your and your spouse's income.)

_____Less than $5,000
(1)

_____$5,000 - $9,999
(2)

_____$10,000 to $14,999
(3)

_____$15,000 to $19,999
(4)

_____$20,000 or more
(5)

26. What is your ethnic background?

_____Mexican-American
(1)

_____Black
(2)

_____White
(3)

_____Other
(4)

27. Do you?

_____Own home
(1)

_____Rent house
(2)

_____Rent apartment
(3)

_____Other
(4)

28. How many automobiles are in your household?

_____None
(1)

_____One
(2)

_____Two
(3)

_____Three or more
(4)

Would you like a summary of the survey results?

_____Yes (1)   _____No (2)

If yes, please fill in the blanks below so we can mail you a summary of the results.

Name______________________________

Address______________________________

____

____

THANK YOU VERY MUCH FOR YOUR COOPERATION!

APPENDIX IX

GRAPHIC PRE-TEST

COUNCIL FOR ADVANCED TRANSPORTATION STUDIES

The University of Texas at Austin

Date: ______________________________

Name: ______________________________

Address: ______________________________ _____

______________________________ _____

Time Scheduled: ______________________

____

Time Started: ______

Time Finished: ______

____

Hello, I'm ____________ ____________ from the University of Texas. I'm conducting the survey for the Council for Advanced Transportation Studies. I believe __________ __________ contacted you for an appointment.

The purpose of this survey is to collect information about consumer attitudes toward the methods of transportation used to get to work or school. Your cooperation is appreciated and will help insure meaningful survey results. Please remember that this survey is STRICTLY CONFIDENTIAL.

Now, I have some general questions I'd like to ask you.

1. Are you a student? Full Time ☐ Part Time ☐ No ☐

2. Are you currently employed? Yes ☐ No ☐

3. If yes, what is the approximate address of your place of employment?

   ____

   ____

4. In a typical week, about how many trips do you take from home to work or school? ______

5. For these trips to work or school, how do you get there?
   Drive Car ☐ Car Pool ☐ City Bus ☐
   UT Shuttle ☐ Walk ☐ Bicycle ☐
   Motorcycle ☐ Other ☐

6. Do you usually travel alone? Yes ☐ No ☐

7. In general, are you satisfied with the transportation you use for getting to work or school?
   Definitely Yes ☐ Moderately Yes ☐ Neutral ☐
   Moderately No ☐ Definitely No ☐

8. Do you? Own Home ☐ Rent Home ☐
Rent Apt. ☐ Other ☐

9. How many people are in your household? ____________

10. How many automobiles are in your household? ____________

11. How often is an automobile available for your use?
24 hrs/day ☐ Day only ☐
Night Only ☐ Wkends Only ☐ Never ☐

12. How long have you lived in Austin? ____________

13. Approximately how long does it take you to get to work or school. ____________

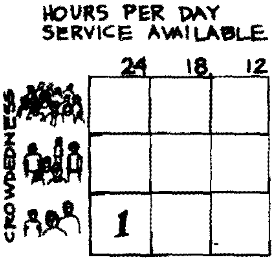
14. Approximately how far is it to work or school? ____________

We have prepared a short example to illustrate the next part of the survey. [Hand the example to the respondent].

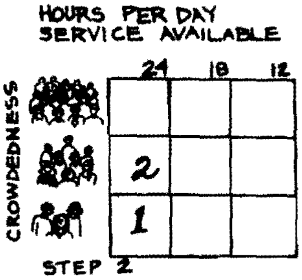
AT TIMES WE HAVE TO GIVE UP SOMETHING TO GET SOMETHING ELSE. SINCE THIS STUDY IS CONCERNED WITH TRANSPORTATION SERVICES, WE ARE INTERESTED IN FINDING OUT WHICH OF THESE SERVICES ARE MOST IMPORTANT TO YOU. TO HELP US DETERMINE YOUR PREFERENCES, WE WOULD APPRECIATE YOUR COMPLETING THE FOLLOWING SCALES.

TO EXPLAIN HOW THE SCALE WORKS, WE WILL GO THROUGH THE FOLLOWING EXAMPLE.

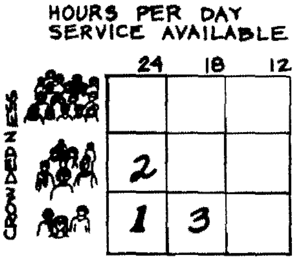
WRITE NUMBER ONE IN THE BLANK WHICH REPRESENTS YOUR FIRST CHOICE. IN ANOTHER BLANK SQUARE, WRITE A NUMBER 2 FOR YOUR SECOND CHOICE. NEXT WRITE NUMBER 3 FOR YOUR THIRD CHOICE AND CONTINUE UNTIL ALL SQUARES ARE FILLED.



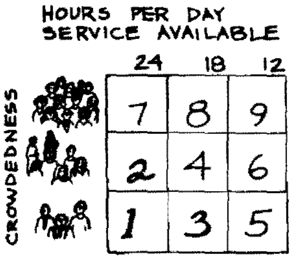
STEP 1
THE FIRST SELECTION INDICATES A PREFERENCE FOR THE MOST HOURS OF SERVICE PER DAY AND THE ABSENCE OF CROWDEDNESS.



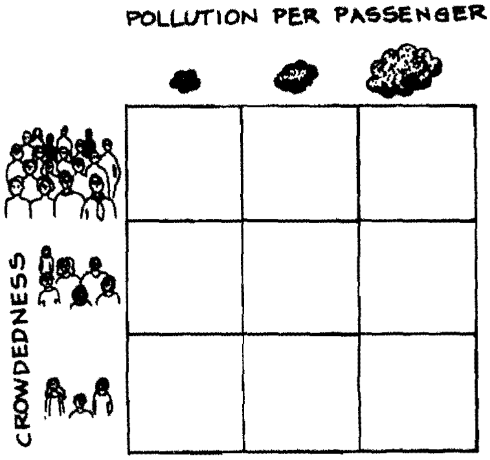
STEP 2
THE SECOND CHOICE INDICATES A PREFERENCE FOR A MORE CROWDED SITUATION RATHER THAN FEWER HOURS OF SERVICE.

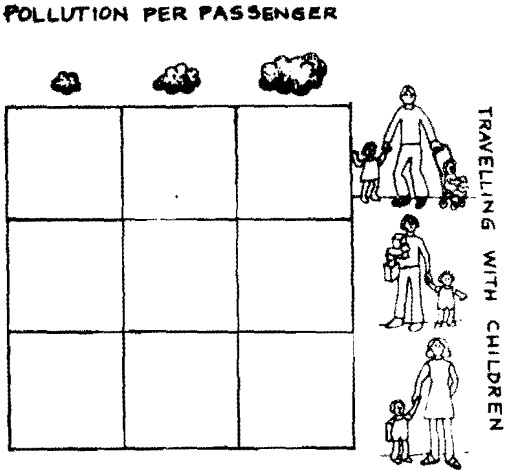


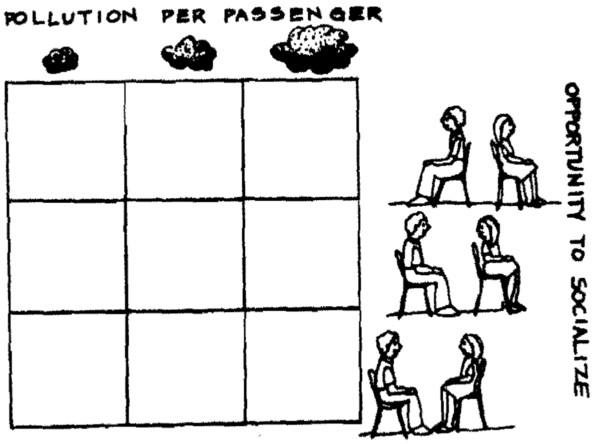
STEP 3
THE THIRD CHOICE SHOWS THAT YOU WOULD RATHER HAVE SIX HOURS LESS SERVICE THAN HAVE A SEVERELY CROWDED SITUATION.

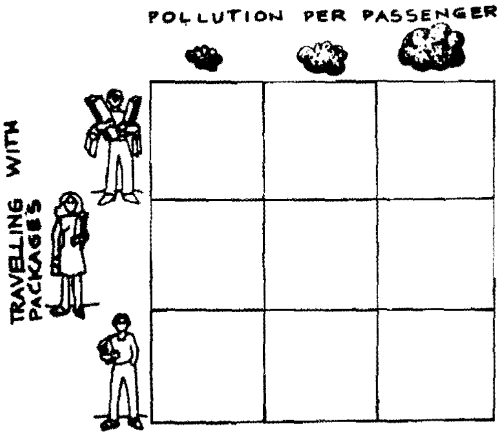


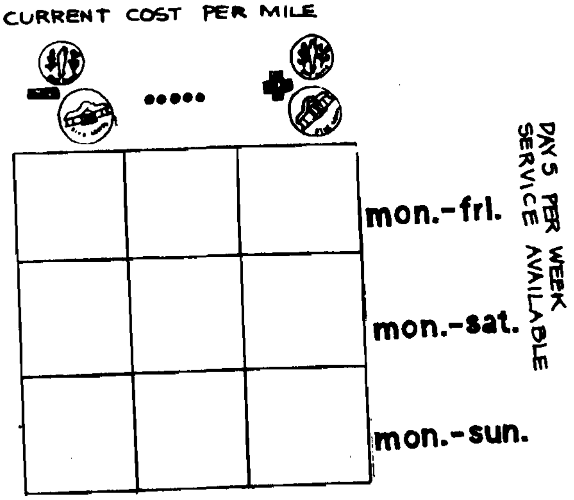
STEP 4
THIS IS ONE EXAMPLE OF HOW PREFERENCES FOR ALL COMBINATIONS IS ORDERED. YOUR CHOICES MAY VARY.

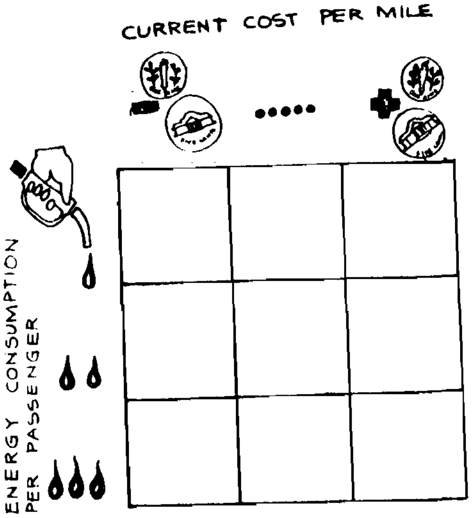


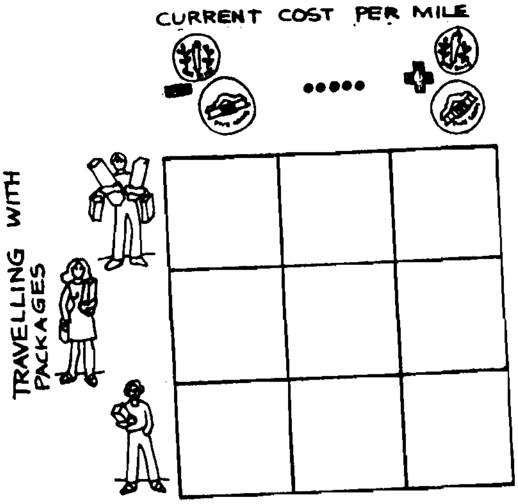


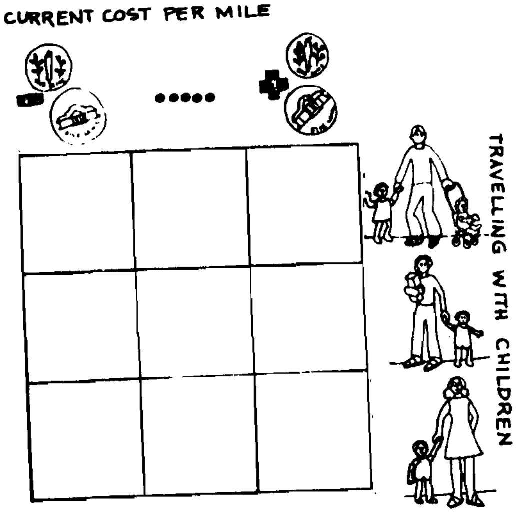


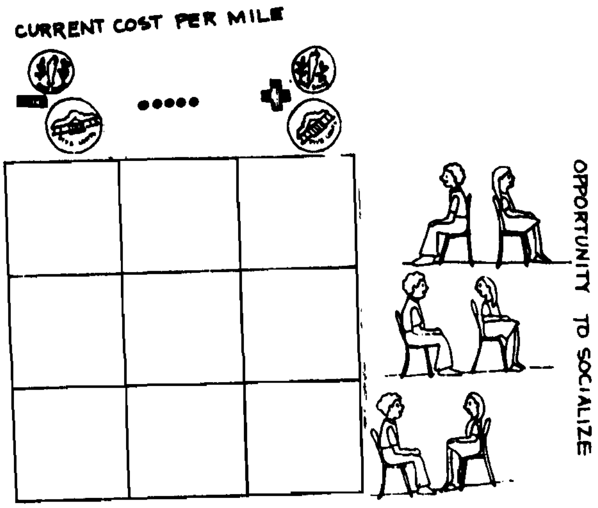


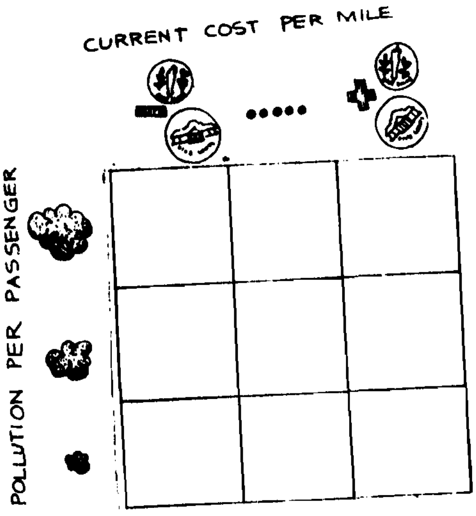

CURRENT COST PER MILE
mon.-fri.
mon.-sat.
mon.-sun.
DAYS PER WEEK SERVICE AVAILABLE

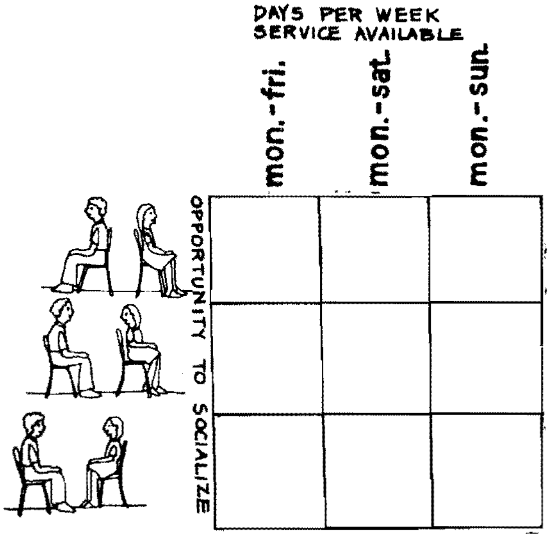

CURRENT COST PER MILE
ENERGY CONSUMPTION PER PASSENGER

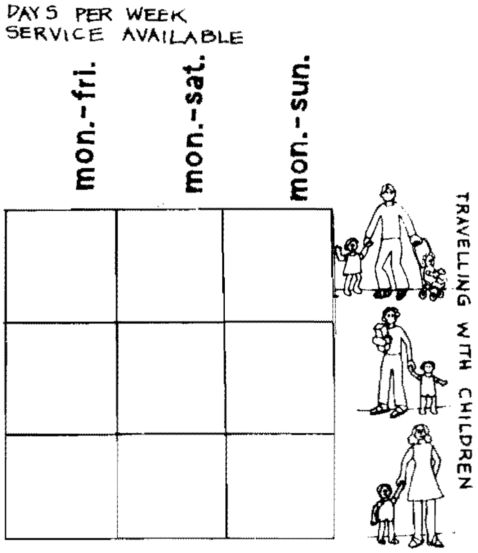

CURRENT COST PER MILE
TRAVELLING WITH PACKAGES

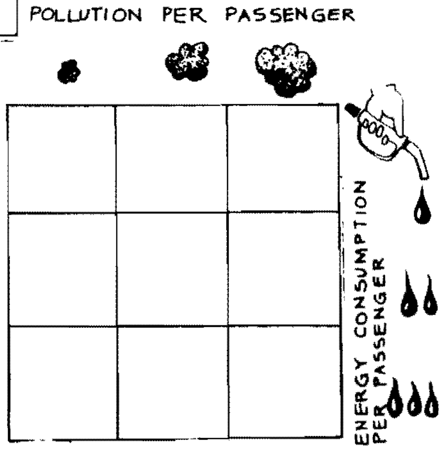

CURRENT COST PER MILE
TRAVELLING WITH CHILDREN

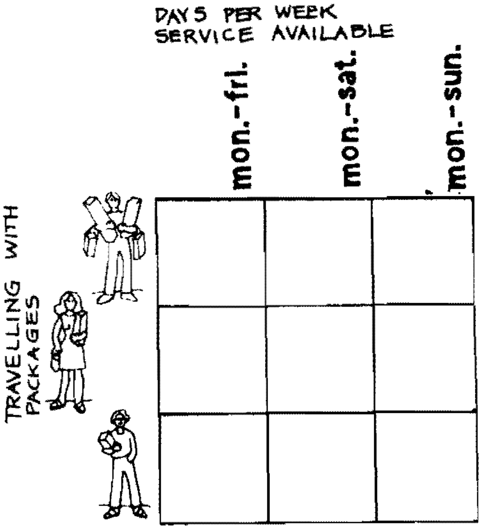

CURRENT COST PER MILE
OPPORTUNITY TO SOCIALIZE

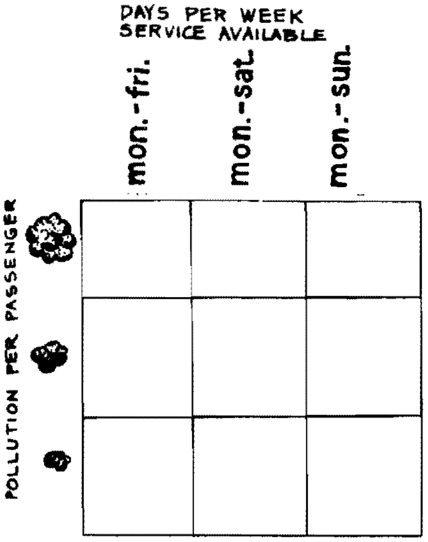

CURRENT COST PER MILE
POLLUTION PER PASSENGER

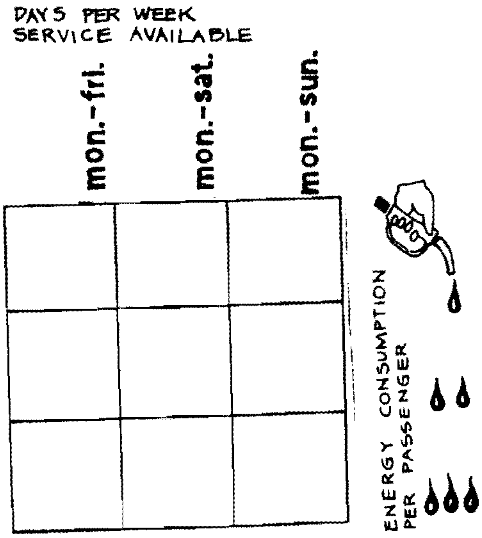

DAYS PER WEEK SERVICE AVAILABLE
mon.-fri.
mon.-sat.
mon.-sun.
OPPORTUNITY TO SOCIALIZE

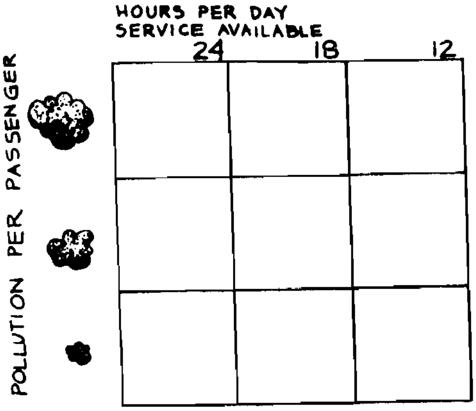

DAYS PER WEEK SERVICE AVAILABLE
mon.-fri.
mon.-sat.
mon.-sun.
TRAVELLING WITH CHILDREN

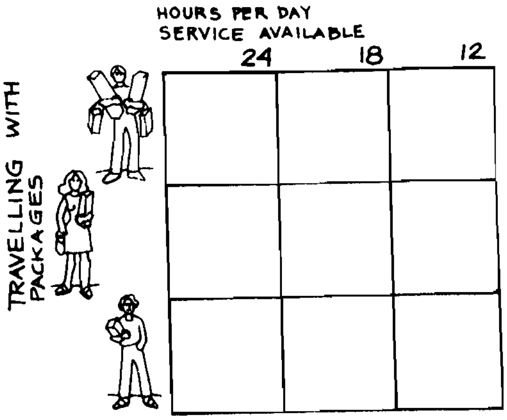

POLLUTION PER PASSENGER
ENERGY CONSUMPTION PER PASSENGER

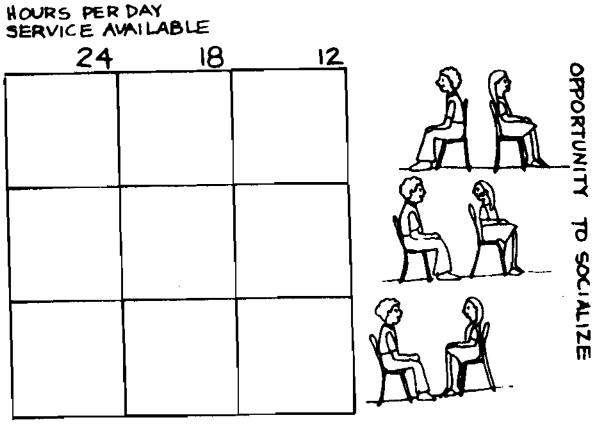

DAYS PER WEEK SERVICE AVAILABLE
mon.-fri.
mon.-sat.
mon.-sun.
TRAVELLING WITH PACKAGES

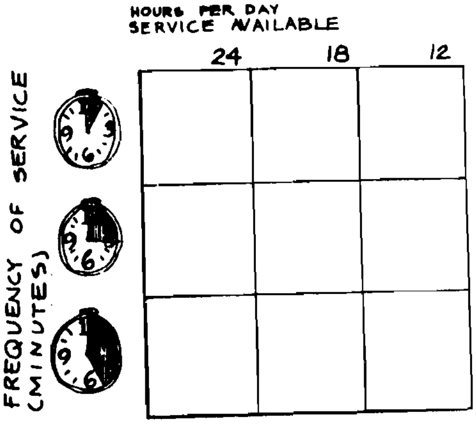

DAYS PER WEEK SERVICE AVAILABLE
mon.-fri.
mon.-sat.
mon.-sun.
POLLUTION PER PASSENGER

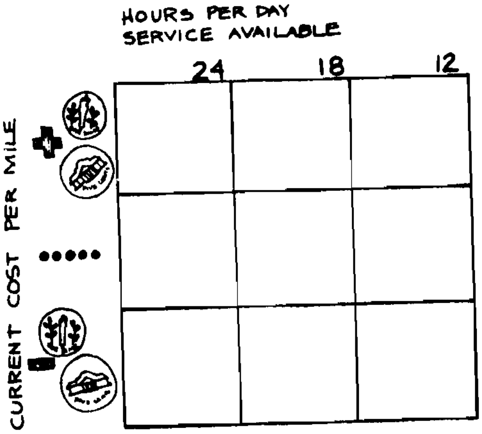

DAYS PER WEEK SERVICE AVAILABLE
mon.-fri.
mon.-sat.
mon.-sun.
ENERGY CONSUMPTION PER PASSENGER

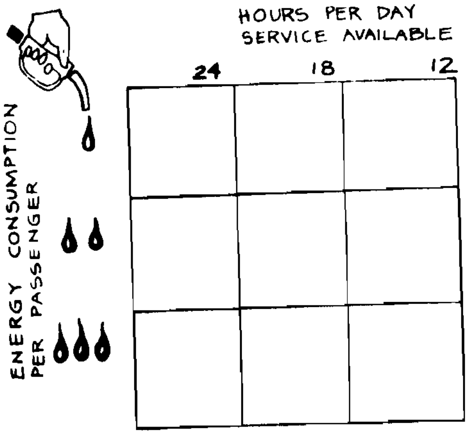

HOURS PER DAY SERVICE AVAILABLE
24
18
12
POLLUTION PER PASSENGER

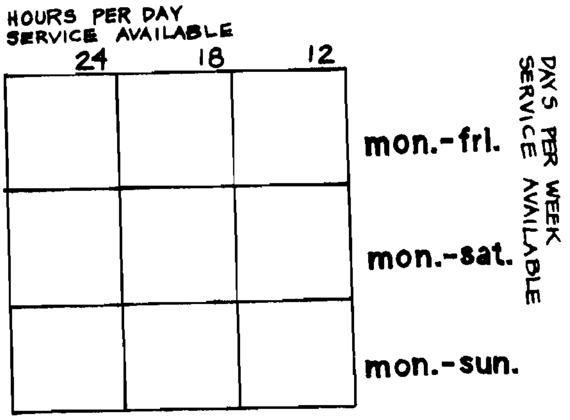

HOURS PER DAY SERVICE AVAILABLE
24
18
12
TRAVELLING WITH PACKAGES

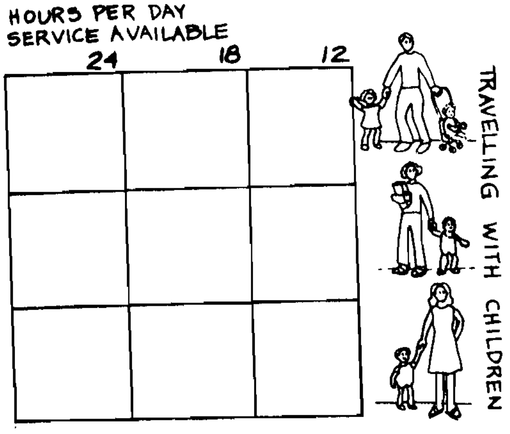

HOURS PER DAY SERVICE AVAILABLE
24
18
12
OPPORTUNITY TO SOCIALIZE

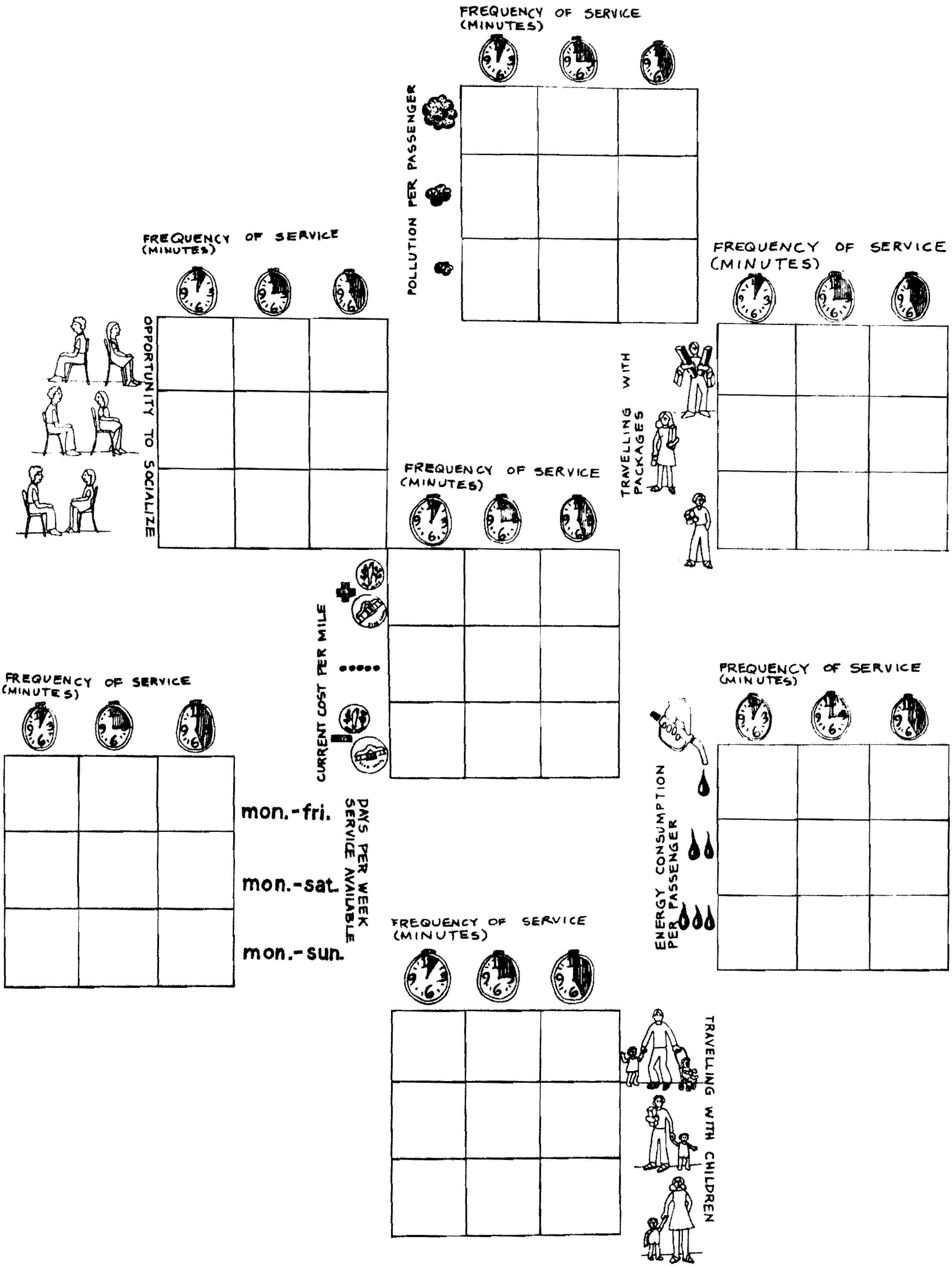

HOURS PER DAY SERVICE AVAILABLE
24
18
12
FREQUENCY OF SERVICE (MINUTES)

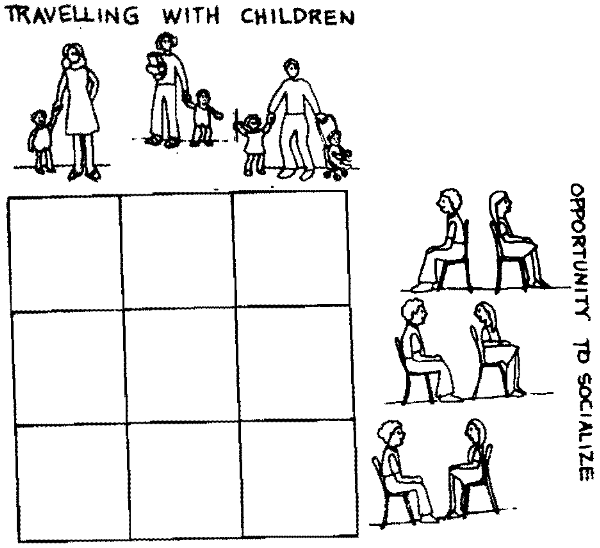

HOURS PER DAY SERVICE AVAILABLE
24
18
12
CURRENT COST PER MILE

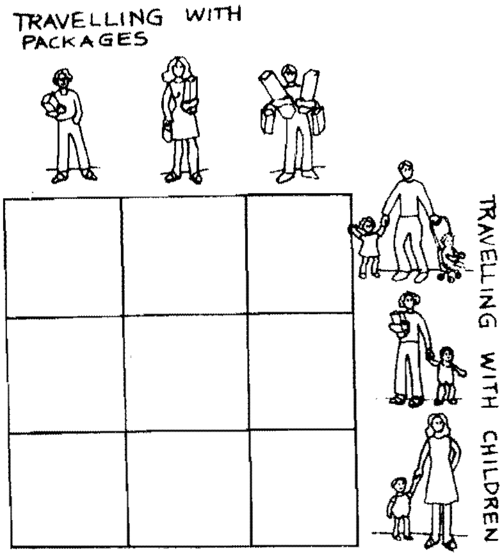

HOURS PER DAY SERVICE AVAILABLE
24
18
12
ENERGY CONSUMPTION PER PASSENGER

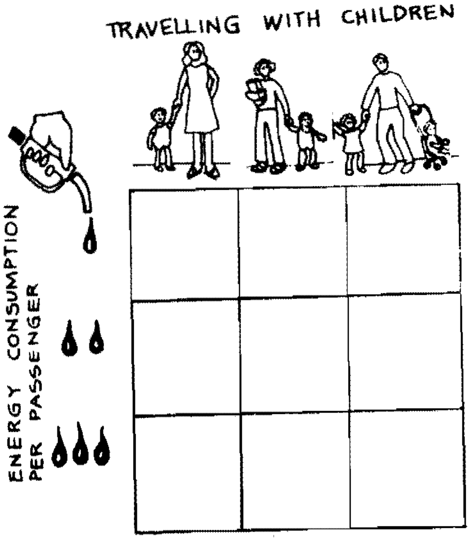

HOURS PER DAY SERVICE AVAILABLE
24
18
12
mon.-fri.
mon.-sat.
mon.-sun.
DAYS PER WEEK SERVICE AVAILABLE

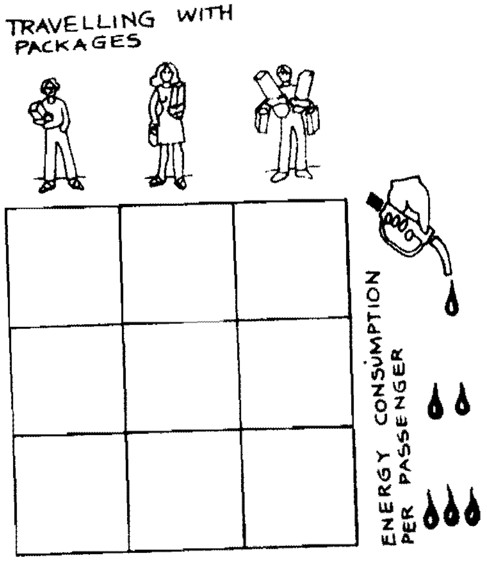

HOURS PER DAY SERVICE AVAILABLE
24
18
12
TRAVELLING WITH CHILDREN

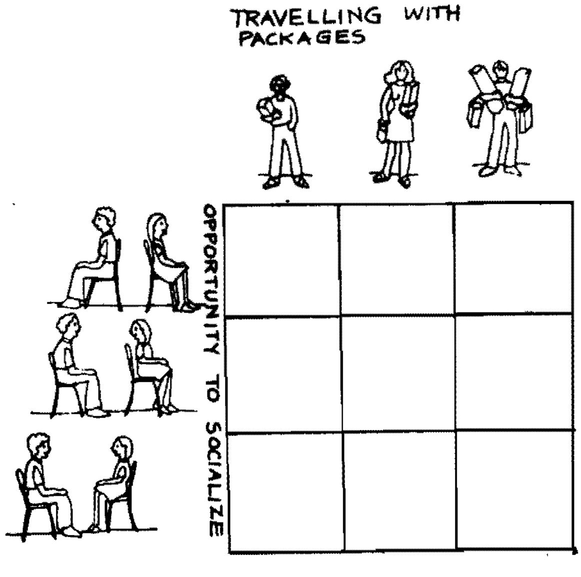

FREQUENCY OF SERVICE (MINUTES)
POLLUTION PER PASSENGER
FREQUENCY OF SERVICE (MINUTES)
OPPORTUNITY TO SOCIALIZE
FREQUENCY OF SERVICE (MINUTES)
TRAVELLING WITH PACKAGES
FREQUENCY OF SERVICE (MINUTES)
CURRENT COST PER MILE
FREQUENCY OF SERVICE (MINUTES)
mon.-fri.
mon.-sat.
mon.-sun.
DAYS PER WEEK SERVICE AVAILABLE
FREQUENCY OF SERVICE (MINUTES)
ENERGY CONSUMPTION PER PASSENGER
FREQUENCY OF SERVICE (MINUTES)
TRAVELLING WITH CHILDREN

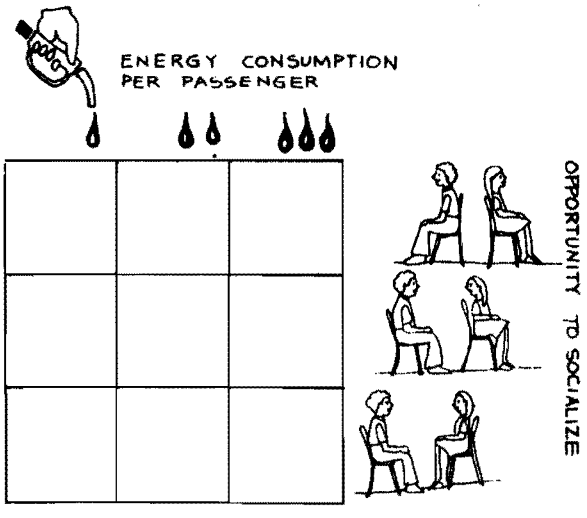

TRAVELLING WITH CHILDREN
OPPORTUNITY TO SOCIALIZE


TRAVELLING WITH PACKAGES
TRAVELLING WITH CHILDREN


TRAVELLING WITH CHILDREN
ENERGY CONSUMPTION PER PASSENGER


TRAVELLING WITH PACKAGES
ENERGY CONSUMPTION PER PASSENGER


TRAVELLING WITH PACKAGES
OPPORTUNITY TO SOCIALIZE


ENERGY CONSUMPTION PER PASSENGER
OPPORTUNITY TO SOCIALIZE

Here are several more questions that we would like you to mark. Please place a check in the appropriate box.

1. Your age?
   (Check one)

   Less than 21 Years ☐
   21-29 Years ☐
   30-44 Years ☐
   45-59 Years ☐
   60 or older ☐

2. What is the highest level of education attained by you? (Check one)

   Junior High or Less ☐
   Some High School ☐
   High School Graduate ☐
   Some College/Professional Training ☐
   College Graduate or Higher ☐

3. Which category best describes your total family income for 1975? If you are a student, indicate only the combined total of you and your spouse's incomes. Your answer to this question and ALL other questions is COMPLETELY CONFIDENTIAL

   Less than $5,000 ☐
   $5,000 to $9,999 ☐
   $10,000 to $14,999 ☐
   $15,000 to $19,999 ☐
   $20,000 or more ☐

4. Would you like a copy of the results?

   Yes ☐
   No ☐

Interviewer's Comments:

APPENDIX X

NON-GRAPHIC PRE-TEST

COUNCIL FOR ADVANCED TRANSPORTATION STUDIES

The University of Texas at Austin

Date: ______________________________

Name: ______________________________

Address: ___________________________ ______

___________________________ ______

Time Scheduled: ______________________

____

Time Started: _________

Time Finished: _________

____

Hello, I'm ______ ______ from the University of Texas. I'm conducting the survey for the Council for Advanced Transportation Studies. (If the respondent hesitates at this point) I believe that ______ ______ contacted you for an appointment.

The purpose of the survey is to collect information about consumer priorities. Your cooperation is appreciated and will help insure meaningful survey results. Please remember that this survey is STRICTLY CONFIDENTIAL.

Now, I have some general Questions I'd like to ask you.

1. Are You a student? Full Time ☐ Part Time ☐ No ☐

2. Are you currently employed? Yes ☐ No ☐

3. If yes what is the approximate address of your place of employment?

____

____

4. In a typical week, about how many trips do you take from home to work or school? ____

5. For these to work or school, how do you get there? Drive Car ☐ Car Pool ☐ City Bus ☐ UT Shuttle ☐ Walk ☐ Bicycle ☐ Motorcycle ☐ Other ☐

6. Do you usually travel alone? Yes ☐ No ☐

7. In general, are you satisfied with the transportation you use for getting to work or school?

   Def. Yes ☐ Mod. Yes ☐ Neutral ☐

   Mod. No ☐ Def. No ☐

8. Do you own your home? Own Home ☐ Rent Home ☐ Rent Apt. ☐ Other ☐

9. How many people are in your household? ____

10. How many automobiles are in your household? ____

11. How often is an automobile available for your use?

24 hrs/day☐ Day Only☐

Night Only☐ Wkends Only☐ Never☐

12. How long have you lived in Austin? ____

13. Approximately how long does it take you to get to work? ____

14. Approximately how far is it to work or school? ____

The next part of the survey involves completing some "trade-off scales". (Give packet to respondent) Please read the instructions and the first sample scale.

At times we have to give up something to get something else. We are interested in finding out which transportation services are most important to you. To help us determine your preferences, we would appreciate your completing the following scales. Though there are no right or wrong answers, your answers are very important.

Each scale is a comparison between two qualities. You are requested to place a one (1) in the box representing the combination that you most prefer, a two (2) in the box that you next prefer, and so on up to nine (9).

The first Sample scale compares crowdedness to the number of hours per day that transportation service is available.

Sample 1:

Step 1. Starting with nine blank boxes, the person who completed this scale placed a 1 in the box representing the absence of crowdedness and the most hours of availability (24 hours).

Service Available __ hours/day

Crowdedness:		12	18	24
	Absent			1
Crowdedness:	Moderate			
	Severe			

Step 2. The second choice indicates a preference for a more crowded situation rather than fewer hours of service.

Service Available __ hours/day

		12	18	24
	Absent			1
Crowdedness:	Moderate			2
	Severe			

Sample 1 continued:

Step 3. The third choice shows that the respondent would rather have six hours less service than have a severely crowed situation.

Service Available __ hours/day

		12	18	24
	Absent		3	1
Crowdedness:	Moderate			2
	Severe			

This is one example of how preferences for all combinations is ordered. Remember, there are no right or wrong answers.

Service Available __ hours/day

		12	18	24
	Absent	5	3	1
Crowdedness:	Moderate	6	4	2
	Severe	9	8	7

Sample 2:

The second sample scale is presented exactly as the rest of the scales will be. Please fill it in, following the instructions outlined for sample one.

Noise Level

		low	med.	high
	+15¢			
Cost Per Mile:	Your Present Cost			
	-15¢			

Please complete the following scales using the same method as described in the example problems.

ENERGY USE PER PASSENGER:

COST PER MILE:

	-15¢	your present cost	+15¢
Low			
Medium			
High			

POLLUTION PER PASSENGER:

COST PER MILE:

	-15¢	your present cost	+15¢
Low			
Medium			
High			

SERVICE AVAILABLE
___DAYS PER WEEK:

COST PER MILE

	-15¢	your present cost	+15¢
5			
6			
7			

SERVICE AVAILABLE
___HOURS PER DAY:

COST PER MILE:

	-15¢	your present cost	+15¢
12			
18			
24			

COST PER MILE:

		-15¢	your present cost	+15¢
SERVICE EVERY ____MINUTES:	5			
	15			
	25			

COST PER MILE:

		-15¢	your present cost	+15¢
TRAVELING WITH PACKAGES:	Easy			
	Acceptable			
	Difficult			

COST PER MILE:

		-15¢	your present cost	+15¢
TRAVELING WITH CHILDREN:	Easy			
	Acceptable			
	Difficult			

COST PER MILE:

		-15¢	your present cost	+15¢
OPPORTUNITY TO SOCIALIZE:	Never			
	Sometimes			
	Often			

ENERGY USE
PER
PASSENGER:

SERVICE AVAILABLE
____ DAYS PER WEEK:

	5	6	7
Low			
Medium			
High			

POLLUTION
PER
PASSENGER:

SERVICE AVAILABLE
____ DAYS PER WEEK:

	5	6	7
Low			
Medium			
High			

SERVICE AVAILABLE
____ HOURS PER DAY:

SERVICE AVAILABLE
____ DAYS PER WEEK:

	5	6	7
12			
18			
24			

TRAVELING WITH
PACKAGES:

SERVICE AVAILABLE
____ DAYS PER WEEK:

	5	6	7
Easy			
Acceptable			
Difficult			

SERVICE AVAILABLE
___ DAYS PER WEEK:

SERVICE EVERY
___ MINUTES:

	5	6	7
5			
15			
25			

SERVICE AVAILABLE
___ DAYS PER WEEK:

TRAVELING
WITH
CHILDREN:

	5	6	7
Easy			
Acceptable			
Difficult			

SERVICE AVAILABLE
___ DAYS PER WEEK:

OPPORTUNITY
TO
SOCIALIZE:

	5	6	7
Never			
Sometimes			
Often			

SERVICE AVAILABLE
___ HOURS PER DAY:

POLLUTION
PER
PASSENGER:

	12	18	24
Low			
Medium			
High			

SERVICE AVAILABLE
___ HOURS PER DAY:

ENERGY USE
PER
PASSENGER:

	12	18	24
Low			
Medium			
High			

SERVICE AVAILABLE
___ HOURS PER DAY:

SERVICE EVERY
___ MINUTES:

	12	18	24
5			
15			
25			

SERVICE AVAILABLE
___ HOURS PER DAY:

TRAVELING
WITH
PACKAGES:

	12	18	24
Easy			
Acceptable			
Difficult			

SERVICE AVAILABLE
___ HOURS PER DAY:

TRAVELING
WITH
CHILDREN:

	12	18	24
Easy			
Acceptable			
Difficult			

SERVICE AVAILABLE
___ HOURS PER DAY:

OPPORTUNITY TO SOCIALIZE:

	12	18	24
Never			
Sometimes			
Often			

SERVICE EVERY
___ MINUTES:

ENERGY USE PER PASSENGER:

	5	15	25
Low			
Medium			
High			

SERVICE EVERY
___ MINUTES:

POLLUTION PER PASSENGER:

	5	15	25
Low			
Medium			
High			

SERVICE EVERY
___ MINUTES:

TRAVELING WITH PACKAGES:

	5	15	25
Easy			
Acceptable			
Difficult			

SERVICE EVERY ___ MINUTES:

		5	15	25
TRAVELING WITH CHILDREN:	Easy			
	Acceptable			
	Difficult			

SERVICE EVERY ___ MINUTES:

		5	15	25
OPPORTUNITY TO SOCIALIZE:	Never			
	Sometimes			
	Often			

ENERGY USE PER PASSENGER:

		Low	Med.	High
POLLUTION PER PASSENGER:	Low			
	Medium			
	High			

ENERGY USE PER PASSENGER:

		Low	Med.	High
TRAVELING WITH PACKAGES:	Easy			
	Acceptable			
	Difficult			

ENERGY USE
PER
PASSENGER:

TRAVELING
WITH
CHILDREN:

	Low	Med.	High
Easy			
Acceptable			
Difficult			

ENERGY USE
PER
PASSENGER:

OPPORTUNITY
TO
SOCIALIZE:

	Low	Med.	High
Never			
Sometimes			
Often			

POLLUTION
PER
PASSENGER:

TRAVELING
WITH
PACKAGES:

	Low	Med.	High
Easy			
Acceptable			
Difficult			

POLLUTION
PER
PASSENGER:

TRAVELING
WITH
CHILDREN:

	Low	Med.	High
Easy			
Acceptable			
Difficult			

POLLUTION PER PASSENGER:

		Low	Med.	High
OPPORTUNITY TO SOCIALIZE:	Never			
	Sometimes			
	Often			

TRAVELING WITH PACKAGES:

		Easy	Acceptable	Difficult
TRAVELING WITH CHILDREN:	Easy			
	Acceptable			
	Difficult			

TRAVELING WITH PACKAGES:

		Easy	Acceptable	Difficult
OPPORTUNITY TO SOCIALIZE:	Never			
	Sometimes			
	Often			

TRAVELING WITH CHILDREN:

		Easy	Acceptable	Difficult
OPPORTUNITY TO SOCIALIZE:	Never			
	Sometimes			
	Often			

Here are several more questions that we would like you to mark. Please place a check in the appropriate box.

1. Your Age?
(Check one)

Less than 21 Years ☐

21-29 Years ☐

30-44 Years ☐

45-59 Years ☐

60 or older ☐

2. What is the highest level of education attained by you? (check one)

Junior High or Less ☐

Some High School ☐

High School Graduate ☐

Some College/Professional Training ☐

College Graduate or Higher ☐

3. Which category best describes your total family income for 1975? If you are a student, indicate only the combined total of you and your spouse's incomes. Your answer to this question and ALL other questions is COMPLETELY CONFIDENTIAL.

Less than $5,000 ☐

$5,000 to $9,999 ☐

$10,000 to $14,999 ☐

$15,000 to $19,999 ☐

$20,000 or More ☐

4. Would you like a copy of the results?

Yes ☐

No ☐

Interviewer's Comments:

APPENDIX XI

MATRIX

2 _ _ 229
1 6

COUNCIL FOR ADVANCED TRANSPORTATION STUDIES

The University of Texas at Austin

Date: ______________________________

Name: ______________________________

Address: ______________________________ ________

______________________________ ________

Time Scheduled: ______________________________

* * * *

Time Started: ______________

Time Finished: ______________

* * * *

Hello, I'm ____________ ____________ from the University of Texas. I'm conducting the survey for the Council for Advanced Transportation Studies. (If the respondent hesitates at this point) I believe that __________ __________ contacted you for an appointment.

The purpose of this survey is to collect information about consumer attitudes toward methods of transportation used to get to work or school. Your cooperation is appreciated and will help assure meaningful survey results. Please remember that this survey is STRICTLY CONFIDENTIAL.

Now, I have some general questions I'd like to ask you.

1. Are you a student? Full Time ☐ Part Time ☐ No ☐ 8

2. Are you currently employed? If yes:
Full Time ☐ Part Time ☐ No ☐ 9

3. If yes (to question #2), what is the approximate address of your place of employment? ______________________________
____

4. In a typical week, about how many round trips do you take from home to work or school? ________ 10-11

5. For these trips to work or school, how do you get there most of the time?
Drive Car ☐ Car Pool ☐ City Bus ☐
UT Shuttle ☐ Walk ☐ Bicycle ☐
Motorcycle ☐ Other ☐ 12

6. Do you usually travel alone? Yes ☐ No ☐ 13

7. In general, are you satisfied with the transportation you use for getting to work or school?

Definitely Yes ☐ Moderately Yes ☐ Neutral ☐

Moderately No ☐ Definitely No ☐ 14

8. Do you?

Own Home ☐ Rent Home ☐

Rent Apt. ☐ Other ☐ 15

9. How many people are in your household? ________ 16-17

10. How many are under the age of 18? ________ 18-19

11. How many automobiles are in your household? ________ 20-21

12. How often is an automobile available for your use?

24 hrs./day ☐ Day Only ☐ Never ☐

Night Only ☐ Weekends Only ☐ 22

13. How long have you lived in Austin? ________ yrs. ________ months
23 - 24 25 - 26

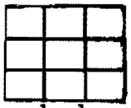
14. Approximately how long does it take you to get to work or school? ________ 27-28

15. Approximately how far is it to work or school from your residence? ________ 29-31

At times we have to give up something to get something else. We are interested in finding out which transportation characteristics are most important to you.

The next part of the survey deals with several transportation characteristics each of which can be applied to many forms of transportation. You will be asked to rank such things as cost of the transportation per mile, comfort while traveling, and fuel use per passenger.

For your information, the American Automobile Association has estimated the cost of transportation by intermediate size car to be 18.3¢ per mile including the initial cost of the car, insurance, and taxes. For a three mile bus trip, the peak time cost is 30¢ (10¢ per mile). This same trip would cost 15¢ at an off peak time resulting in a cost of 5¢ per mile. Comfort usually means such things as low noise level, a smooth ride, and an acceptable temperature. Fuel consumption per passenger is the amount of fuel used to get to a destination divided among the number of passengers carried.

Each scale () is a comparison between two qualities or attributes. Each box (within the scale) represents a unique combination of the two qualities. Place a one (1) in the box representing the combination that you most prefer, a two (2) in the box that represents the combination you next prefer and so on. If you find it more convenient you can start with the most preferred and least preferred combination (one and nine) and then complete the blocks in between.

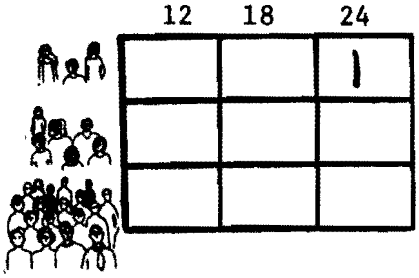
The first sample scale shows the procedure that one person used to fill in a scale comparing crowdedness to the number of hours per day that transportation is available.

SAMPLE 1:

Step 1. Starting with nine blank boxes, the person who completed this scale placed a 1 in the box representing the absence of crowdedness and the most hours of availability (24 hours).

Transportation available ___ hours/day

Crowdedness

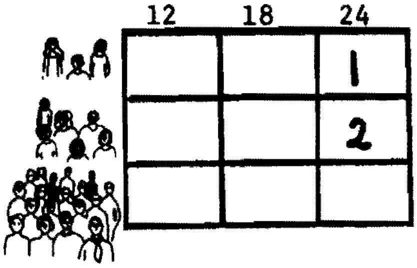


	12	18	24
			1

Step 2. The second choice indicates a preference for a more crowded situation rather than fewer hours of transportation.

Transportation available ___ hours/day

Crowdedness

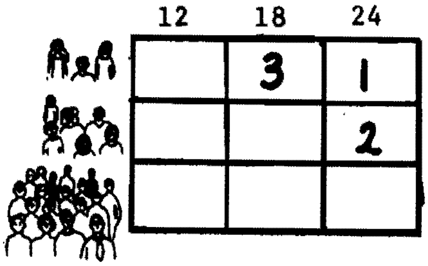


	12	18	24
			1
			2

Step 3. The third choice shows that the respondent would rather have six hours less transportation than have a severely crowded situation.

Transportation Available ___ hours/day

Crowdedness



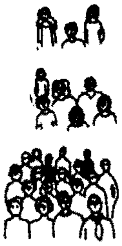
	12	18	24
		3	1
			2

Sample 1 continued:

This is one example of how the nine combinations can be ordered. Remember, there are no right or wrong answers.

Transportation Available ___ hours/day

Crowdedness



	12	18	24
	7	3	1
	8	4	2
	9	6	5

SAMPLE 2:

Step 1: The person who filled in this scale started by placing a one (1) in the box representing the most preferred combination and a nine (9) in the box representing the least preferred.

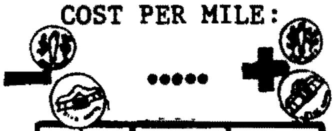
COST PER MILE:

POSSIBILITY OF HAVING AN ACCIDENT

	-15¢	your current cost	+15¢
High			9
Medium			
Low	1		

Step 2: By placing a 2 in the square representing the combination of the current cost per mile (the same cost that the respondent was then paying), and a low possibility of having an accident, the respondent indicated a willingness to pay a little more and still have a low possibility of having an accident.

COST PER MILE:

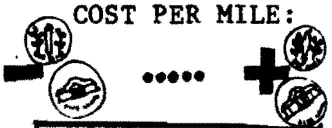


POSSIBILITY OF HAVING AN ACCIDENT

High			9
Medium			
Low	1	2	

Step 3: This was the scale when completed.

COST PER MILE:

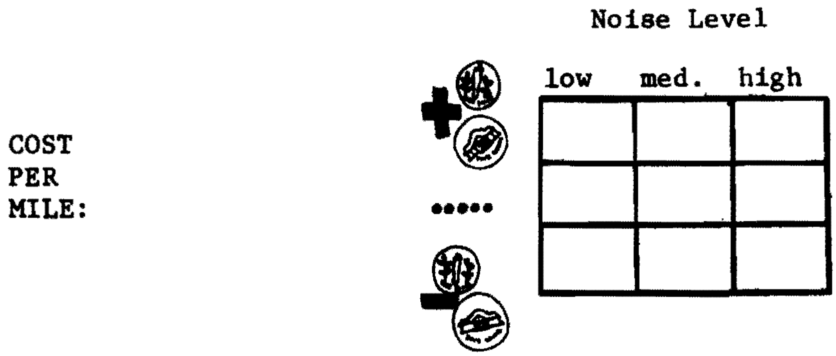


POSSIBILITY OF HAVING AN ACCIDENT

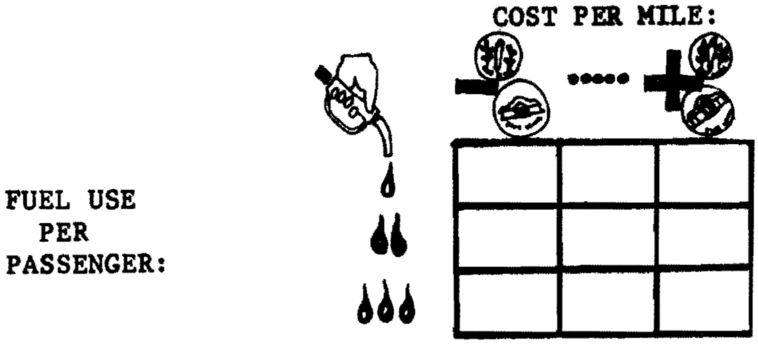
High	7	8	9
Medium	4	5	6
Low	1	2	3

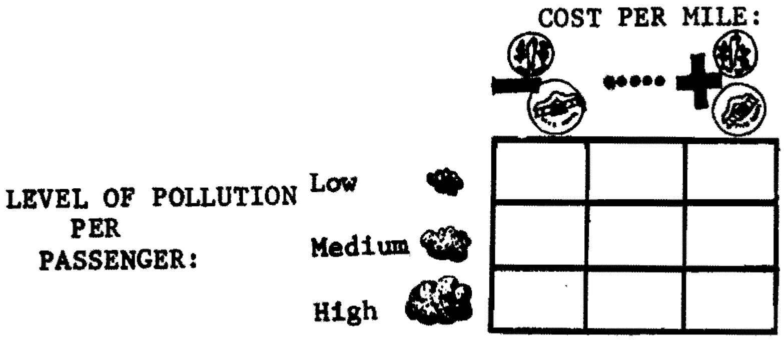
SAMPLE 3:

The third sample scale is presented exactly as the rest of the scales will be. Please fill it in, following the instructions outlined for sample one.



PLEASE COMPLETE THE FOLLOWING SCALES using the instructions described in the examples. REMEMBER that all of the characteristics used below can be applied to many forms of transportation.





COST PER MILE:

− ••••• +

TRANSPORTATION AVAILABLE____ DAYS PER WEEK:

mon.-fri. 5			
mon.-sat. 6			
mon.-sun. 7			

COST PER MILE:

− ••••• +

TRANSPORTATION AVAILABLE_____ HOURS PER DAY:

12			
18			
24			

COST PER MILE:

− •••••• +

TOTAL TRAVEL TIME IS_____MINUTES:

15			
30			
60			

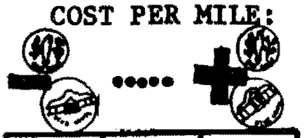
COST PER MILE:

− •••••• +

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE

Never			
Sometimes			
Often			

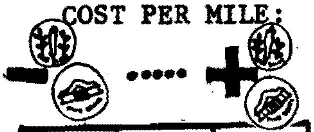
COST PER MILE:



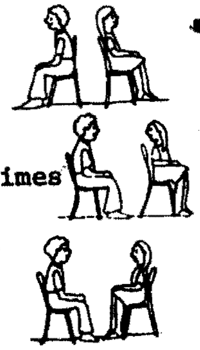
LEVEL OF COMFORT:

Low			
Medium			
High			

COST PER MILE:



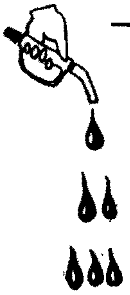
OPPORTUNITY TO SOCIALIZE:



Never			
Sometimes			
Often			

TRANSPORTATION AVAILABLE ________ DAYS PER WEEK:

FUEL USE PER PASSENGER:



	5	6	7

TRANSPORTATION AVAILABLE ______ DAYS PER WEEK:

LEVEL OF POLLUTION PER PASSENGER:

	5	6	7

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

TRANSPORTATION
AVAILABLE______
HOURS PER DAY:

	5	6	7
12			
18			
24			

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

POSSIBILITY OF
ENCOUNTERING
DANGEROUS PEOPLE:

	5	6	7
Never			
Sometimes			
Often			

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

TOTAL TRAVEL
TIME IS
______MINUTES:

	5	6	7
15			
30			
60			

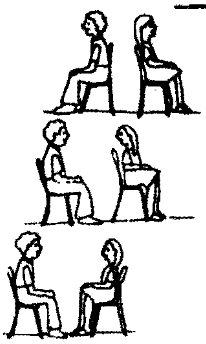
TRANSPORTATION AVAILABLE
______DAYS PER WEEK:

LEVEL OF
COMFORT:

	5	6	7
Low			
Medium			
High			

TRANSPORTATION AVAILABLE
______ DAYS PER WEEK:

OPPORTUNITY
TO
SOCIALIZE:



	5	6	7

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

LEVEL OF POLLUTION
PER
PASSENGER:

	12	18	24

TRANSPORTATION AVAILABLE
______ HOURS PER DAY:

FUEL USE PER
PASSENGER:

	12	18	24
💧 Low			
💧💧 Medium			
💧💧💧 High			

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

TOTAL TRAVEL TIME
IS_____ MINUTES:

	12	18	24
15			
30			
60			

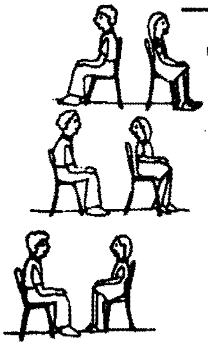
TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

		12	18	24
POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE	Never			
	Sometimes			
	Often			

TRANSPORTATION AVAILABLE
_____ HOURS PER DAY:

		12	18	24
LEVEL OF COMFORT:	Low			
	Medium			
	High			

TRANSPORTATION AVAILABLE
____ HOURS PER DAY:



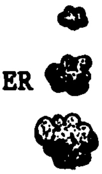
	12	18	24
OPPORTUNITY TO SOCIALIZE:			

TOTAL TRAVEL TIME IS
_______ MINUTES:

		15	30	60
FUEL USE PER PASSENGER:	💧			
	💧💧			
	💧💧💧			

TOTAL TRAVEL TIME IS_____ MINUTES:

LEVEL OF POLLUTION PER PASSENGER:



	15	30	60
Low			
Medium			
High			

TOTAL TRAVEL TIME IS ______MINUTES:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

	15	30	60
Never			
Sometimes			
Often			

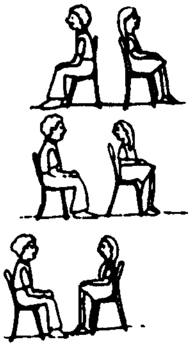
TOTAL TRAVEL TIME IS ______MINUTES:

LEVEL OF COMFORT:

	15	30	60
Low			
Medium			
High			

TOTAL TRAVEL TIME IS _______MINUTES:

OPPORTUNITY TO SOCIALIZE:



	15	30	60

FUEL USE PER PASSENGER:

LEVEL OF POLLUTION PER PASSENGER:

	💧	💧💧	💧💧💧
Low			
Medium			
High			

FUEL USE PER PASSENGER:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

	💧	💧💧	💧💧💧
Never			
Sometimes			
Often			

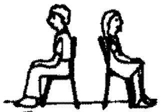
FUEL USE PER PASSENGER:

LEVEL OF COMFORT:

	💧	💧💧	💧💧💧
Low			
Medium			
High			

FUEL USE PER PASSENGER:

OPPORTUNITY TO SOCIALIZE:

	💧	💧💧	💧💧💧
			
			
			

LEVEL OF POLLUTION PER PASSENGER:

POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

	☁	☁	☁
Never			
Sometimes			
Often			

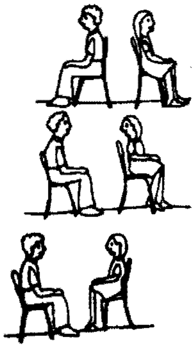
LEVEL OF POLLUTION PER PASSENGER:

LEVEL OF COMFORT:

	☁	☁	☁
Low			
Medium			
High			

LEVEL OF POLLUTION PER PASSENGER:

OPPORTUNITY TO SOCIALIZE:



	☁	☁	☁

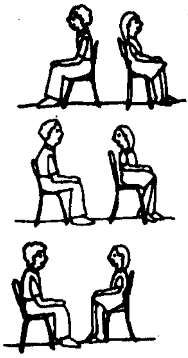
POSSIBILITY OF ENCOUNTERING DANGEROUS PEOPLE:

LEVEL OF COMFORT:

	Never	Sometimes	Often
Low			
Medium			
High			

POSSIBILITY OF ENCOUNTERING
DENGEROUS PEOPLE:

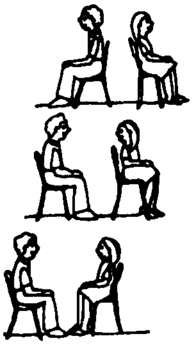
OPPORTUNITY
TO
SOCIALIZE:



Never	Sometimes	Often

LEVEL OF COMFORT:

OPPORTUNITY TO
SOCIALIZE:



Low	Med.	High

In the next section, please mark the level of each attribute that is most appropriate for private car (in the first part) and for public transportation (in the second part). For example, the person who checked the sample below felt that a medium level of parking problems was characteristic of a private automobile and a low level of parking problems was characteristic of public transportation.

Example:

Private Automobile

Level of parking problems Low ☐ Medium ☑ High ☐

Public Transportation

Level of parking problems Low ☑ Medium ☐ High ☐

Please check the levels which are characteristic of a private automobile.

PRIVATE AUTOMOBILE

					CODING Use Only
A.	Transportation available ____ hours per day.	12 ☐	18 ☐	24 ☐	8
B.	Transportation available ____ days per week.	5 ☐	6 ☐	7 ☐	9
C.	Total travel time is ____ minutes.	15 ☐	30 ☐	60 ☐	10
D.	Pollution per passenger.	Low ☐	Medium ☐	High ☐	11
E.	Possibility of encountering dangerous people.	Never ☐	Sometimes ☐	Often ☐	12
F.	Fuel use per passenger.	Low ☐	Medium ☐	High ☐	13

CODING Use Only

G. Level of comfort. Low ☐ Medium ☐ High ☐ 14

H. Opportunity to socialize. Never ☐ Sometimes ☐ Often ☐ 15

I. Cost per mile. 15¢ lower than your present cost ☐ Your present cost ☐ 15¢ more than your present cost ☐ 16

Please check the levels which are characteristic of public transportation.

PUBLIC TRANSPORTATION

A. Transportation available _____ hours per day. 12 ☐ 18 ☐ 24 ☐ 17

B. Transportation available _____ days per week. 5 ☐ 6 ☐ 7 ☐ 18

C. Total travel time is _____ minutes. 15 ☐ 30 ☐ 60 ☐ 19

D. Pollution per passenger. Low ☐ Medium ☐ High ☐ 20

E. Possibility of encountering dangerous people. Never ☐ Sometimes ☐ Often ☐ 21

F. Fuel use per passenger. Low ☐ Medium ☐ High ☐ 22

G. Level of comfort. Low ☐ Medium ☐ High ☐ 23

H. Opportunity to socialize. Never ☐ Sometimes ☐ Often ☐ 24

I. Cost per mile. 15¢ lower than your present cost ☐ Your present cost ☐ 15¢ more than your present cost ☐ 25

Here are several more questions that we would like you to mark. Please place a check in the appropriate box.

CODING Use Only

1. Your age?
   (Check one)

Less than 21 Years ☐

21-29 Years ☐

30-44 Years ☐

45-59 Years ☐

60 or older ☐ 26

2. What is the highest level of education attained by you?
   (Check one)

Junior High or Less ☐

Some High School ☐

High School Graduate ☐

Some College/Professional Training ☐

College Graduate or Higher ☐ 27

3. Which category best describes your total family income for 1975? If you are a student, indicate only the combined total of you and your spouse's incomes. Your answer to this question and ALL other questions is COMPLETELY CONFIDENTIAL.

Less than $5,000 ☐

$5,000 to $9,999 ☐

$10,000 to $14,999 ☐

$15,000 to $19,999 ☐

$20,000 or more ☐ 28

4. Would you like a copy of the results?

Yes ☐

No ☐

SEX: M _____ F _____ 29

ETHNICITY: _______ Caucasian

_______ Negro

_______ Spanish American

_______ Other _________ 30

INTERVIEWER NUMBER: __________

COMMENTS:

APPENDIX XII

CARD SORT

1 _ _ 1 0 2

1 6

COUNCIL FOR ADVANCED TRANSPORTATION STUDIES

THE UNIVERSITY OF TEXAS AT AUSTIN

Date: ______________________

Name: ______________________

Address: ______________________

____

Time Scheduled: ______________

Time Started: ______________

Time Finished: ______________

Hello, I'm ____________ ____________ from the University of Texas. I'm conducting the survey for the Council for Advanced Transportation Studies. I believe ____________ ____________ contacted you for an appointment.

The purpose of this survey is to collect information about consumer attitudes toward methods of transportation used to get to work or school. Your cooperation is appreciated and will help assure meaningful survey results. Please remember that this survey is STRICTLY CONFIDENTIAL.

Now, I have some general questions I'd like to ask you.

1. Are you a student? Full Time ☐ Part Time ☐ No ☐ 8

2. Are you currently employed? If yes:
Full Time ☐ Part Time ☐ No ☐ 9

3. If yes (to question #2), what is the approximate address of your place of employment? ____________________________
____

4. In a typical week, about how many round trips do you take from home to work or school? _______ 10-11

5. For these trips to work or school, how do you get there most of the time?
Drive Car ☐ Car Pool ☐ City Bus ☐
UT Shuttle ☐ Walk ☐ Bicycle ☐
Motorcycle ☐ Other ☐ 12

6. Do you usually travel alone? Yes ☐ No ☐ 13

7. In general, are you satisfied with the transportation you use for getting to work or school?

Definitely Yes ☐ Moderately Yes ☐ Neutral ☐

Moderately No ☐ Definitely No ☐ 14

8. Do you?

Own Home ☐ Rent Home ☐

Rent Apt. ☐ Other ☐ 15

9. How many people are in your household? ________ 16-17

10. How many are under the age of 18? ________ 18-19

11. How many automobiles are in your household? ________ 20-21

12. How often is an automobile available for your use?

24 hrs./day ☐ Day Only ☐ Never ☐

Night Only ☐ Weekends Only ☐ 22

13. How long have you lived in Austin? ________ yrs. ________ months

23 - 24 25 - 26

14. Approximately how long does it take you to get to work or school? ________ 27-28

15. Approximately how far is it to work or school from your residence? ________ 29-31

The next part of the survey deals with several transportation characteristics each of which can be applied to many forms of transportation. You will be asked to rank such things as cost of the transportation per mile, comfort while traveling, and fuel use per passenger.

For your information, the American Automobile Association has estimated the cost of transportation by intermediate size car to be 18.3¢ per mile including the initial cost of the car, insurance, and taxes. For a three mile bus trip, the peak time cost is 30¢ (10¢ per mile). This same trip would cost 15¢ at an off peak time resulting in a cost of 5¢ per mile. Comfort usually means such things as low noise level, a smooth ride, and an acceptable temperature. Fuel consumption per passenger is the amount of fuel used to get to a destination divided among the number of passengers carried. A series of cards containing sets of these characteristics will be used for the next part of the survey.

The example on the next page was ranked according to the following instructions.

INSTRUCTIONS:

Study each combination (card) and put them in order of preference (rank them from your most preferred combination to your least preferred combination).

EXAMPLE:

Scenery, very easy to look at. Moderately crowded. No parking problems. Moderately easy to find your way.	(combination most preferred)
Scenery, difficult to look at. Very crowded. Moderately difficult to park. Easy to find your way.	(combination ranked second)
Scenery, difficult to look at. Not crowded. Moderately difficult to park. Difficult to find your way.	(combination ranked third)
Scenery, can see with some effort. Not crowded. Difficult to park. Difficult to find your way.	(combination ranked fourth)

(You may not have ranked these combinations in the same order as this person did.)

Please rank the cards that the interviewer will give you.

FORMATS FOR CARD SORT

Cost will be 15¢ more per mile than your current cost.
Transportation is available 18 hours per day.
High level of comfort.
Total travel time is 60 minutes.
There is never an opportunity to socialize.
High fuel use per passenger.
Transportation is available 6 days per week.
Low level of pollution per passenger.
Sometimes, there is a possibility of encountering dangerous people.

High level of pollution.
Transportation is available 18 hours per day.
Total travel time is 30 minutes.
Often, there is the possibility of encountering dangerous people.
Low fuel use per passenger.
Transportation is available 5 days per week.
There is never an opportunity to socialize.
Medium level of comfort.
Cost will be 15¢ more per mile than your current cost.

Often, there is the possibility of encountering dangerous people.
High fuel use per passenger.
High level of comfort.
Often, there is an opportunity to socialize.
Cost will be 15¢ more per mile than your current cost.
Transportation is available 24 hours per day.
High level of pollution per passenger.
Total travel time is 60 minutes.
Transportation is available 7 days per week.

FORMATS FOR CARD SORT

Transportation is available 6 days per week.
Often, there is a possibility of encountering dangerous people.
Low level of comfort.
Cost will be 15¢ more per mile than your present cost.
High level of pollution per passenger.
Transportation is available 12 hours per day.
Sometimes, there is an opportunity to socialize.
Medium fuel use per passenger.
Total travel time is 15 minutes.

There is never an opportunity to socialize.
Medium fuel use per passenger.
Cost will be 15¢ more per mile than your current cost.
Medium level of pollution per passenger.
Transportation is available 7 days per week.
High level of comfort.
Never, is there is possibility of encountering dangerous people.
Total travel time is 15 minutes.
Transportation is available 18 hours per day.

Often, there is an opportunity to socialize.
Transportation is available 6 days per week.
There is never a possibility of encountering dangerous people.
Low level of comfort.
Medium level of pollution.
Total travel time is 30 minutes.
Low fuel use per passenger.
Cost will be 15¢ more per mile than your present cost.
Transportation is available 24 hours per day.

FORMATS FOR CARD SORT

Transportation is available 12 hours per day
Low level of pollution per passenger.
Cost will be 15¢ more per mile than your current cost.
Sometimes, there is an opportunity to socialize.
Total travel time is 30 minutes.
High level of comfort.
Transportation is available 7 days per week.
Sometimes, there is a possibility of encountering dangerous people.
Low fuel use per passenger.

Low level of pollution per passenger.
Medium fuel use per passenger.
Transportation is available 5 days per week.
Often, there is an opportunity to socialize.
Sometimes, there is a possibility of encountering dangerous people.
Transportation is available 24 hours per day.
Cost will be 15¢ more per mile than your current cost.
Medium level of comfort.
Total travel time is 15 minutes.

Medium level of comfort.
Transportation is available 5 days per week.
Transportation is available 12 hours per day.
Cost will be 15¢ more per mile than your present cost.
High fuel use per passenger.
Medium level of pollution per passenger.
Total travel time is 60 minutes.
There is never a possibility of encountering dangerous people.
Sometimes, there is an opportunity to socialize.

FORMATS FOR CARD SORT

Transportation is available 5 days per week.
Medium fuel use per passenger.
High level of pollution per passenger.
Transportation is available 12 hours per day.
High level of comfort.
Total travel time is 30 minutes.
Often, there is an opportunity to socialize.
There is never a possibility of encountering dangerous people.
Cost will be the same per mile as your current cost.

Cost will be 15¢ less per mile than your current cost.
Transportation is available 6 days per week.
Medium level of pollution per passenger.
High fuel use per passenger.
Often, there is an opportunity to socialize.
There is never a possibility of encountering dangerous people.
Transportation is available 12 hours per day.
Total travel time is 15 minutes.
Low level of comfort.

Transportation is available 18 hours per day.
Sometimes, there is a possibility of encountering dangerous people.
Medium level of comfort.
Medium fuel use per passenger.
Medium level of pollution per passenger.
Sometimes, there is an opportunity to socialize.
Cost will be the same per mile as your current cost.
Total travel time is 30 minutes.
Transportation is available 6 days per week.

FORMATS FOR CARD SORT

Sometimes, there is a possibility of encountering dangerous people.
High level of comfort.
Total travel time is 60 minutes.
Low fuel use per passenger.
Medium level of pollution per passenger.
Transportation is available 24 hours per day.
Cost will be the same per mile as your present cost.
There is never an opportunity to socialize.
Transportation is available 5 days per week.

Transportation is available 12 hours per day.
Transportation is available 6 days per week.
Low pollution per passenger.
Often, there is a possibility of encountering dangerous people.
Total travel time is 60 minutes.
Often, there is an opportunity to socialize.
Cost will be the same per mile as your current cost.
Low fuel use per passenger.
Medium level of comfort.

Cost per mile will be the same as your current cost.
Low level of pollution per passenger.
High level of comfort.
Transportation is available 18 hours per day.
Often, there is the possibility of encountering dangerous people.
High fuel use per passenger.
Total travel time is 15 minutes.
Transportation is available 5 days per week.
Sometimes, there is an opportunity to socialize.

FORMATS FOR CARD SORT

Cost will be the same per mile as your current cost.
Medium level of comfort.
There is never a possibility of encountering dangerous people.
High fuel use per passenger.
High level of pollution per passenger.
Total travel time is 15 minutes.
There is never an opportunity to socialize.
Transportation is available 24 hours per day.
Transportation is available 6 days per week.

Transportation is available 18 hours per day.
Transportation is available 7 days per week.
High level of pollution per passenger.
There is never a possibility of encountering dangerous people.
Low fuel use per passenger.
Total travel time is 60 minutes.
Sometimes, there is an opportunity to socialize.
Cost will be the same per mile as your current cost.
Low level of comfort.

Low level of comfort
Transportation is available 7 days per week.
Total travel time is 30 minutes.
Medium fuel use per passenger.
Transportation is available 24 hours per day.
Often, there is the possibility of encountering dangerous people.
Low level of pollution per passenger.
Cost will be the same per mile as your current cost.
There is never an opportunity to socialize.

FORMATS FOR CARD SORT

Medium level of pollution per passenger.
Sometimes, there is an opportunity to socialize.
Often, there is a possibility of encountering dangerous people.
Transportation is available 7 days per week.
Cost will be 15¢ less per mile than your current cost.
Transportation is available 24 hours per day.
Total travel time is 15 minutes.
Medium level of comfort.
Low fuel use per passenger.

Total travel time is 60 minutes.
Cost will be 15¢ more per mile than your current cost.
There is never a possibility of encountering dangerous people.
Medium fuel use per passenger.
There is never an opportunity to socialize.
Transportation is available 24 hours per day.
Transportation is available 6 days per week.
Low level of pollution per passenger.
High level of comfort.

Transportation is available 5 days per week.
There is never a possibility of encountering dangerous people.
There is never an opportunity to socialize.
Low fuel use per person.
Low level of comfort.
Transportation is available 12 hours per day.
Cost will be 15¢ per mile less than your current cost.
Total travel time is 15 minutes.
Low level of pollution per passenger.

FORMATS FOR CARD SORT

Often, there is a possibility of encountering dangerous people
Often, there is an opportunity to socialize.
Transportation is available 18 hours per day.
Medium fuel use per passenger.
Medium level of pollution per passenger
Transportation is available 5 days per week.
Cost will be 15¢ less per mile than your current cost.
Total travel time is 60 minutes.
Low level of comfort

Transportation is available 6 days per week.
Often, there is a possibility of encountering dangerous people.
Total travel time is 30 minutes.
High level of comfort.
There is never an opportunity to socialize.
Medium level of pollution per passenger.
Transportation is available 12 hours per day.
Cost will be 15¢ less per mile than your present cost.
High fuel use per passenger.

Transportation is available 6 days per week.
Low fuel use per passenger
Total travel time is 15 minutes.
Often, there is an opportunity to socialize.
High level of pollution per passenger.
Sometimes, there is a possibility of encountering dangerous people.
Cost will be 15¢ less per mile than your current cost.
Transportation is available 18 hours per day.
High level of comfort.

FORMATS FOR CARD SORT

There is never an opportunity to socialize.
Sometimes, there is a possibility of encountering dangerous people.
High level of pollution per passenger.
Medium fuel use per passenger.
Transportation is available 7 days per week.
Medium level of comfort.
Cost will be 15¢ less per mile than your current cost.
Total travel time is 60 minutes.
Transportation is available 12 hours per day.

Transportation is available 5 days per week.
Sometimes, there is an opportunity to socialize.
Total travel time is 30 minutes.
High fuel use per passenger.
High level of pollution per passenger.
Cost will be 15¢ less per mile than your present cost.
Sometimes, there is a possibility of encountering dangerous people.
Low level of comfort.
Transportation is available 24 hours per day.

Low level of pollution per passenger.
Medium level of comfort.
There is never a possibility of encountering dangerous people.
Transportation is available 18 hours per day.
High fuel use per passenger.
Often, there is an opportunity to socialize.
Transportation is available 7 days per week.
Total travel time is 30 minutes.
Cost will be 15¢ less per mile than your current cost.

In the next section, please mark the level of each attribute that is most appropriate for private car (in the first part) and for public transportation (in the second part). For example, the person who checked the sample below felt that a medium level of parking problems was characteristic of a private automobile and a low level of parking problems was characteristic of public transportation.

Example:

Private Automobile

Level of parking problems Low ☐ Medium ☑ High ☐

Public Transportation

Level of parking problems Low ☑ Medium ☐ High ☐

Please check the levels which are characteristic of a private automobile.

PRIVATE AUTOMOBILE

					CODING Use Only
A.	Transportation available ____ hours per day.	12 ☐	18 ☐	24 ☐	8
B.	Transportation available ____ days per week.	5 ☐	6 ☐	7 ☐	9
C.	Total travel time is ____ minutes.	15 ☐	30 ☐	60 ☐	10
D.	Pollution per passenger.	Low ☐	Medium ☐	High ☐	11
E.	Possibility of encountering dangerous people.	Never ☐	Sometimes ☐	Often ☐	12
F.	Fuel use per passenger.	Low ☐	Medium ☐	High ☐	13

CODING Use Only

G. Level of comfort. Low ☐ Medium ☐ High ☐ 14

H. Opportunity to socialize. Never ☐ Sometimes ☐ Often ☐ 15

I. Cost per mile. 15¢ lower than your present cost ☐ Your present cost ☐ 15¢ more than your present cost ☐ 16

Please check the levels which are characteristic of public transportation.

PUBLIC TRANSPORTATION

A. Transportation available ______ hours per day. 12 ☐ 18 ☐ 24 ☐ 17

B. Transportation available ______ days per week. 5 ☐ 6 ☐ 7 ☐ 18

C. Total travel time is _____ minutes. 15 ☐ 30 ☐ 60 ☐ 19

D. Pollution per passenger. Low ☐ Medium ☐ High ☐ 20

E. Possibility of encountering dangerous people. Never ☐ Sometimes ☐ Often ☐ 21

F. Fuel use per passenger. Low ☐ Medium ☐ High ☐ 22

G. Level of comfort. Low ☐ Medium ☐ High ☐ 23

H. Opportunity to socialize. Never ☐ Sometimes ☐ Often ☐ 24

I. Cost per mile. 15¢ lower than your present cost ☐ Your present cost ☐ 15¢ more than your present cost ☐ 25

CODING Use Only

Here are several more questions that we would like you to mark. Please place a check in the appropriate box.

1. Your age?
   (Check one)

Less than 21 Years ☐

21-29 Years ☐

30-44 Years ☐

45-59 Years ☐

60 or older ☐ 26

2. What is the highest level of education attained by you?
   (Check one)

Junior High or Less ☐

Some High School ☐

High School Graduate ☐

Some College/Professional Training ☐

College Graduate or Higher ☐ 27

3. Which category best describes your total family income for 1975? If you are a student, indicate only the combined total of you and your spouse's incomes. Your answer to this question and ALL other questions is COMPLETELY CONFIDENTIAL.

Less than $5,000 ☐

$5,000 to $9,999 ☐

$10,000 to $14,999 ☐

$15,000 to $19,999 ☐

$20,000 or more ☐ 28

4. Would you like a copy of the results?

Yes ☐

No ☐

RANKING: ____________

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SEX: M ☐ F ☐ 29

ETHNICITY:

☐ Caucasian

☐ Negro

☐ Spanish American

☐ Other ____________ 30

COMMENTS:

INTERVIEWER NUMBER ____________

APPENDIX XIII

LONGITUDINAL STUDY
(1974 versus 1975)

APPENDIX XIII

LONGITUDINAL STUDY
(1974 Versus 1975)

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LIST OF TABLES AND EXHIBITS

EXHIBITS

LONGITUDINAL STUDY (1974 vs. 1975)

During the second year of this three-year study, it was considered desirable to measure the extent to which data obtained in the first year's survey might be stable over time and changing conditions. In the Spring of 1974, when most of the first year's data were collected, the "energy crisis" was first being widely perceived by the public, with lengthened lines at gasoline stations, rapidly rising prices for gasoline, and increased rhetoric about the Arab oil embargo, self-sufficiency, and related issues. By the time Spring of 1975 had come, gas lines were a (temporary?) thing of the past, and talk of gasoline rationing was not heard amongst the general public. Accordingly, it seemed appropriate to explore whether the general public in the survey area might still seek the same configuration of transportation features, including the relatively high determinants of energy savings and low pollution per passenger. In addition, one could also examine the extent to which relative preferences for funding public transportation may have shifted amidst the changing economic and political circumstances of these two years. Changes in perceived images of private autos, buses, and the differences between the two, could also be monitored to see whether public transit was perceived as "gaining" in a significant way, due to changes in public attitudes, transit improvements, or the like.

Obviously, studying trends in attitudes and transit priorities over a two year period in one study area does not constitute a sufficient data base for generalizing about long-term trends. However, it was felt that some insight into sensitivities to "the energy crisis," and possible changes towards different criteria for travel choice might be gained through examining public responses to the same questions one year "after the crisis." In addition, having determined in the first year that certain ambiguous attributes (e.g., convenience, flexibility...) were apparently determinants of modal choice, we decided to attempt more specific definitions of these terms, to see what meanings were suggested and how each might be operationalized by transportation management.

The central research objectives in the second year were:

1. To replicate the major elements of the 1974 survey, with general Austin adults interviewed in the same manner as previously,

2. To compare relative criteria for transportation choice, perceived features of public vs. private transportation, and priorities for funding public transportation, and

3. To provide specific meanings for transportation features previously identified as determinant attributes of travel mode choice: flexibility, dependability, and convenience.

This appendix contains a description of the survey methodology, major findings, relationships between 1974 and 1975 results, and an interpretation of their meaning for transportation planning in the short and intermediate planning horizon.

A copy of the survey instrument, modified to show one page on each separate sheet, is included in this appendix. This instrument is a modified version of the one used in the first year, with three major changes. First, we removed the series of importance and difference questions pertaining to trips for shopping and personal business (see Alpert & Davies, op. cit.), in order to shorten the survey and highlight the attitudes toward work/school trips, which were considered more critical for improving the efficiency of transit during peak times. Thus while Part 1 was the same in both years, Part 2 was replaced with questions probing for specific meanings of flexible, dependable, and convenient. From a list of phrases for each term, generated from exploratory interviews and refined through pre-testing the questions, respondents were then asked to indicate the two phrases that best describe the meaning of each transportation feature.

Part 3 contained the same questions that were asked in 1974, concerning relative desirability of several proposed transit funding mechanisms, city planning goals, problems with public transportation, reactions to various transit proposals, along with willingness to switch to public transit if it were improved. Part 4 inquires about respondents' exposure to various media (for targeting promotional messages), but was shortened by removing the questions about specific programs and times watched. Given the primary purposes of this longitudinal study, the belief that specific viewing and listening habits might vary over time, only general media exposure patterns were probed (thereby cutting about 15 minutes from completion time). Part 5 covered the same demographic and shopping patterns as were asked before, changing the year during which household income was requested. The major purpose of this section was to relate other answers to demographic correlates, as well as compare the two samples for basic demographic similarities or differences. To the extent that different demographic profiles were obtained in the two survey years, differences in attitudes, features sought, etc. might need to be explained in part by such demographic variations (and their correlates) in addition to changes in the general population's attitudes over time.

SURVEY METHODOLOGY

Data were collected in substantially the same manner as had been done during the first year's survey, except that sample size was trimmed by about one-third (159 usable responses versus 252 in Year One). Data were again obtained between April and June (1975), using the same collection methods, cover story, and the modified version of the first year's questionnaire. While a longitudinal study ideally involves obtaining data from the same persons during two or more different time periods, this approach was varied for this study. We decided to apply similar criteria for sample selection in both years, but not to attempt to interview the same households. It was felt that persons who were willing to respond a second time to our questionnaire, after having spent 45 minutes doing so a year earlier, were likely to be more positively biased towards public transportation than were those who merely completed the process one time. A lower response rate was also likely, and this would increase survey costs while lowering reliability. Inability to contact people who had moved since the first interview would also bias results, since original respondents were contacted door-to-door, and not from a year-old list. The study thus is longitudinal in the same sense that similarly selected samples are used to generalize parameters for the survey area in 1974 versus 1975. Given the care that was taken to choose samples representing the community adult population, it is argued that differences between the mean responses for the two survey years would represent community attitude changes over time, provided these differences were significantly greater than those that could be allowed due to random sampling fluctuations. (Some demographic differences between the two samples were observed, but as will be later discussed, these had minimal impact on the key comparisons between respondents for the two survey years.)

Following the procedure of Year One (Alpert and Davies, op. cit., page 3), general adults were contracted in a stratified random sample of Austin households by census tract (quotas proportional to population). Interviewers enumerated households within each census tract, beginning from the same randomly chosen starting points that had been used in 1974. Walking directions were arbitrarily shifted ninety degrees to minimize the chance that the same persons might be contacted two years in a row. Every third household was again contacted, with three call-backs, staggered interviewing hours, and alternately selected male and female respondents (18 years and over). Quotas from each starting point were approximately two-thirds of those for the previous year. Respondents were told this was a study to learn what people want in personal and public transportation, and individual confidentiality was stressed. Interviewers explained the procedures for respondents to fill out the questionnaires, provided clarification of questions. Personal interviewing aided in insuring cooperation, clarifying questions, and translating to Spanish where needed. To increase the speed and candor of responses, respondents again filled out their own questionnaires, except where translation necessitated a more active role by the bilingual interviewers.

RESULTS

Exhibit 2 contains a summary of the responses obtained from the sample of Austin adults in 1975. Relating the percentage distributions for various questions, mean responses, and number responding to various questions, allows one to make inferences concerning the community characteristics and attitudes. Considerable detail is contained in this exhibit, and the most relevant figures will be noted in the discussion below, particularly regarding the major comparisons with comparable statistics for the previous year's respondents. Tables A1 - A12 highlight these comparisons and will be discussed after examining the refined definitions of convenience, flexibility and dependability.

Semantic confusion is always present in attitude research. Examples may be seen in the results of the phrases that were elicited as descriptions of the meanings of flexibility, dependability, and convenience, as features of transportation modes. Research from the first year had indicated that these three criteria were highly valued as characteristics of a desired commuting mode. Unlike some of the other determinant attributes, such as low energy use per passenger, low pollution per passenger, and economy, there seemed to be quite a bit of ambiguity concerning what people meant by these terms, as well as their relative overlap. From "meanings" associated from among the pre-screened components of each term, these connotations and interrelationships were partially clarified.

Exhibit 2 shows that flexibility was most often associated with frequent service, as 51.6 percent of the respondents named that as one of the two phrases that best described the meaning of flexibility as a transportation feature. The next two most frequently named responses involve having service available at all hours and every day. There is also some association with variable routes. Hence flexibility implies ease in variation of origins destinations, and having transportation whenever one wants.

Dependability was cited by 61 percent of the responses as meaning "getting to your destination at the scheduled time," and by 47.2 percent as "getting to where you get on -- on schedule," both of which seem quite intuitive as meanings. However, 47.8 percent of the respondents also consider dependability to mean available every day, which overlaps flexibility.

Convenience was most often defined as "available at many locations," (50.9 percent), but almost as frequently mentioned were "minimum waiting time" (44 percent), frequent service (41.5 percent) and, once again, "available seven days a week" (36.5 percent).

These associations help to indicate what specific system features are sought under the general heading of "convenience, flexibility, and dependability." These can be built in, subject to the specific levels of trade-offs discussed in the conjoint measurement section of this report. Designing promotional messages may profitably use the specific phrases most often associated with the general terms.

Table A1 presents a descending ranking of the determinance scores of the 27 characteristics of modes used for transportation to work or school, as rated by the entire 1975 sample. As noted in the first year's report, the determinance of an attribute is obtained by multiplying the respondent's rating of the relative importance of a trait in determining her/his choice of a

TABLE A1

DETERMINANCE SCORES AND MODAL COMPARISONS FOR ALL ADULTS, YEAR 2
(WORK/SCHOOL)

RANK	ATTRIBUTE	Z VALUE	CAR OR BUS SUPERIOR?
1	Convenience	7.72[1]	Car[2]
2	Dependability	6.69[1]	Car[2]
3	Economy	5.83[1]	Bus[2]
4	Freedom from repairs	5.65[1]	Bus[2]
5	No parking problems	5.47[1]	Bus[2]
6	Low energy use per passenger	5.15[1]	Bus[2]
7	Low pollution per passenger	3.74[1]	Bus[2]
8	Flexibility	3.66[1]	Car[2]
9	Brief travel time	2.99[1]	Car[2]
10	Freedom from accidents	1.93[1]	Car[1]
11	Uncrowded	1.42[2]	Car[2]
12	Safe from dangerous people	1.07	Car[2]
13	Ease of travel with packages	1.02	Car[2]
14	Avoid traffic congestion	.22	n.s.d.
15	Freedom from weather	.03	Car[2]
16	Relaxing	- .71	n.s.d.
17	Privacy	-1.36	Car[2]
18	Ease of travel with children	-1.88	Car[2]
19	Quiet ride	-2.05	Car[2]
20	Pleasant riding surroundings	-2.79	Car[2]
21	Smooth Ride	-4.15	Car[2]
22	Fun to drive	-4.64	Car[2]
23	Ability to look at scenery	-4.86	Bus[2]
24	Can listen to radio or tape	-5.85	Car[2]
25	Ability to read	-6.16	Bus[2]
26	Opportunity to socialize	-6.50	Bus[1]
27	Socially accepted transportation	-8.74	Car[2]

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[1] $p < .05$

[2] $p < .01$

commuting mode, times the amount of perceived differences among alternative transportation modes, in terms of this trait or attribute (Alpert, 1971). Avoiding traffic congestion, for example was perceived as relatively high in importance, but probably does not determine modal choice (in this area) because all modes were seen as relatively similar in their ability (or inability) to avoid traffic congestion.

The "z-values" represent the comparison of the mean determinance rating for each attribute with the mean for all attributes, adjusting for the standard deviation of these ratings, and the number rating each attribute. The right hand column summarizes the results of comparing the perceived images of cars versus buses for commuter trips, in terms of attributes such as economy, dependability, and the like. One can note that for the eleven attributes that are significantly high in determining modal choices, cars were seen as significantly better in six, and buses in five. Tables A3 and A4 show the statistical details and mean image profiles for these comparisons, which were analyzed using Analysis-of-Variance, with repeated measures (bus versus car) for each dependent variable. While a more precise quantification of the utility model underlying modal choices is given in the conjoint measurement section of this report, Tables A1, A3, and A4 may be interpreted to show that cars have sufficiently large perceived superiorities along highly determinant attributes (such as convenience and dependability) that more than offset the perceived superiorities (typically smaller in magnitude) of buses in features that are seen as less determinant of modal choice.

While specific policy recommendations cannot be made without specifically analyzing the determinant attributes for potential switchers to public transit (rather than the general public), this longitudinal study sought to compare general community attitudes and criteria for modal choice. Overall changes would be important indicators of general community trends, independent of their importance to various sub-segments of transportation interest. Table A2 shows a remarkable degree of similarity between the profile of determinance scores derived during the two years. Observing the means for each attribute for both years (averaging the product of importance x perceived differences for each attribute, within each sample), shows almost identical statistics for both years. Attempting to discriminate Year One versus Year Two respondents on the basis of these 27 variables would be futile, since the

TABLE A2

GENERAL ADULTS
DISCRIMINATION BETWEEN DETERMINANCE SCORES
YEAR 1 VERSUS YEAR 2

		Year 1	Year 2	F-ratio
1.	Economy	13.4	13.9	.40
2.	Convenience	15.5	15.0	.41
3.	Brief Travel Time (door to door)	12.7	12.2	.41
4.	Smooth Ride	7.4	7.8	.30
5.	Freedom from Weather (door to door)	10.6	10.3	.22
6.	Opportunity to Socialize	6.8	6.3	.74
7.	Avoid Traffic Congestion	10.4	10.4	.00
8.	Socially Accepted Transportation Mode	4.6	4.9	.32
9.	No Parking Problems	12.6	13.6	1.22
10.	Flexibility	13.5	12.6	1.28
11.	Uncrowded	10.6	11.0	.25
12.	Freedom from Accidents	11.4	11.6	.08
13.	Fun to Drive	6.8	7.3	.54
14.	Freedom from Repairs	13.0	13.7	.54
15.	Safe from Dangerous People	10.2	10.9	.57
16.	Low Pollution Per Passenger	12.6	12.6	.00
17.	Relaxing	10.0	9.7	.11
18.	Ease of Travel with Packages	11.2	10.9	.14
19.	Ability to Look at Scenery	7.9	7.1	1.22
20.	Ability to Read	7.0	6.2	1.03
21.	Low Energy Use Per Passenger	12.7	12.7	.01
22.	Can Listen to Radio or Tape	7.0	6.4	.63
23.	Dependability	14.8	14.1	.53
24.	Pleasant Riding Surroundings	8.4	8.5	.00
25.	Privacy	9.5	9.2	.19
26.	Ease of Traveling with Children	9.5	9.0	.28
27.	Quiet Ride	8.1	8.8	.96

Wilks Lambda = .940
Probability = .97

TABLE A3

GENERAL ADULTS
CAR VERSUS BUS, YEAR 2

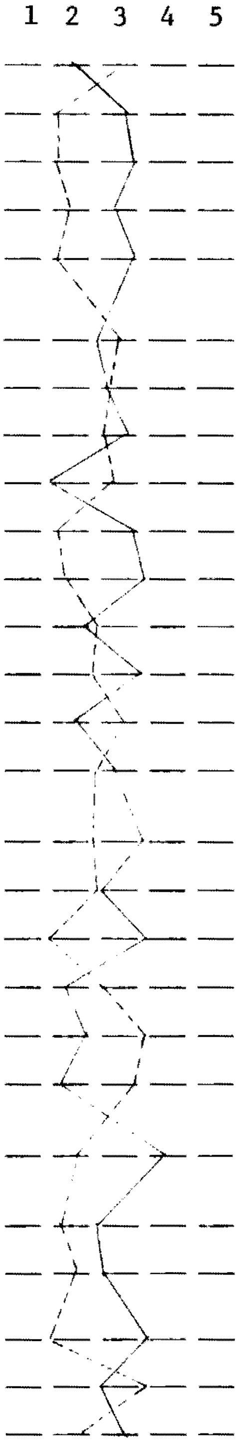
	Variables	Car Mean	Bus Mean	F Ratio
1.	Economical-Expensive	3.220	2,055	41.079[2]
2.	Convenient-Inconvenient	1.817	3.257	47.436[2]
3.	Brief Travel Time-Long Travel Time	1.817	3.395	101.573[2]
4.	Smooth Ride-Rough Ride	2.037	2.936	44.078[2]
5.	Free From Weather-Exposed to Weather (door to door) (door to door)	1.826	3.321	85.681[2]
6.	Easy to Socialize-Hard to Socialize	3.018	2.651	4.996[1]
7.	Avoids Traffic Congestion-Gets Into Traffic Congestion	2,945	2.807	.686
8.	High Status-Low Status	2.817	3.184	8.034[2]
9.	Few Parking Problems-Many Parking Problems	2.963	1.651	55.149[2]
10.	Flexible-Inflexible	1.835	3.367	91.762[2]
11.	Uncrowded-Crowded	1,945	3.450	110,464[2]
12.	Safe from Accidents-Likely to Have Accidents	2,670	2.358	5.082[1]
13.	Fun to Drive-Not Fun to Drive	2.495	3,349	29.792[2]
14.	Free from Repairs-Not Free From Repairs	3.184	2.110	40.438[2]
15.	Safe From Dangerous People-Not Safe From Dangerous People	2,578	2.963	7.110[2]
16.	High Pollution per Rider-Low Pollution per Rider	2,486	3.532	34.730[2]
17.	Relaxing-Full of Tension	2.514	2.606	.382
18.	Easy with Packages-Difficult with Packages	1.725	3.642	160.145[2]
19.	Can Look at Scenery-Can't Look at Scenery	2.661	1.973	25.175[2]
20.	Easy to Read-Hard to Read	3.569	2.385	66.397[2]
21.	Low Energy Use per Passenger-High Energy Use per Passenger	3.395	1.973	63.211[2]
22.	Radio or Tape Deck Available-No Radio or Tape Deck Available	2.211	3.991	109.448[2]
23.	Dependable-Undependable	1.844	2.633	26.537[2]
24.	Pleasant Riding Surroundings-Unpleasant Riding Surroundings	2,174	2.743	26.315[2]
25.	High Privacy-Low Privacy	1,679	3.670	200.252[2]
26.	Difficult with Children-Easy w/ Children	3.596	2.661	30.27 [2]
27.	Quiet Ride-Noisy Ride	2.211	3.119	47.352[2]

(1 = extremely, 2 = moderately, 3 = neutral, 4 = moderately, 5 = extremely)

[1] $p < .05$ [2] $p < .01$

TABLE A4

GENERAL ADULTS
CAR VERSUS BUS
YEAR 2 (PROFILE)



			Probability
1.	Economical	Expensive	.000
2.	Convenient	Inconvenient	.000
3.	Brief travel time	Long Travel Time	.000
4.	Smooth Ride	Rough Ride	.000
5.	Free from Weather (door to door)	Exposed to Weather (door to door)	.000
6.	Easy to Socialize	Hard to Socialize	.026
7.	Avoids Traffic Congestion	Gets into Traffic Congestion	.414
8.	High Status	Low Status	.006
9.	Few Parking Problems	Many Parking Problems	.000
10.	Flexible	Inflexible	.000
11.	Uncrowded	Crowded	.000
12.	Safe from Accidents	Likely to have Accidents	.025
13.	Fun to Drive	Not Fun to Drive	.000
14.	Free from Repairs	Not Free from Repairs	.000
15.	Safe From Dangerous People	Not Safe From Dangerous People	.009
16.	High Pollution Per Rider	Low Pollution Per Rider	.000
17.	Relaxing	Full of Tension	.545
18.	Easy with Packages	Difficult with Packages	.000
19.	Can Look at Scenery	Can't Look at Scenery	.000
20.	Easy to Read	Hard to Read	.000
21.	Low Energy Use Per Passenger	High Energy Use Per Passenger	.000
22.	Radio or Tape Deck Available	No Radio or Tape Deck Available	.000
23.	Dependable	Undependable	.000
24.	Pleasant Riding Surroundings	Unpleasant Riding Surroundings	.000
25.	High Privacy	Low Privacy	.000
26.	Difficult with Children	Easy with Children	.000
27.	Quiet Ride	Noisy Ride	.000

Car - - - Bus ———

Wilks Lambda statistic evaluated by the linear discriminant analysis model has an estimated 97 percent probability of being due to chance or sampling fluctuations. In other words, one could not assert that the general profile of criteria for modal choice changed from 1974 to 1975 without taking a 97 percent chance of being incorrect. Furthermore, not one of the attributes was rated as significantly more or less determinant in 1975 than in 1974, even though at the .05 level of significance one would expect between one or two to show such fluctuations due to chance. Of specific interest is the fact that energy usage and pollution remain important criteria (and perceived advantages of public transportation), one year after the temporary peak in the "energy crisis." Freedom from repairs and parking problems may be gaining, but not significantly so, and these kinds of variations have to be considered due to sample fluctuations. Should any trends develop over a longer time span, changes in determinance of various features may prove relatively favorable or unfavorable to public transportation. At this point, the relative modal choice criteria in the community seem stable and retain the mix of attributes in which public transportation was initially seen as superior in some traits and inferior in others. Next, let us examine whether changes in the relative ability of these modes to provide these features changed during this one year period.

Tables A3 - A10 provide considerable detail regarding relative images of cars versus buses during both years, as well as changes in car image and changes in bus image over time. Examining these data, one would have to conclude much the same thing as was said above about criteria for modal choice. Not only were the determinance scores stable, people's perceptions of the relative ability of buses versus cars in supplying these attributes were essentially stable during this time period. The 1974 mean profiles of car versus bus shown in Tables A3 - A4 show patterns of relative superiority for cars in convenience, privacy, dependability and the like, and relative superiority of buses in avoiding parking problems and repairs, as well as ecological advantages. The 1975 mean profiles of car versus bus shown in Tables A5 - A6 show the same basic patterns of pluses and minuses were noted one year later. In general, where there was a low probability of obtaining sample means for car versus bus images due to changes for a particular attribute in 1974 (right-hand column in Table A4), there was always a

TABLE A5

GENERAL ADULTS
CAR VERSUS BUS, YEAR 1

Variables	Car Mean	Bus Mean	F Ratio
1. Economical-Expensive	3.172	2.255	30.445[2]
2. Convenient-Inconvenient	1.655	3.359	123.587[2]
3. Brief Travel Time-Long Travel Time	.800	3.510	152.763[2]
4. Smooth Ride-Rough Ride	2.166	3.110	50.166[2]
5. Free from Weather-Exposed to Weather (door to door) (door to door)	1.966	3.386	92.962[2]
6. Easy to Socialize-Hard to Socialize	3.228	2.500	21.772[2]
7. Avoids Traffic Congestion-Gets Into Traffic Congestion	2.900	2.924	.030
8. High Status-Low Status	2.821	3.241	12.024[2]
9. Few Parking Problems-Many Parking Problems	2.890	1.614	59.738[2]
10. Flexible-Inflexible	1.786	3.386	107.594[2]
11. Uncrowded-Crowded	1.669	3.531	180.433[2]
12. Safe from Accidents-Likely to have Accidents	2.766	2.448	5.598[1]
13. Fun to Drive-Not Fun to Drive	2.552	3.462	44.388[2]
14. Free from Repairs-Not Free from Repairs	3.303	2.062	65.326[2]
15. Safe from Dangerous People-Not Safe from Dangerous People	2.490	2.986	14.291[2]
16. High Pollution per Rider-Low Pollution per Rider	2.669	3.579	27.649[2]
17. Relaxing-Full of Tension	2.641	2.710	.252
18. Easy with Packages-Difficult w/Packages	1.731	3.648	192.355[2]
19. Can Look at Scenery-Can't Look at Scenery	2.793	1.966	42.474[2]
20. Easy to Read-Hard to Read	3.855	2.469	82.155[2]
21. Low Energy Use per Passenger-High Energy Use per Passenger	3.207	1.917	61.592[2]
22. Radio or Tape Deck Available-No Radio or Tape Deck Available	2.159	3.986	149.437[2]
23. Dependable-Undependable	1.786	2.807	58.017[2]
24. Pleasant Riding Surroundings-Unpleasant Riding Surroundings	2.207	2.945	30.893[2]
25. High Privacy-Low Privacy	1.662	4.035	321.189[2]
26. Difficult w/Children-Easy w/Children	3.531	2.628	34.735[2]
27. Quiet Ride-Noisy Ride	2.221	3.441	94.014[2]

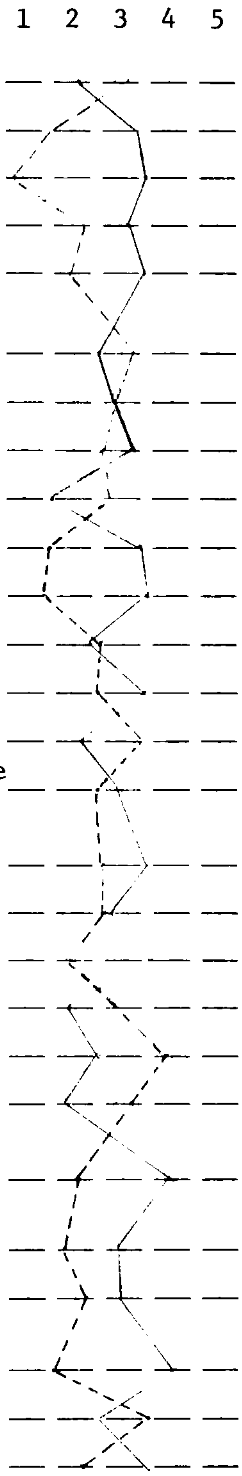
(1=extremely, 2=moderately, 3=neutral, 4=moderately, 5=extremely)

[1] $p < .05$

[2] $p < .01$

TABLE A6

GENERAL ADULTS
CAR VERSUS BUS
YEAR 1 (PROFILE)



			Probability
1.	Economical	Expensive	.000
2.	Convenient	Inconvenient	.000
3.	Brief Travel Time	Long Travel Time	.000
4.	Smooth Ride	Rough Ride	.000
5.	Free from Weather (door to door)	Exposed to Weather (door to door)	.000
6.	Easy to Socialize	Hard to Socialize	.000
7.	Avoids Traffic Congestion	Gets into Traffic Congestion	.857
8.	High Status	Low Status	.001
9.	Few Parking Problems	Many Parking Problems	.000
10.	Flexible	Inflexible	.000
11.	Uncrowded	Crowded	.000
12.	Safe from Accidents	Likely to have Accidents	.018
13.	Fun to Drive	Not Fun to Drive	.000
14.	Free from Repairs	Not Free from Repairs	.000
15.	Safe from Dangerous People	Not Safe From Dangerous People	.001
16.	High Pollution Per Rider	Low Pollution Per Rider	.000
17.	Relaxing	Full of Tension	.622
18.	Easy with Packages	Difficult with Packages	.000
19.	Can Look at Scenery	Can't Look at Scenery	.000
20.	Easy to Read	Hard to Read	.000
21.	Low Energy Use Per Passenger	High Energy Use Per Passenger	.000
22.	Radio or Tape Deck Available	No Radio or Tape Deck Available	.000
23.	Dependable	Undependable	.000
24.	Pleasant Riding Surroundings	Unpleasant Riding Surroundings	.000
25.	High Privacy	Low Privacy	.000
26.	Difficult with Children	Easy with Children	.000
27.	Quiet Ride	Noisy Ride	.000

Car - - - Bus ———

low probability of attributing the perceived gap between the two modes as rated in 1975, in terms of the same attribute (right column in Table A6). In other words, where significant differences were found between the two modes' characteristics in one year, these tended to be observed in the next year.

Observing Tables A7 - A10 provides some insight into why these gaps remained essentially constant. Table A7 indicates that there is a .67 probability that the differences obtained between profiles of mean scores for car image along the 27 attributes in 1974 versus 1975 is due to chance fluctuations about the same universe mean. Thus one could not conclude that car image changed significantly during this time period, without taking more than an acceptable risk of being mistaken (the type-I error probability would be far more than the usual .05 level). Inspecting the profile of mean scores for car images in 1974 versus 1975, shown in Table A8, confirms this inference; the profiles are almost identical.

Tables A9 and A10 show even more stability in the perceived image of buses as a commuter mode in this area. The Wilks Lambda statistic for overall discriminability of the 27 attribute ratings for 1974 versus 1975 is again nowhere near statistically significant (alpha = .85). Similarly, the profiles of image mean scores shown in Table A10 were virtually identical. For both the car and bus images, given the lack of overall significance between profiles for the two years, and given no more than three attributes that appeared to change significantly, at the .05 level, (with 2.7 expected changes out of 54 comparisons, due to chance), it would be unwise to attempt to attribute any meaning to either of the "perceived changes" for either mode. Perhaps as conditions in the environment change more dramatically, and perhaps as more people might begin to utilize public transportation, changes in the relative utility of the two major modes might be reflected in their perceived images. During the 1974 to 1975 time frame, in Austin, Texas, no significant changes in perceptions can be reliably reported.

The last two tables show the only instance of real variation between the data for the two survey years, although here again the practical significance of these differences for transit planning purposes is quite marginal. In Table A11, we note that there were found significant changes, from 1974 to 1975, in mean desirability scores for seven of the ten evaluated financing alternatives for public transportation. All of these shifts were

TABLE A7

GENERAL ADULTS
CAR IMAGE (W/S)
YEAR 1 VERSUS YEAR 2

Variables	Car Mean Year 1	Car Mean Year 2	F-Ratio
1. Economical-Expensive	3.172	3.220	.076
2. Convenient-Inconvenient	1.655	1.817	1.197
3. Brief Travel Time-Long Travel Time	1.800	1.817	.017
4. Smooth Ride-Rough Ride	2.166	2.037	1.025
5. Free from Weather-Exposed to Weather (door to door) (door to door)	1.966	1.826	1.159
6. Easy to Socialize-Hard to Socialize	3.228	3.018	1.685
7. Avoids Traffic Congestion-Gets Into Traffic Congestion	2.900	2.945	.092
8. High Status-Low Status	2.821	2.817	.001
9. Few Parking Problems-Many Parking Problems	2.890	2.963	.162
10. Flexible-Inflexible	1.786	1.835	.142
11. Uncrowded-Crowded	1.669	1.945	4.093[1]
12. Safe from Accidents-Likely to have Accidents	2.766	2.670	.503
13. Fun to Drive-Not Fun to Drive	2.552	2.495	.149
14. Free from Reparis-Not Free from Repairs	3.303	3.184	.618
15. Safe from Dangerous People-Not Safe from Dangerous People	2.490	2.578	.448
16. High Pollution per Rider-Low Pollution per Rider	2.669	2.486	1.214
17. Relaxing-Full of Tension	2.641	2.514	.861
18. Easy with Packages-Difficult w/Packages	1.731	1.725	.003
19. Can Look at Scenery-Can't Look at Scenery	2.793	2.661	.866
20. Easy to Read- Hard to Read	3.855	3.569	3.193[2]
21. Low Energy Use Per Passenger-High Energy Use per Passenger	3.207	3.395	1.046
22. Radio or Tape Deck Available-No Radio or Tape Deck Available	2.159	2.211	.103
23. Dependable-Undependable	1.786	1.844	.195
24. Pleasant Riding Surroundings-Unpleasant Riding Surroundings	2.207	2.174	.079
25. High Privacy-Low Privacy	1.602	1.679	.024
26. Difficult w/Children-Easy with Children	3.531	3.596	.200
27. Quiet Ride-Noisy Ride	2.220	2.211	.007

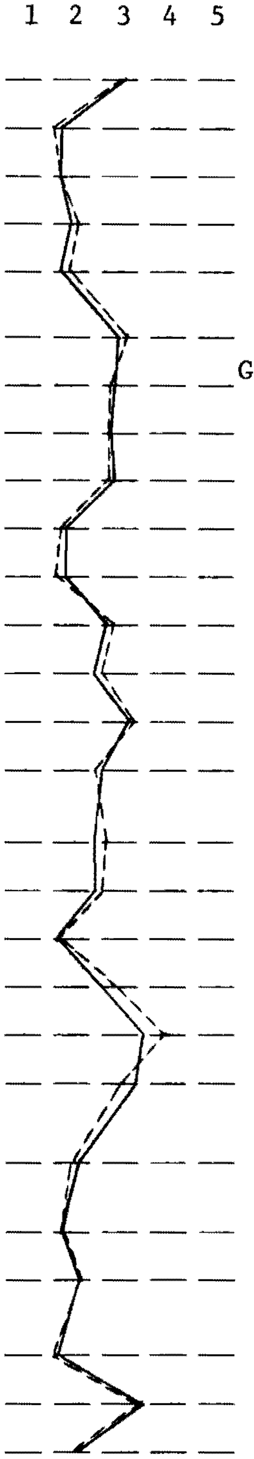
(1=extremely; 2=moderately; 3=neutral; 4-moderately; 5=extremely)

[1] $p < .05$ Wilks Lambda = .907

[2] $p < .10$ Probability = .67

TABLE A8

GENERAL ADULTS
CAR IMAGE (W/S)
YEAR 1 VERSUS YEAR 2 (PROFILE)



			Probability
1.	Economical	Expensive	.780
2.	Convenient	Inconvenient	.274
3.	Brief Travel Time	Long Travel Time	.891
4.	Smooth Ride	Rough Ride	.313
5.	Free from Weather (door to door)	Exposed to Weather (door to door)	.282
6.	Easy to Socialize	Hard to Socialize	.192
7.	Avoids Traffic Congestion	Gets into Traffic Congestion	.760
8.	High Status	Low Status	.973
9.	Few Parking Problems	Many Parking Problems	.690
10.	Flexible	Inflexible	.708
11.	Uncrowded	Crowded	.041
12.	Safe from Accidents	Likely to Have Accidents	.486
13.	Fun to Drive	Not Fun to Drive	.702
14.	Free from Repairs	Not Free from Repairs	.438
15.	Safe from Dangerous People	Not Safe From Dangerous People	.511
16.	High Pollution Per Rider	Low Pollution Per Rider	.271
17.	Relaxing	Full of Tension	.357
18.	Easy with Packages	Difficult with Packages	.957
19.	Can Look at Scenery	Can't Look at Scenery	.356
20.	Easy to Read	Hard to Read	.071
21.	Low Energy Use Per Passenger	High Energy Use Per Passenger	.308
22.	Radio or Tape Deck Available	No Radio or Tape Deck Available	.747
23.	Dependable	Undependable	.664
24.	Pleasant Riding Surroundings	Unpleasant Riding Surroundings	.776
25.	High Privacy	Low Privacy	.871
26.	Difficult with Children	Easy with Children	.660
27.	Quiet Ride	Noisy Ride	.934

Year 1 - - - Year 2 ———

TABLE A9

GENERAL ADULTS
BUS IMAGE (W/S)
YEAR 1 VERSUS YEAR 2

Variables	Bus Mean Year 1	Bus Mean Year 2	F Ratio
1. Economical-Expensive	2.255	2.055	1.647
2. Convenient-Inconvenient	3.359	2.257	.333
3. Brief Travel Time-Long Travel Time	3.510	3.395	.516
4. Smooth Ride-Rough Ride	3.110	2.936	1.643
5. Free from Weather-Exposed to Weather (door to door) (door to door)	3.386	3.321	.156
6. Easy to Socialize-Hard to Socialize	2.497	2.651	1.241
7. Avoids Traffic Congestion-Gets Into Traffic Congestion	2.924	2.807	.547
8. High Status -Low Status	3.241	3.184	.245
9. Few Parking Problems-Many Parking Problems	1.614	1.651	.080
10. Flexible-Inflexible	3.386	3.367	.013
11. Uncrowded-Crowded	3.531	3.450	.324
12. Safe from Accidents-Likely to have Accidents	2.448	2.358	.451
13. Fun to Drive-Not Fun to Drive	3.462	3.349	.745
14. Free from Repairs-Not Free from Repairs	2.062	2.110	.107
15. Safe from Dangerous People-Not safe from Dangerous People	2.986	2.963	.027
16. High Pollution per Rider-Low Pollution per Rider	3.579	3.532	.082
17. Relaxing-Full of Tension	2.710	2.606	.603
18. Easy with Packages-Difficult with Packages	3.648	3.642	.002
19. Can Look at Scenery-Can't Look at Scenery	1.966	1.973	.003
20. Easy to Read-Hard to Read	2.469	2.385	.350
21. Low Energy Use per Passenger-High Energy...	1.917	1.973	.164
22. Radio or Tape Deck Available-No Radio or Tape Deck Available	3.986	3.991	.001
23. Dependable-Undependable	2.807	2.633	1.296
24. Pleasant Riding Surroundings-Unpleasant Riding Surroundings	2.945	2.743	2.413
25. High Privacy-Low Privacy	4.035	3.670	6.979[1]
26. Difficult with Children-Easy w/Children	2.628	2.661	.050
27. Quiet Ride-Noisy Ride	3.441	3.119	5.331[1]

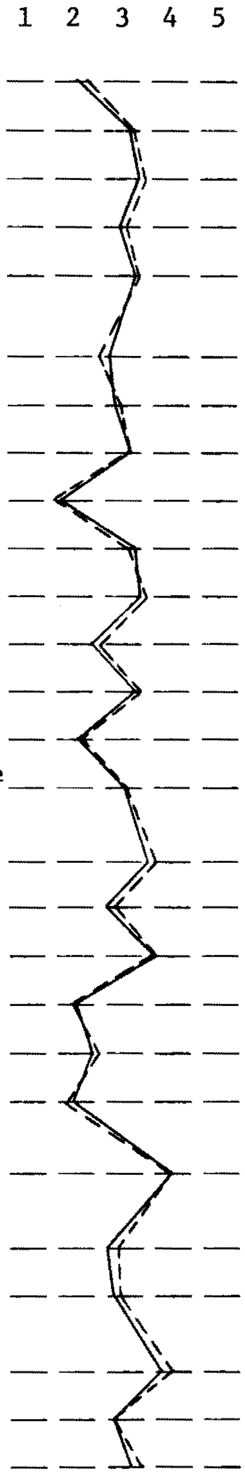
(1=extremely; 2=moderately; 3=neutral; 4=moderately;5=extremely)

[1] $p < .05$

Wilks Lambda = .922
Probability = .85

TABLE A10

GENERAL ADULTS
BUS IMAGE (W/S)
YEAR 1 VERSUS YEAR 2 (PROFILE)



			Probability
1.	Economical	Expensive	.198
2.	Convenient	Inconvenient	.572
3.	Brief Travel Time	Long Travel Time	.481
4.	Smooth Ride	Rough Ride	.198
5.	Free from Weather (door to door)	Exposed to Weather (door to door)	.696
6.	Easy to Socialize	Hard to Socialize	.266
7.	Avoids Traffic Congestion	Gets into Traffic Congestion	.467
8.	High Status	Low Status	.627
9.	Few Parking Problems	Many Parking Problems	.775
10.	Flexible	Inflexible	.905
11.	Uncrowded	Crowded	.577
12.	Safe from Accidents	Likely to have Accidents	.510
13.	Fun to Drive	Not Fun to Drive	.393
14.	Free from Repairs	Not Free from Repairs	.743
15.	Safe From Dangerous People	Not Safe From Dangerous People	.865
16.	High Pollution Per Rider	Low Pollution Per Rider	.772
17.	Relaxing	Full of Tension	.444
18.	Easy with Packages	Difficult with Packages	.968
19.	Can Look at Scenery	Can't Look at Scenery	.955
20.	Easy to Read	Hard to Read	.562
21.	Low Energy Use Per Passenger	High Energy Use Per Passenger	.689
22.	Radio or Tape Deck Available	No Radio or Tape Deck Available	.972
23.	Dependable	Undependable	.255
24.	Pleasant Riding Surroundings	Unpleasant Riding Surroundings	.118
25.	High Privacy	Low Privacy	.009
26.	Difficult with Children	Easy with Children	.818
27.	Quiet Ride	Noisy Ride	.021

Year 1 - - - Year 2 ______

in the direction of lower desirability for various subsidy plans. However, the relative ordering of these alternatives was virtually unchanged from 1974 to 1975, with a Spearman rank correlation coefficient of .976 (significant at beyond the .01 level). Moreover, the frequently proposed subsidy from the "highway trust fund" is still relatively favorably received, provided the subsidy is a relatively minor part of the non-rider burden (one or two cents tax per gallon). "No-fare" plans for riders continued to lack popular support, only "more so" than before, and attitudes towards electric bill subsidies are the most negatively perceived financing mechanism. The increasing resistance to property and electric bill tax subsidies may be partially due to increased unemployment in the study area (and in the U.S.) from 1974 to 1975, along with a dramatic increase in electric utility bills (Austin has been recently -- in 1975 -- ranked in the top five cities in the U.S. in electricity costs, even though the utility is municipally owned and the city is generally among the lowest cost metropolitan areas in the country).

Table A12 suggests that the generally more conservative approach to tax and other subsidies for public transportation might also be partially due to differences in the demographic composition of the second year sample. Compared to the respondents from 1974, the 1975 group were significantly less female (50 percent versus 62 percent), older (mean age about 37 versus 35.7), longer residents in Austin (mean about 6 months longer), and less educated (by about one-half year of formal education). Most of this difference is probably due to tighter controls over the representativeness of the sample, since the 1975 group is somewhat more representative of the average Austinite (especially in the percent female) than was the 1974 sample. However, it should be noted that although statistically significant, most of these differences are slight, and apparently had impact more on the financing attitude profiles than on the modal choice criteria and mode images. To check this, we correlated demographic variables with the other survey questions, with particular attention given to the correlations with age, education, sex, and time in Austin, as large correlations with these variables might have confounded the changes (or counteracted what would have been changed, where none were reported). The results indicate that little effect can be attributed to demographic variations between the two samples. The highest correlation between any of these four variables and criteria for modal choice showed that

TABLE A11

GENERAL ADULTS
DISCRIMINANT ANALYSIS ON FINANCING ATTITUDES
YEAR 1 VERSUS YEAR 2

	Year 1		Year 2		
	Mean Attitude	Rank	Mean Attitude	Rank	F ratio
Would you pay 1 or 2 cents tax/gal. of gasoline with that money going to mass transit?	2.72	1	2.81	2	.40
Riders should pay full costs of service	2.88	2	2.79	1	.40
Riders pay most costs; with balance from gasoline tax revenue	2.93	3	3.30	3	7.42[1]
Would you be in favor of a 1/2% increase in the current sales tax with the money collected earmarked for mass transit improvement?	3.12	4	3.43	4	4.61[1]
Would you . . . favor paying higher vehicle license plate fees on your personal vehicle with the money . . . for mass transit	3.25	5	3.52	5	3.33[2]
"No fare" for riders; mass transit financed by gasoline tax . . .	3.40	6	3.63	6	2.52
Riders pay most costs, with balance from tax added to property taxes	3.89	7	4.25	7	9.23[1]
Riders pay most costs, with balance from tax on electric bills	4.03	8	4.39	9	10.64[1]
"No fare" for riders; mass transit financed by tax added to property taxes	4.07	9	4.38	8	6.93[1]
"No fare" for riders; mass transit financed by tax added to electric bills	4.27	10	4.47	10	3.69[2]

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[1] $p < .05$

[2] $p < .10$

Definitely yes=1, Yes = 2, Neutral = 3, No = 4, Definitely no = 5.
$r_s = .976$
Probability (one-tailed test) < .01

TABLE A12

GENERAL ADULTS
DISCRIMINANT ANALYSIS ON DEMOGRAPHIC PROFILES
YEAR 1 VERSUS YEAR 2

Variable	Year 1 Mean	Year 2 Mean	F-ratio
Sex (1=M, 2=F)	1.619	1.503	5.401[1]
Marital Status (1=Single, 2=Married, 3=Other)	1.825	1.837	.032
Student Status (1=Full time student, 2=Part time student, 3=Not student)	2.635	2.648	.031
1 2 3 4 5 Age (<21, 21-19, 30-44, 45-59, >60)	2.814	3.044	3.764[1]
Household Size (1=1, 2=2, 3=3, 4=4, 5=5)	2.861	2.786	.319
Education (1=Jr Hi, 2=Hi sch, 3=Hi sch grad, 4=College/Prof, 5=College grad)	3.758	3.509	3.921[1]
1 2 3 Income (<5,000, 5,000-9,999, 10,000-14,999 4 5 15,000-19,999, >20,000)	2.429	2.459	.055
Number of Autos (1=none, 2=1, 3=2, 4=3+)	2.571	2.440	2.343
Time in Austin 1 2 3 4 5 (<6 mo, 6 mo-1yr, 1-3yr, 3-5yr, 5yr+)	4.179	4.434	5.264[1]
Work Downtown (1=yes, 2=no)	1.778	1.755	.291
Shop Downtown 1 2 3 4 5 (2/wk 2-3/mo 1/mo every 2-3mo. almost never)	3.833	3.925	.413
Shop Highland Mall (same scale as above)	3.270	3.333	.251
Shop Hancock Center (same scale as above)	3.468	3.491	.032
Shop Southwood Center (same scale as above)	4.452	4.434	.029

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[1] $p < .05$

Number in Year 1 = 252
Number in Year 2 =159

Wilks Lambda = .941
Probability = .043

more educated people sought more convenience than did less educated people. Thus convenience should have become less determinant in 1975, given a less educated sample (and it did drop slightly, but not significantly). However, the shared variation between education and need for convenience was less than 8 percent (r = .28), and may have been partially offset by the negative correlation between convenience and time in Austin (r = -.136), and the slightly longer average time in Austin for the Year Two group. The vast majority of correlations between demographic variables (where sampling differences were found) and modal choice criteria and modal perceptions were not statistically significant, and where so, involved between 3 percent to 5 percent shared variance between demographic variations and choice criteria. Thus, for practical purposes, one could take either 1974 or 1975 data as representative of the average Austinite's criteria in modal choice and perceptions of buses versus cars. (The exception would be that non-response bias affects both groups and probably overstates the receptivity to public transit and its funding, but this effect is probably constant throughout the time period).

Inspecting the correlations between these four demographics and financing attitudes also showed some slight correlations, although again most were not significant. For example, the correlation between the willingness to pay one or two cents per gallon from the gasoline tax as a public transit subsidy (which both years' data indicate is the preferred subsidy method, if there is going to be one) correlated .038 with sex, .043 with age, -.108 with education, and .147 with time in Austin. With such small correlations, little impact on the mean attitude towards this method can be attributed to demographic fluctuations in the samples. However, the less educated and longer-in-Austin 1975 group might have raised the mean slightly (indicating slightly less favorable attitude than before.) Similarly, the slightly stronger correlations between these demographic variables and attitudes towards substantial use of the highway trust fund versus riders paying the entire cost, show a slightly greater effect of more conservative demographics in 1975 influencing some of the slight shift in this direction regarding financing alternatives. However, again the highest demographic correlate is .248, or about 6 percent shared variation between "time in Austin" and resistance to using the highway trust fund for public transit. The overall attitude towards this mechanism was still neutral to positive, and whatever impact these small correlations with demographic variations might have had on some mean score shifts between 1974 and 1975 was minimal. The relative preferences for financing alternatives was, as noted above, virtually unchanged during this interval, and modal choice criteria and perceived images were similarly stable.

SUMMARY

The data obtained in the first two years of this study and abstracted in tables in this appendix suggest relatively little variation was found in the major survey variables. In spite of manifest changes in automobile brand purchases (moving back toward larger cars), there appears to have been little movement in the basic determinant attributes of modal choice. Further, the general image gaps between private versus public transportation modes in this study area remained roughly constant over the interval. Given the rather large disparity between cars versus buses, for the average respondent, who has considerable discretion, it is not surprising that significant modal switching did not occur. Our data indicated a modest increase in car-pooling activities and slightly bigger car purchases. Given the current environmental conditions, and perceived benefits of private versus public transportation (especially in dependability, convenience, and flexibility) for this survey area, relatively major changes will be needed either in the perceived attributes of public transportation, or perhaps over time in the relative determinance of attributes in which public transportation is already seen as superior. At the margins, some potential switchers may be converted, as noted in our earlier report, but the average respondent is still rather far from altering his/her life-style to the extent that conversion to public transportation implies at present. The body of this report discussed promotional message strategies that may be beneficial, but notes that promotion alone will not work, given the perceived characteristics of public versus private transportation in low-density cities such as Austin. Implementing changes in the attributes shown as determinants of modal choice by both the survey methods of Years One and Two and also the conjoint measurement's more precise estimates of utility levels, is more likely to bring about shifts in travel patterns and modal choices. Many of these changes may be expensive, but our data suggest a public willingness for tapping the highway trust fund, particularly if increased utility in public transportation is produced, in terms of attributes sought by the travelers (and to some extent lacking in private transportation). If further research indicates the same kind of stability in modal choice criteria as was shown here, improvements in the system characteristics will become even more important for generating behavioral changes. If public desires are stable, the system must become more responsive; so far the data presented here indicate that criteria are not changing in any significant way. Neither is the available public transportation system seen as sufficiently competitive to private alternatives. In this study area, the gaps were not closed from 1974 to 1975. Perhaps trends may be observed in further research that can monitor the public's modal choice criteria and their evaluation of alternative modes' abilities to meet them, as both programmed and unplanned changes occur in the relevant transportation system and its environment.

EXHIBIT 1: TRANSPORTATION SURVEY (1975)

PART 1

1. In a typical week, about how many trips do you take from home to work or school?

None_____ 1 to 4 _____ 5 or more _____ (If none, go to Part 2).

2. For these trips to work or school, how do you usually get there? (Please check one only).

As car driver_____ Car pool_____ City bus_____ UT shuttle bus_____ Walking_____ Bicycle _____ Motorcycle_____ Other _____

3. Do you usually travel alone? Yes _____ No _____

4. In general, are you satisfied with the transportation you use for getting to work or school?

Definitely yes_____ Moderately yes_____ Neutral_____ Moderately no_____ Definitely no_____

IMPORTANCE RATING FORM

(Transportation to Work, (or School, if you are a Student)

Please place a check in the appropriate column to indicate how important each feature is in your choice of a way (car, bus, car pool, taxi, etc.) to travel to work (or school). Please check only one column for each feature.

	No Importance	Slightly Important	Moderately Important	Very Important	Extremely Important
5. Economy					
6. Convenience					
7. Brief Travel Time (door to door)					
8. Smooth Ride					
9. Freedom from Weather (door to door)					
10. Opportunity to Socialize					
11. Avoid Traffic Congestion					
12. Socially Accepted Transportation Mode					
13. No Parking Problems					
14. Flexibility					
15. Uncrowded					
16. Freedom from Accidents					
17. Fun to Drive					
18. Freedom from Repairs					
19. Safe from Dangerous People					
20. Low Pollution Per Passenger					
21. Relaxing					
22. Ease of Travel with Packages					
23. Ability to Look at Scenery					
24. Ability to Read					
25. Low Energy Use Per Passenger					
26. Can Listen to Radio or Tape					
27. Dependability					
28. Pleasant Riding Surroundings					
29. Privacy					
30. Ease of Traveling with Children					
31. Quiet Ride					

CONTINUE ON OPPOSITE SIDE WITH QUESTION 32

DIFFERENCE RATING FORM

How much difference do you feel there is among the different ways (car, bus, car pool, taxi, etc.) of getting to work (or school) in each of these features.
Please check only one column for each feature.

	No Differences	Slight Differences	Moderate Differences	Large Differences	Extreme Differences
32. Economy					
33. Convenience					
34. Brief Travel Time (door to door)					
35. Smooth Ride					
36. Freedom from Weather (door door)					
37. Opportunity to Socialize					
38. Avoid Traffic Congestion					
39. Socially Accepted Transportation Mode					
40. Parking Problems					
41. Flexibility					
42. Uncrowded					
43. Freedom from Accidents					
44. Fun to Drive					
45. Freedom from Repairs					
46. Safe from Dangerous People					
47. Low Pollution Per Passenger					
48. Relaxing					
49. Ease of Travel with Packages					
50. Ability to Look at Scenery					
51. Ability to Read					
52. Low Energy Use Per Passenger					
53. Can Listen to Radio or Tape					
54. Dependability					
55. Pleasant Riding Surroundings					
56. Privacy					
57. Ease of Traveling with Children					
58. Quiet Ride					

TURN PAGE OVER AND CONTINUE WITH QUESTION 59

EXHIBIT 1: TRANSPORTATION SURVEY (1975)
(continued)

PART I CONTINUED

Place a check on the position between each pair of terms that best describes the suitability of your car (whether or not you own one) for trips made to work or school. For example, if you feel your car would be moderately interesting as a way of getting to work or school, you would place a check on the "Interesting-Boring" Scale as shown below. Please do this for each pair of items, without skipping any.

Now, please use these scales to indicate your feelings about the degree to which a bus would be suitable for trips made to work or school. Please do as you did before, without skipping any of the scales.

EXAMPLE: Extremely Moderately Neutral Moderately Extremely
Interesting _____:__X__:_____:_____:_____ Boring

YOUR OWN CAR FOR TRIPS TO WORK OR SCHOOL

59. Economical _____:_____:_____:_____:_____ Expensive
60. Convenient _____:_____:_____:_____:_____ Inconvenient
61. Brief Travel Time _____:_____:_____:_____:_____ Long Travel Time
62. Smooth Ride _____:_____:_____:_____:_____ Rough Ride
63. Free from Weather (door to door) _____:_____:_____:_____:_____ Exposed to Weather (door to door)
64. Easy to Socialize _____:_____:_____:_____:_____ Hard to Socialize
65. Avoids Traffic Congestion _____:_____:_____:_____:_____ Gets into Traffic Congestion
66. High Status _____:_____:_____:_____:_____ Low Status
67. Few Parking Problems _____:_____:_____:_____:_____ Many Parking Problems
68. Flexible _____:_____:_____:_____:_____ Inflexible
69. Uncrowded _____:_____:_____:_____:_____ Crowded
70. Safe from Accidents _____:_____:_____:_____:_____ Likely to Have Accidents
71. Fun to Drive _____:_____:_____:_____:_____ Not Fun to Drive
72. Free from Repairs _____:_____:_____:_____:_____ Not Free from Repairs
73. Safe from Dangerous People _____:_____:_____:_____:_____ Not Safe from Dangerous People
74. High Pollution Per Rider _____:_____:_____:_____:_____ Low Pollution Per Rider
75. Relaxing _____:_____:_____:_____:_____ Full of Tension
76. Easy with Packages _____:_____:_____:_____:_____ Difficult with Packages
77. Can Look at Scenery _____:_____:_____:_____:_____ Can't Look at Scenery
78. Easy to Read _____:_____:_____:_____:_____ Hard to Read
79. Low Energy Use Per Passenger _____:_____:_____:_____:_____ High Energy Use Per Passenger
80. Radio or Tape Deck Available _____:_____:_____:_____:_____ No Radio or Tape Deck Available
81. Dependable _____:_____:_____:_____:_____ Undependable
82. Pleasant Riding Surroundings _____:_____:_____:_____:_____ Unpleasant Riding Surroundings
83. High Privacy _____:_____:_____:_____:_____ Low Privacy
84. Difficult with Children _____:_____:_____:_____:_____ Easy with Children
85. Quiet Ride _____:_____:_____:_____:_____ Noisy Ride

86. In a typical week, about how many trips do you take from home to work or school, driving your car?

None_____ 1 to 4 _____ 5 or more _____

CONTINUE ON OPPOSITE SIDE WITH QUESTION 87

BUS FOR TRIPS TO WORK OR YOUR SCHOOL

87. Economical _____:_____:_____:_____:_____ Expensive
88. Convenient _____:_____:_____:_____:_____ Inconvenient
89. Brief Travel Time _____:_____:_____:_____:_____ Long Travel Time
90. Smooth Ride _____:_____:_____:_____:_____ Rough Ride
91 Free from Weather (door to door) _____:_____:_____:_____:_____ Exposed to Weather (door to door)
92. Easy to Socialize _____:_____:_____:_____:_____ Hard to Socialize
93. Avoids Traffic Congestion _____:_____:_____:_____:_____ Gets into Traffic Congestion
94. High Status _____:_____:_____:_____:_____ Low Status
95. Few Parking Problems _____:_____:_____:_____:_____ Many Parking Problems
96. Flexible _____:_____:_____:_____:_____ Inflexible
97. Uncrowded _____:_____:_____:_____:_____ Crowded
98. Safe from Accidents _____:_____:_____:_____:_____ Likely to Have Accident
99. Fun to Drive _____:_____:_____:_____:_____ Not Fun to Drive
100. Free from Repairs _____:_____:_____:_____:_____ Not Free from Repairs
101. Safe from Dangerous People _____:_____:_____:_____:_____ Not Safe from Dangerous People
102. High Pollution Per Rider _____:_____:_____:_____:_____ Low Pollution Per Rider
103. Relaxing _____:_____:_____:_____:_____ Full of Tension
104. Easy with Packages _____:_____:_____:_____:_____ Difficult with Packages
105. Can Look at Scenery _____:_____:_____:_____:_____ Can't Look at Scenery
106. Easy to Read _____:_____:_____:_____:_____ Hard to Read
107. Low Energy Use Per Passenger _____:_____:_____:_____:_____ High Energy Use Per Passenger
108. Radio or Tape Deck Available _____:_____:_____:_____:_____ No Radio or Tape Available
109. Dependable _____:_____:_____:_____:_____ Undependable
110. Pleasant Riding Surroundings _____:_____:_____:_____:_____ Unpleasant Riding Surroundings
111. High Privacy _____:_____:_____:_____:_____ Low Privacy
112. Difficult with Children _____:_____:_____:_____:_____ Easy with Children
113. Quiet Ride _____:_____:_____:_____:_____ Noisy Ride

114. In a typical week, about how many trips do you take from home to work or school, using a bus?

None_____ 1 to 4 _____ 5 or more _____

CONTINUE WITH QUESTION 115 BELOW IN PART 2

PART 2

Now we would like to find our more concerning what is meant by some particular features of a transportation mode. For each of the following questions, please check the two phrases that best describe the meaning of each transportation feature.

115. If you considered a public transportation system "flexible," it would have which of the following characteristics:

_____Round the clock service
_____More service during weekends and holidays
_____Can alter point of origin and/or destination
_____Frequent service
_____Variable routes
_____Other (Specify ______________________)

116. If you considered a public transportation system "dependable," it would have which of the following characteristics:

_____Available 7 days a week
_____Available late at night
_____Gets to your boarding point on schedule
_____Frequent service
_____Gets to your destination at scheduled time
_____Other (Specify______________________)

117. If you considered a public transportation system "convenient," it would have which of the following characteristics:

_____Frequent service
_____Minimum waiting time
_____Available at many locations
_____Exact change not necessary
_____Available 7 days a week
_____Available late at night
_____Other (Specify______________________)

CONTINUE WITH QUESTION 118 IN PART 3 ON NEXT PAGE

EXHIBIT 1: TRANSPORTATION SURVEY (1975)
(continued)

PART 3

TRANSIT ATTITUDES

118. A public mass transit system could be financed in a number of ways. Please rate the following in terms of your preference for financing a public mass transit system:

a) Riders should pay the full cost of service. Definitely yes____ Moderately yes____ Neutral____ Moderately no____ Definitely no

b) "No fare" for riders; mass transit financed by gasoline tax revenues.
Definitely yes____ Moderately yes ____ Neutral____ Moderately no____ Definitely no____

c) "No fare"for riders; mass transit financed by tax added to electric bills.
Definitely yes____ Moderately yes____ Neutrel ____ Moderately no____ Definitely no____

d) "No fare" for riders; mass transit financed by tax added to property taxes.
Definitely yes____ Moderately yes____ Neutral ____ Moderately no____ Definitely no____.

e) Riders pay most costs, with balance from gasoline tax revenue.
Definitely yes____ Moderately yes____ Neutral____ Moderately no____ Definitely no____

f) Riders pay most costs, with balance from tax on electric bills.
Definitely yes____ Moderately yes____ Neutral____ Moderately no____ Definitely no____

g) Riders pay most costs, with balance from tax added to property taxes.
Definitely yes____ Moderately yes____ Neutral____ Moderately no____ Definitely no____

119. Indicate which four of the following areas should receive high importance for city tax dollar priorities. (Please check the four most important).

______a) local street paving
______b) street crossing safety
______c) traffic safety
______d) automobile noise control
______e) automobile pollution control
______f) rail mass transit
______g) bus mass transit
______h) exclusive bus lanes
______i) residential sidewalks
______j) hike and bike trails

120. How much is the fare for a typical (about 5 miles) bus trip in the City of Austin? (If you don't know, leave blank).
a) 20¢______ b) 25¢______ c) 30¢______ d) 35¢ ______ e) 40¢______

121. If you were to change residence would you consider the distance of the new residence from your place of employment as a major selection criterion?
Definitely yes______ Moderately yes______ Neutral______ Moderately no______ Definitely no______

122. If express service were provided at the auditorium or other locations outside the downtown area, would you be willing to park there and take the express to the downtown area? Definitely yes_____ Moderately yes_____ Neutral_____ Moderately no_____ Definitely no_____

123. Which form of mass transit would you prefer?
a) buses as now______ b) buses with special bus lanes____ c) rail mass transit____ d) Other____

124. Should government encourage the use of non-auto transportation as a solution to traffic congestion and air pollution?
Definitely yes_____ Moderately yes_____ Neutral______ Moderately no______ Definitely no_____.

125. Do you believe that Austin will soon have a severe air pollution problem because of excessive automobile traffic?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no______

126. Does the lack of sidewalks deter you from walking short distances in your neighborhood?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no_____.

127. Are the streets in your neighborhood well maintained? Definitely yes____ Moderately yes____ Neutral____ Moderately no____ Definitely no_____

128. Should employers be responsible for supplying parking for their employees to reduce on-street parking?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no_____.

129. Do you often use the streets that have bicycle lanes? Yes_____ No_____ If so, do these lanes interfere with traffic?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no______

130. Would you be in favor of bus passes as a fringe benefit of your employment?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no_____

131. Would a bus pass as a fringe benefit cause you to ride the buses more frequently, especially to and from work?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no_____.

132. Would you be in favor of car pools to travel to and from work if your car were in a pool?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no______

133. If vehicles (cars, vans, trucks, etc.) were supplied by employers, would you favor car pools?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no_____

134. Would you pay 1 or 2 cents more per gallon of gasoline with that money being used to help pay for a mass transit system?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no_____

135. Would you be in favor of a 1/2% increase in the current sales tax with the money collected earmarked for mass transit improvement?
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no______

136. Would you be in favor of paying higher annual vehicle license plate fees on your personal vehicle with the money collected earmarked for mass transit improvement? Definitely yes______ Moderately yes______ Neutral______ Moderately no______ Definitely no_____

137. Do you think that it is less expensive to ride the bus to and from work (assuming 60¢ or less per round trip) than it is to drive your own car (taking into account gas, oil, parking, depreciation, insurance, etc.?)
Definitely yes_____ Moderately yes______ Neutral______ Moderately no______ Definitely no_____

138. Do you need your car for business trips during the day? Definitely yes____ Moderately yes____ Neutral____ Moderately no_____ Definitely no_____

139. Are the city bus schedules and maps easy for you to understand? (If you have not seen any, leave this question blank).
Definitely yes_____ Moderately yes_____ Neutral_____ Moderately no_____ Definitely no_____

140. If you had to pay to park your car, what price for parking your vehicle each day would cause you to switch to using transit?
___50¢ ___51¢ to 99¢ _____$1 _____$1.01 to $1.50 ______$1.51 to $2 _____More than $2

141. If you do not ride the bus, what not? Or if you ride the bus, which of the following items bother you? (Rank the worst 3 with #1 being the worst).

_____Long walks to bus stop (How far is too long--on level ground?
_____blocks; uphill? __________blocks?
_____Risk of being stranded, especially at night
_____Long waits for buses
_____Cost of fare
_____Dirty buses
_____Old buses
_____Rude bus drivers
_____Lack of information about system
_____Other (Specify______________________________)
_____No bus shelters
_____Not good when you have children with you
_____Slower than car
_____Routes do not go where you want to go
_____Too many bus riders are dangerous or undesirable people
_____Inconvenient when you have packages
_____Loss of personal freedom
_____No bus service available

TURN PAGE OVER AND CONTINUE WITH QUESTION 142

EXHIBIT 1: TRANSPORTATION SURVEY (1975)
(continued)

PART 3 CONTINUED

142. If city mass transit were improved, low-cost and provided convenient service, would you use it for trips to work or school?
Definitely yes_____ Moderately yes_____ Neutral_____ Moderately no_____ Definitely no_____

143. If city mass transit were improved, low-cost and provided convenient service, would you use it for shopping or personal business?
Definitely yes_____ Moderately yes_____ Neutral_____ Moderately no_____ Definitely no_____

144. How long does it take you to get to work (or your school, if student) usually?
_____0 to 5 minutes _____6 to 15 minutes _____16 to 30 minutes _____More than 30 minutes

145. If you drive to work, where do you usually park?

Parking garage_____
Parking lot _____
Street with parking meter _____
Street without parking meter _____
Other _____________________

146. How far from your work place do you usually park? _____________________blocks

PART 4

We would like to find out some good ways of <u>informing</u> people about changes and improvements in the transportation system for roads, safety, buses, etc. Please answer the following questions concerning your preferences in radio, t.v., newspapers, and the like.

147. How much time on the average, do you spend each day using a newspaper, radio, etc?

Reading the newspaper	Reading Magazines	Listening to the Radio	Watching Television
_____Don't read the newspaper	_____Don't read magazines	_____Don't listen at all	_____Don't watch at all
_____1-30 minutes	_____1-30 minutes	_____1-60 minutes	_____1-60 minutes
_____31-60 minutes	_____31-60 minutes	_____1-3 hours	_____1-3 hours
_____Over 1 hour	_____Over 1 hour	_____Over 3 hours	_____Over 3 hours

148. Which newspaper(s) do you normally read at least 3 times per week?

_____None
_____AUSTIN AMERICAN STATESMAN
_____Spanish language newspaper
_____THE DAILY TEXAN
_____Other (Which one?)_____________________

149. What sections of the newspaper do you usually read (Please check your 4 favorites)?

_____General news (1st section)
_____Comics
_____Sports
_____Women's Section
_____Business Section
_____Want Ads
_____Ann Landers or Dear Abby
_____Entertainment
_____Advertisements
_____Other (Which?)_____________________

150. What programs do you usually listen to (please rank your first 4 choices)?

_____None
_____News
_____Variety
_____Sports
_____Talk-shows
_____"Top-40" Music
_____Country-Western Music
_____Classical Music
_____"Easy-Listening"
_____Other Programs

151. What programs do you usually watch (please rank your first 4 choices)?

_____None
_____Variety
_____Sports
_____Children's
_____News
_____Talk Shows
_____Movies
_____Soap Operas
_____Game Shows
_____Westerns
_____Comedies
_____Police/Detective
_____Plays
_____Other (Which?)_____________________

152. What clubs or organizations do you belong to and attend about once per month or more?

_____None
_____Church Organizations
_____Other(s) (Which?)_____________________
_____Political Groups
_____PTA
_____Athletic Team
_____Card Group
_____Neighborhood Organizations

PART 5

Finally, we would like to have some information about you, for analysis and tabulation purposes. Please answer the following CONFIDENTIAL questions.

153. Sex: Male _____ Female_____
154. Marital Status: Single_____ Married_____ Other_____
155. Are you a student? Full time_____ Part time _____ Not a student_____
156. What is the approximate address of your place of employment? (If not employed, leave blank) Address or nearest intersection _____________
157. Your age: Less than 21 years_____ 21-29 years_____ 30-44 years_____ 45-59 years_____ 60 years or older_____
158. How many people in your household? One_____ Two_____ Three_____ Four_____ Five or More_____
159. Please indicate the age of your oldest child living at home. If you have no children living at home, lease question <u>blank</u>.
3 yrs. or younger_____ 4-5 years_____ 6-12 years_____ 13-19 years_____ 20 years or older_____
160. What is the highest level of education attained by you?
Jr. High or less_____ Some High School_____ High School Graduate_____ Some College/Professional Training_____ College Graduate or Higher_____
161. Which category best describes your family income for 1974? If you are a student, indicate <u>only</u> the combined total of your and your spouse's incomes. Your answer to this question and <u>all</u> other questions is COMPLETELY CONFIDENTIAL.
Less than $5,000_____ $5,000-$9,999_____ $10,000-$14,999_____ $15,000-$19,999_____ $20,000 or more_____
162. What is your ethnic background? Mexican-American_____ Black_____ White_____ Other _____________
163. Do you? Own home_____ Live in Mobile Home_____ Rent Home_____ Rent Apartment_____ Other _____________
164. How many automobiles are in your household? None_____ One_____ Two_____ Three or More_____
165. How long have you lived in Austin? Less than 6 months_____ 6 mos. to 1 yr._____ 1 to 3 yrs._____ 3 to 5 yrs._____ 5 yrs. or more_____
166. Do you work in the downtown area of Austin (U.T., Capitol Area, Central Business District)? Yes_____ No_____
167. Approximately how often do you shop in stores in the <u>downtown</u> area of Austin?
Twice a week or more often_____ 2 or 3 times a month_____ Once a month_____ Every 2 or 3 months_____ Almost never_____
168. Approximately how often do you shop in stores in <u>Highland Mall</u>?
Twice a week or more often_____ 2 or 3 times a month_____ Once a month_____ Every 2 or 3 months_____ Almost never_____
169. Approximately how often do you shop in stores in <u>Hancock Center</u>?
Twice a week or more often_____ 2 or 3 times a month_____ Once a month_____ Every 2 or 3 months_____ Almost never_____
170. Approximately how often do you shop in stores in <u>Southwood Center</u>?
Twice a week or more often_____ 2 or 3 times a month_____ Once a month_____ Every 2 or 3 months_____ Almost never_____
171. Approximately how often do you shop in stores in <u>Northcross Mall</u>?
Twice a week or more often_____ 2 or 3 times a month_____ Once a month_____ Every 2 or 3 months_____ Almost never_____

Comments: ____

Your help and cooperation are greatly appreciated. If you would like a summary of the results of this study, please indicate it and fill in your name and address. Yes_____________ No_____________

NAME AND ADDRESS (if results desired) _____________________________

EXHIBIT 2

SUMMARY DATA
TRANSPORTATION SURVEY YEAR 2

Part 1

1. In a typical week, about how many trips to you take from home to work or school?

N=159

None	27%
1 to 4	9%
5 or more	64%

---

2. For these trips to work or school, how do you usually get there? (Please check one only).

N=115

As car driver	61%
Car pool	11%
City bus	5%
U.T. Shuttle bus	6%
Walking	9%
Bicycle	5%
Motorcycle	*
Other	*

---

3. Do you usually travel alone?

N-115

Yes	74%
No	25%

---

4. In general, are you satisfied with the transportation you use for getting to work or school?

N=115, $\overline{x} = 1.99$

Definitely yes	40%	(1)
Moderately yes	37%	(2)
Neutral	11%	(3)
Moderately no	9%	(4)
Definitely no	3%	(5)

Importance - Difference Rating Form

(Transportation to Work, (or School, if you are a Student)

Attribute (questions 5 - 31)	Mean Importance	Rank	Mean Difference	Rank
1. Economy	$\bar{x}=3.76$	4	$\bar{x}=3.61$	6
2. Convenience	$\bar{x}=4.09$	2	$\bar{x}=3.67$	4
3. Brief Travel Time	$\bar{x}=3.42$	10	$\bar{x}=3.55$	7
4. Smooth Ride	$\bar{x}=2.71$	18	$\bar{x}=2.84$	19
5. Freedom from Weather (door to door)	$\bar{x}=3.16$	13	$\bar{x}=3.19$	13
6. Opportunity to Socialize	$\bar{x}=2.12$	24	$\bar{x}=2.92$	18
7. Avoid Traffic Congestion	$\bar{x}=3.59$	7	$\bar{x}=2.82$	20
8. Socially Accepted Transportation Mode	$\bar{x}=1.98$	26	$\bar{x}=2.35$	22
9. No Parking Problems	$\bar{x}=3.48$	8	$\bar{x}=3.75$	1
10. Flexibility	$\bar{x}=3.45$	9	$\bar{x}=3.50$	9
11. Uncrowded	$\bar{x}=3.14$	14	$\bar{x}=3.50$	9
12. Freedom from Accidents	$\bar{x}=4.05$	3	$\bar{x}=2.87$	18
13. Fun to Drive	$\bar{x}=2.42$	22	$\bar{x}=2.93$	17
14. Freedom from Repairs	$\bar{x}=3.71$	5	$\bar{x}=3.68$	3
15. Safe from Dangerous People	$\bar{x}=3.63$	6	$\bar{x}=2.96$	16
16. Low Pollution Per Passenger	$\bar{x}=3.37$	11	$\bar{x}=3.65$	5
17. Relaxing	$\bar{x}=3.14$	14	$\bar{x}=3.07$	15
18. Ease of Travel with Packages	$\bar{x}=3.06$	15	$\bar{x}=3.54$	8
19. Ability to Look at Scenery	$\bar{x}=2.52$	21	$\bar{x}=2.73$	21
20. Ability to Read	$\bar{x}=2.01$	25	$\bar{x}=2.96$	16
21. Low Energy Use Per Passenger	$\bar{x}=3.36$	12	$\bar{x}=3.72$	2
22. Can Listen to Radio or Tape	$\bar{x}=2.18$	23	$\bar{x}=2.96$	16
23. Dependability	$\bar{x}=4.25$	1	$\bar{x}=3.36$	11
24. Pleasant Riding Surroundings	$\bar{x}=2.89$	16	$\bar{x}=2.96$	16
25. Privacy	$\bar{x}=2.54$	20	$\bar{x}=3.48$	10
26. Ease of Traveling with Children	$\bar{x}=2.61$	19	$\bar{x}=3.25$	12
27. Quiet Ride	$\bar{x}=2.75$	17	$\bar{x}=3.16$	14

N=115	N=114
(1=No importance,	(1=No difference,
2=slightly important,	2=slight difference
3=moderately impor-	3=moderate difference
4=very important,	4=Large difference
5=extremely important)	5=Extreme difference)

Part 2

Now we would like to find out more concerning what is meant by some particular features of a transportation mode. For each of the following questions, please check the two phrases that best describe the meaning of each transportation feature.

115. Flexible

If you considered a public transportation system "flexible," it would have which of the following characteristics:

N=159

Round the clock service	37.1%
More service during weekends and holidays	30.8%
Can alter point of origin and/or destination	27.7%
Frequent service	51.6%
Variable routes	29.6%
Other (specify)	3.8%

116. Dependable

If you considered a public transportation system "dependable," it would have which of the following characteristics:

N=159

Available 7 days a week	47.8%
Available late at night	18.9%
Gets to your boarding point on schedule	47.2%
Frequent service	23.9%
Gets to your destination at scheduled time	61.0%
Other	3.1%

117. Convenient

If you considered a public transportation system "convenient," it would have which of the following characteristics:

N=159

Frequent service	41.5%
Minimum waiting time	44.0%
Available at many locations	50.9%
Exact change not necessary	17.0%
Available 7 days a week	36.5%
Available late at night	12.6%
Other	1.9%

Part 3

118. A public mass transit system could be financed in a number of ways. Please rate the following in terms of your preference for financing a public mass transit system:

	Mean
a) Riders should pay the full cost of service	$\bar{x}=2.79$
b) "No fare" for riders; mass transit financed by gasoline tax revenues.	$\bar{x}=3.63$
c) "No fare" for riders; mass transit financed by tax added to electric bills.	$\bar{x}=4.47$

d) "No fare" for riders; mass transit financed by tax added to <u>property taxes</u>.	$\bar{x}=4.38$
e) Riders pay most costs, with balance from <u>gasoline tax revenue</u>.	$\bar{x}=3.30$
f) Riders pay most costs, with balance from tax on <u>electric bills</u>.	$\bar{x}=4.39$
g) Riders pay most costs, with balance from tax added to <u>property taxes</u>.	$\bar{x}=4.25$

(1=Definitely yes,
2=Moderately yes,
3=Neutral,
4=Moderately No,
5=Definitely No.)

---

119. Indicate which four of the following areas should receive high importance for city tax dollar priorities. (Please check the four most important).

a) local street paving	56%
b) street crossing safety	41%
c) traffic safety	68%
d) automobile noise control	18%
e) automobile pollution control	34%
f) rail mass transit	13%
g) bus mass transit	50%
h) exclusive bus lanes	16%
i) residential sidewalks	49%
j) hike and bike trails	25%

---

120. How much is the fare for a typical (about 5 miles) bus trip in the city of Austin? (If you don't know, leave blank).

a) 20¢	4%
b) 25¢	6%
c) 30¢	81%
d) 35¢	8%
e) 40¢	*%
Left blank	1%

	<u>Mean</u>
121. If you were to change residence would you consider the distance of the new residence from your place of employment as a major selection criterion?	$\bar{x}=2.08$
122. If express service were provided at the auditorium or other locations outside the downtown area, would you be willing to park there and take the express to the downtown area?	$\bar{x}=2.54$

123.	Which form of mass transit would you prefer? (1=buses as now, 2=buses with special bus lanes, 3=rail mass transit, 4=other).	$\bar{x}=1.87$
124.	Should government encourage the use of non-auto transportation as a solution to traffic congestion and air pollution?	$\bar{x}=2.35$
125.	Do you believe that Austin will soon have a severe air pollution problem because of excessive automobile traffic?	$\bar{x}=2.46$
126.	Does the lack of sidewalks deter you from walking short distances in your neighborhood?	$\bar{x}=3.12$
127.	Are the streets in your neighborhood well maintained?	$\bar{x}=2.38$
128.	Should employers be responsible for supplying parking for their employees to reduce on-street parking?	$\bar{x}=1.97$
129.	Do you often use the streets that have bicycle lanes?	$\bar{x}=3.23$
130.	Would you be in favor of bus passes as a fringe benefit of your employment?	$\bar{x}=2.51$
131.	Would a bus pass as a fringe benefit cause you to ride the buses more frequently, especially to and from work?	$\bar{x}=2.57$
132.	Would you be in favor of carpools to travel to and from work if your car were in a pool?	$\bar{x}=2.20$
133.	If vehicles (cars, vans, trucks, etc.) were supplied by employers, would you favor car pools?	$\bar{x}=2.19$

134.	Would you pay 1 or 2 cents more per gallon of gasoline with that money being used to help pay for a mass transit system?	$\bar{x}$=2.81
135.	Would you be in favor of a 1/2% increase in the current sales tax with the money collected earmarked for mass transit improvement?	$\bar{x}$=3.43
136.	Would you be in favor of paying higher annual vehicle license plate fees on your personal vehicle with the money collected earmarked for mass transit improvement?	$\bar{x}$=3.52
137.	Do you think that it is less expensive to ride the bus to and from work (assuming 60¢ or less per round trip) than it is to drive your own car (taking into account gas, oil, parking, depreciation, insurance, etc.?)	$\bar{x}$=2.33

(Question 121-122, 124-137:
1=Definitely yes,
2=Moderately yes,
3=Neutral,
4=Moderately no,
5=Definitely no)

138.	Do you need a car for business trips during the day?	Definitely yes	25%
		Moderately yes	23%
		Neutral	23%
		Moderately no	10%
		Definitely no	19%
139.	Are the city bus schedules and maps easy for you to understand? (If you have not seen any, leave this question blank).	Definitely yes	15%
		Moderately yes	21%
		Neutral	46%
		Moderately no	11%
		Definitely no	7%
140.	If you had to pay to park your car, what price for parking your vehicle each day would cause you to switch to using transit?	50¢	22%
		51¢ to 99¢	12%
		$1	22%
		$1.01 to $1.50	28%
		$1.51 to $2	9%
		More than $2	8%

				RANK
141.	If you do not ride the bus, why not? Or if you ride the bus, which of the following items bother you? (Rank the worst 3 with #1 being the worst).	Long walks to bus stop	13.9%	11
		How far is too long?		
		blocks on level ground	29.1%	4
		blocks uphill	11.4%	13
		Risk of being stranded, especially at night	25.3%	5
		Long waits for buses	44.3%	2
		Cost of fare	7.6%	15
		Dirty buses	6.3%	16
		Old buses	5.1%	17
		Rude busdrivers	6.3%	16
		Lack of information about system	22.2%	7
		Other	16.5%	9
		No bus shelters	20.3%	8
		Not good when you have children with you	9.5%	14
		Slower than car	37.3%	3
		Routes do not go where you want to go	46.8%	1
		To many bus riders are dangerous or undesirable people	5.1%	17
		Inconvenient when you have packages	12.0%	12
		Loss of personal freedom	24.1%	6
		No bus service available	15.2%	10

142.	If city mass transit were improved, low-cost and provided convenient service, would you use it for trips to work or school? n = 157	Definitely yes	25%
		Moderately yes	32%
		Neutral	27%
		Moderately no	6%
		Definitely no	10%

143.	If city mass transit were improved, low-cost, and provided convenient service, would you use it for shopping or personal business? n = 157	Definitely yes	20%
		Moderately yes	39%
		Neutral	19%
		Moderately no	12%
		Definitely no	9%

144.	How long does it take you to get to work (or your school, if student) usually?	0 to 5 minutes	10%
		6 to 15 minutes	58%
		16 to 30 minutes	31%
		More than 30 minutes	2%

145.	If you drive to work, where do you usually park?	Parking garage	1%
		Parking lot	44%
		Street with parking meter	7%
		Street without parking meter	15%
		Other	32%

146.	How far from your work place do you usually park?	0 blocks	62%
		1 block	23%
		2 blocks	6%
		3 blocks	7%
		4 blocks	1%
		5-9 blocks	< 1%

Part 4

147.	How much time on the average, do you spend eacy day using a newspaper, radio, etc?	Reading the newspaper $\bar{x}$=2.17.	
		Don't read the newspaper	15%
		1-30 minutes	58%
		31-60 minutes	18%
		Over 1 hour	8%
		Reading Magazines $\bar{x}$=2.13	
		Don't read magazines	16%
		1-30 minutes	62%
		31-60 minutes	13%
		Over 1 hour	8%
		Listening to the Radio $\bar{x}$=2.52	
		Don't listen at all	8%
		1-60 minutes	48%
		1-3 hours	30%
		Over 3 hours	15%
		Watching Television $\bar{x}$=2.79	
		Don't watch at all	11%
		1-60 minutes	25%
		1-3 hours	36%
		Over 3 hours	27%

148.	Which newspaper(s) do you normally read at least 3 times per week?	None	12.6%
		AUSTIN AMERICAN STATESMAN	76.7%
		Spanish language newspaper	1.9%
		THE DAILY TEXAN	28.9%
		Other	5.7%

149. What sections of the newspaper do you usually read (Please check your four favorites)?

General news (1st section)	82.4%
Comics	36.5%
Sports	34.0%
Women's Section	24.5%
Business Section	20.8%
Want Ads	24.5%
Ann Landers or Dear Abby	29.6%
Entertainment	47.2%
Advertisements	36.5%
Other	6.9%

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150. What programs do you usually listen to (please rank your first 4 choices)?

None	8.8%
News	77.4%
Variety	34.6%
Sports	26.4%
Talk-shows	28.9%
"Top-40" Music	37.1%
Country-Western Music	39.6%
Classical Music	25.8%
"Easy-Listening"	35.9%
Other Programs	16.4%

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151. What programs do you usually watch (please rank your first 4 choices)?

None	9.4%
Variety	22.0%
Sports	30.8%
Children's	5.7%
News	57.2%
Talk Shows	28.3%
Movies	58.5%
Soap Operas	15.7%
Game Shows	18.9%
Westerns	19.5%
Comedies	28.3%
Police/Detective	36.5%
Plays	10.1%
Other	5.0%

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152. What clubs or organizations do you belong to and attend about once per month or more?

None	42.1%
Church Organizations	40.3%
Political Groups	3.8%
P.T.A.	8.8%
Athletic Team	8.8%
Card Group	3.8%
Neighborhood Organizations	5.7%
Other(s)	13.8%

PART 5

153. Sex:	Male	50%
	Female	50%
154. Marital Status:	Single	30%
	Married	57%
	Other	13%
155. Are you a student?	Full time	14%
	Part time	8%
	Not a student	79%
157. Your age:	Less than 21 years	6%
	21-29 years	35%
	30-44 years	23%
	45-59 years	20%
	60 years or older	16%
158. How many people in your household?	$\bar{x}$=2.79	
	One	19%
	Two	28%
	Three	21%
	Four	17%
	Five or More	14%
160. What is the highest level of education attained by you?	$\bar{x}$ =3.51	
	Jr. High or less	13%
	Some High School	12%
	High School Graduate	14%
	Some College/Professional Training	31%
	College Graduate or Higher	29%
161. Which category best describes your family income for 1974? If you are a student, indicate <u>only</u> the combined total of your and your spouse's incomes.	$\bar{x}$ =2.46	
	Less than $5,000	33%
	$5,000 - $9,999	25%
	$10,000 - 14,999	18%
	$15,000 - $19,999	13%
	$20,000 or more	12%
162. What is your ethnic background?	Mexican-American	11%
	Black	10%
	White	77%
	Other	2%

163.	Do you?	Own home	53%
		Live in Mobile Home	0%
		Rent Home	27%
		Rent Apartment	11%
		Other	6%
164.	How many automobiles are in your household?	None	14%
		One	41%
		Two	31%
		Three or More	14%
165.	How long have you lived in Austin?	$\bar{x}$=4.43	
		Less than 6 months	2%
		6 mos. to 1 year	3%
		1 to 3 years	14%
		3 to 5 years	14%
		5 years or more	68%
166.	Do you work in the downtown area of Austin (U.T., Capitol Area, Central Business District)?	Yes	25%
		No	75%
167.	Approximately how often do you shop in stores in the downtown area of Austin?	$\bar{x}$=3.92	
168.	Approximately how often do you shop in stores in Highland Mall?	$\bar{x}$=3.33	
169.	Approximately how often do you shop in stores in Hancock Center?	$\bar{x}$=3.49	
170.	Approximately how often do you shop in stores in Southwood Center?	$\bar{x}$=4.43	
171.	Approximately how often do you shop in stores in Northcross Mall?	$\bar{x}$=4.12	

(Questions 167-171: 1=Twice a week or more often; 2=2 or 3 times a month; 3=once a month; 4=every 2 or 3 months; 5=almost never).

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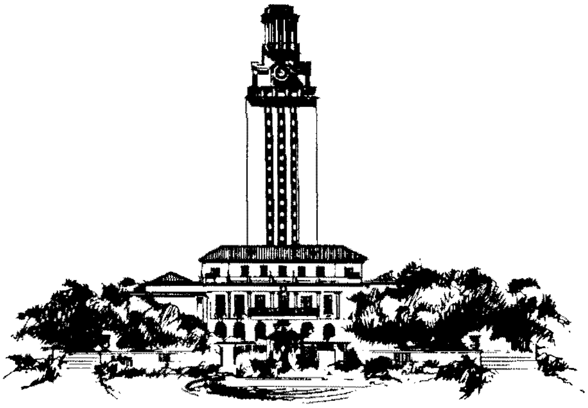

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