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# SCENERY AND THE SHOPPING TRIP: THE ROADSIDE ENVIRONMENT AS A FACTOR IN ROUTE CHOICE

by
Roger Steffen Ulrich

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Geography)
in The University of Michigan
1973

Doctoral Committee:

Professor Gunnar Olsson, Chairman
Professor L. A. Peter Gosling
Professor Stephen Kaplan
Professor George Kish

ABSTRACT

SCENERY AND THE SHOPPING TRIP: THE ROADSIDE ENVIRONMENT AS A FACTOR IN ROUTE CHOICE

by

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The emphasis of the study is on the goals which affect spatial behavior. By concentrating on a sample of shoppers who possess high levels of knowledge concerning two alternative routes, it was possible to focus on the goals underlying the route choice decision.

A study area was located in Ann Arbor, Michigan, which contained a pair of parallel routes to a shopping center: one of the routes was scenic, but non-optimal in terms of travel time; the second route was non-scenic, but offered savings in travel time. Data were obtained from personal interviews with shoppers whose homes are located between the two route alternatives, and who have nearly equal access to either road for the trip to the shopping center. Two different techniques were employed in the interview to determine the considerations underlying the shoppers' route choice decisions: (1) a constrained-response questionnaire; and (2) a rating procedure involving a series of photographs of natural roadside scenery. The purpose of the latter procedure was to identify non-verbal issues relevant

to the assessment of scenery as a factor in trip behavior. The principal quantitative techniques employed in the interpretation of the data were non-metric factor analysis and analysis of variance.

The overt behavior of the subjects indicated that in about one-half of the shopping trips functional distance was not minimized. This failure to minimize distance occurred despite the fact that the shoppers were aware that one of the routes provided a faster and more economic alternative. The findings from the interviews linked a number of non-economic considerations to the route choices of the shoppers. These non-economic motivations appeared to override time-saving considerations for a large proportion of the trips. It is concluded, therefore, that the Economic Man assumption as it applies to route choice behavior is unrealistic.

The most important non-economic benefit appeared to be the visual environment of the slower scenic route. The results suggested that the roadside environment--by being an experiential element associated with distance--may serve as a source of utility in functional trips, and can affect individuals' spatial behavior accordingly. Other prominent non-economic considerations included the danger/safety characteristics of the roads, and the apparent need of many shoppers for variety in their trip behavior. There was also evidence that an individual's goals could vary in response to different moods or circumstances.

A broad range of trip behavior was observed, and this was consistent with the finding that attitudes towards the two routes varied widely between different individuals. Thus many of the shoppers differed with respect to the benefits and disutilities which they associate with each of the two routes. These differences became most evident when the shoppers were grouped according to their (1) sex and (2) route choice behavior. Although the various route user groups differed in several of their attitudes, they were in consistent agreement about which elements contributed to the visual quality of the scenic route.

On the basis of the data from the picture rating procedure, it was possible to identify coherent domains of natural landscape content--both for the study area and for its environs. This underlies the feasibility of developing objective procedures for the assessment of visual landscapes.

ACKNOWLEDGEMENTS

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Finally, I am indebted to my wife, Ann-Margret. Her European perspective on the United States first opened my eyes to the importance of scenic amenity, and has engendered

in me an obstinate refusal to take the American landscape for granted.

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# CHAPTER I

# INTRODUCTION

## The Behavioral Approach and Planning

The formulation of geographic theory based on explicit and realistic behavioral assumptions holds considerable appeal. By designating explicit relationships between human behavior and spatial patterns, the researcher is often alerted to the logical weaknesses of inferring behavior from spatial patterns. Additionally, theories which incorporate realistic behavioral assumptions offer the prospect of higher levels of understanding.[1] It was with this point in mind that Olsson asserted that ". . . the reliability, explanatory power, and the potential planning applications

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[1]G. Olsson, "Inference Problems in Locational Analysis," in Behavioral Problems in Geography: A Symposium, edited by K. Cox and R. Golledge, Northwestern University Studies in Geography, No. 17 (Evanston, Illinois, 1969), pp. 14-34; D. Harvey, "Theoretical Concepts and the Analysis of Land-use Patterns," Annals, Assoc. of American Geographers, Vol. 56 (1967), pp. 361-74; L. King, "The Analysis of Spatial Form and Its Relation to Geographic Theory," Annals, Assoc. of American Geographers, Vol. 59 (1969), pp. 573-95; R. Golledge, "Process Approaches to the Analysis of Human Spatial Behavior," Discussion Paper No. 16, Department of Geography, Ohio State University, 1970.

of any social science theory depend on its treatment of individual and group behavior.[1]

The appeal of the behavioral approach is particularly strong in the context of planning, where it seems desirable to complement our existing descriptions of spatial patterns with a better understanding of underlying individual behavior. Ideally, planners should have perfect knowledge concerning the consequences of all possible planning alternatives. To approach this ideal would require highly reliable scientific formulations relating to all of the properties of a social situation. However, as Karl Popper has emphasized, no such holistic formulation has ever been achieved.[2] Rather, our existing models and theories tend to be aggregate descriptions which at best can make statements about only specific aspects of a social "whole." Under these circumstances, it is hazardous to rely exclusively on such a model in a planning context, because to the extent that the model pertains only to a specific aspect of the social whole, there is no logical basis for the planner to make inferences concerning the other constituent properties and parts. Particularly, if the model or theory is not based on explicit and realistic behavioral assumptions,

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[1]Olsson, "Inference Problems," p. 20.

[2]Karl Popper, The Poverty of Historicism (New York: Harper, 1957), p. 79.

it is difficult to say anything reliable about the human consequences of a planning project. It was in part this recognition which led Popper to propose his well-known "piecemeal" concept of planning.[1] In this view, the social engineer must be acutely conscious of ". . . how little he knows."[2] Accordingly, planning should be undertaken step by step to achieve small adjustments. This gradual procedure enables the planner to better evaluate the achieved results, and to minimize undesirable side-effects.

A problem of the behavioral approach is that statements about the behavior of a large number of individuals are difficult to incorporate into theories. With this point in mind, Harvey has noted the advantages of stochastic formulations for expressing the aggregate effects of the behavior of individuals. It seems likely, therefore, that probability models will prove to be important vehicles through which behavioral statements can be brought to bear on the problem of planning. Also, it can be expected that the determination of empirical statements concerning individual or group behavior would aid the piecemeal social engineer in his task

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[1]Popper, The Poverty of Historicism.

[2]Ibid., p. 67.

[3]D. Harvey, "Conceptual and Measurement Problems in the Cognitive-Behavioral Approach to Location Theory," in Behavioral Problems in Geography: A Symposium, ed. by K. Cox and R. Golledge, Northwestern University Studies in Geography, No. 17 (Evanston, Illinois, 1969), pp. 38-39.

of minimizing unwanted human side-effects. Therefore, even if geographers and other social scientists achieve only a modicum of success in ascertaining realistic behavioral postulates, it can be hoped that this approach will contribute to better planning.

## Human Spatial Behavior: The Search for Assumptions

Although the emergence and formal discussion of the "behavioral approach" is rather recent, the employment of behavioral assumptions by geographers is not at all new. Harvey[1] has noted that human geographers have nearly always made assumptions about behavior--however, these assumptions have commonly been implicit in the analysis, rather than explicit in theoretical statements. The most notable exception has of course been the case of the "Economic Man" assumption. This normative behavioral postulate has been used extensively by geographers in both implicit and explicit fashions--to the point where much of location theory bears a close relationship to classical economics. Thus Olsson and Gale[2] have noted that most spatial theories rely on the same behavior assumptions as the theory of the firm.

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[1] D. Harvey, "Behavioral Postulates and the Construction of Theory in Human Geography," Bristol Seminar Paper, Series A, No. 6 (1966), p. 1.

[2] G. Olsson and S. Gale, "Spatial Theory and Human Behavior: A Study of Anarchistic Vector Spaces," Papers and Proceedings of the Regional Science Association, Vol. 21 (1968), p. 230.

The well-known behavioral assumptions embodied in the Economic Man concept are reflected in the (1) knowledge and (2) goals attributed to the individual. Thus, it is assumed that behavior is based on knowledge which is omniscient and perfect, and which precludes uncertainty from predictions. Behavior is oriented towards goals which optimize profits or utility. The extension of these goals into a spatial context results in the producer attempting to increase the size of his market area, while the consumer attempts to reduce purchasing costs by minimizing the expenses and effort associated with distance.[1] Similarly, the theory of route choice behavior--for whatever trip purpose--is characterized by decisions which minimize distance, travel cost, or travel effort; people are assigned to routes in the same way that boxcars are assigned to rail lines.

The fact that the above behavioral assumptions are unrealistic and inaccurate is well known. Economists, for example, have long been aware that producers rarely attain optimum profit levels. Non-normative economics, therefore, recognizes that business decision-makers possess imperfect knowledge and problem-solving ability, and that their goals under certain circumstances may be non-optimizing. The

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[1]Olsson and Gale, "Spatial Theory and Human Behavior," p. 230.

failure of real man to correspond with the actions of the firm have prompted various reformulations of the behavior assumptions. Simon,[1] for example, has proposed the principle of "bounded rationality"--which emphasizes the limits to problem solving capacities and the availability of knowledge.

Geographers have widely criticized the Economic Man assumption in a spatial context. Particularly, spatial analysts have recognized the need for adjusting the distance optimizing function. Thus, linear distance has now been largely replaced in geographic models by "functional" measures such as accessibility or travel time. These adjustments, however, have not accounted for observed discrepancies between the normative-economic behavioral model and real-world locational and trip activity.[2] The widespread recognition of these discrepancies has prompted many geographers to seek reformulations or alternatives to the

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[1] H. Simon, Models of Man (New York: Wiley), 1957.

[2] E.g., T. Brennan, Midland City (London: Dobson), 1948; J. Wolpert, "The Decision Process in a Spatial Context," Annals, Assoc. of American Geographers, Vol. 54 (1964), pp. 537-58; D. Marble, "A Theoretical Exploration of Individual Travel Behavior," in Quantitative Geography, Part I: Economic and Cultural Topics, ed. by W. Garrison and D. Marble, Northwestern University Department of Geography Study No. 13 (Evanston, Illinois), 1967; W. Clark, "Consumer Travel Patterns and the Concept of Range," Annals, Assoc. of American Geographers, Vol. 58 (1968), pp. 386-96; W. Clark and G. Rushton, "Models of Intra-Urban Consumer Behavior and Their Implications for Central Place Theory," Economic Geography, Vol. 46 (1970), pp. 486-97.

Economic Man concept. One research tack--explored notably by Curry[1]--attempts to replace behavioral assumptions with mathematical (Poisson) process descriptions of spatial activity. This strategy is attractive if one's purpose is to construct aggregate models incorporating human behavior. However, the lack of explicit behavior assumptions reduces its reliability for inferring disaggregate results.

The other general tack--the one followed by most researchers--attempts to modify behavior assumptions in order to make them more realistic. This strategy is reflected in the work by Rushton concerning the locational preferences underlying a population's spatial behavior.[2] This approach assumes that an individual's spatial behavior is affected by his "preference function." Thus, by aggregating the preference functions of individuals, a pattern of behavior can be generated for any distribution of spatial

---

[1]L. Curry, "The Random Spatial Economy--An Exploration in Settlement Theory," Annals, Assoc. of American Geographers, Vol. 54 (1964), pp. 138-46; "Central Places in the Random Spatial Economy," Journal of Regional Science, Vol. 7 (supplement; 1967), pp. 217-38.

[2]G. Rushton, "Analysis of Spatial Behavior by Revealed Space Preference," Annals, Assoc. of American Geographers, Vol. 59 (1969), pp. 391-400; "The Scaling of Locational Preferences," in Behavioral Problems in Geography: A Symposium, Northwestern University Studies in Geography, No. 17 (Evanston, Illinois, 1969a), pp. 197-227; "Behavioral Correlates of Urban Spatial Structure," Economic Geography, Vol. 47 (1971), pp. 49-58.

opportunities. This method is descriptive in the sense that there is no attempt to explain why one opportunity is favored over another in the preference function.

For the most part, research efforts to determine more realistic assumptions have focused on the information and knowledge aspects of spatial behavior. In this regard, one approach has been to employ the Theory of Games in order to introduce the effects of risk and uncertainty into spatial decision-making. These studies, which in geography have emphasized the agricultural context[1] demonstrate that conditions of imperfect knowledge may preclude the possibility of short-run economic optimizing behavior, but may result in a kind of long-run equilibrium solution.

In addition to the game theory studies, a flurry of descriptive and analytic research has demonstrated that informational biases characterize the real-world and may have important effects on spatial behavior. Migration studies, for example, have revealed that the biased information flows caused by inter-personal relationships affect the destination choices of migrants.[2] These latter studies have

---

[1]P. Gould, "Man Against His Environment: A Game Theoretical Framework," Annals, Assoc. of American Geographers, Vol. 53 (1963), pp. 290-97; Harvey, "Theoretical Concepts."

[2]T. Hagerstrand, "Migration and Area," in Migration in Sweden, ed. by D. Hannerberg, T. Hagerstrand, and B. Odeving, Lund Studies in Geography, Series B, Human Geography No. 13 (Lund, Sweden, 1967); C. Tilly, Migration

drawn many of their concepts from sociology. In the case of agriculture, Wolpert[1] was able to partially account for non-optimizing behavior in Central Sweden by examining the limitations and biases characterizing the information available to the farmers. In his analysis he describes the farmers' behavior as "satisficing," or "intendedly rational," rather than as optimizing in the sense of the Economic Man assumption. The satisficing notion[2] assumed that in the absence of perfect knowledge behavior is directed towards an alternative which is satisfactory, but not necessarily optimal.

A growing body of literature has recently approached the problem of spatial behavior by emphasizing more complex views of the nature of man. These studies have stressed the role of "within-man" factors as mediators between information, knowledge, and behavior. Man's role as an agent between behavior and the environment, therefore, changes from a simple normative concept to a complex intervening variable.[3] In this regard, investigators have paid

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to an American City, University of Delaware, Division of Urban Affairs (Newark, Delaware, 1965); H. Schwarzweller, J. Brown, and J. Mangalam, Mountain Families in Transition: A Case Study in Appalachian Migration (University Park, Pennsylvania), 1971.

[1]Wolpert, "The Decision Process."

[2]Simon, Models of Man.

[3]R. Downs, "Geographic Space Perception," in Progress in Geography, Vol. 2, edited by R. Chorley, P. Haggett, and D. Stoddart (London: Arnold, 1970), pp. 65-108.

particular attention to various distortions and limitations of spatial knowledge which are associated with human perception and learning processes. These studies have come from several disciplines--notably psychology, urban planning, architecture, and geography. The research has commonly derived its methodologies from the behavioral sciences, and with few exceptions has approached the study of human behavior at the level of individuals or small groups. A frequent issue in these studies has been individual or group differences--differences in the perception and cognition of information, as well as in spatial activity.

In geography, much of this research falls into the category of "perception studies."[1] The best developed area of this research deals with the perception of natural hazards.[2] Here the approach has been to evaluate the attitudes and behavior of individuals who are faced with a particular kind of uncertainty--that is, whether or not a natural hazard will occur that could cause property loss or

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[1]T. Saarinen, "Perception of Environment," Assoc. of American Geographers, Resource Paper No. 5 (Washington, D.C., 1969).

[2]R. Kates, Hazard and Choice Perception in Flood Plain Management, Department of Geography Research Paper No. 78, University of Chicago, 1962; Ian Burton and Robert Kates, "Perception of Hazards in Resource Management," Natural Resources Journal, Vol. III (1964), pp. 412-41; T. Saarinen, Perception of the Drought Hazard on the Great Plains, Department of Geography Research Paper No. 106, University of Chicago (Chicago, Illinois, 1966).

physical harm. The results have consistently revealed a tendency for many individuals to underestimate the risk from such natural events. From the point of view of understanding human behavior, these studies call attention to problem-solving weaknesses which are associated with a long-run context of uncertainty.

Elsewhere, investigators from several disciplines have studied individuals' perceptions and knowledge of geographic spaces.[1] A broad range of scales--from the neighborhood to the nation--have been examined. The research has attempted to determine: the kind of spatial elements which are most easily remembered and organized; the ways in which such knowledge is mentally structured and related; and the degree of correspondence between spatial knowledge and reality. Thus the well-known work of Lynch[2] showed that people's knowledge of cities is distorted and highly selective, and consists of element types which are high in clarity (legibility) and which evoke strong mental images (imageability). Several other investigators have confirmed and extended Lynch's work. Appleyard,[3] for example, showed that the spatial knowledge of most inhabitants of a new city in

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[1]Downs, "Geographic Space Perception," pp. 65-108.

[2]K. Lynch, The Image of the City (Cambridge, Mass.: M.I.T. Press, 1960).

[3]D. Appleyard, "Styles and Methods of Structuring a City," Environment and Behavior, Vol. 2 (1970), pp. 100-17.

Venezuela consisted primarily of "sequential" elements such as roads. These same sequential elements were also important to the inhabitants for organizing and relating other spatial elements, including buildings and districts. Appleyard's study also revealed substantial group and individual differences. For example, there was great variation in the specific spatial elements that were known, as well as broad differences in the accuracy of the inhabitants' knowledge of distances and directions.

The issues of spatial knowledge on the one hand, and spatial behavior on the other, are in a sense reconciled in the concept of the cognitive--or mental--map.[1] The cognitive map is an intuitive notion relation to the mental representation of spatial information. It asserts that individuals store spatial knowledge in a simplified and usable--if distorted--form. The form of the information reflects the

---

[1]E. Tolman, "Cognitive Maps in Rats and Men," Psychological Review, Vol. 55 (1948), pp. 189-208; P. Gould, On Mental Maps, Michigan Inter-University Community of Mathematical Geographers, Discussion Paper No. 9 (Ann Arbor: Department of Geography, University of Michigan, 1966); D. Stea, "Environmental Perception and Cognition: Towards a Model for 'Mental Maps,'" in Response to Environment, edited by G. Coates and K. Moffett, School of Design, North Carolina State University, Raleigh, North Carolina, 1969, pp. 63-76; S. Kaplan, "Cognitive Maps in Perception and Thought," in Cognitive Mapping: Images of Spatial Environments, edited by R. Downs and D. Stea (Chicago: Aldine, 1973, in press); S. Kaplan, "Cognitive Maps, Human Needs and the Designed Environment," in Environmental Design Research, edited by W. Preiser, Proceedings of the Environmental Design Research Association, Conference Four, 1973; J. S. Adams, "Directional Bias in Intra-Urban Migration," Economic Geography, Vol. 45 (1969), pp. 302-323.

peculiarities of human perceptual and cognitive processes, and the past experience of the individual. These cognitive "representations" contain information not only about specific spatial elements, but also about relationships between the elements. On the basis of such information, it is assumed, the individual plans and executes behavior in space.

The notion that the distorted nature of individuals' spatial knowledge is reflected in behavior has been empirically supported. Lee[1] showed that shoppers may perceive distances towards the city center as being "shorter" than equivalent distances in other directions. Using these findings, he was able to account for biases in consumer trip behavior which were observed by Brennan.[2] In addition, recent studies[3] have revealed the important role that an individual's movement behavior plays in supplying him with spatial information. The suggestion here is that there are self-reinforcing aspects to spatial movements--that is, an individual's movements affect his stock of spatial knowledge, which in turn affects his future movements.

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[1]T. Lee, "Perceived Distance as a Function of Direction in the City," Environment and Behavior, Vol. 2 (1970), pp. 40-51.

[2]Brennan, Midland City.

[3]F. Horton and D. Reynolds, "Effects of Urban Spatial Structure on Individual Behavior," Economic Geography, Vol. 47 (1971), pp. 36-48.

It is at least partly the recognition of these issues which has prompted some geographers to study human cognitive processes. These researchers approach the problem of spatial behavior by seeking a deeper understanding of the mental processes which affect spatial knowledge. In this view, the above-mentioned perception studies are seen as dealing with only one aspect of cognition. The assumptions and concepts employed by these investigators are of course derived from psychology.[1] An example of their use by a geographer is Golledge's[2] discussion of the relevance of learning theories to the study of spatial behavior.

These approaches--which are often termed "cognitive-behavioral"--represent perhaps the most complex views of human behavior which any group of geographers has held. They therefore mark an appropriate endpoint for this review --which has emphasized the recent trend of research towards more realistic assumptions of spatial behavior. Although the discussion has been brief, several points have emerged: first, it was noted that the goal of formulating realistic behavior assumptions is attractive both from the point of

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[1]R. Hart and G. Moore, "The Development of Spatial Cognition: A Review," Place Perception Research Report No. 7, Clark University, Worcester, Mass., 1971.

[2]R. Golledge, "The Geographical Relevance of Some Learning Theories," in Behavioral Problems in Geography: A Symposium, edited by K. Cox and R. Golledge, Northwestern University Studies in Geography, No. 17, Evanston, Illinois, 1969, pp. 101-45.

view of constructing spatial theory and for planning purposes. Next, it was pointed out that the most widely used behavioral assumption, the Economic Man concept, is extremely unrealistic in a geographic context. Finally, various research approaches were reviewed which have been employed in efforts to reach a more refined level of understanding of spatial behavior. These approaches for the most part have borrowed their concepts from psychology and sociology, rather than from economics. One result of the investigations has been that man's spatial behavior is now viewed as being extremely complex. Also it was particularly emphasized that the bulk of these studies has been concerned with the imperfections which characterize decision-makers' knowledge in a spatial context. This research trend, therefore, rejects the concept of a stereotyped man possessing perfect knowledge and perfect powers of judgement. Rather, it proposes a view of man which evaluates his sub-optimal behavior in the light of the peculiarities of his cognitive processes, and limitations in the availability of information.

## Goals of Spatial Behavior

It is important to note that while considerable research has recently focused on the knowledge aspects of behavior assumptions, relatively little attention has been paid to the goals towards which spatial behavior is directed. In part this may be a result of the difficulties associated

with determining goals and utility functions. The fact remains, however, that the well-documented instances of sub-optimal spatial behavior have for the most part been interpreted as a result of imperfect knowledge. Geographers have only infrequently suggested that decision-makers may have goals which are non-economic or non-normative. In this regard Wolpert's comments concerning the sub-optimal behavior of Swedish farmers are an exception: "It is debatable . . . as to whether we have an optimizing population with imperfect knowledge, or a population with goals other than pure profit maximization." This point is seldom echoed in the literature, which leaves the impression that optimizing behavior indeed is the rule but that it is tempered by the fact that decision-makers normally do not possess perfect knowledge. Thus, the recent efforts to formulate realistic views of spatial behavior have wrought considerable change in knowledge assumptions, but have left largely intact the goal assumptions expressed in normative economics.

The goals embodied in Economic Man have been briefly discussed above, where it was pointed out that spatial behavior is assumed to be economically optimizing. The producer is viewed as attempting to maximize profits and to minimize costs associated with location. Translated to the context of trip behavior, the individual attempts to

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[1]Wolpert, "The Decision Process," p. 545.

minimize the costs and efforts associated with distance. The fact that the goals of producers may in some cases not be optimizing has been recognized in non-normative economics. Pred,[1] basing his arguments on findings from non-normative economics, has enumerated a variety of situations where it is questionable that producers would attempt to maximize profits. Also, there is evidence that other types of behavior may not be consistent with the goals expressed in the normative-economic model. At the cultural level, for example, several studies[2] have noted that the "irrationalities" of farmers and workers in Communist China are due to ideological, rather than economic, considerations. In a spatial context, Firey[3] has provided a rare empirical example in his study showing that the cultural values of Boston's inhabitants result in "non-economic" locational processes.

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[1]A Pred, Behavior and Location: Foundations for a Geographic and Dynamic Location Theory, Part I (Lund: Gleerups, 1967).

[2]R. Murphey, "Man and Nature in China," Modern Asian Studies, Vol. 1 (1967), pp. 313-33; J. Gurley, "Capitalist and Maoist Economic Development," Bulletin of Concerned Asian Scholars, Vol. 2 (1970), pp. 34-50; C. Salter, "The Litany of Tachai and the Foolish Old Man: Agricultural Landscape Modification in Mainland China," The Professional Geographer, Vol. 24 (1972), pp. 113-17.

[3]W. Firey, "Sentiment and Symbolism as Ecological Variables," American Sociological Review, Vol. 10 (1945), pp. 140-48.

In the case of trip behavior, it has already been noted that the distance optimizing function has been refined to include so-called "functional" measures such as travel time and accessibility. Additionally, a few investigations have suggested that an individual's trip behavior is affected by various experiential factors associated with distance. Fox[1] has shown that a driver's dislike for the stoplights and other impedances characterizing a particular route may cause him to choose another route--even if he gains nothing in terms of time or distance. Michaels[2] has used the galvanic skin response test to demonstrate that motorists' route choice behavior may be directed towards minimizing the tension associated with driving. The implication here is that the stress levels characterizing different roads--irrespective of time or distance considerations--may determine which route is chosen. In view of these research developments, distance becomes a complex and rather fuzzy concept. Regardless of which view of distance is taken, however, it retains its cost-effort aspects, and the essential goal of minimization remains.

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[1]P. Fox, The Value of Time for Passenger Cars: A Behavioral Study of Driver Route Choice, Bureau of Public Roads Contract No. CPR 11-0950 (Menlo Park, Calif.: Stanford Research Institute, 1969).

[2]R. Michaels, "Effect of Expressway Design on Driver Tension Responses," Highway Research Board Bulletin No. 330, 1962, pp. 16-25.

## An Hypothesis: Roadside Scenery Is a Factor Affecting Shoppers' Route Choices

Most models of travel behavior define a spatial setting which is highly abstract. The geographic environment is reduced to a set of trip origins, destinations, and connecting movement paths. These features are typically conceptualized as points and lines, and the time/distance relationships between the elements are taken to be the dominant factors affecting the pattern of movement behavior. This level of abstraction in a sense denies that there are other environmental elements which significantly affect trip behavior. The sole goal of the route choice decision is held to be the minimization of linear or functional distance. In this view, therefore, movement per se is treated purely as a disutility--that is, there is no payoff associated with the experiential aspects of distance.

The investigations of the experiential aspects of travel represent steps towards reducing the level of abstraction. In other words, various elements--such as traffic, stoplights, a rough road surface, and so on--are introduced into the trip setting when they are shown to affect behavior. These experiential elements have for the most part been "on-the-road" factors which influence the levels of effort or stress associated with driving.

In the real-world, of course, "off-the-road" elements constitute a component of distance experience as well.

In this regard it is well known that a large portion of drivers' perceptual activity is directed towards the roadside environment.[1] This raises the possibility that the visual configurations of roadside environments--through their effect on the driver's trip experience--may influence spatial behavior. Rephrased, this suggests that the sensitivity of individuals to attractive roadside views may be a factor which affects their route choices. Scenic amenity, therefore, is introduced as a possible source of utility in the trip experience. This notion is hardly startling in view of the well-documented case of vacation travel. However, little attention has been paid to the possibility that roadside scenery may also affect functional trips such as shopping or the journey-to-work.

The few studies which have considered scenery as a variable in the route decision have approached the issue only peripherally. Thus there is no provision in the research designs of these studies to ensure that subjects have access to scenic route alternatives. The approach has been to administer a questionnaire to a sample of respondents in order to determine the factors underlying their route choices for a variety of trip purposes--including the

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[1] D. Appleyard, K. Lynch, and J. Myer, The View from the Road (Cambridge, Mass.: M.I.T. Press, 1964); S. Carr and D. Schissler, "The City as a Trip," Environment and Behavior, Vol. 1 (1969), pp. 7-35.

journey-to-work, the shopping trip, and the social-recreation trip. In this manner, Wachs found that drivers' considered scenery to be more important for social-recreation trips than for work trips.[1] Also, his results appeared to indicate that high preference for scenic routes is associated with high levels of income and education.[2] A study by Hille and Martin suggested that the scenery variable is important to drivers only for out-of-town trips.[3] Another survey concluded that ". . . scenery seemed to play a minor role in route choice."[4]

However, in these studies the samples of subjects were drawn from urban areas. In the context of an urban setting, it is by no means safe to assume that each subject will have access to scenic routes for his various trip purposes. To the extent that scenic routes were unavailable to the subjects, it can be expected that the importance of scenery as a factor in their route choice decisions was under-represented. Thus this point clouds the finding that preference for scenic routes is related to levels of income

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[1]M. Wachs, "Relationships between Drivers' Attitudes Toward Alternate Routes and Driver and Route Characteristics," Highway Research Record, No. 197, 1967, p. 72.

[2]Ibid., p. 85.

[3]S. Hille and T. Martin, "Consumer Preference in Transportation," Highway Research Record, No. 197, 1967, p. 40.

[4]Stanford Research Institute, "The Value of Time," Stanford Research Institute Journal, Vol. 22 (1968), p. 14.

and education; the relatively high importance attached to scenery by the upper income subjects may only reflect the fact that scenic routes were more numerous in the areas of their residences. Similarly, the finding that scenery was important only in the decision for out-of-town trips may simply echo an absence of scenery in the in-town setting. It seems clear, therefore, that an accurate evaluation of the "scenery hypothesis" requires a study area which provides visually attractive route alternatives.

## Visual Environment and Human Behavior

The notion that visual environment affects the activities or well-being of individuals has not found expression in the behavioral assumptions of any spatial theory or model. In part this may reflect the influence of theoretical developments in geography in the 1960's--which tended to regard landscapes as spatial settings for the analysis of geometric patterns. This theoretical emphasis on geometry, distance, and space per se, contributed to a situation that was perhaps ironic from the point of view of the history of geography--landscape and the physical environment were in a very real sense abstracted out of geographic theories and models.

The lack of explicit behavioral assumptions relating to visual environments may also reflect a legacy of anti-environmental determinism--which, in Sonnenfeld's words

". . . has discouraged the study of man's environmental sensitivities and behaviors."[1] However, perhaps the most important obstacle to the delineation of such assumptions has been the absence of direct empirical evidence showing that visual landscapes have utility or the capacity to satisfy human needs. The concept of scenic benefits has remained a largely subjective issue--supported only by "indirect" empirical evidence, and the personal convictions of individuals and groups.

Despite the incomplete or subjective nature of existing evidence, it nonetheless suggests the plausibility of the hypothesis that attractive roadside scenery serves as a positive payoff in the functional trip experience. A few studies, for example, have indirectly implied the benefit of scenery by demonstrating that lands adjacent to scenic roads increase in value at disproportionate rates.[2] At a more subjective level, Lowenthal has interpreted landscapes in terms of both their visual appearances, and the cultural

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[1]J. Sonnenfeld, "Environmental Perception and Adaptation in the Arctic," in Environmental Perception and Behavior, edited by D. Lowenthal, Department of Geography Research Paper No. 109, University of Chicago (Chicago, Illinois, 1967), p. 53.

[2]D. L. Ames and J. T. Davis, Parkway Impact Study (St. Louis: George Washington University, 1962); M. Cherner, "Property Values as Affected by Highway Landscape Developments," Highway Research Record, No. 53, 1964); H. Williams and W. D. Davis, "Effect of Scenic Easements on the Market Value of Real Property," Appraisal Journal, Vol. 36 (1968), pp. 15-24.

values which they reflect.[1] Underlying Lowenthal's work is an orientation towards landscape aesthetics, and explicit in many of his discussions of cultural attitudes is the notion of human responsiveness to the visual environment.

The most formal expressions of support for the concept of scenic amenity are seen in the acts of courts and legislatures. Thus a series of judicial and legislative actions have legally affirmed the notion that visual landscapes affect public welfare and the quality of life.[2] In the area of court rulings, a notable example is the 1954 Supreme Court decision of Berman vs. Parker, which upheld the use of eminent domain for aesthetic purposes. Similarly, the legislatures of several states have passed laws which allow scenic easements to be acquired from private owners along highways.[3] Also, some states--notably California--have undertaken programs to establish extensive networks of scenic roads.[4] The rationale supporting these legislative

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[1]D. Lowenthal and H. Prince, "The English Landscape," Geographical Review, Vol. 54 (1964), pp. 309-46; "English Landscape Tastes," Geographical Review, Vol. 55 (1965), pp. 186-222; D. Lowenthal, "The American Scene," Geographical Review, Vol. 52 (1968), pp. 61-88.

[2]American Bar Association, Junkyards, Geraniums, and Jurisprudence: Aesthetics and the Law, Proceedings of a Two-day National Institute, Chicago, Illinois, 1967.

[3]J. Matheny, "Acquisition of Scenic Easements," Highway Research Record No. 166, 1967, pp. 40-42.

[4]California State Transportation Agency, The Scenic Route: A Guide for the Designation of an Official Scenic Highway, Department of Public Works, State of California, 1968.

actions is typified by the remarks of President Johnson in his message to Congress prior to the passage of the Highway Beautification Act of 1965:

> . . . Association with beauty can enlarge man's imagination and revive his spirit. Ugliness can demean the people who live among it. What a citizen sees every day is his America. If it is attractive it adds to the quality of his life. If it is ugly it can degrade his existence.[1]

Such comments--which explicitly assert that visually attractive landscapes have human benefits--are common in the context of scenic legislation and court rulings. It appears evident, therefore, that the judicial/governmental acts recognizing the concept of scenic amenity rest on a series of behavioral assumptions--assumptions for which there is as yet no systematic empirical basis. Thus, these assumptions remain subjective in the sense that to a considerable extent they reflect the personal convictions of judges, legislators, and planners.

## Introduction to the Investigation

A principal objective of the study which follows is to assess the importance of the roadside environment as a variable affecting drivers' route choice behavior. Underlying this objective is the notion that scenic amenity may have utility for many individuals in the context of the trip

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[1]Matheny, "Acquisition of Scenic Easements," p. 36.

experience. This hypothesis is examined for the case of the shopping trip. The shopping trip is appropriate to the objectives of the investigation in the sense that it represents a functional trip purpose. It will be recalled that spatial theory has traditionally viewed functional trip behavior as being oriented towards the minimization of linear or functional distance.

The evaluation of roadside scenery as a "non-economic" payoff is part of a broader objective of identifying the factors which affect the driver's route choice decision for the shopping trip. The determination of the factors underlying route choice allows an appraisal of the Rational-Economic Man assumption. An evaluation of the Economic Man concept is desirable because most route-predictor models, as well as much of geographic theory, are based on this behavioral postulate. The investigation therefore reflects a concern for assessing the reliability of existing models which incorporate behavioral statements, and for identifying components of perhaps more realistic and accurate behavioral assumptions.

The investigation represents an extension of the research trend reviewed earlier in the sense that it strives for a more realistic understanding of spatial behavior. However, the study differs from the trend in that it does not emphasize the knowledge aspects of trip behavior. Rather, it is more concerned with examining the issues of goals. By

explicitly considering the roadside environment as an element in the trip experience, scenic amenity is introduced as a possible non-economic payoff affecting route choice. Thus, by raising the issue of drivers' responsiveness to the visual environment, the investigation questions the normative-economic assertion that the goal of route choice behavior is the minimization of linear or functional distance.

Although the investigation is essentially framed as a problem in shopping trip behavior, there may be underlying issues of broader importance. Thus a prominent aspect of the issue of environmental quality is reflected in the study's consideration of scenery as a payoff in the shopping trip. In recent years increasing attention has been paid to the notion that the visual appearance of environment is an important component of environmental quality. This has been formally expressed, for example, in the court rulings and legislative acts which have explicitly cited scenic landscapes as sources of public welfare. Also, planners have increasingly attempted to incorporate scenic considerations into their projects. The implementation of scenic values in planning, however, has been handicapped by the virtual nonexistence of empirical studies demonstrating the importance of scenic amenity relative to other payoffs. Attempts by researchers to quantify the value of scenic amenity have met with little success. In this regard, the planning problem

has been aggravated by the fact that the major procedures for evaluating planning alternatives--i.e., cost-benefit analyses--rely on quantifiable inputs. In the absence of supportive empirical studies, scenic amenity has remained a subjective issue--as such, the concept of scenic benefits currently is perhaps more reconcilable with judicial and legislative processes than with our formal procedures for evaluating planning alternatives. Despite please and suggestions for expanding cost-benefit analysis to include "qualitative" considerations,[1] it appears that the planning process remains compatible only with those components of a project which have demonstrable costs and benefits--that is, components which can be expressed in terms of dollars, or relative values. As a result, the planning process often omits scenic considerations altogether, or relegates them to the status of "qualitative footnotes." In some cases, planners have assigned dollar or relative values to scenic improvements--usually with little, if any, basis for their judgements. It is appropriate here to note that the behavioral postulate which is most compatible with cost-benefit analysis--the Economic Man assumption--effectively ignores scenic considerations. In view of the apparent high level of public concern for visual quality in the environment, it

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[1]E.g., D. Haney, Problems, Misconceptions, and Errors in Benefit-Cost Analyses of Transit Systems, Stanford Research Institute (Menlo Park, California, 1970).

is reasonable to suggest that planning which relies on models employing the Economic Man assumption may be missing the mark of public values.

It has been noted that an objective of the investigation is to assess the importance of roadside scenery relative to other factors in route choice behavior. To the extent that this objective is attained, the results of the study may aid in the evaluation of planning alternatives. Also, in the sense that the research attempts to appraise the importance of scenery in the trip experience, the study may serve as an empirical argument in favor of the explicit consideration of scenic amenity in the planning process. It is therefore evident that a set of rather pragmatic planning considerations underlie the purposes of the investigation.

## The Investigation

The objectives discussed above dictated a particular set of requirements for the study area and choice of sample population. First, the testing of the scenery hypothesis required that the study's empirical observations be drawn from a spatial setting which contained both scenic and non-scenic shopping route alternatives. Also, the study's concern for evaluating the goals underlying route choice required that the investigation be specifically directed at subjects who possessed nearly perfect knowledge concerning the route alternatives to a shopping destination. In the

absence of perfect knowledge, it would not have been possible to reliably infer whether the attitudes and observed behavior of the subjects were due to their goals, or to imperfect levels of knowledge.

The study's empirical observations were drawn from an area located in Ann Arbor, Michigan. Data were obtained from personal interviews with a sample of shoppers. Two different techniques were employed in the interview to determine the considerations underlying the subjects' route choice decisions. First, a constrained-response questionnaire was utilized to identify the variables affecting route choice, and to give an indication of their relative importance. Second, the respondents were asked to provide preference ratings for a series of photographs of natural roadside scenery. The purpose of this latter procedure was to identify possible non-verbal issues which would be relevant to the assessment of scenery as a factor in trip behavior. The second phase of the interview was also motivated by the recognition that rather little is known concerning individuals' landscape preferences. In this regard the data collection was intended as a step towards the delineation of content domains in natural landscapes.

The aspects of the investigation relating to the questionnaire procedure are presented in Chapters II, III, and IV. Chapter II begins with descriptions of the research strategy, methodology, and study area, and proceeds

to a discussion of the findings of a preliminary study which formed the basis for the construction of the questionnaire. In the first part of Chapter III, findings are presented concerning the pattern of route choice behavior of the subjects; the bulk of the chapter is devoted to a discussion of the shoppers' attitudes towards the routes in the study area. In Chapter IV, the dimensions of attitudes underlying the route behavior of the subjects are identified and discussed; on the basis of the dimensions, scales are then constructed for the purpose of systematically comparing the attitudes of the shoppers.

The methodology and findings relating to the picture rating procedure are discussed in Chapter V: landscape dimensions are identified on the basis of preference domains; and the preference ratings are related to the shoppers' trip behavior. General conclusions from the findings of the two procedures are presented in Chapter VI.

# CHAPTER II

# METHODOLOGY OF QUESTIONNAIRE PROCEDURE

## Overview

To satisfy the particular requirements of the research design, a study area was located which contained a pair of parallel routes to a shopping center: one of the routes was scenic, but non-optimal in terms of travel time; the second route was non-scenic, but offered savings in travel time.

A preliminary survey was conducted which revealed that a large proportion of the shoppers' trips were made on the slower, scenic road. Open-ended responses recorded in the preliminary study suggested specific support for the scenery hypothesis, and also pointed to a number of other non-economic variables affecting the shoppers' route choice behavior. The findings from the preliminary study were used as a basis for developing the constrained-response questionnaire which was employed in the final interview procedure.

## Research Strategy

It has been noted that testing the scenery hypothesis requires that the study area contain both scenic and

non-scenic shopping route alternatives. The study's objective of evaluating the goals of route choice meant that the subjects had to possess high levels of knowledge about available shopping routes. In the absence of such knowledge, it would not be possible to attribute observed route behavior to variations in the shoppers' goals. In addition to these requirements, the study requires that the subjects have a choice between obtaining scenic benefits and minimizing distance.

In view of these requirements, the choice of study area itself necessarily became a crucial element in the research strategy. The study area was conceptualized as shown in Figure 2.1. This idealization specifies that each shopper has equal access to the alternative routes. The routes, which terminate in a common shopping destination, are differentiated on the basis of travel time and scenic appearance. Travel time, as a measure of functional distance, is the variable which determines the optimal route choice in an economic sense. The emphasis on travel time reflects the findings of several studies which have shown

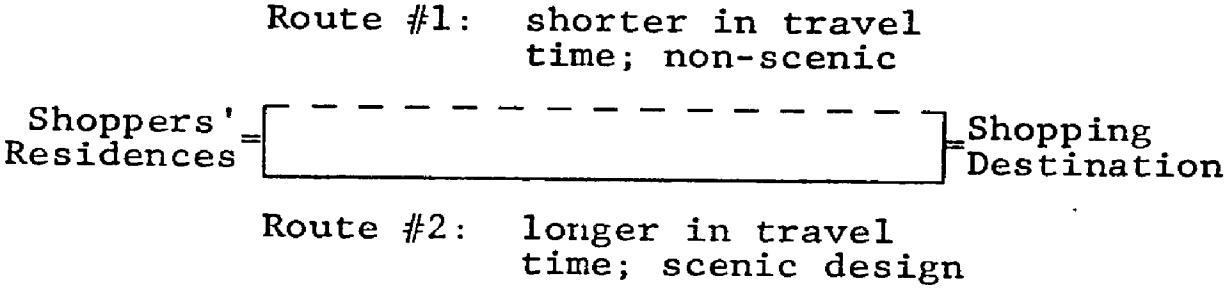


Figure 2.1.--Conceptualization of Study Area.

time savings to be the most important consideration in route choice.[1] In the conceptualized study area, selection of the slower, scenic route is interpreted as non-optimal behavior. The observation of such behavior in a real-world setting could be construed as preliminary support for the notion that non-economic factors affect shoppers' route choices.

## Study Area

A real-world counterpart of the conceptualization was located in Ann Arbor, Michigan (see Figure 2.2). In this study area, the two route alternatives are represented by: (1) the Huron Parkway, a scenic, divided four-lane highway with "controlled" access; and (2) a parallel section of expressway, which reflects the design specifications of the Federal Interstate System. The trip origin is Orchard Hills subdivision, and the trip destination is "Arborland," a large shopping center. Arborland's prominence suggested that it is nearly universally known to the shoppers within the study area.

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[1]S. Hille and T. Martin, "Consumer Preference in Transportation," Highway Research Record No. 197, 1967, pp. 36-41; P. Claffey, "Characteristics of Passenger-Car Travel on Toll Roads and Comparable Free Roads for Highway User Benefit Studies," Public Roads, Vol. 31 (1961), pp. 167-76; E. W. Campbell and R. McCargar, "Objective and Subjective Correlates of Expressway Use," Highway Research Board, Bulletin No. 119, 1956, pp. 17-38; Cook County Highway Department, Chicago, Illinois, Expressway Influence on Parallel Routes: A Study of Edens Expressway (Chicago: Inland Press, Inc., 1955).

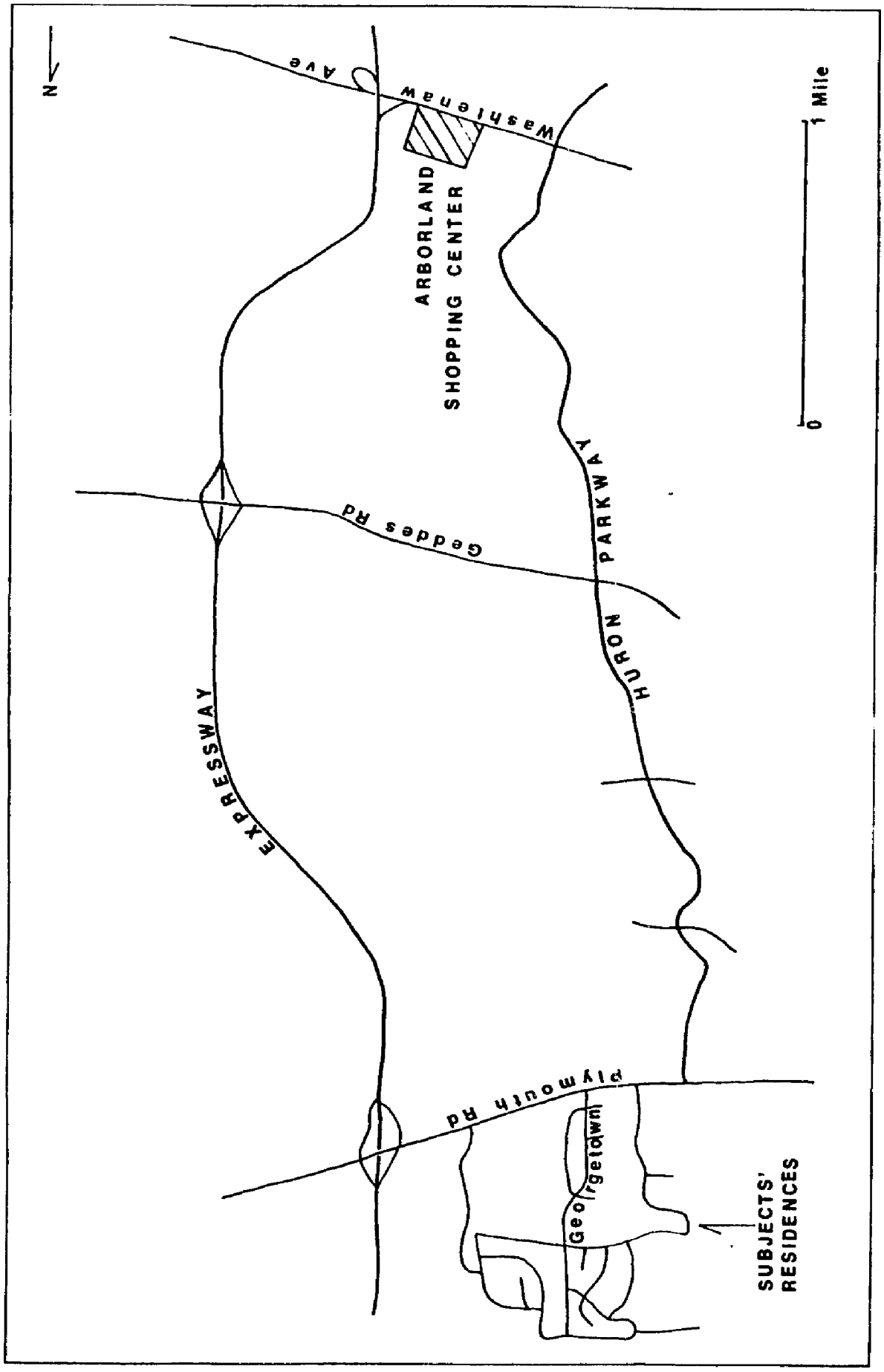


Figure 2.2.--Study Area

Table 2.1 summarizes various characteristics of the two alternative routes to Arborland Shopping Center. It is evident that the Expressway route is optimal in terms of minimizing functional distance. Although the Expressway distance for a one-way trip is approximately one mile longer than the Parkway, the travel time required on the former is about three minutes shorter than on the latter.[1] This

TABLE 2.1

TRAVEL TIME AND DISTANCE CHARACTERISTICS OF THE ROUTES TO ARBORLAND SHOPING CENTER

| | Huron Parkway Route | Expressway Route |
|---|---|---|
| Trip Distance (one-way: as measured from corner of Georgetown Blvd. and Plymouth Rd. | 3.9 miles | 4.8 miles |
| Trip Time | (av.) 8 minutes, 45 seconds | (av.) 5 minutes, 50 seconds |
| Speed Limit | 35 mph | 70 mph |
| No. of Stoplights | 6 | 2 |

[1]The travel time listed for each route represents the mean value for a large number of trips made under "average" driving conditions. The times listed do not reflect trips made during rush hours. In this regard it should be noted that the Parkway trip--if made during the rush hours--can be as much as 8-10 minutes longer than the Expressway trip. This increase in travel time is largely due to traffic congestion at the intersection of Washtenaw Avenue and the Parkway. The non-optimal character of the Parkway relative to the Expressway, therefore, is sharply heightened during peak traffic conditions.

represents an appreciable time saving in view of the overall trip times.

A scenic route alternative is well represented in the study area by the Huron Parkway. Indeed, scenic considerations received explicit emphasis in the road's design. Thus much of the land immediately adjacent to the Parkway has been landscaped to achieve bays and other scenic effects (Figure 2.3). Utility lines have been placed underground,



Figure 2.3.--The Huron Parkway

and billboards are rigidly excluded. The road's scenic character derives in part from the fact that it was largely built on public-owned, undeveloped land. In this regard, the designers of the Parkway attempted to achieve scenic

beauty by minimizing disruption of the existing natural landscape.[1] The road therefore was engineered to fit the terrain--in order to reduce landscape damage caused by cuts and fills. Partly as a consequence of this design objective, the Huron Parkway has numerous curves and hills. These latter features contribute to the non-optimal character of the Parkway relative to the Expressway. In one respect, the Expressway is not ideal as a non-scenic route alternative to the Huron Parkway. The Expressway's shortcoming in this regard is that its roadside scenery is rather too attractive to establish a dramatic contrast between scenic beauty and ugliness with respect to the Parkway. The Expressway route traverses a section of countryside characterized by moraine relief and considerable natural vegetation. The relatively sparse residential and commercial development along the route is not visually blighted, and a local ordinance has prevented the erection of billboards. (This latter characteristic is in marked contrast to the majority of expressway roadsides in Michigan.) Despite the semi-scenic character of the Expressway, however, important differences exist between the two routes with regard to the driver's experience of their respective roadside environments. Thus the Expressway's environment--unlike that of the Parkway--has not been specifically landscaped to achieve

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[1]Personal communication from Howard F. Russell, Ann Arbor Public Works Department.

scenic effects. Furthermore, the extreme width of the Expressway roadway dictates that the observer is generally located farther from the roadside environment than he is on the Parkway.[1] Finally, it was hypothesized that the high driving speed of the Expressway restricts the driver's ability to visually process roadside scenery. It was felt that these differences collectively result in a scenic superiority for the Parkway vis-a-vis the Expressway.

An additional deviation of the real-world example from the idealized study area occurs in the case of the differences in access between the shopping center and the two routes. In particular, these differences favor the Expressway route for the trip to Arborland. The Expressway is located closer to the entrances to Arborland's parking lot than is the Huron Parkway. Also, access from the Expressway

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[1]The absence of foreground scenery on the Expressway is in part the result of safety considerations. Thus expressway specifications dictate the provision of wide shoulders and the removal of adjacent landscape elements to create a broad "recovery area." These design requirements result in the replacement of the existing environment with strips of pavement and grass adjacent to the road that are often more than 100 feet wide. The driver on the Huron Parkway, by contrast, is never more than approximately 40 feet from features of the natural environment.

In any event, the driver's perception of most foreground elements on the Expressway is precluded by the high driving speeds. The report by Edwards and Kelcey, Inc. (1972, p. 55) points out that when travel speed is 70 mph, individual foreground objects are blurred out to a distance of approximately 70 feet from the road. High driving speeds, however, do not preclude the perception of linear foreground elements such as hedges or rows of trees.

to Arborland requires two right-hand turns that are unobstructed by stoplights; access from the Parkway, on the other hand, involves more difficult left-hand turns and possible delays by stoplights. This advantage for the Expressway, however, is at least partially offset by the access characteristics of the two routes for the trip from Arborland. Here the Parkway holds perhaps a slight advantage. Two right-hand turns are required for access to the Parkway from the shopping center, while access to the Expressway ramp involves a difficult left-hand turn across the four lanes of congested traffic. It was anticipated that these differences--favoring the Expressway to Arborland, and the Parkway from Arborland--would be reflected in the route choice behavior of some of the shoppers.

## The Population Sampled

It was noted above that the research strategy requires the shoppers to have equal access to the alternative routes. This requirement restricts the possible locations of trip origins, and in so doing may dictate the particular population of shoppers which can be sampled.

The sample of shoppers for the study was selected from a group of approximately 400 families whose homes are located in Orchard Hills subdivision between the Expressway and the Huron Parkway, and who have nearly equal access to either route for the trip to Arborland. The 1970 Census

data place the households in middle and upper-middle income categories, and reveal a rather high degree of socio-economic homogeneity within the study area. Most of the families own two cars; all the families live in single unattached residences having values in the range of thirty-five to forty-thousand dollars. The vast majority of the household heads are between the ages of 25 and 44 years, and very few are older than 59 years. Most of the families have two children of elementary school age. The adults are highly educated--about 90 percent are high school graduates, and the majority have college degrees. This high level of education is reflected in the census data by the fact the "Professional, Technical, and Kindred" workers constitute the largest single occupation category.

It could be argued that the socio-economic homogeneity of the subjects represent both an advantage and a disadvantage. On the one hand, such homogeneity largely eliminates any need to control for socio-economic variables, and enhances the validity of the results for the particular population being sampled. On the other hand, the subjects' homogeneity restricts the extension of the results to other contexts. In this regard it might seem that the results speak reliably only for individuals whose levels of income and education--while not unrepresentative of Ann Arbor--are well above national averages. This objection, however, does not appear too serious since the research methodology is

amenable to replication. Underlying this latter point is the conviction that a research event should be viewed as a single step in the context of a larger, continuing process.

## Preliminary Study

Several considerations made a preliminary study advisable. First, inasmuch as many of the study's objectives are contingent on the existence of non-optimizing trip behavior, it seemed imprudent to embark on the full-scale data collection without having first verified the presence of such behavior. Also, a preliminary investigation was necessary for the construction of a constrained-response questionnaire. This questionnaire format was selected for the final data collection primarily because of its compatibility with quantitative analysis. The strategy of the preliminary study involved using an open-ended format to investigate the route choice behavior of a limited sample of shoppers. The results of this open-ended study provided a basis for formulating and evaluating a number of hypotheses, some of which eventually were incorporated into the final constrained questionnaire.

Thirty-one shoppers were interviewed for the preliminary study (11 males; 20 females). The individuals were selected by a stratified random sampling procedure.[1]

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[1]The individuals were selected from the Ann Arbor Telephone Directory. Specifically, an initial sample was drawn which included those shoppers who were listed on the

Initial contact with the subjects was made through a letter of introduction; the open-ended interviews followed shortly thereafter and were conducted by telephone.

In the interview each subject was first asked a series of questions to determine whether he shopped at Arborland; how frequently he shopped there; which route or routes he drove to Arborland; and the percentage of trips taken on each route. This was followed by open-ended questions concerning the advantages and disadvantages which the subject associated with the Huron Parkway and the Expressway. Finally, responses were recorded regarding length of residence; vehicle age; and whether children accompanied the subject on his trips to Arborland.

The interviews revealed that all thirty-one respondents shopped at Arborland (an average of 3.1 times/month/individual). Also, every shopper indicated that he was aware of both the Expressway and the Parkway as route alternatives. This suggested that the subjects chose their routes to Arborland under conditions which approximate perfect knowledge. Put differently the preliminary study indicated that it is indeed appropriate to attribute the subjects' route choice behavior to differences in their goals, rather than to limitations in their levels of knowledge.

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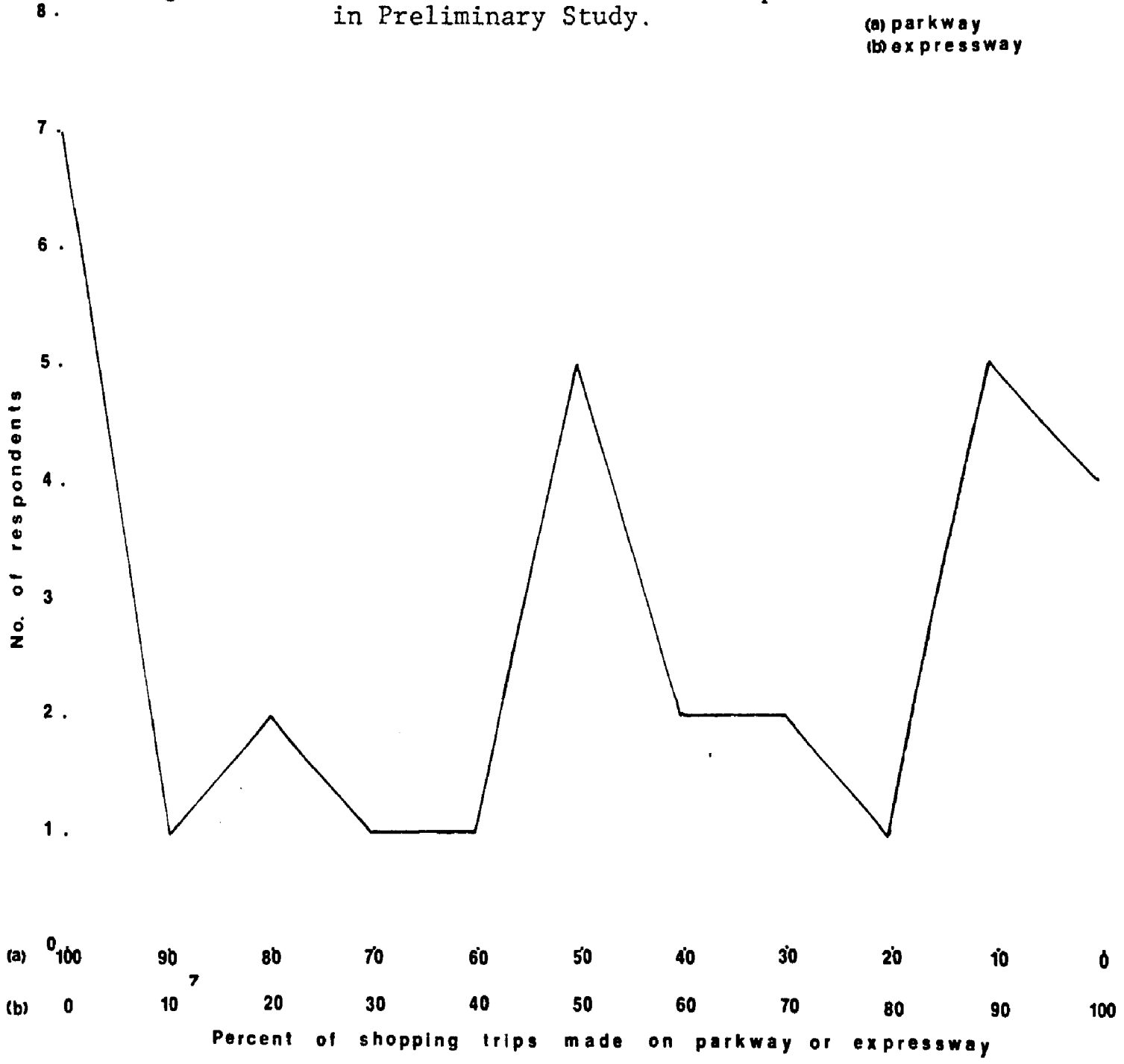
even-numbered pages of the directory. From this group, the final sample was selected using a random numbers table.

The route choice behavior of the subjects in the preliminary study is shown in Figure 2.4. The figure reveals that only four of the shoppers behaved in strict accordance with the Economic Man assumption, that is, they chose the Expressway 100 per cent of the time. The remaining twenty-seven subjects either varied their routes, or relied exclusively on the Parkway. The importance of the Parkway is suggested by the fact that 54 per cent of the total trips of the subjects were made on this route. Figure 2.5, which differentiates the route choice decisions according to sex, suggests that the male shoppers are somewhat more inclined than the females to favor the Expressway. However, even among the males there appears to be considerable route choice behavior which was non-optimizing in an economic sense.

The open-ended responses given by the shoppers in the preliminary study strongly suggested that non-economic considerations were in fact responsible for the observed non-optimizing behavior. An examination of the responses revealed that the shoppers associate economic (distance-minimizing) advantages with the Expressway, while they attribute non-economic advantages to the Huron Parkway.

A careful evaluation of the open-ended responses indicated that a variety of variables should be included in the final constrained questionnaire under the umbrella of non-economic considerations. To aid in both evaluating the preliminary results and in constructing the final

Figure 2.4.--Route Choice Behavior of Respondents in Preliminary Study.



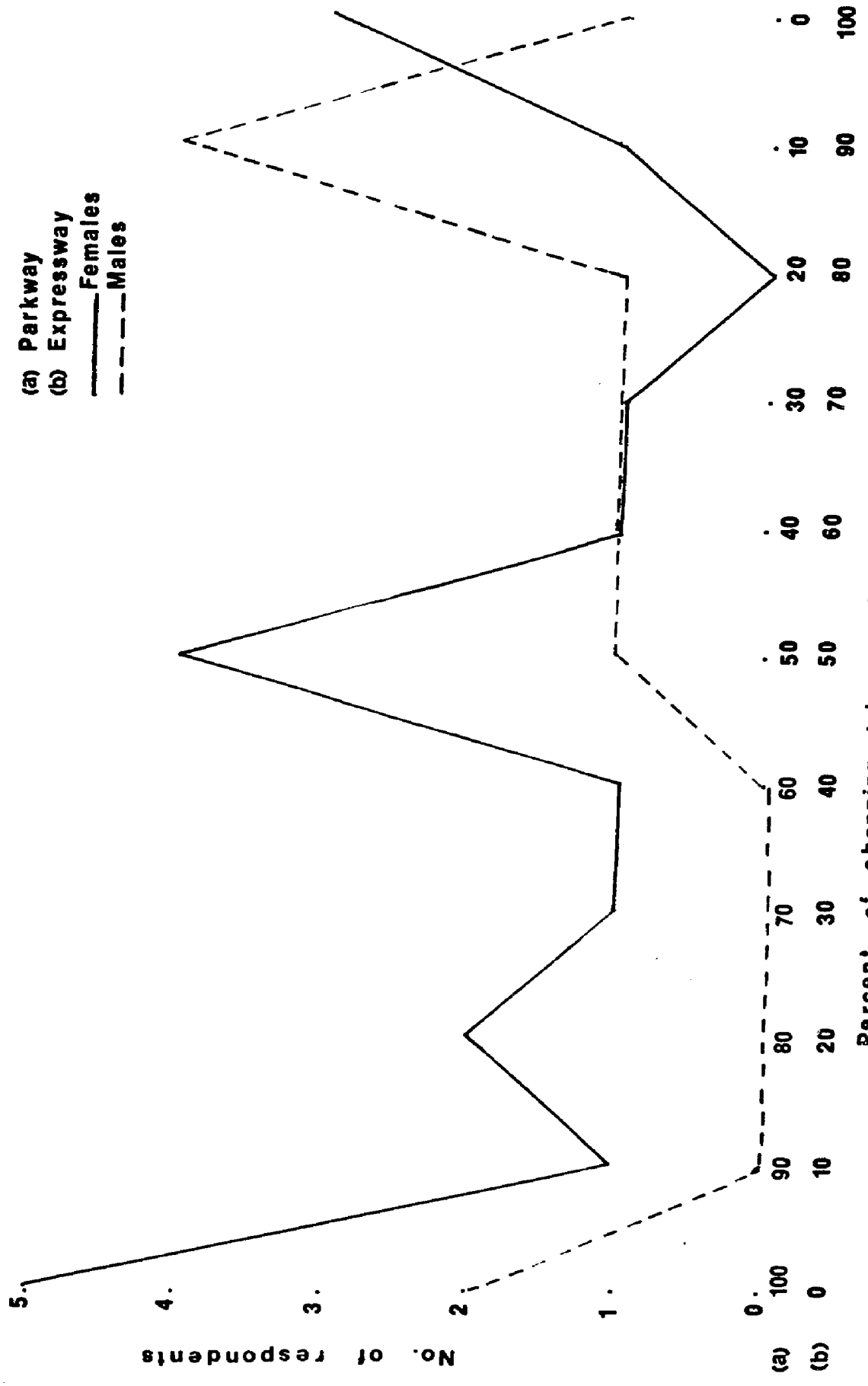



Figure 2.5.--Route Choice Behavior of Males and Females in Preliminary Study.

questionnaire, these variables were grouped into tentative dimensions. These dimensions, which are listed below, served in the final study as a set of hypotheses concerning the non-economic factors which affect route choice behavior.

Non-Economic Dimensions (Tentative):

1. roadside scenery
2. danger/safety
3. level of attention required for driving
   (This affects, for example, the driver's ability to view the roadside environment; to cope with in-car distractions; to feel relaxed; etc.)
4. changing moods/needs of the driver
   (The shopper's route choice may be affected by whether or not he is "in a hurry"; or "feels like a change"; etc.)

Importantly, the route characteristic most frequently mentioned by the subjects in the preliminary study as an "advantage" was the scenic appearance of the Huron Parkway. A number of the subjects' open-ended responses strongly suggested that the Parkway's scenery was an important factor in motivating their choice of the route. For example, one respondent stated: "I take the Parkway because of the view." Another said: "I know I'm going out of my way, but it's so pretty it's worth it." Several Parkway users emphasized that the road's beauty was "the most important thing" affecting their choice. The open-ended responses therefore suggested support for the hypothesis that the appearance of roadside environments affects drivers' route choice decisions.

In summary, the preliminary study achieved several objectives which laid the groundwork for the final data collection. By documenting the existence of non-optimizing route choice behavior, and in particular by supporting the scenery hypothesis, the preliminary results indicated that the intended study was conceptually sound. Also by revealing that the subjects possess knowledge of both route alternatives to the shopping center, the preliminary investigations demonstrated that the population satisfies an important pre-condition of the research. Finally, the preliminary findings shed light on the factors which affect route choice behavior, and thereby formed a basis for constructing the constrained-response questionnaire.

## The Final Questionnare

The final questionnaire--which appears in Appendix A --was constructed after a careful evaluation of the subjects' open-ended responses. An attempt was also made to incorporate into the questionnaire various issues which were not specifically verbalized by the respondents--but which nonetheless appeared to affect their route decisions. In this regard the results of the preliminary study suggested that some of the shoppers were not aware of all the factors which influenced their choices. For example, it was observed that women with young children tended to prefer the Huron Parkway for the trip to Arborland. This behavior was tentatively

attributed in part to considerations of (1) danger and (2) attention. This latter point implies that the women prefer the Parkway because the road requires a lower level of driver attention--which permits the driver to better cope with distractions from children. These and other hypotheses were incorporated into the questionnaire in an attempt to isolate non-verbal issues.

It was noted above that information concerning the subject's length of residence was collected in the preliminary study. An examination of the preliminary results indicated that the length of residence variable was not related to the respondents' attitudes or route choice behavior. Consequently, this variable was not included in the final questionnaire. Also, neither the preliminary nor the final study assessed the importance of cost considerations in the shoppers' route choice decisions. The cost variable was omitted since several studies[1] which have shown that drivers attach little or no importance to automobile operating costs.

The questionnaire was specifically designed so that the respondent could indicate either a positive or negative response regarding a given route characteristic. This

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[1] J. B. Lansing and G. Hendricks, "How People Perceive the Cost of the Journey to Work," Highway Research Record No. 197, 1967, pp. 44-55; R. M. Michaels, "Attitudes of Drivers Toward Alternative Highway and Their Relation to Route Choice," Highway Research Record No. 122, 1966, pp. 50-74.

strategy was necessary because there were several instances in the preliminary study where attitudes towards a specific route characteristic varied widely between individuals. An example is seen in the responses concerning the curves of the Huron Parkway. Thus seven shoppers described the curves as disadvantages--reporting that the curves "slow you up," or make driving more difficult. In contrast, four other subjects said they though the curves made the Parkway more scenically attractive, and therefore listed them as advantages.

Underlying the differences in the "advantage" and "disadvantage" responses is the fact that a given route feature may be characterized by a wide range of meanings and associations. The finding that several of the route features are multidimensional was one of the principal insights gained through the preliminary study. The quality of multidimensionality was also observed in the case of the "driving speed" variable. Thus the open-ended responses suggested that one group of shoppers views driving speed primarily as an element which affects travel time. Accordingly, these shoppers perceive the Expressway's driving speed as an advantage. The preliminary data also showed, however, that another group of subjects views driving speed as a route characteristic affecting their sense of safety or danger. On this basis these subjects tend to perceive the Expressway's speed as a disadvantage. Additionally, it seemed that many

subjects may associate driving speed with the driver's ability to view the roadside environment. As a result, these shoppers conceive of the Parkway's slower speed as an advantage.

The questionnaire was designed to reflect the apparent multidimensional character of several of the route variables. In this regard the questionnaire ascertains the level of importance which the respondent attaches to each variable within the context of a number of different dimensions. The results therefore reflect the meaning, as well as the level of importance, of each variable in the respondent's route choice decision.

Underlying the questionnaire is the view that the driver's scenic experience is the product of several variables. In addition to the roadside environment, the questionnaire also assessed the role of various other factors in affecting the quality of the visual experience. These variables include: (1) driving speed; (2) the appearance of the roadway alignment; and (3) the angles at which scenery is viewed.

The effect of driving speed on the scenic experience has already been noted. The road alignment variable was included to examine the notion--advanced notably by Pushkarev[1]

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[1]B. Pushkarev, "The Esthetics of Freeway Design," Landscape, Vol. 10 (1961), pp. 7-14.

and Appleyard et al.[1]--that the highway ribbon in itself has potential as an esthetic feature. In this latter regard, the curving alignment of the Huron Parkway may perhaps be expected to be more visually pleasing than the relatively straight alignment of the Expressway. The viewing angle variable was included in the questionnaire to assess the possibility that the curves and hills of the Parkway facilitate the driver's viewing of the roadside environment. Thus a number of designers have emphasized the importance of curved roadway alignments in focusing the observer's attention on landscape displays.[2]

Obviously the questionnaire does not examine all the factors which constitute the scenic experience of the drivers. Indeed, the questionnaire does not at all examine variables relating to "sequential" visual experience and "kinesthetic" sensation.[3] The former, which is sometimes

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[1]D. Appleyard, K. Lynch, and J. Meyer, The View from the Road (Cambridge, Mass.: M.I.T. Press, 1966).

[2]H. Hubbard and T. Kimball, An Introduction to the Study of Landscape Design (New York: Macmillan, 1917; G. Cullen, Townscape (New York: Reinhold, 1961); P. L. Hornbeck (project director), Highway Esthetics: Functional Criteria for Planning and Design, Department of Landscape Architecture, Harvard University Graduate School of Design, Cambridge, Mass., 1968; M. Rapuano et al., The Freeway in the City: Principles of Planning and Design (Washington, D.C D.C., 1968); Edwards and Kelcey, Inc., Highway Planning Studies, Upper Great Lakes Region, Volume 4, General Findings and Applications (Minneapolis, Minnesota, 1972).

[3]Appleyard et al., The View from the Road.

also called "serial vision,"[1] refers to the experiencing of a continuous succession of self-contained, contrasting scenes. The latter refers to the driver's sense of his body's motion in relation to the elements of the landscape. The possible importance of these sensations is acknowledged; their treatment, however, was beyond the scope of the study.

## Interview Procedure

The shoppers interviewed for the final data collection were selected from the study area by a stratified random sampling procedure.[2] Those individuals who had been interviewed in the preliminary study were intentionally excluded from the final survey. Initial contact with the subjects was made through a letter of introduction which briefly explained the nature of the study. Within a few days after receiving the letter, each subject was contacted by telephone in order to obtain his consent for participation in the study, and to arrange an appointment for the interview.

The interview was performed in the subject's home, and required approximately 45 minutes of the respondent's time. A total of fifty-two shoppers constituted the sample;

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[1]Cullen, Townscape.

[2]The shoppers in the final study were selected according to the same sampling procedure employed in the preliminary study.

the data from forty-eight of the individuals (24 males; 24 females) were retained for the study. The information from four interviews had to be discarded, largely because of incompletely filled out questionnaires.

# CHAPTER III

## QUESTIONNAIRE RESULTS: ROUTE CHOICE BEHAVIOR RESPONDENTS' ATTITUDES

### Overview

In the first part of the interview, each subject was asked to complete a constrained-response questionnaire. The questionnaire--which had been developed on the basis of the findings of the preliminary study--was designed to determine the subject's route choice behavior for the trip to Arborland Shopping Center, and to identify the variables which affected his decisions. The findings from the questionnaire procedure are presented here and in Chapter IV.

This chapter begins by describing the pattern of route choice behavior which characterizes the study area. Next, findings are presented concerning the respondents' attitudes towards the two alternative routes--the Huron Parkway and the Expressway. In an attempt to delimit the variability characterizing the subjects' perceptions and values, particular attention is drawn to the differences between the shoppers' questionnaire responses. In order to analyze these differences, the shoppers are stratified into a number of groups on the basis of categorical variables. These

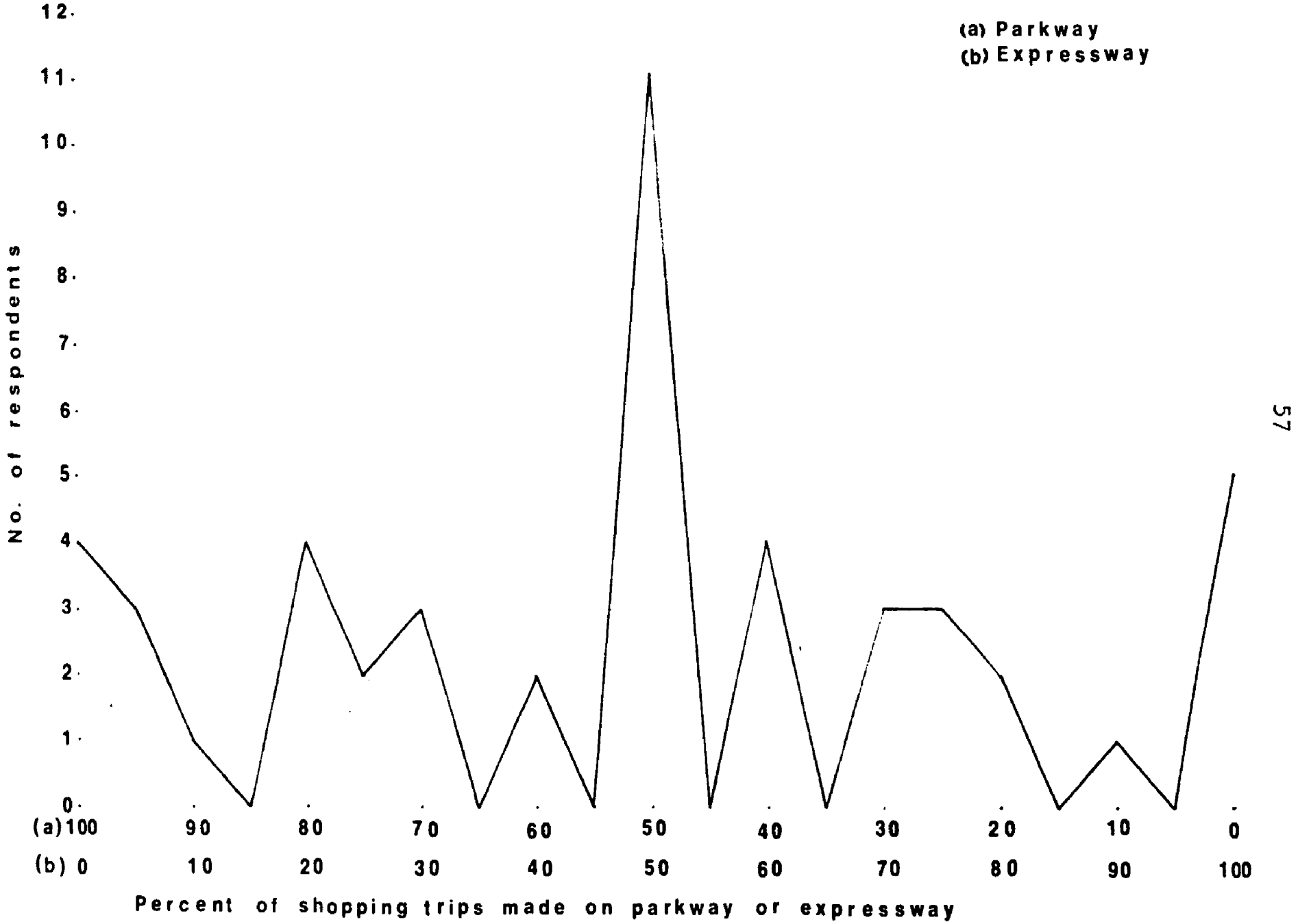
variables include sex; rate of Parkway usage; shopping frequency; age of vehicle; and whether children accompanied the driver. The results of quantitative analyses (t-tests, analysis of variance) are presented which identify instances where the attitudes of the various strata of shoppers are significantly different. In many cases, the attitudes of the subject groups are related to the observed pattern of their route choice behavior.

## Observed Route Choice Behavior

The interviews revealed that all forty-eight subjects shopped at Arborland. It was also evident that all of the respondents were aware of both the Huron Parkway and the Expressway as route alternatives. Each shopper made an average of about 3.5 trips to Arborland per month. (In the preliminary study, the shoppers made an average of 3.1 trips/month/individual.) The majority of the subjects made from two to four trips to the shopping center per month; few of the respondents made less than two trips, or more than five trips per month.

Figure 3.1 below shows the route choice behavior of the shoppers. As in the preliminary study, there is considerable behavior which is non-optimizing in an economic sense. The results reveal that only five of the forty-eight subjects behave in strict accordance with the Economic Man assumption,

Figure 3.1.--Route Choice Behavior of Respondents in Final Study.



that is, they use the Expressway 100 per cent of the time. The remaining subjects either rely exclusively on the Parkway, or vary their routes.

It had been anticipated that the shoppers in the final study would be somewhat more oriented towards the Expressway in their route choices than were the respondents in the preliminary study. The principal reason for this expectation was that two additional stoplights were installed on the Parkway in the interim between the studies. These new stoplights increased the travel time required for a one-way trip to Arborland by an average of approximately twenty seconds.[1] It was expected that this widening of the time differential between the two routes would be reflected by an increase in the proportion of trips made on the Expressway.

Another consideration which led to the expectation of increased Expressway usage was that the preliminary study was conducted during the summer months, while the final study was performed in the winter. Thus, it was speculated that the absence of leaves and other vegetation during the

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[1]Table 2.1, which summarizes the characteristics of the two route alternatives, lists the average time required for a one-way trip on the Parkway as 8 minutes, 45 seconds. This figure reflects the effects of the new stoplights, and therefore represents the conditions prevailing during the final study. At the time of the preliminary study, a one-way trip on the Parkway was approximately 20 seconds shorter, requiring on the average about 8 minutes, 25 seconds.

winter would detract from the scenic superiority of the Parkway. In this regard it is appropriate to note that seven shoppers in the preliminary study had somewhat ambiguously mentioned "greenness" as a scenic attribute of the Parkway. It was therefore felt that the importance of roadside scenery as a non-economic payoff would be diminished at the time of year of the final data collection, and the appeal of the Parkway as a route alternative would consequently be reduced.

The results of the final study fail to support the expectation of increased Expressway usage. Indeed, the findings reveal that, on the average, the shoppers in the final study used the Huron Parkway for a slightly larger percentage of their trips to Arborland than did the subjects in the preliminary study (56 per cent vs. 54 per cent). A comparison of Figure 3.1 with Figure 2.3 reveals that the primary difference between the behavior of the two groups of subjects is the relatively larger proportion of shoppers in the final study which divided its trips equally between the Parkway and the Expressway. Also, a smaller proportion of the final sample of respondents relies exclusively on only one route for their trips to the shopping center.

These findings do not necessarily refute the expectation that the use of the Expressway would be larger for the final than for the preliminary study. To the contrary, a few respondents in the final study verbally expressed their

annoyance at the additional trip interruptions caused by the new stoplights on the Parkway.[1] A possible explanation for the observed increase in Parkway usage is that the various factors that may have favored the Expressway at the time of the final data collection were offset by other seasonal conditions which enhanced the appeal of the Parkway. For example, the results suggested that when winter driving conditions prevailed, some shoppers who normally drove the Expressway would opt for the slower Parkway. Unfortunately, firm conclusions with regard to the seasonal advantages or disadvantages of the routes are not possible because the open-ended responses of the preliminary study cannot be systematically compared with the results of the final questionnaire. It appears likely, however, that the considerations underlying the shoppers' route choices in the final study differed at least slightly from those of the subjects' in the preliminary study. In any event, the point remains that both studies revealed a substantial level of non-optimizing shopping trip behavior in the study area.

Figure 3.2 differentiates the route choice behavior of the subjects according to sex. A notable feature of the

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[1]A larger group of respondents voiced a different objection to the stoplights. These shoppers said they felt that the utility poles, cables, etc., associated with the new installations were "eyesores," and as such detracted from the scenic quality of the Parkway. This group of subjects did not mention travel time considerations in their objections to the stoplights.

results is the rather high degree of conformity existing between the two groups. A t-test performed on the means of the two groups' route usage behavior (expressed as the percentage of total trips which used the Parkway) indicated that the choice behavior of the males was not significantly different from that of the females. An examination of Figure 3.2 indicates that the male shoppers only slightly more inclined than the females to favor the Expressway. The females, on the other hand, show a slight preference for the Huron Parkway. It is appropriate here to note that the findings of other researchers have indicated that men tend to prefer expressways more than do women.[1] The differences between the trip behavior of the sexes shown in Figure 3.2 are less pronounced than those revealed in the preliminary study (see Figure 2.4). Despite these differences, the findings from both studies indicate that a substantial level of non-optimizing behavior exists among both sexes in the study area.

## Attitude Differences Between Males and Females

Following the observational phase of the study, the analytical phase began with an examination of the differences

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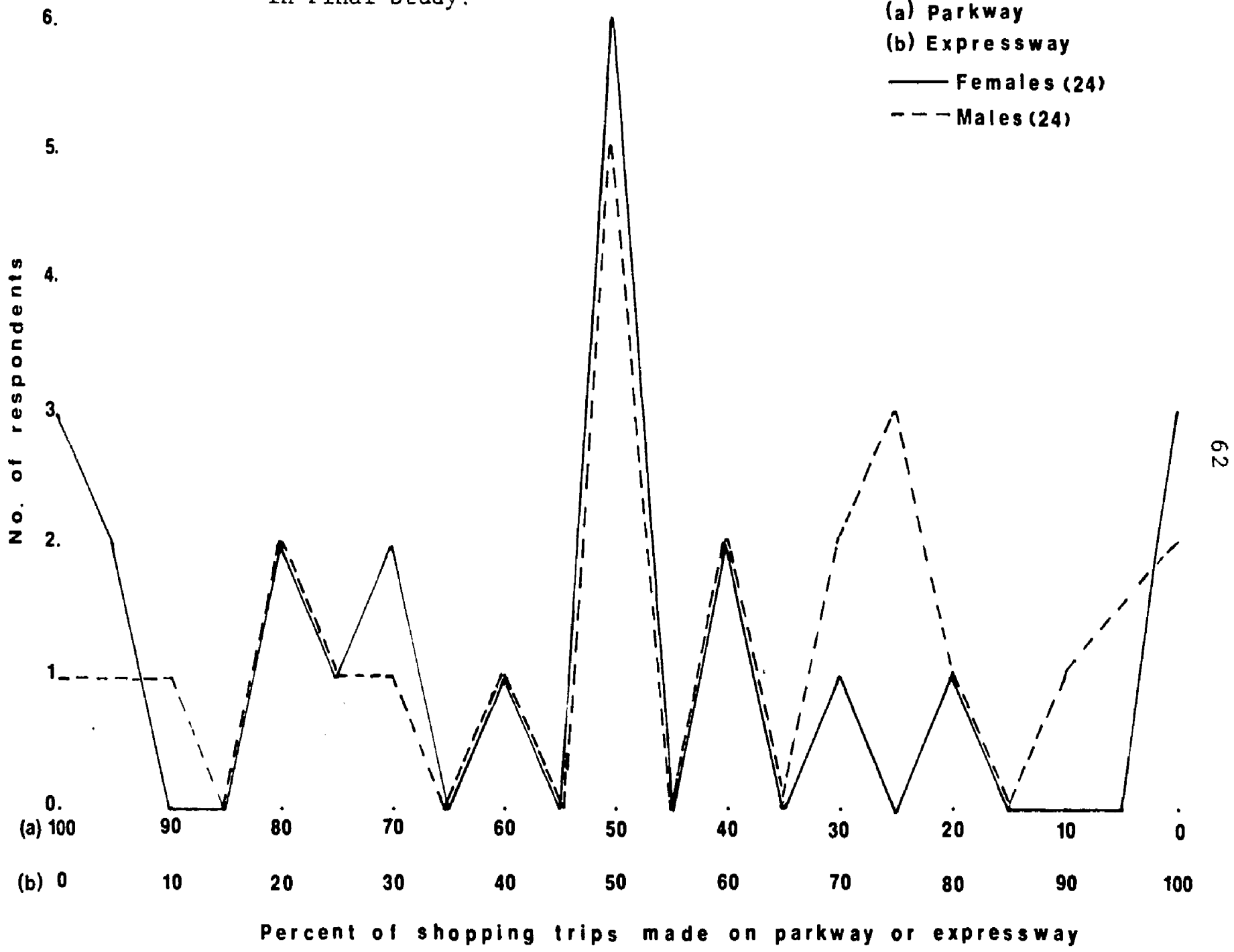
[1]Cook County Highway Department, Chicago, Illinois, Expressway Influence on Parallel Routes: A Study of Edens Expressway (Chicago: Inland Press, Inc., 1955); R. M. Michaels, "Attitudes of Drivers Toward Alternative Highways and Their Relation to Route Choice," Highway Research Record No. 122, 1966, pp. 50-74.

Figure 3.2.--Route Choice Behavior of Males and Females in Final Study.



between male and female attitudes. The pattern of route choice behavior indicated that the male shoppers were perhaps slightly oriented to the Expressway, while the females' choices somewhat favored the Parkway. In view of this pattern of behavior, it was reasonable to speculate that the analysis of the questionnaire responses would point to attitude differences between the males and females. Accordingly, t-tests were performed to determine if the means of the males' responses in the questionnaires differed significantly from the means of the females' responses.

Table 3.1 below summarizes the findings of the t-test analysis for those parts of the questionnaire that were answered by all forty-eight subjects.[1] The results in Table 3.1 relate only to those questions for which statistically significant differences (level ≥ 95 per cent) were found to exist between the means of the responses. A high value does not necessarily indicate a positive or negative attitude. Therefore it is necessary to look at the exact wording of the question in order to interpret the results correctly. Regardless of the wording, a mean response of 3.5 indicates perfect indifference.

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[1]These include Parts III, V, VI, VII, and VIII. If the subject relied exclusively on the Parkway for his trips to Arborland, he was asked to omit Part IV of the questionnaire; if he relied exclusively on the Expressway route, he omitted Part II.

TABLE 3.1

RESPONSES INDICATING SIGNIFICANTLY DIFFERENT (PROBABILITY ≥ 95%) ATTITUDES BETWEEN MALE AND FEMALE SHOPPERS. ALL SUBJECTS (1-6 point scale)[a]

| Variable No. | Question Content | Mean Responses Male | Mean Responses Female | Interpretation of Responses |
|---|---|---|---|---|
| 21 | The curves in the Parkway make the road more attractive. | 5.29 | 5.67 | Both sexes agree with the statement, but the females agree more strongly. |
| 55 | Merging onto the Expressway makes me feel unsafe. | 3.16 | 4.04 | Females slightly agree; males slightly disagree. |
| 59 | Traffic density on the Expressway requires that a high level of attention be paid to driving. | 4.17 | 5.29 | Males agree slightly; females agree strongly. |
| 63 | The driving speed on the Expressway makes me feel safe. | 3.50 | 2.71 | Males are indifferent--they neither agree nor disagree; females disagree. |
| 65 | The driving speed on the Expressway is favorable for people with older cars. | 3.50 | 2.71 | Males disagree slightly; females disagree strongly. |
| 75 | To what degree do you associate the mood--"feel like viewing nature"--with choosing the Expressway? | 1.67 | 1.17 | Females associate the mood "not at all," males associate the mood very slightly. |

Table 3.1.--(continued)

| Variable No. | Question Content | Mean Responses Male | Mean Responses Female | Interpretation of Responses |
|---|---|---|---|---|
| 78 | Indicate preference for choosing Parkway or the Expressway: when it's snowing. | 3.96 | 2.79 | Males slightly prefer the Expressway; females slightly prefer the Parkway. |

[a]A mean score > 4.70 or < 2.30 connotes "strong" attitude.
Mean = 2.80-4.20 connotes "slight" attitude.

The results reveal a pro-Expressway orientation on the part of the males, and a pro-Parkway stance on the part of the females. These findings are consistent with the slight biases in route choice behavior that were described earlier. It is important to note that most of the variables included in Table 3.1 deal specifically with the Expressway, and a number appear to be associated with considerations of danger and attention. A tentative conclusion in this regard is that the pro-Parkway behavior of some of the females may be related to their perception of the Expressway as a dangerous road. The appearance of variable #21 in Table 3.1 (concerning whether or not the curves in the Parkway enhance the road's appearance) is ambiguous, and may indicate that a "halo effect" was operative. This possibly suggests either that a female's response can be biased upwards by her liking for the Parkway, or that a male's response to the question could be biased downards by his orientation to the Expressway.

Table 3.2 summarizes the results of the t-test analyses relative to male/female differences for part II and IV of the questionnaire. These sections were omitted by the subjects who relied exclusively on one route for the trip to Arborland. The results in Table 3.2 are generally consistent with those reported in Table 3.1. The females' responses again tend to be more positive than the males' towards the Huron Parkway, and more critical than those of

TABLE 3.2

RESPONSES INDICATING SIGNIFICANTLY DIFFERENT (PROBABILITY ≥ 95%) ATTITUDES BETWEEN MALE AND FEMALE SHOPPERS. 39 SUBJECTS--EXCLUDING SUBJECTS WHO RELY ON ONE ROUTE

| Variable No. | Question Content | Mean Responses | | Interpretation of Responses |
|---|---|---|---|---|
| | | Male | Female | |
| 7 | Rate as advantage or disadvantage: traffic density on Parkway. | 3.86 | 4.50 | Slight advantage to males; more important advantage to females. |
| 8 | Rate as advantage or disadvantage: Parkway trip time. | 2.86 | 3.61 | Males view as slight disadvantage; females are indifferent. |
| 40 | Rate as advantage or disadvantage: the view on the Expressway. | 2.52 | 1.94 | Disadvantage to males; important disadvantage to females. |
| 43 | Rate as advantage or disadvantage: access from Arborland to the Expressway. | 3.52 | 2.44 | Males are indifferent; females view as disadvantage. |

the men towards the Expressway. The difference in the sexes' responses to question #8, concerning the trip time of the Parkway route, are of particular interest. Thus it has been emphasized that the Expressway route offers time savings relative to the Parkway. The males' perceptions in this regard are accurate, as is evident from Table 3.2. The females' responses, however, indicate a position of indifference regarding the Parkway's travel time, and on this basis it might be argued that their knowledge of the Parkway is imperfect. This view gains some support from the findings of Campbell and McCargar, who reported that expressway users are more accurate in their judgments of travel time than are non-users.[1] The above argument is contradicted, however, by the women's responses to other questions which indicate that they possess accurate knowledge concerning the time/distance characteristics of the two routes. Thus both the female and male shoppers accurately rated the Parkway's trip distance as an "advantage" relative to the Expressway (variable #16). More importantly, the women agreed with the males in their responses to question #46 by rating the Expressway's trip time as an advantage. It appears possible, therefore, that the women's "indifference" rating regarding the Parkway travel time may be in part attributable to a

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[1] E. W. Campbell and R. McCargar, "Objective and Subjective Correlates of Expressway Use," Highway Research Board, Bulletin No. 119, 1956, p. 35.

halo effect as described earlier. Another likely explanation is that on those occasions when they choose the Parkway, the travel time variable may not be an important factor in the route choice decision. This interpretation is supported by the results from question #46, which indicate that the females consider travel time as an important variable on those occasions when they choose the Expressway. Thus, a shopper's utilization of the Parkway may reflect the priority of non-economic considerations at the particular time of the route choice decision. Such a priority might relegate--at least temporarily--the travel time variable to a position of little importance in the decision.

A final point to be noted from Table 3.2 is the particularly low ratings given by both sexes concerning the scenery on the Expressway. In the context of Part IV of the questionnaire, these responses indicate that the quality of the roadside view was the most important disadvantage which the subjects associated with the Expressway route. This finding is discussed in Chapter IV in greater detail. The significantly lower ratings given by the females probably result from the operation of a halo effect.

## Attitude Differences Between Parkway and Expressway Users

The sample of shoppers was divided into three groups on the basis of route choice behavior, and a series of one-way analyses of variance was performed in order to determine

whether the means of the groups' questionnaire responses were significantly different. Route choice behavior therefore served in this series of analyses as a categorical variable having three strata. Each stratum was defined in terms of a particular range of usage of the Huron Parkway. Thus the shopers who chose the Parkway for 0-39 per cent of their trips were assigned to the "Low" group; shoppers who drove the Parkway for 40-60 per cent of their trips constitute the "Mid" group; and the "High" group includes subjects who used the Parkway for 61-100 per cent of their trips. The Low stratum of course connotes a high proportion of Expressway usage; the Mid group reflects a medium level of Expressway usage, and so on. The Low stratum comprised fourteen shoppers; while the Mid and High groups each contained seventeen subjects.

The results from this series of analyses are summarized in Table 3.3. The findings pertain to those parts of the questionnaire that were answered by all forty-eight subjects (parts III, V, VI, VII, and VIII). The content of Table 3.4 is limited to the responses which the F-statistic singled out as having strata means that were significantly different. It is notable in this respect that of the total of fifty-four questions answered by all subjects, nineteen were found to have significantly different response means. In the case of the differences between the males and females (Table 3.1), only seven of the response means differed

TABLE 3.3

SIGNIFICANTLY DIFFERENT ($\geq$ 95% LEVEL) RESPONSES AMONG LOW, MID, AND HIGH PARKWAY-USERS. ALL SUBJECTS

| Variable No. | Question Content | Mean Response Group | | | Interpretation of Responses |
|---|---|---|---|---|---|
| | | Low | Mid | High | |
| 18 | The curves in the Parkway are dangerous | 2.21 | 3.53 | 2.29 | Low and High groups both disagree strongly with statement; Mid group is indifferent. |
| 23 | The hills in the Parkway are dangerous. | 2.07 | 2.88 | 1.82 | Low and High groups both disagree strongly; Mid group disagrees slightly. |
| 31 | The traffic density on the Parkway often makes the trip undesirably slow. | 3.50 | 2.41 | 2.41 | Low group is indifferent; Mid and High groups both disagree. |
| 36 | The driving speed on the Parkway makes me feel safe. | 4.21 | 3.88 | 4.82 | Mid slightly agrees; Low agrees; High agrees strongly. |
| 53 | The Expressway scenery is attractive. | 3.50 | 3.59 | 2.65 | Low and Mid are indifferent; High disagrees. |
| 56 | I prefer the Expressway because I like to drive fast. | 4.14 | 3.47 | 2.53 | Low group agrees; Mid is indifferent; High disagrees. |
| 60 | The driving speed on the Expressway allows the roadside environment to be adequately viewed. | 3.36 | 2.53 | 1.88 | Low group disagrees slightly; Mid disagrees; High disagrees strongly. |

TABLE 3.3--(continued)

| Variable No. | Question Content | Mean Response Group | | | Interpretation of Responses |
|---|---|---|---|---|---|
| | | Low | Mid | High | |
| 61 | The driving speed on the Expressway allows the driver to cope with in-car distractions. | 3.00 | 2.76 | 2.00 | Low group slightly disagrees; Mid disagrees; High disagrees strongly. |
| 66 | To what degree do you associate the mood--"in a Hurry" --with choosing the Parkway | 1.00 | 1.29 | 1.76 | Low group associates not at all; Mid and High very slightly. |
| 69 | To what degree do you associate the mood--"want to change routes for variety"-- with choosing the Parkway? | 5.57 | 4.76 | 3.24 | Low group associates very much; Mid group--to a lesser extent; High group--slightly. |
| 71 | To what degree do you associate the mood--"in a hurry" --with choosing the Expressway? | 5.79 | 5.94 | 4.29 | Low and Mid groups--very much; High group--somewhat. |
| 75 | To what degree do you associate the mood--"feel like viewing nature"--with choosing the Expressway? | 1.79 | 1.41 | 1.12 | Low and Mid groups--very slightly; High group--not at all. |
| 76 | Preference for choosing Parkway or Expressway at night. | 4.21 | 3.59 | 2.47 | Low group slightly prefers Expressway; Mid is indifferent; High group prefers Parkway. |

TABLE 3.3--(continued)

| Variable No. | Question Content | Mean Response Group | | | Interpretation of Responses |
|---|---|---|---|---|---|
| | | Low | Mid | High | |
| 77 | Preference for choosing Parkway or Expressway when it's raining. | 4.00 | 3.47 | 2.41 | Low group slightly prefers Expressway; Mid is indifferent; High prefers Parkway. |
| 78 | Preference for choosing Parkway or Expressway when it's snowing. | 4.57 | 3.41 | 2.35 | Low prefers Expressway; Mid is indifferent; High prefers Parkway. |
| 81 | Preference for choosing Parkway or Expressway in the summer. | 3.07 | 2.06 | 1.94 | Low group slightly prefers Parkway; Mid and High more strongly prefer Parkway. |
| 82 | Preference for choosing Parkway or Expressway in the winter. | 4.00 | 3.00 | 2.29 | Low slightly prefers Expressway; Mid slightly prefers Parkway; High prefers Parkway. |
| 83 | Preference for choosing Parkway or Expressway for the trip to Arborland. | 4.79 | 4.12 | 2.59 | Low prefers Expressway; Mid slightly prefers Expressway; High prefers Parkway. |
| 84 | Preference for choosing Parkway or Expressway for the trip from Arborland. | 3.79 | 2.59 | 2.18 | Low group slightly prefers Expressway; Mid prefers Parkway; High prefers Parkway more strongly. |

significantly. This suggests that differences in the respondents' attitudes are less associated with sex than they are with route choice behavior.

The results in Table 3.3 reveal, as might be expected, that the shoppers in the Low and High groups are positively oriented towards the particular route which they most frequently use. Thus the Low group is more positive in its opinions of the Expressway and tends to be more critical concerning the Parkway, while the shoppers in the High stratum express opposite opinions. Both the Expressway users and the Parkway users are in a sense "devoted" to their respective routes. It should be noted that the High group is perhaps more positive in its attitudes towards the Parkway than the Low stratum is towards the Expressway. This suggests that the Parkway users are more committed to their particular route.

An examination of Table 3.3 discloses that, with some exceptions, the means of the Mid group's responses fall between those of the Low and High strata. The Mid group shoppers are neither as critical of the Expressway as are the Parkway users, nor are they as positive towards the route as are the Expressway users. By the same token, they are less favorable towards the Huron Parkway than is the High group, and less critical than the Low group. An exception to this pattern is seen in a few of the Mid stratum's

responses concerning the Parkway. Thus, in questions #18, #23, and #36, the means of the Mid group's responses reveal that it considers various Parkway features to be less safe than do the shoppers in the other strata. With the exception of these particular responses, however, the Mid stratum otherwise tends to show a slight preference for the Huron Parkway. For example, in their attitudes towards questions #81 and #82, the Mid group shoppers indicate that they prefer the Parkway over the Expressway in both summer and winter.

Despite its slight leaning to the Parkway, the Mid stratum stands out as the group of shoppers who is least committed to a particular route for the trip to Arborland. In this regard, one of the most interesting points revealed by the study is that the Mid group's route choice decisions are perhaps more responsive to changing conditions than are the decisions of the other shoppers. Thus, for example, the means of the responses to questions #83 and #84 indicate that the Mid stratum is the most sensitive to the access advantages which characterize the study area. This leads the Mid group shoppers to indicate a slight Expressway preference for the trip to Arborland, and a rather strong preference for the Parkway for the trip from Arborland. Also, the mean of the stratum's responses to question #71 shows that these shoppers make the highest association between being "in a hurry" and the decision to take the

Expressway. This suggests that the route choices of the Mid group may be particularly responsive to exigencies prevailing at the time of the choice decision. The variability of the Mid stratum's behavior apparently reflects the shoppers' relative "open-mindedness." That is, the Mid group--to a greater extent than the other strata--perceives advantages and disadvantages in both routes. The Low and High shoppers, on the other hand, have overriding preferences for a particular road which tend to preclude their choice of the alternative route in the face of changing conditions. While it may appear on the surface that the Expressway users are most like Economic Man, this suggests that the Mid group may indeed come closest to the standard of optimizing behavior.

Although the Mid group's responses indicated a particularly high level of association between being "in a hurry" and choosing the Expressway, the other strata also gave rather high ratings in the case of this variable (question #71). The mean of the High stratum's responses was somewhat lower than those of the other groups, perhaps indicating that the Parkway users are less prone to be "in a hurry." Taken as a whole, however, these responses suggest that travel time is an important consideration in the decision to take the Expressway to Arborland. In contrast to this finding are the responses concerning the moods associated with the Parkway trip (questions #66 and #69). As is evident from Table 3.3, the shoppers only very slightly, if

at all, relate being in a hurry with choosing to drive the Parkway. It therefore appears that travel time is a relatively unimportant consideration on those occasions when the Parkway route is chosen. This supports the notion that drivers are attracted to the Parkway by the prospect of non-economic payoffs. In regard to this latter point, it is appropriate to note the responses of the Expressway users concerning their desire for route variety (question #69). The results show that these shoppers very strongly associate a desire for "variety" with choosing to drive the Parkway. The implication here is that a shopper's need for variety may on occasion override his consideration of distance-minimizing payoffs--prompting him to consciously change his route choice. The tendency of drivers to consciously vary their routes has also been noted in a study by Fox.[1]

Interestingly, the findings in the case of variable #56 suggest that many Expressway users enjoy driving fast. The payoff implied by these responses appears to be independent of distance-minimizing considerations. That is, the experiential aspects of driving fast--as an issue apart from the effects of driving speed on travel time--may be interpreted by some shoppers as a benefit of the Expressway route. On the other hand, the Parkway users clearly do not consider

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[1]P. Fox, The Value of Time for Passenger Cars: A Behavioral Study of Driver Route Choice, Bureau of Public Roads Contract No. CPR 11-0950 (Menlo Park, California: Stanford Research Institute, 1969), p. 6.

the sensation of high-speed driving to be an advantage of the Expressway.

The number of variables indicating significant differences among the three strata is large, and appears to encompass a range of different dimensions. In this respect the findings support the conclusions of a study by Wachs, which showed that drivers' attitudes towards route characteristics varied widely between individuals.[1] The diversity of issues represented in Table 3.3 includes, for example, attention levels on the Expressway; the degree of safety of the Parkway; access advantages; and moods associated with each route. In view of the broad range of issues, it is extremely noteworthy that none of the results relates to the scenic appearance of the Huron Parkway. Therefore, despite marked differences in their attitudes regarding several issues, the shoppers in the various strata were inconsistent agreement regarding the factors which constitute the driver's scenic experience on the Parkway.

As was pointed out earlier, the results in Table 3.3 are limited to the parts of the questionnaire that were answered by all subjects. A series of analyses of variance were also performed on the sections of the questionnaire (parts II and IV) that were omitted by the nine shoppers who

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[1] M. Wachs, "Relationships Between Drivers' Attitudes Toward Alternate Routes and Driver and Route Characteristics," Highway Research Record No. 197, 1967, p. 86.

relied exclusively on one route. The analyses revealed no significant differences among the means of the responses of the three strata for any of the variables. Thus, it appears that the ratings of the "100% users"--the subjects who rely exclusively on either the Parkway or the Expressway--were a major factor in the differences among the strata's responses which were discussed above.

## Attitude Differences Between Miscellaneous Groups

In Part I of the questionnaire, the subject was asked to provide information concerning: how frequently he shopped at Arborland; the likelihood of children accompanying him on the trip to Arborland; and the age of his vehicle. The results from each of these questions were utilized as categorical information to define different subject groups. A series of statistical analyses was subsequently performed for each categorical variable to determine if the attitudes of the different groups of shoppers varied significantly towards the two routes.

### Accompanying Children

Two groups of shoppers were distinguished on the basis of whether or not children were likely to accompany the driver on the trip to Arborland. It was hypothesized that the drivers having children in the car would favor the Huron Parkway in their responses. This hypothesis was based

on two speculations: first, that the slower driving speed on the Parkway requires a lower level of attention from the driver, thereby enabling him to better cope with the distractions of children; and second, that drivers would favor the slower Parkway speed because of a concern for the safety of their children.

Thirty subjects (16 males, 14 females) constituted the group which had children accompanying them; eighteen subjects (8 males, 10 females) comprised the group with no children. A series of t-tests was performed on the means of the two strata's responses for those parts of the questionnaire that were answered by all subjects (parts III, V, VI, VII, and VIII). The t-statistic singled out four instances where the means of the groups' responses were significantly different. The results are summarized below in Table 3.4.

The findings suggest some support for the hypotheses. Specifically, the different responses reflect a tendency for shoppers with children in the car to prefer the Parkway. The shoppers without children in the car, on the other hand, indicate a slight preference for the Expressway. It is appropriate here to note that in their responses to question #80--which did not yield a significant difference between the group means--<u>both</u> strata indicated a slight Parkway preference when the condition was stipulated that children accompany the driver.

TABLE 3.4

QUESTIONNAIRE RESPONSES REVEALING SIGNIFICANT DIFFERENCES (≥ 95% LEVEL) AS A FUNCTION OF WHETHER OR NOT CHILDREN ACCOMPANY THE DRIVER. ALL SUBJECTS

| Variable No. | Question Content | Group 1 With Children | Group 2 Without Children | Interpretation of Responses |
|---|---|---|---|---|
| 71 | To what degree do you associate the mood--"in a hurry"--with choosing the Expressway? | 5.70 | 4.67 | Group 1: very much associates mood.<br>Group 2: associates mood to lesser degree. |
| 77 | Preference for choosing Parkway or Expressway when it's raining. | 2.87 | 3.89 | Group 1: prefers Parkway.<br>Group 2: slightly prefers Expressway. |
| 78 | Preference for choosing Parkway or Expressway when it's snowing. | 2.97 | 4.06 | Group 1: slightly prefers Parkway.<br>Group 2: slightly prefers Expressway. |
| 82 | Preference for choosing Parkway or Expressway in the winter. | 2.67 | 3.67 | Group 1: prefers Parkway.<br>Group 2: very slightly prefers Expressway. |

The differences between the two groups are reflected largely in responses which relate to hazardous driving conditions. It appears that safety considerations may have some importance in motivating shoppers with accompanying children to choose the Parkway. The findings, however, do not support the notion that shoppers with children prefer the Parkway because of lower attention requirements. In fact it seems that the presence of children in the car exerted a very limited effect on the shopper's route choice decision. The effect is associated with a preference for the Huron Parkway route, and appears to be important only when hazardous driving conditions prevail.

Shopping Frequency

In another series of analyses, three groups of subjects were defined on the basis of shopping frequency. More specifically, a subject was assigned to either a Low, Mid, or High group according to the average number of trips which he made to Arborland each month. Analyses of variance were performed to determine if the means of the strata's responses differed significantly. The parts of the questionnaire that were not filled out by all subjects were omitted from the analysis (parts II and IV). The F-statistic revealed only one instance where the means of the groups' responses were significantly different. This occurred in the case of variable #59, where the mean of the High group's ratings

indicated that these shoppers "agreed less" than the other strata with the statement that the traffic density on the Expressway requires a high level of driver attention. The fact that only one significant results was obtained suggests that trip frequency is unimportant as a factor affecting route choice. This conclusion is supported by the results from an analysis of variance performed on the means of the groups' route choice decisions (expressed as the percentage of each group's trips which used the Parkway) which indicated that their behavior was the same.

Vehicle Age

Finally, each shopper was assigned to a stratum on the basis of the age of the vehicle which he drove to Arborland. In this way three strata were defined. The first consisted of shoppers whose cars were not more than three years old; the second stratum was composed of subjects whose cars were from four to six years old; and the third group included those having vehicles that were more than six years old. It was expected that differences would be revealed both in the route choice behavior of the three groups, as well as in their questionnaire responses. Thus, the research of Michaels[1] indicated that the age of the driver's vehicle was related to route preference. Specifically, Michaels' study[2]

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[1]Michaels, "Attitudes of Drivers."

[2]Ibid., p. 58.

suggested that drivers having newer automobiles were more positive in their attitudes towards expressways. It was therefore surmised that the group of shoppers with newer vehicles would be more oriented to the Expressway in their route choice behavior, and more positive towards the route in their responses.

These stated hypotheses were only weakly supported by the subsequent findings. An analysis of variance indicated that the three groups did not differ significantly in the percentage of trips which were made on the Parkway or the Expressway. Also, another series of analyses of variance revealed no instances where the means differed significantly. However, in their responses to question #65, the three groups unanimously indicated that the driving speed on the Expressway was not favorable for people with older cars. It therefore appears that although the shoppers associated vehicle age with route favorability, this did not affect their route choice behavior.

## Summary

It was observed in both the preliminary and final studies that in about one-half of the shopping trips functional distance was not minimized. Only about 10 per cent of the subjects were found to behave in strict accordance with the simple normative model--that is, they used the Expressway for all of their trips. This failure to minimize

functional distance occurred despite the fact that the shoppers possess almost perfect knowledge about the two route alternatives. For instance, they were all aware that the Expressway provides the fastest and most economic alternative. The observed route choice behavior therefore suggests that the shoppers' goals may not be captured by the simplified version of the Economic Man assumption; many shoppers seem to forego distance-minimization in order to attain other, non-economic, advantages which they associate with the slower Parkway.

The broad range of observed behavior is consistent with the finding that the attitudes towards the two routes varied widely between different individuals. This indicates that many of the shoppers differ with respect to the benefits and disutilities which they associate with each of the two routes. The differences became most evident when the shoppers were grouped according to their (1) sex and (2) route choice behavior.

It was found that the female shoppers perceived the Expressway to be more dangerous than did the men. This difference was evidenced by the females' slight preference for the Parkway as expressed both in their inferred attitudes and in their overt route choice behavior. In contrast, the males were slightly positive towards the Expressway.

Differences in attitudes became particularly apparent when the subjects were divided into groups based on

their observed route choice behavior. The various groups displayed dissimilar views regarding a large number of route features on both the Parkway and the Expressway. For instance, those who used the Expressway for most of their shopping trips tended to be positive in their attitudes toward the Expressway and somewhat critical towards the Parkway. For the Parkway users, the picture was reversed. However, the analysis showed that the Parkway users tend to have more favorable opinions of the Parkway than the Expressway users have of the Expressway; the Parkway users therefore appeared to be more committed to their route. In contrast, the shoppers with the most balanced views of the two routes tended to divide their trips between the Parkway and the Expressway. The decisions of these shoppers seemed most responsive to changing conditions. Perhaps this suggests that the most sophisticated decision-makers can be found in this flexible middle group.

Many of the Expressway users were found to enjoy fast driving. This payoff appeared to be independent of distance-minimizing considerations, and instead to be related to the purely experiential aspects of the trip. Likewise, most subjects valued the Huron Parkway as a source of variety. Finally, although the various route user groups differed in several of their attitudes, they were in consistent agreement about the driver's scenic experience on

the Parkway. Most significantly, there was high agreement about which elements contributed to the visual quality of the Parkway.

# CHAPTER IV

# QUESTIONNAIRE RESULTS: DIMENSIONS UNDERLYING ROUTE CHOICE

## Overview

A portion of the last chapter was devoted to the respondents' attitudes towards the two shopping routes. The attitudes were examined in terms of the shoppers' responses to single variables in the questionnaire. The present chapter will extend the analysis by examining the shoppers' attitudes in terms of dimensions--or groupings--of variables. A given dimension is comprised of those variables for which the subjects' responses exhibited similar patterns of interrelationships.

The chapter begins by describing the quantitative procedures employed to identify the dimensions. Next, the various dimensions of attitudes are enumerated and discussed. The dimensions are then utilized to construct scales which make it possible to systematically compare the subjects' responses with respect to the dimensions of attitudes. The chapter ends with a presentation of the results of the respondents' ratings of individual route elements as advantages/disadvantages.

## Procedures for Determining Dimensions

Two different quantitative analyses were performed on the questionnaire data in order to determine the underlying dimensions characterizing Expressway and Parkway use. More specifically, the analysis employed were: (1) the Guttman-Lingoes Smallest Space Analysis III (SSA-III), which is a non-metric factor analysis;[1] and (2) ICLUST, a hierarchical cluster analysis.[2]

One feature of the Guttman-Lingoes SSA-III algorithm which distinguishes it from other non-metric factor analyses is that operations are performed on the rank order of the original correlation matrix, rather than on the correlation matrix itself.[3] This characteristic is potentially an important advantage if the researcher wishes to compare data from different samples. Thus, the absolute correlation magnitudes typically vary from one sample to another, even though

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[1]J. L. Lingoes, "An IBM-7090 Program for Guttman-Lingoes Smallest Space Analysis-III," Behavioral Science, Vol. 11 (1966), pp. 75-76; "Non-metric Factor Analysis: A Rank-Reducing Alternative to Linear Factor Analysis," Multivariate Behavioral Research, Vol. 2 (1967), pp. 485-505.

[2]J. Kulik, W. Revelle, and W. Kulik, "Scale Construction by Hierarchical Cluster Analysis," Unpublished paper, Department of Psychology, University of Michigan, 1970.

[3]For concise summaries of various multidimensional scaling algorithms, including the Guttman-Lingoes series, see: R. G. Golledge and Gerard Rushton (1972): Multidimensional Scaling: Review and Geographical Applications, Commission of College Geography, Resource Paper No. 10, Association of American Geographers, Washington, D.C.

the relative ordering of the values may be the same.[1] In such cases, results from the SSA-III procedure will more accurately reflect the similarities between the samples.

The ICLUST program, which is based on work by Tryon and Bailey,[2] is distinctly different from the SSA-III procedure. In ICLUST, each dimension, or cluster, is determined with respect to a so-called "pivot variable." The pivot variable--which is found in the first stage of the procedure--is the variable which has the highest correlations with the largest number of the other variables. Variables are then assigned to a particular cluster if they have relationships similar to those of the pivot variable. ICLUST is a step-wise hierarchical procedure designed to isolate clusters within clusters.

Since the SSA-III and ICLUST analyses are based on different algorithms, they yield somewhat different results when applied to the same set of data. R. Kaplan has noted that by applying both procedures to the same data, the researcher gains a more complete understanding of the results.[3] This strategy contrasts with the common practice

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[1]R. Kaplan, "The Dimensions of the Visual Environment: Methodological Considerations," in Environmental D Design Research, Proceedings of the Environmental Design Research Association, Conference Three, 1972, p. 3.

[2]R. C. Tryon and D. E. Bailey, Cluster Analysis (New York: McGraw-Hill, 1970).

[3]Kaplan, "The Dimensions of the Visual Environment," p. 3.

of dimensionalizing data solely on the basis of one procedure. The utilization of two procedures allows the interpretive and intuitive abilities of the researcher to play a more prominent role in defining the dimensions. This is desirable in view of the fact that the results from any statistical procedure reflect the error components and assumptions of the particular algorithm.

In practice, it was found useful to perform the ICLUST analysis prior to the SSA-III procedure. The advantage of this sequence was that on the basis of the ICLUST output, a preliminary estimate could be made of the number of dimensions which characterized the data. The estimate was then specified as the number of dimensions for the SSA-III solution. This strategy meant that it was not necessary to perform a series of the expensive SSA-III analyses for different numbers of dimensions. Thus the early use of ICLUST plays somewhat the same role in relation to SSA-III as the open-ended preliminary interview played in relation to the final constrained-response questionnaire.

A feature ICLUST is that the relationships between variables within the various clusters and sub-clusters can be spatially plotted, thereby contributing a visual component to the process of interpretation. The visual evaluation of the ICLUST output enables the researcher to readily distinguish patterns of relationships that may be particularly coherent within a given dimension. In cases where the

SSA-III analysis resulted in large, ambiguous dimensions, it was possible--on the basis of the ICLUST clusters and subclusters--to define smaller, more coherent groups of variables. The dimensions of attitudes underlying the questionnaire data, therefore, were not defined rigidly in terms of the output from one procedure. Rather, a flexible approach was adopted, whereby some of the dimensions were defined according to factor loadings from the SSA-III analysis, while others were defined in terms of alpha values from the ICLUST output.

## Dimensions Underlying Route Choice

The ICLUST and SSA-III analyses were performed on the parts of the questionnaire that were answered by all respondents (parts III, V, VI, VII, and VIII). These sections of the questionnaire contained a total of 54 variables, from which the following eight dimensions were isolated:

1. Route Preference Under Different Conditions
2. Expressway: Danger/Safety and Attention
3. Scenic Attributes of Parkway
4. Parkway Hills and Curves: Negative Aspects
5. Moods: Not in a Hurry; Want to Relax
6. Mood: In a Hurry
7. Parkway Driving Speed
8. Parkway Attention Level

The variables which comprise a particular dimension have similar patterns of relationships with each other, and represent an independent group of attitudes underlying the respondents' route choice behavior. Table 4.1, which summarizes the dimensions, reveals a number of insights concerning the attitudes of the shoppers. For instance, it became clear that one of the dimensions is comprised of variables which relate to the scenic attributes of the Huron Parkway. This suggests that the sensitivity of drivers to the visual environment may affect their route choice behavior. The results are also consistent with the notion that a number of factors in addition to roadside scenery contribute to the driver's scenic experience on the Parkway. Thus, the subjects' responses relate the Parkway's driving speed--through its effect on viewing time--to the grouping of scenery variables. Also, the Parkway's hills and curves play prominent roles in the scenery dimension. In this latter regard, it appears that the subjects relate the hills and curves both to the attractiveness of the road's alignment, and to the driver's ability to view the roadside scenery. As further evidenced by Table 4.2, which lists the means and standard deviations of the responses, all of the variables in dimension 3 were related positively to the scenic experience on the Parkway. Of particular note are the very high mean and the low standard deviation concerning the attractiveness of the Parkway's scenery (variable #17). The low standard

TABLE 4.1

DIMENSIONS OF ROUTE ATTITUDES

| Dimension No. | Criterion of Dimension | | Variable No. | Dimension Name and Variables |
|---|---|---|---|---|
| | | | | Route Preference Under Different Conditions |
| 1 | ICLUST Cluster: All alphas ≥ .80. | | 83 | Prefer Parkway or Expressway: for trip to Arborland. |
| | | | 81 | Prefer Parkway or Expressway: in the summer. |
| | | | 84 | Prefer Parkway or Expressway: for trip from Arborland. |
| | | | 77 | Prefer Parkway or Expressway: when it's raining. |
| | | | 76 | Prefer Parkway or Expressway: at night. |
| | | | 79 | Prefer Parkway or Expressway: during rush hours. |
| | | | 82 | Prefer Parkway or Expressway: in the winter. |
| | | | 80 | Prefer Parkway or Expressway: when there are children in the car. |
| | | Loading | | Expressway: Danger/Safety and Attention |
| 2 | SSA-III factor loading ≥ .45; no secondary loading ≥ .35. | -.706 | 63 | Expressway driving speed makes me feel safe. |
| | | .673 | 54 | Big trucks on Expressway make me feel unsafe. |
| | | .632 | 57 | Traffic density on Expressway frequently makes makes driving dangerous. |

TABLE 4.1--(continued)

| Dimension No. | Criterion of Dimension | | Variable No. | Dimension Name and Variables |
|---|---|---|---|---|
| | | .629 | 55 | Merging onto Expressway makes me feel unsafe. |
| | | -.545 | 56 | I prefer Expressway because I like to drive fast. |
| | | .454 | 59 | Traffic density on Expressway require that high level of attention be given to driving. |
| | | Loading | | Scenic Attributes of Parkway |
| 3 | SSA-III factor loading ≥ .45. | .744 | 20 | Curves in Parkway open up views of roadside environment. |
| | | .665 | 21 | Curves in Parkway make road itself more attractive. |
| | | .663 | 26 | Hills in Parkway make road itself more attractive. |
| | | .660 | 25 | Hills in Parkway open up views of roadside environment. |
| | | .600 | 33 | Parkway driving speed allows roadside environment to be adequately viewed. |
| | | .582 | 17 | Roadside scenery on Parkway is attractive. |
| | | .580 | 29 | Radar traps on Parkway make me feel safer. |
| | | .532 | 70 | Parkway mood: feel like viewing nature. |

TABLE 4.1--(continued)

| Dimension No. | Criterion of Dimension | | Variable No. | Dimension Name and Variables |
|---|---|---|---|---|
| | | Loading | | Parkway Hills and Curves: Negative Aspects |
| 4 | SSA-III loading ≥ .45. | .810 | 27 | Parkway hills add unnecessary burden to driver's task. |
| | | .704 | 24 | Parkway hills add unnecessary time to trip. |
| | | .688 | 22 | Parkway curves add unnecessary burden to driver's task. |
| | | .685 | 18 | Parkway curves are dangerous. |
| | | .668 | 23 | Parkway hills are dangerous. |
| | | .659 | 19 | Parkway curves add unnecessary time to trip. |
| | | .580 | 30 | Parkway traffic density frequently makes driving dangerous. |
| | | Loading | | Moods: Not in a Hurry; Want to Relax |
| 5 | SSA-III loading ≥ .45. | .705 | 72 | Expressway mood: not in a hurry. |
| | | .704 | 73 | Expressway mood: feel like taking a break. |
| | | .471 | 75 | Expressway mood: feel like viewing nature. |
| | | -.457 | 67 | Parkway mood: not in a hurry. |

TABLE 4.1--(continued)

| Dimension No. | Criterion of Dimension | | Variable No. | Dimension Name and Variables |
|---|---|---|---|---|
| | | Loading | | Mood: In a Hurry |
| 6 | SSA-III loading ≥ .45. | .637 | 71 | Expressway mood: in a hurry |
| | | -.624 | 66 | Parkway mood: in a hurry |
| | | Loading | | Parkway Driving Speed |
| 7 | SSA-III loading ≥ .45. | .570 | 38 | Parkway driving speed is favorable for people with older cars. |
| | | .516 | 37 | Parkway driving speed allows efficient rate of travel. |
| | | .513 | 36 | Parkway driving speed makes me feel safe. |
| | | Loading | | Parkway Attention Level |
| 8 | SSA-III loading ≥ .45 | .630 | 34 | Parkway driving speed allows driver to cope with in-car distractions. |
| | | .585 | 32 | Parkway traffic density requires that high level of attention be paid to driving. |

deviation, of course, reflects a high level of agreement among the shoppers.

The variables comprising dimension 2 support the hypothesis that considerations of danger and attention influence the route choice behavior of some shoppers. Specifically, this grouping of attitudes relates solely to characteristics of the Expressway. It is appropriate here to note that the ICLUST analysis indicated that a particularly coherent sub-cluster was formed by the three Expressway danger variables (#54, #57, and #55). The low means and rather high standard deviations of the responses (Table 4.2) reflect the fact that many of the subjects viewed the variables in dimension 2 as describing undesirable attributes of the Expressway. In this regard it was pointed out in Chapter III that statistically significant differences exist between the response means of the males and females concerning the level of danger of the Expressway (Table 3.1). Indeed, three of the six variables in the danger/safety dimension (variables #63, #55, and #59) revealed significant attitude differences between the sexes. Thus, it appears that the grouping of Expressway danger variables in dimension 2 is at least in part attributable to the patterns of responses of the males and females.

Prior to the application of the ICLUST and SSA-III procedures, it had been anticipated that the output would yield a dimension consisting of economic

TABLE 4.2

MEANS AND STANDARD DEVIATIONS OF RESPONSES FOR PARTS III, V, VI, VII, AND VIII OF QUESTIONNAIRE. ALL SUBJECTS

| Part | Variable No. | Mean | s.d. | Variable Description |
|---|---|---|---|---|
| III | 17 | 5.79 | 0.41 | Parkway scenery is attractive. |
| | 18 | 2.71 | 1.54 | Parkway curves are dangerous. |
| | 19 | 2.35 | 1.23 | Parkway curves add unnecessary time to trip. |
| | 20 | 5.33 | 0.63 | Parkway curves open up views of roadside environment. |
| | 21 | 5.48 | 0.58 | Parkway curves make road itself more attractive. |
| | 22 | 2.73 | 1.58 | Parkway curves add unnecessary burden to driver's task. |
| | 23 | 2.27 | 1.22 | Parkway hills are dangerous. |
| | 24 | 2.27 | 1.16 | Parkway hills add unnecessary time to trip. |
| | 25 | 5.25 | 0.64 | Parkway hills open up views of roadside environment. |
| | 26 | 5.48 | 0.58 | Parkway hills make road itself more attractive. |
| | 27 | 2.46 | 1.22 | Parkway hills add unnecessary burden to driver's task. |
| | 28 | 3.19 | 1.73 | Police radar traps on Parkway prevent me from driving as fast as I'd like. |
| | 29 | 3.83 | 1.45 | Police radar traps on Parkway make me feel safer. |

TABLE 4.2--(continued)

| Part | Variable No. | Mean | s.d. | Variable Description |
|---|---|---|---|---|
| | 30 | 2.31 | 1.27 | Parkway traffic density frequently makes driving dangerous. |
| | 31 | 2.73 | 1.36 | Parkway traffic density often makes trip undesirably slow. |
| | 32 | 3.17 | 1.33 | Parkway traffic density requires that high level of attention be paid to driving. |
| | 33 | 4.88 | 0.84 | Parkway driving speed allows roadside environment to be adequately viewed. |
| | 34 | 4.35 | 0.86 | Parkway driving speed allows driver to cope with in-car distractions. |
| | 35 | 4.44 | 1.07 | Parkway driving speed allows driver to be in thoughtful frame of mind. |
| | 36 | 4.31 | 1.13 | Parkway driving speed makes me feel safe. |
| | 37 | 4.21 | 1.35 | Parkway driving speed allows efficient rate of travel to Arborland. |
| | 38 | 4.21 | 1.03 | Parkway driving speed is favorable for people with older cars. |
| V | 53 | 3.23 | 1.22 | Roadside scenery is attractive on Expressway. |
| | 54 | 3.69 | 1.56 | Big trucks on Expressway make me feel unsafe. |
| | 55 | 3.60 | 1.33 | Merging onto Expressway makes me feel unsafe. |
| | 56 | 3.33 | 1.51 | I prefer Expressway because I like to drive fast. |

TABLE 4.2--(continued)

| Part | Variable No. | Mean | s.d. | Variable Description |
|---|---|---|---|---|
| | 57 | 3.27 | 1.41 | Expressway traffic density frequently makes driving dangerous. |
| | 58 | 2.15 | 0.92 | Expressway traffic density often makes trip undesirably slow. |
| | 59 | 4.73 | 1.14 | Expressway traffic density requires that high level of attention be paid to driving. |
| | 60 | 2.54 | 1.34 | Expressway driving speed allows roadside environment to be adequately viewed. |
| | 61 | 2.56 | 1.24 | Expressway driving speed allows driver to cope with in-car distractions. |
| | 62 | 2.79 | 1.25 | Expressway driving speed allows driver to be in thoughtful frame of mind. |
| | 63 | 3.10 | 1.24 | Expressway driving speed makes me feel safe. |
| | 64 | 5.12 | 0.96 | Expressway driving speed allows efficient rate of travel to Arborland. |
| | 65 | 2.56 | 0.97 | Expressway driving speed is favorable for people with older cars. |
| VI | 66 | 1.38 | 0.82 | Parkway mood: in a hurry. |
| | 67 | 5.15 | 1.17 | Parkway mood: not in a hurry. |
| | 68 | 4.98 | 1.34 | Parkway mood: feel like taking a break. |
| | 69 | 4.46 | 1.68 | Parkway mood: want to change routes for variety. |
| | 70 | 5.38 | 0.94 | Parkway mood: feel like viewing nature. |

TABLE 4.2--(continued)

| Part | Variable No. | Mean | s.d. | Variable Description |
|---|---|---|---|---|
| VII | 71 | 5.31 | 1.46 | Expressway mood: in a hurry. |
| | 72 | 1.77 | 1.15 | Expressway mood: not in a hurry. |
| | 73 | 1.48 | 0.80 | Expressway mood: feel like taking a break. |
| | 74 | 2.15 | 1.50 0 | Expressway mood: want to change routes for variety. |
| | 75 | 1.42 | 0.74 | Expressway mood: feel like viewing nature. |
| VIII | 76 | 3.38 | 1.81 | Prefer Parkway or Expressway: at night. |
| | 77 | 3.25 | 1.63 | Prefer Parkway or Expressway: when it's raining. |
| | 78 | 3.38 | 1.82 | Prefer Parkway or Expressway: when it's snowing. |
| | 79 | 4.17 | 1.56 | Prefer Parkway or Expressway: during rush hours. |
| | 80 | 2.71 | 1.27 | Prefer Parkway or Expressway: when there are children in the car. |
| | 81 | 2.31 | 1.40 | Prefer Parkway or Expressway: in the summer. |
| | 82 | 3.04 | 1.54 | Prefer Parkway or Expressway: in the winter. |
| | 83 | 3.77 | 1.53 | Prefer Parkway or Expressway: for the trip from home to Arborland. |
| | 84 | 2.79 | 1.56 | Prefer Parkway or Expressway: for the trip from Arborland to home. |

(distance-minimizing) variables. This expectation, however, was not borne out by the analysis. For the most part, the time/distance variables did not have sufficiently high factor loadings or alpha values to qualify them for membership in a dimension. In one case (variable #64: "The driving speed on the Expressway allows an efficient rate of travel"), the variable did not load on any factor from the SSA-III analysis, nor was it related to any of the clusters defined by the the ICLUST procedure. However, although none of the dimensions consisted of distance-minimizing variables, these issues are in a sense reflected by the two dimensions which relate to the moods associated with choosing the routes. Thus, dimension 6 indicates that the route choice decision is influenced by whether or not the driver feels "in a hurry." This is consistent with results presented in Chapter III, as well as with the findings listed in Table 4.2 which show that the shoppers very strongly associate being "in a hurry" with choosing the Expressway route. It should also be noticed that the shoppers make virtually no association between the above mood and choosing to drive the Parkway.

Dimension 5 is also comprised exclusively of variables which define driving moods. These variables, in contrast to those in dimension 6, do not relate to moods which connote feelings of time demands. Rather, they define states of mind where the driver feels "not in a hurry," or

desires relaxation. In this latter regard, it is extremely interesting to note that the "viewing nature" mood loaded on this dimension. As is evident from the list of response means in Table 4.2, the shoppers do not associate these moods with their decisions to drive the Expressway. On the other hand, the "not in a hurry" mood is strongly linked to the choice of the Parkway route. In view of these findings, it is evident that the moods which the shoppers associate with the Parkway are distinctly different from those which they link to the Expressway. Also, it appears reasonable to conclude that the mood of the driver is an important factor affecting the outcome of his route choice decision.

Importantly, the results from the ICLUST and SSA-III analyses clearly indicate that some characteristics of the two routes are multidimensional. This agrees with findings from the preliminary study, and from the analysis of single variables in Chapter III. An example of multidimensionality is seen in the case of the hills and curves of the Huron Parkway. Thus, dimension 4 reflects an independent grouping of attitudes concerning negative aspects of the hills and curves. Here the features are associated with the levels of danger, driving effort, and trip time which characterize the Parkway route. As was pointed out earlier, the hills and curves are also prominent in dimension 3, where they are associated with the scenic quality of the Parkway. The Parkway's hills and curves, therefore, are not viewed as

unidimensional elements--rather, they are complex features which have a variety of associations.

Similarly, it is apparent from Table 4.1 that driving speed is a multidimensional route characteristic. It will be recalled that the findings from the preliminary study also indicated that driving speed is multidimensional. In the case of the questionnaire data, variables relating to driving speed loaded on dimensions 2, 3, 7, and 8. In dimension 3, driving speed is grouped with the scenic attributes of the Huron Parkway. In dimension 8, it is related to the level of attention required of the driver on the Parkway route. Elsewhere, dimension 7 is comprised exclusively of variables relating to the Parkway's driving speed, and dimension 2 includes two variables concerned with the effects of the Expressway driving speed. In conclusion, it appears that the Parkway's speed limit exerts a more complex influence on the shopper's route choice decision than does the speed limit on the Expressway. In any event, the findings strongly suggest that the shoppers do not associate driving speed solely with economic considerations.

The variables discussed above are those which had factor loadings or alpha values that were sufficiently high to meet the criterion of a dimension. It is also appropriate here to note one instance where an insight was gained despite the fact that the variable did not load highly on a single dimension. Thus, the SSA-III results revealed that

variable #68 (Parkway driving mood: "feel like taking a break") loaded equally on dimensions 3 and 8 (loadings = .515 and .509 respectively). The implication here is that many shoppers associate feelings of relaxation with the attributes of the Parkway which relate to both scenery and to the level of attention required from the driver. This is intriguing, since nine subjects in the open-ended responses of the preliminary study said they liked the Huron Parkway because it was "relaxing." It is perhaps justified to speculate that some shoppers experience lower stress levels because of the visual environment of the Parkway.

## Scale Scores

As a further step in the analysis of the questionnaire date, the dimensions identified by the SSA-III and ICLUST results were used to construct scales for comparing the attitudes of the respondents. A total of eight scales were constructed--one for each of the eight dimensions. This procedure entailed computing scores for each subject on the basis of his responses to those items in the questionnaire which had been grouped as dimensions. For example, if a dimension consisted of four questionnaire items and a subject's responses to the items had been 3, 3, 4, and 5, then by simple addition his cumulative score for the particular dimension was 15. In practice, the computation of the scores was more complex because the values for the responses had to

be adjusted to compensate for differences in the phrasing of the questions. These scores made it possible to systematically compare the subjects' responses with respect to dimensions of attitudes--rather than with respect to only single variables.

The procedure to compute the scale scores utilized "ALPHA," a program by Revelle.[1] In addition to calculating scores, this program also computes alpha and r values--thereby indicating the internal and external reliability of the scales. The alpha values, which appear in Table 4.3, show that the level of internal consistency of most of the scales is rather high. Exceptions occur in the cases of scale 6 (Mood: In a Hurry) and scale 8 (Parkway Attention Level), where the values are only .55 and .52, respectively. These two scales are comprised of the fewest number of items. The intercorrelation values computed by ALPHA revealed no instances where two scales were highly interrelated. Indeed, it was found that the highest correlation between two scales was only .41. The high alpha values indicate that the scales are characterized by high levels of internal consistency and reliability; likewise, the r values indicate that there is a rather low level of external interrelation between the scales.

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[1]W. Revelle, "ALPHA: Scale Scoring and Internal Consistency," unpublished paper, Department of Psychology, University of Michigan, 1971.

TABLE 4.3

INTERNAL AND EXTERNAL RELIABILITY OF SCALES

| Scale[a] | | No. of Items | Mean | s.d. | Alpha | Av. r |
|---|---|---|---|---|---|---|
| 1 | Route Preference under Different Conditions | 8 | 25.42 | 9.65 | .91 | .55 |
| 2 | Expressway: Danger/Safety and Attention | 6 | 19.15 | 6.36 | .87 | .52 |
| 3 | Scenic Attribute of Parkway | 8 | 41.42 | 4.38 | .82 | .37 |
| 4 | Parkway Hills and Curves; Negative Aspects | 7 | 17.10 | 7.04 | .88 | .50 |
| 5 | Moods: Not in a Hurry; Want to Relax | 4 | 6.52 | 2.94 | .73 | .41 |
| 6 | Mood: In a Hurry | 2 | 10.94 | 1.96 | .55 | .37 |
| 7 | Parkway Driving Speed | 3 | 12.73 | 2.81 | .70 | .44 |
| 8 | Parkway Attention Level | 2 | 8.19 | 1.84 | .52 | .35 |

[a]Number of scale agrees with number of corresponding dimension.

## Differences Between Males and Females

The sample of shoppers was stratified on the basis of sex, and a series of t-tests was performed to determine if the means of the males' scores were significantly different from those of the females. The results from these analyses revealed one instance where the means differed significantly at the 95 per cent level. Thus, it was found that the males' scores were higher than the females' for scale 2 (Expressway: Danger/Safety and Attention). This indicates that males considered the Expressway route to be safer. That is, the males consider the Expressway route to be safer and less demanding of driver attention than do the females. This point is consistent with findings which have been discussed above.

## Differences Between Parkway and Expressway Users

As in Chapter III, the subjects were stratified into three groups on the basis of route choice behavior. Analysis of variance was then employed to determine whether the means of the strata's scale scores were significantly different. As before, the Low group consisted of shoppers who chose the Parkway for 0-39 per cent of their trips to Arborland; the Mid (middle) group included those who drove the Parkway for 40-60 per cent of their trips; and the High stratum was comprised of shoppers who used the Parkway for 61-100 per cent of their trips.

The F-statistic singled out two instances where the strata's mean scores differed significantly at the 95 per cent level. First, marked differences were observed between the mean scores for scale 1 (Route Preference Under Different Conditions). In this regard, the scores for the Low, Mid, and High groups were respectively 31.7, 25.9, and 19.7.[1] The high mean score of the Low stratum indicates that these shoppers tend to prefer the Expressway route under a variety of different conditions. In the same manner, the relatively low scale score of the High group reflects the fact that these shoppers prefer the Parkway route under the same conditions. The intermediate score of the Mid stratum supports the earlier finding that the route preferences of this group vary in response to changing conditions. It should also be noted that the rank-order pattern of these scale scores is consistent with the observed route choice behavior of the three groups.

The other marked difference in the scores occurred in the case of scale 6 (Mood: In a Hurry). Here the scores of the Low and Mid groups were 11.8 and 11.6 respectively, while the High group's score was 9.5.[2] The Low and Mid

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[1]The highest possible score was 48 and the lowest was 8. This is because the number of items in the scale was 8, reflecting that there were eight variables included in the dimension, and that the answers to each question were quantified on a scale of 1 to 6.

[2]Possible range: 2-12.

strata, therefore, score nearly equally on scale 6, while the High group's mean score is substantially lower. These results indicate that the High group associates the "in a hurry" mood to a lessor extent than do the other strata with the route choice decision. Earlier, it was noted that the Parkway users tended to give lower ratings for the "in a hurry" variables. It might be speculated, therefore, that there are personality differences between the groups of shoppers. Alternatively, it may be that the shoppers in the Low and Mid groups more frequently perform their shopping trips under time pressure.

Differences Between Miscellaneous Groups

The shoppers were also divided into strata on the basis of three other categorical variables, namely vehicle age; whether or not children accompany the shopper; and shopping frequency. A series of t-tests was performed in each of the first two instances to determine if the mean scale scores of the strata differed significantly. Analysis of variance was utilized for the strata of the third variable. In neither case did the analyses reveal any statistically significant differences. With regard to the variables of vehicle age and shopping frequency, these results are consistent with earlier findings from this study. In the case of the "children in car" variable, the finding was somewhat unexpected. Thus, instances were noted earlier of

differences between the response means of the two strata defined by this variable. Specifically, it was found that the group of shoppers having children in the car tended to prefer the Parkway route. Apparently, this tendency is not sufficiently marked to be reflected in the scale scores.

## Ratings of Route Elements As Advantages/Disadvantages

In an attempt to assess the relative importance of various route elements, the subjects were asked in parts II and IV of the questionnaire to rate the features according to whether they were perceived as advantages or disadvantages. The route features listed in part II relate to the Parkway; those in part IV relate to the Expressway. If a subject relied exclusively on one route for his trips to Arborland, he was asked not to rate the elements which pertained to the other route.

Tables 4.4 and 4.5 list the means and standard deviations of the subjects' ratings for the route features. The results support the findings of the preliminary study to the extent that they suggest that the shoppers associate distance-minimizing advantages with the Expressway (Table 4.5). The features of the Expressway route which appear to be important advantages include the ease of access to Arborland; the number of stoplights (fewer relative to the Parkway); and the driving speed and travel time. Firm conclusions with respect to the latter two variables are not

TABLE 4.4

RATINGS OF PARKWAY ROUTE FEATURES
AS ADVANTAGES/DISADVANTAGES

Note: A rating scale of 1-6 was employed; 1=very important disadvantage . . . 6=very important advantage.

| Variable No. | Mean rating | s.d. | Variable Description |
|---|---|---|---|
| 1 | 3.10 | 1.17 | driving speed |
| 2 | 5.41 | 0.68 | view |
| 3 | 4.08 | 0.81 | access from home to Parkway |
| 4 | 3.08 | 1.06 | access from Parkway to Arborland |
| 5 | 3.97 | 1.09 | access from Arborland to Parkway |
| 6 | 3.46 | 0.97 | condition of the pavement |
| 7 | 4.15 | 0.96 | traffic density |
| 8 | 3.21 | 1.00 | length of time required for trip |
| 9 | 3.77 | 1.01 | curviness of the Parkway |
| 10 | 3.92 | 0.93 | hilliness of the Parkway |
| 11 | 2.85 | 0.87 | number of stoplights |
| 12 | 2.85 | 1.04 | traffic congestion at some stoplights |
| 13 | 4.05 | 1.19 | degree of safety |
| 14 | 4.06 | 0.97 | accessibility to stores other than those in Arborland |
| 15 | 3.23 | 1.18 | police patrols and speed traps |
| 16 | 3.82 | 0.76 | trip distance |

TABLE 4.5

RATINGS OF EXPRESSWAY ROUTE FEATURES
AS ADVANTAGES/DISADVANTAGES

Note: A rating scale of 1-6 employed; 1=very important disadvantage . . . . 6=very important advantage.

| Variable No. | Mean rating | s.d. | Variable Description |
|---|---|---|---|
| 39 | 4.89 | 1.23 | driving speed |
| 40 | 2.26 | 0.85 | view |
| 41 | 3.82 | 0.88 | access from home to Expressway |
| 42 | 4.87 | 0.83 | access from Expressway to Arborland |
| 43 | 3.03 | 1.39 | access from Arborland to Expressway |
| 44 | 3.97 | 0.99 | condition of the pavement |
| 45 | 3.49 | 1.12 | traffic density |
| 46 | 4.82 | 0.91 | length of time required for trip |
| 47 | 4.46 | 0.97 | straightness of the road |
| 48 | 4.26 | 0.99 | flatness of the road |
| 49 | 4.90 | 0.85 | number of stoplights |
| 50 | 3.33 | 1.22 | degree of safety |
| 51 | 3.49 | 0.60 | trip distance |
| 52 | 3.67 | 1.28 | accessibility to stores other than those in Arborland |

possible because of the multidimensionality of the driving speed variable. The fact that the ratings for driving speed are characterized by a high standard deviation is another illustration of the multidimensional nature of the variable.

As revealed by Table 4.4, the shoppers tended to associate economic disadvantages with the Parkway. The most important drawback in this respect appears to be the relatively greater number of stoplights on the Parkway--as well as the traffic congestion associated with the stoplights. The Parkway's trip time, it should be noted, is rated as only a "slight" disadvantage relative to the Expressway. More importantly, the analysis showed that the Parkway's view received the highest mean "advantage" rating of any of the elements of the two routes. The ratings of the scenery variable also exhibited one of the lowest standard deviations, which indicates a high level of agreement between the subjects. In contrast, the Expressway's view was rated as the most important disadvantage of either of the routes. Together, these results clearly indicate that the visual environment is a non-economic factor affecting trip behavior in the study area.

## Summary

The analysis of the questionnaire data identified a number of independent attitude dimensions which underlie the shoppers' route choice decisions. These dimensions reflect

a broad range of "non-economic" considerations which work against the normative-economic notion of functional distance minimization. For instance, the data revealed a coherent non-economic dimension of attitudes with regard to the degree of danger/safety of the Expressway route. The attitudes of the males and females with respect to this dimension were significantly different, such that the females perceived the Expressway to be more dangerous than did the men. This point supports the findings of Chapter III.

The analyses supported the view that some features of the Parkway and Expressway are multidimensional. Two such features were the hills and curves of the Huron Parkway. Thus one of the dimensions indicated that the shoppers associated these features with the negative aspects of trip time, degree of danger/safety, and level of driving effort, while in another dimension the hills and curves were positively associated with the scenic appearance of the Parkway. The hills and curves are therefore complex elements which influence the shoppers' route choice decisions in different ways. Similar arguments apply to the driving speed variable. It was observed, for example, that variables measuring the Parkway's driving speed loaded on three different dimensions, reflecting considerations of danger, attention, scenery, and distance. Thus, driving speed is perceived as both an economic and non-economic variable in the shoppers' decision-making.

The data revealed that the shoppers associate distinctly different moods with the two routes. Also, the results suggested that the mood of the driver may affect the outcome of his route choice decision. The most important mood in this regard appeared to be the feeling of being "in a hurry." Variables relating to this mood comprised one of the dimensions of attitudes, which in turn meant that the Expressway tended to be favored when the shopper was short of time. Similarly, the moods most associated with the Parkway included "not in a hurry"; "feel like taking a break"; and "feel like viewing nature."

The results from parts II and IV of the questionnaire suggested that distance-minimizing advantages are linked to the Expressway. Thus features of the Expressway which were rated as important advantages included the access characteristics to Arborland; the number (fewer) of stoplights; and the driving speed and travel time. Perhaps more interesting was the finding that the shoppers' ratings of the driving speed variable exhibited a particularly high standard deviation. This obviously supports the idea that driving speed is a multidimensional variable. In the case of the Parkway, the shoppers tended to associate economic disadvantages with the route, especially in terms of the stoplights.

The findings presented in this chapter lend support to the hypothesis that the scenic appearance of the Huron

Parkway affects the shoppers' route choice decisions. For instance, it is notable that one of the independent attitude dimensions consisted of variables relating to the scenic attributes of the Huron Parkway. The importance of scenery was also suggested by the fact that the Parkway's "view" was rated as the most important advantage of the Parkway route relative to the Expressway. Indeed, the scenery on the Parkway received the highest positive rating of any of the elements on either route. These ratings also exhibited a particularly low standard deviation. In contrast, the scenery of the Expressway was rated as the most important disadvantage.

The results show that roadside scenery is only one of several elements which the shoppers associate with the scenic experience on the Huron Parkway. Thus the dimensional analysis grouped roadside scenery together with variables relating both to driving speed and to hills and curves. The shoppers appeared to associate the hills and curves not only with the attractiveness of the Parkway's alignment, but also with the driver's ability to view the roadside scenery. More specifically, the respondents indicated high agreement with the statement that "The driving speed on the Huron Parkway allows the roadside environment to be adequately viewed." This seems to indicate that the slower speed of the Parkway enhances the driver's scenic experience by allowing him more time to visually process the roadside displays.

# CHAPTER V

# PICTURE RATING: METHODOLOGY AND RESULTS

## Overview

It will be recalled that two different techniques were employed in the personal interviews to determine the considerations underlying the subjects' route choice decisions. The methodology and results pertaining to the first of these techniques--the questionnaire--have formed the focus of the preceding chapters. In this chapter, the discussion will be concerned with the procedure utilized in the second part of the interview, wherein the shoppers were asked to provide preference ratings for a series of photographs of natural roadside scenery.

The purpose of the picture rating procedure was to identify possible non-verbal issues relevant to the assessment of scenery as a factor in trip behavior. This seemed to be an appropriate extension of the objectives of the questionnaire because of the importance that many respondents in the preliminary study attached to scenery. Apart from addressing the question of trip behavior, a further objective of this part of the data collection was to make

an empirical contribution to the issue of landscape preference per se.

The strategy of this phase of the research relies on the identification of landscape content domains on the basis of preference ratings; the content domains--or landscape dimensions--are then used to construct scales which enable the subjects' route attitudes and trip behavior to be related to their scenery preferences. The analytical procedures will be essentially the same as those employed in Chapter IV.

## Methodology

### Photographic Procedure

The photographs shown to the respondents were selected from a group of approximately 450 pictures taken during the months of September and October in southeastern Michigan. This meant that vegetation was prominent in the scenes. The pictures were all taken alongside roads and depicted "natural" environments in the sense that man-made features were excluded or were not readily visible. Many of the scenes were nevertheless man-influenced. The study was restricted to natural views because this general domain of scenery is characteristic of the roadsides of both the Parkway and the Expressway. Another reason was that Kaplan, Kaplan, and Wendt[1] have shown that it is useful to

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[1]S. Kaplan, R. Kaplan, and J. Wendt, "Rated

distinguish between natural and urban domains when analyzing landscape preferences. It is important that Coughlin and Goldstein[1] have provided limited evidence that subjects' ratings of photographs are consistent with their responses to the same views in the field.

Of the total number of pictures taken for the study, only a small portion portrayed scenes on the Expressway and Parkway. The bulk of the photographs was shot from other roads, and an attempt was made to sample the diversity of natural landscape content in the environs of the study area. The large proportion of pictures taken outside the immediate study area was necessary for the objective of identifying content dimensions in the natural landscape. Also it was considered inadvisable to show the subjects scenes from only the Expressway and Parkway; in such circumstances the respondent could be expected to recognize the origins of the photos and, depending on his preferences for either of the routes, his pattern of ratings for the scenes would likely be biased. Finally, by showing a mix of scenes--including photos from both within and outside of the study area--it

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Preference and Complexity for Natural and Urban Visual Material," Perception and Psychophysics, Vol. 12 (1972), p. 355.

[1]R. Couglin and K. Goldstein, "The Extent of Agreement Among Observers on Environmental Attractiveness," Regional Science Research Institute Discussion Paper Series, No. 37 (Philadelphia: Regional Science Research Institute, 1970), p. 12.

seemed possible to evaluate the scenery of the Parkway and Expressway within the context of the larger natural landscape.

In order to ensure that the photos accurately reflected the diversity of landscape content in the environs of the study area, two different procedures were followed in shooting the pictures. In the first procedure, approximately one-half of the photos were taken according to a kind of systematic sampling procedure; the photographer drove for a specified number of seconds, then stopped the car and took a picture, drove for the specified number of seconds, and so on. The time interval was changed frequently. In the second procedure, the photos were shot in a subjective, or "conscious" manner, to use the terminology of Bartlein and Freifeld.[1] These pictures depicted scenes which in the mind of the photographer were representative of the landscape. The photos from both procedures were unspectacular in content. In all cases the pictures were taken from the right-hand side of the road, at an angle of 30-40° from the road alignment. Each picture was oriented so that a small portion of the road surface was visible in the lower left-hand corner of the scene.

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[1]P. Bartlein and S. Freifeld, "Perceptually Relevant Environmental Quality Measures for Environmental Inventories and Impact Evaluations," unpublished mimeograph, 1972.

Black-and-white film was employed exclusively in the study partly because of cost considerations but principally as a way of eliminating possible preference biases associated with ephemeral color effects. Also, in a departure from normal procedures, a yellow filter was not utilized. This tactic minimized the representation of clouds in the photos, thereby reducing the possibility of biases caused by these ephemeral features.

A 35 mm semi-wide angle lens was used in the photography. A standard lens (50 mm or 55 mm) depicts landscape element size and distance more accurately, but the breadth of the viewing angle is narrow compared to that of the human eye. A lens having a very wide angle, on the other hand, more nearly approximates the viewing angle of the eye, but it distorts distance and element size. The choice of the 35 mm lens, therefore, represented a compromise between these extremes.

## Development of Rating Procedure

Since it was both undesirable and infeasible to have the subjects rate the entire collection of photographs, the number of pictures was reduced in order not to fatigue the subject or cause the interview to be excessively long. The problem therefore became one of identifying a smaller number of photos which accurately represented the diversity of landscape content portrayed by the larger collection of pictures.

In the first step, a number of scenes were rejected because of obvious redundancies, excessive presence of man-made elements, photographic imperfections, etc. The remaining photos were then evaluated in terms of several variables and hypotheses which have emerged from the literature on landscape preference and assessment. From this evaluation, a group of 127 pictures was singled out as exhibiting a wide variety in terms of: texture, complexity,[1] and coherence.[2] In addition, the selection reflected a range of foreground, middleground, and background distances,[3] as well as vegetation "walls" and "screens."[4]

This selected photographs, however, were still too many to be shown to the subjects--particularly considering

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[1]J. Wohlwill, "Amount of Stimulus Exploration and Preference As Differential Functions of Stimulus Complexity," Perception and Psychophysics, Vol. 4 (1968), pp. 307-12; "The Emerging Discipline of Environmental Psychology," American Psychologist, Vol. 25 (1970), pp. 303-12.

[2]S. Kaplan, "Cognitive Maps, Human Needs and the Designed Environment," in Environmental Design Research, edited by W. Preiser, Proceedings of the Environmental Design Research Association, Conference Four, 1973; R. Kaplan, "Predictors of Environmental Preference: Designers and Clinets," in Environmental Design Research, edited by W. Preiser, Proceedings of the Environmental Design Research Association, Conference Four, 1973.

[3]R. Litton, "Forest Landscape Description and Inventories--A Basis for Land Planning and Design," U.S.D.A. Forest Service Research Paper PSW-49, Pacific Southwest Forest and Range Experiment Station, Berkeley, California, 1968.

[4]P. Thiel, "A Sequence-Experience Notation," Town Planning Review (April, 1961).

their additional task of completing the lengthy questionnaire discussed in Chapters II-IV. It was necessary, therefore, to further reduce the sample of photos. To this end it was decided to utilize a panel of judges[1] in order to obtain content judgments for the scenes. In this procedure each photo is given ratings by the judges according to the extent which it reflects specifically defined qualities. On the basis of these explicit ratings, a sub-sample of scenes can be selected which reflects the content diversity of the collection of photographs.

An important element in this strategy relates to the criteria according to which the panel of judges rates the various photographs. In the absence of a well-developed theory of visual landscape assessment, it has not been established which criteria are appropriate in such a rating procedure. It was decided, therefore, to undertake a limited "hypothesis gathering" study in the expectation that the results would aid in the selection of relevant judgment criteria.

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[1]K. Craik, A System of Landscape Dimensions: Appraisal of Its Objectivity and Illustration of Its Scientific Application, Report to Resources of the Future, Inc., (Berkeley: University of California Institute of Personality Assessment and Research, 1970); R. Kaplan, "The Dimensions of the Visual Environment: Methodological Considerations," in Environmental Design: Research and Practice, edited by W. Mitchell, Proceedings of the Environmental Design Research Association, Conference Three, 1972.

In this limited supplemental study, five laymen were individually given a randomized "deck" which consisted of the 127 landscape photographs. Initially, the respondent was asked to sort the photos into piles of "similar scenes," or scenes that in his mind "went together." The photos were 5" x 3 1/2" prints--a size that was found to be convenient for sorting. The subject was told that he could create as many piles, or categories, of scenes as he wished, and that he could choose any criteria as the basis for his sorts. Also, the subject was allowed as much time as he desired for completing the task.

When the sorting task (which required approximately 20-30 minutes) was finished, each of the five laymen was asked to describe insofar as possible the criteria which he had used for forming his various groups of scenes. Lastly, the respondent was requested to rank the categories according to preference, and to explain his reasons for liking or disliking each of the groups of pictures.

The author has not located a precedent for the particular methodology followed here and has tentatively dubbed it a "Free Category Sort" (FCS). The FCS procedure is attractive because it avoids the arbitrary imposition of a fixed scale or set number of categories. Rather, the subject is able to interpret content in terms of his own preference abilities. Also, the FCS procedure is useful for obtaining insights into the relationships between visual

categorization on the one hand, and verbal content on the other. Such insights appear desirable, particularly in the light of evidence that man's visual processing powers may be at least as highly developed as his verbal abilities.[1]

Drawing on research evidence concerning human information processing abilities,[2] it was anticipated that each of the subjects in the FCS procedure would isolate from five to nine groups of photos. This was in fact borne out by the results in the sense that one layman sorted six categires; two laymen sorted seven; one sorted eight; and there was one instance of nine categories.

Although the supplemental study was limited in scope, the consistent pattern of the results was rather striking. Thus it was observed that all the laymen defined a category of pictures on the basis of the presence of water in the scenes. This category was unanimously ranked as most preferred. Also, all of them isolated a group of photos on the basis of "park-like" qualities. These scenes were characterized by the presence of mowed grass and "separated" trees (either single trees or small groves). As a category, the

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[1]S. Kaplan, "The Challenge of Environmental Psychology: A Proposal for a New Functionalism," American Psychologist, Vol. 27 (1972), pp. 140-43.

[2]G. Miller, "The Magical Number Seven, Plus or Minus Two--Some Limits on Our Capacity for Processing Information," Psych. Review, Vol. 63 (1956), pp. 81-97.

park-like scenes were unanimously ranked second in order of preference.

The groups of pictures ranked as having middle levels of preference were ambiguous in the sense that they reflected neither consistent categorization criteria nor a discernible pattern of preference ranking. However, in the case of the least preferred category, there was once again unanimous agreement among the five laymen of the complementary study. Thus each of them sorted a group of pictures that was largely composed of scenes having foreground "walls" --to use Thiel's terminology.[1] The walls were both vegetative and earthen, the latter caused by highway cuts. All scenes grouped in this least preferred category were characterized by restricted space. In this regard, three of the subjects explicitly remarked that these photos made them feel "confined" or "claustrophobic." The findings from the FCS procedure therefore suggested that visual distance/space is an important variable in landscape content and preference.

Based on the findings from the supplemental study, "distance/space" was selected as one criterion to be rated by the panel of judges. Also, it was decided to exclude water scenes from the photos under consideration to be shown to the shoppers. These scenes were excluded because it has been rather well established--both in the intuitive design

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[1]Thiel, "A Sequence-Experience Notation."

literature and by empirical research--that the presence of water enhances visual landscape preference.

In addition to the distance/space criterion, the criteria selected to be rated by the panel of judges included "complexity"[1] and "coherence."[2] For each of these three criteria the panel of judges was asked to rate the 127 pictures on a five-point scale, ranging from "not at all" to "a great deal." The instructions given to the judges defined the ratings as follows:

1. Complexity
   How intricate (number of major elements) or complex do you find the picture?
2. Coherence
   To what extent does the scene "hang together"? What is the degree of order characterizing the elements of the scene?
3. Sense of Distance/Space
   To what extent is space enclosed or expansive in the scene? To what degree is there a feeling of distance?

The panel of judges was composed of two geographers, two psychologists, and one landscape artist. The judges worked independently, and rated the collection of pictures first for complexity, then again for coherence, and lastly

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[1]Wohlwill, "Amount of Stimulus Exploration"; and "The Emerging Discipline of Environmental Psychology."

[2]S. Kaplan, "Cognitive Maps, Human Needs"; R. Kaplan, "Predictors of Environmental Preference."

for distance/space. The judges' ratings were generally characterized by high levels of agreement: the mean variance of the ratings for complexity was .25; for coherence .41; and for distance/space .31. On the basis of these judgments, a final sample of fifty-three photographs was selected which was felt to reflect a balance of the chosen criteria. These photographs constituted the scenes which were ultimately shown to the shoppers in the personal interviews.[1] (A diagram outlining the development of the picture rating procedure appears in Appendix B.)

## Final Rating Procedure

It will be recalled that the personal interview with each of the shoppers consisted of two parts. In the first part the subject completed the questionnaire. In the second, he was asked to provide preference ratings for each of the fifty-three landscape photographs that were selected in the manner just discussed. In the landscape rating procedure, the photos, or "environmental displays"[2] were presented to the subjects via a "picture book." The picture book

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[1]It is appropriate to note that the results from both the supplemental study and the judges' ratings were suggestive of an interactive model of landscape preference--a model based on the variables of complexity, coherence, and distance/space. This model, with its implications for the prediction of landscape preference, will be presented elsewhere as a separate study.

[2]Craik, A System of Landscape Dimensions.

consisted of a large loose-leaf binder holding numbered pages on which the photos were mounted. The scenes were mounted one to a page. In the course of data collection, the order of scenes was changed at regular intervals.

The high portability of the picture book was compatible with the demands of the home interview procedure. Also, the concept of the picture book offered certain methodological advantages relative to the commonly used display technique of slides. Thus the picture book allowed the subject to compare easily different scenes when making his preference judgments. In addition, this display method enabled the respondent to proceed in his ratings at his own pace, that is, at a speed commensurate with his preference abilities. It was felt that the picture book technique avoided the imposition of a set viewing time for each display--a set viewing time has typically characterized rating procedures which utilize slides.

Each shopper was given a response sheet which listed a six-point preference scale for every landscape photograph. (The response sheet appears in Appendix C.) The scale of preference ranged from "not at all" to "a great deal." The instruction given to the subjects was to ". . . indicate how much you like each of the roadside scenes."

Immediately prior to commencing his preference ratings, each subject was given a "pre-test."[1] In the

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[1]Coughlin and Goldstein, "The Extent of Agreement."

pre-test, the respondent was instructed to simply "thumb through the pages of scenes for a couple of minutes." The purpose of this preliminary procedure was to expose the subject to the range of landscape content in the displays, and thereby assist him in forming relative preference judgments.

As noted above, the shopper was allowed as much time as he desired for rating the pictures. In practice it was found that the subjects were able to make their preference judgments rather quickly, requiring on the average from ten to fifteen minutes to rate the fifty-three scenes. In no instance did a shopper verbally indicate that he had difficulty making the judgments. These points support the observations of Coughlin and Goldstein that subjects ". . . do not require specific instructions and definitions as to what constitutes the attractiveness of the natural environment."[1]

## Results

### Dimensions of Landscape Content

In a procedure similar to that followed in Chapter IV, dimensional analyses were performed to identify content domains in the landscape photographs. The input data consisted of the preference ratings of the forty-eight shoppers. The dimensional analyses employed were again the

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[1] Ibid., p. 25.

Guttman-Lingoes Smallest Space Analysis III (SSA-III)[1] and ICLUST.[2]

Each dimension identified from the results is comprised of a group of scenes for which the subjects' ratings were intercorrelated or exhibited similar patterns of interrelationships. Although the input data consisted of preference ratings, the fact that the dimensional algorithms analyze the patterns of responses means that the photos comprising a given dimension do not necessarily reflect similar levels of preference. Indeed, it is possible that the preference levels for the scenes in a dimension can vary rather widely. Irrespective of preference levels, the fact that the ratings for some groups of photos are highly interrelated indicates that the shoppers responded to the scenes in each group in similar ways. Thus the concept of a landscape dimension implies an independent domain of visual content--a domain identified in terms of distinct patterns in the subjects' responses.

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[1]J. Lingoes, "An IBM-7090 Program for Guttman-Lingoes Smallest Space Analysis-III," Behavioral Science, Vol. 11 (1966), pp. 75-76; "Non-metric Factor Analysis: A Rank-Reducing Alternative to Linear Factor Analysis," Multivariate Behavioral Research, Vol. 2 (1967), pp. 485-505; "A General Survey of the Guttman-Lingoes Nonmetric Program Series," in Multidimensional Scaling: Theory and Application in the Behavioral Sciences, Vol. 1 (1972).

[2]J. Kulik, W. Revelle, and W. Kulik, "Scale Construction by Hierarchical Cluster Analysis," unpublished paper, Department of Psychology, University of Michigan, 1970.

As a result of the SSA-III and ICLUST procedures, five content dimensions were identified from the photographs of roadside environments. Employing a criterion of an SSA-III factor loading greater than .45, the following dimensions were identified:

1. Raggedness; High Complexity

   This domain (16 scenes) is characterized by high complexity arrays in the foreground and in some cases also the middleground. Most of the scenes have ragged or "scruffy" textures, reflecting low levels of order in the complexity. The scruffiness is frequently the result of irregular clumps of tall weeds. (Examples: Figures 5.1, 5.2, 5.3, and 5.4)

2. Park-Like and Parkway-Like

   This dimension (13 scenes) is distinguished by the universal presence of mowed grass and trees. The Parkway-Like displays typically have mowed foregrounds, and a tree "wall" in the middleground. The Park-Like scenes lack tree walls (though some have tree "screens"), and tend to give a greater feeling of distance/space. The scenes all reflect landscaped qualities and a rather high degree of human influence. (Examples: Figures 5.5, 5.6, 5.7, and 5.8)

3. Uniform Texture Tall Weeds

   This domain (4 scenes) is characterized by foreground/middleground unmowed vegetation of uniform lengths. The fact that the vegetation is rather uniform results in low levels of complexity. There are no foreground walls or screens. The vegetation

is typically weeds, although in one case it consists partly of a cornfield. (Examples: Figures 5.9 and 5.10)

4. Low Complexity Mowed Weeds

These displays (4 scenes) are distinguished by mowed weeds--typically in the foreground. The mowed weeds are more ragged and patchy than mowed grass. All scenes were rated as having low complexity by the panel of judges, and two of the scenes are characterized by a particularly restricted sense of space. (Examples: Figures 5.11 and 5.12)

5. Foreground Screens

The scenes (4 photos) in this dimension all have foreground screens--composed of either trees, bushes, or high weeds. The screens serve as a belt of intervening elements through which the observer can see into the middleground or background beyond. All the scenes give a feeling of open space in the middleground areas immediately beyond the screens. (Examples: Figures 5.13 and 5.14)

TABLE 5.1

DIMENSIONS OF LANDSCAPE CONTENT

| No. | Dimension Name | No. of Items | Mean Item Preference | s.d. |
|---|---|---|---|---|
| 1 | Raggedness; High Complexity | 16 | 3.30 | .57 |
| 2 | Park-Like and Parkway-Like | 13 | 4.75 | .47 |
| 3 | Uniform Texture Tall Weeds | 4 | 3.31 | .37 |
| 4 | Low Complexity Mowed Weeds | 4 | 2.97 | .70 |
| 5 | Foreground Screens | 4 | 4.14 | .30 |



Figure 5.1.--Dimension 1--Raggedness; High Complexity. Loading = .79.



Figure 5.2.--Dimension 1--Raggedness; High Complexity. Loading = .78.



Figure 5.3.--Dimension 1--Raggedness; High Complexity. Loading = .76.



Figure 5.4.--Dimension 1--Raggedness; High Complexity. Loading = .69.



Figure 5.5.--Dimension 2--Park-Like and Parkway-Like. Loading = .76.



Figure 5.6.--Dimension 2--Park-Like and Parkway-Like. Loading = .60.



Figure 5.7.--Dimension 2--Park-Like and Parkway-Like. Loading = .78.



Figure 5.8.--Dimension 2--Park-Like and Parkway-Like. Loading = .68.



Figure 5.9.--Dimension 3--Uniform Texture Tall Weeds. Loading = .67.



Figure 5.10.--Dimension 3--Uniform Texture Tall Weeds. Loading = .49.



Figure 5.11.--Dimension 4--Low Complexity Mowed Weeds. Loading = .62.



Figure 5.12.--Dimension 4--Low Complexity Mowed Weeds. Loading = .67.



Figure 5.13.--Dimension 5--Foreground Screens. Loading = .54.



Figure 5.14.--Dimension 5--Foreground Screens. Loading = .50.

The results from the quantitative analyses are summarized in Table 5.1. From this table, it is evident that a "Park-Like and Parkway-Like" dimension can be identified. Of the total of fifty-three photos shown to the shoppers, all of the pictures in the sample taken on the Huron Parkway (six pictures) loaded on this dimension. It should also be pointed out that the ICLUST results defined two coherent subclusters of scenes within this dimension; one of the subclusters consisted entirely of the Park-Like photos, and the other was comprised entirely of the Parkway-Like scenes. (Figures 5.5 and 5.6 were clustered as Park-Like; Figures 5.7 and 5.8 were clustered with the Parkway-Like scenes.) The results reflect the fact that the shoppers responded in similar, consistent ways to the various photos of the Huron Parkway. Put differently, the dimensional analyses therefore indicated that the Parkway's scenery falls within a content domain which is distinct vis-a-vis the landscape in the environs of the study area.

In contrast to the photos of the Huron Parkway and Parkway-Like displays, the pictures taken on the Expressway and other freeways did not load on a single dimension. Rather, these scenes (totalling eleven pictures) were scattered through the landscape domains, with a majority loading on the dimensions of "Uniform Texture Tall Weeds" and "Low Complexity Mowed Weeds." (Figures 5.10 and 5.12, for example, are expressway shots.) Three of the freeway pictures

did not have factor loadings which were sufficiently high to meet the criterion of a dimension. The subjects therefore did not respond in similar ways to the various photographs of the Expressway. The patterns of the shoppers' ratings suggest that the scenes on the Expressway are less distinct relative to the larger landscape than is the scenery on the Parkway.

Importantly, the preference ratings for the photos in the Park-Like and Parkway-Like dimension were higher by a considerable margin than those for the scenes in the other content domains (Table 5.1). This finding suggests that the Parkway's scenery is highly preferred not only with respect to the roadside environment of the Expressway, but also relative to the views from other roads in the vicinity of the study area.[1] The photo ratings lend support to findings

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[1]The pictures shown to the shoppers were of course static representations of segments of roadside environments. It might be argued that under the artificial conditions of the picture book procedure, the subject's pattern of landscape ratings would not correspond to his preferences under "real" driving conditions. While driving, the shopper would typically be exposed to brief or fleeting glimpses of roadside scenes--not the static views and leisurely perceptual pace of the interview. However, in a recent study R. Kaplan has demonstrated that subjects' preferences for visual landscapes remain essentially constant regardless of differences in exposure time (R. Kaplan, "Prediction of Preference in the Outdoor Environment," Contribution to the symposium: "Environmental Aesthetics: Outdoor Environment as a Source of Affect" at annual meetings of American Psychological Association, Montreal, 1973). In the course of Kaplan's study, exposure durations as brief as 10 msec. were employed. These findings suggest that the shoppers' preferences as

from both the preliminary study and the questionnaire, which had indicated that the shoppers liked the views on the Huron Parkway, and that many of them considered the Parkway's scenery to be an important advantage relative to the Expressway. Thus, the consistently high preference ratings accorded to the Parkway photos--coupled with the fact that the pictures all loaded on a coherent dimension of content--support the idea that the Huron Parkway represents a source of scenic amenity for the shoppers in the study area.

The finding that the "Park-Like and Parkway-Like" dimension was most preferred is consistent with the findings of Rabinowitz and Coughlin.[1] Although their research did not consider visual material from parkways, they noted a tendency for subjects to prefer areas that were landscaped, and which were characterized by ". . . mowed grass and scattered large shade trees."[2] The fact that none of the dimensions had a particularly low mean preference rating is in accord with other research results which indicate that observers prefer virtually any natural scenery to urban or

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reflected by the picture book procedure would be similar to those revealed under the "real" conditions of the automobile.

[1]C. Rabinowitz and R. Coughlin, "Analysis of Landscape Characteristics Relevant to Preference," Regional Science Research Institute Discussion Paper Series No. 38 (Philadelphia: Regional Science Research Institute, 1970), p. 7.

[2]Ibid.

suburban displays.[1] The photographs having the lowest ratings tended to be those which were characterized by "ragged" texture and/or a restricted sense of space. A few of the lowest rated pictures were distinguished by low complexity.

## Group Differences

The dimensions identified by the SSA-III results were used to construct scales for comparing the preference ratings of different groups of shoppers. Using the "ALPHA" program,[2] cumulative scale scores were computed for each subject on the basis of his ratings for the scenes in the various dimensions. The results are shown in Table 5.2.

TABLE 5.2

LANDSCAPE CONTENT SCALES

| Scale Name | No. of Items | Mean | s.d. | Alpha | Av. r |
|---|---|---|---|---|---|
| Raggedness; High Complexity | 16 | 52.85 | 14.39 | .94 | .50 |
| Park-Like and Parkway-Like | 13 | 61.79 | 9.13 | .91 | .43 |
| Uniform Texture Tall Weeds | 4 | 13.25 | 3.20 | .66 | .33 |
| Low Complexity Mowed Weeds | 4 | 11.88 | 3.51 | .70 | .37 |
| Foreground Screens | 4 | 16.54 | 3.13 | .70 | .36 |

[1]Kaplan, Kaplan and Wendt, "Rated Preference and Complexity."

[2]W. Revelle, "ALPHA: Scale Scoring and Internal Consistency," unpublished paper, Department of Psychology, University of Michigan, 1971.

In order to analyze possible differences in landscape preference, the shoppers were stratified as before according to sex, route choice behavior, and shopping trip frequency. A series of t-tests and analyses of variance was performed to determine if the mean scale scores of the strata differed significantly.

In the case of all three categorical variables, the results revealed no statistically significant differences between the strata's mean scores. Indeed, the t and F tests revealed that the various groups of shoppers exhibited high levels of agreement. These results are consistent with findings by Coughlin and Goldstein[1] who showed that there is "substantial" agreement among observers on preference for visual environments.

From the point of view of assessing the importance of scenic amenity in the shoppers' route choice decisions, it should be emphasized that those who used the Parkway had essentially the same landscape preferences as the shoppers who relied on the Expressway. This lends support to the finding from the questionnaire data that the Parkway users and the Expressway users agreed that the Huron Parkway is visually attractive. Since the Parkway users and Expressway users apparently have similar landscape tastes, it appears

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[1]Coughlin and Goldstein, "The Extent of Agreement Among Observers," p. 6.

that these two groups of shoppers differ with respect to the value they place on scenic amenity. This suggests that scenic amenity had greater utility for the shoppers who chose the Parkway. Thus, despite widespread agreement in preference judgments, the overt behavior of the individuals suggests that they place different values on the utility of scenery.

# CHAPTER VI

## GENERAL CONCLUSIONS

In recent years a growing concern in geography and other disciplines has been with the determination of realistic assumptions relating to spatial behavior. For the most part, these efforts have focused on issues of informational biases and imperfect knowledge. The study presented here has differed from this research trend in its emphasis on the goals which affect behavior. By concentrating on a sample of shoppers who possess high levels of knowledge concerning two alternative routes, it was possible to focus on the goals underlying trip behavior.

Fundamental to the study has been the view that any trip behavior represents an experiential event. This implies that the particular characteristics of the route and travel mode affect the nature of the trip experience, and in so doing may serve as benefits or disbenefits associated with distance. To the extent that route characteristics influence the trip experience, they may result in spatial behavior which is less dependent on time or distance considerations. This view contrasts with the normative-economic

behavioral assumption which asserts that individuals' trip behavior is directed towards the minimization of functional distance.

The findings demonstrate that the experiential aspects of the shopping trip indeed play an important role in behavior. In this regard a number of "non-economic" considerations were linked to the route choices of the shoppers. For example, many subjects chose the route which they felt was safer, or which they felt demanded less driver attention. For a large proportion of the trips, such non-economic motivations appeared to override time-saving considerations. As a result, it may be concluded that the Economic Man assumption as it applies to route choice behavior is unrealistic. This conclusion was reached despite the fact that the shoppers possessed virtually perfect knowledge of the route alternatives.

The most important non-economic benefit appeared to be the visual environment of the Huron Parkway. Thus it was clearly established--via open-ended responses, questionnaire data, and picture ratings--that the scenery of the slower Parkway route represented a source of visual amenity. The findings provided a rough indication of the relative utility of the Parkway's "view"; first, the scenery was rated as the most important advantage characterizing either of the routes, secondly, the scenic benefits of the Parkway seemed to motivate many shoppers to forego the time-saving

advantages of the Expressway.[1] In conclusion, the results suggested that the visual environment--by being an experiential element associated with distance--may serve as a source of utility in functional trips, and can affect individuals' spatial behavior accordingly.

The finding that an attractive roadside environment constitutes a benefit to individuals is hardly surprising. Nevertheless it is worth noting because of its relevance for planning. Thus it has been pointed out that the virtual nonexistence of empirical studies demonstrating the benefits of scenic amenity has handicapped the inclusion of scenic values in the planning context. Perhaps the most important feature of the study is not the conclusions per se, therefore, but rather the fact that they have been based on empirical evidence. To the extent that the findings affirm the concept of scenic benefits, they represent a step towards establishing the public's equity in the visual landscape. It appears that only a comprehensive empirical delineation of such equity will assure that scenic values are explicitly and effectively incorporated into formal planning.

Apart from the general issue of reconciling scenic amenity with the planning process, the findings have other design and planning implications. In the area of highway

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[1]Perhaps this can be interpreted as meaning that the "worth" of the scenery exceeded a time-savings payoff of three minutes.

design, for instance, the results suggest that planners should give more careful consideration to the experiential aspects of routes. Thus it was shown that driver benefits were enhanced through the landscaping of roadsides. Likewise, it was noted that a driver's well-being is dependent not only on the road's "statistical" safety, but also on its ability to make him feel safe. In this regard, it should be recalled that the female shoppers considered the Expressway to be more dangerous than the slower Huron Parkway. The males, on the other hand, felt that the Expressway was safe. Perhaps this indicates that in those areas where a high proportion of total auto trips are made by females for purposes of shopping, taking children to school, etc., planners should opt for road designs with comparatively low speed limits and not strive for expressways or other high-speed alternatives.

The findings have relevance also at a more general level of urban/regional planning. Specifically, the illustration that the shoppers are not stereotyped individuals suggests broad design prescriptions for spatial environments. Thus a point consistently apparent was that the particular considerations underlying the route choice decisions frequently varied widely between individuals. The broad range of behavior observed in the study area was consistent with the finding that many shoppers differ with respect to the

benefits and disutilities they associate with each of the routes. Also, there was evidence that an individual's goals could vary in response to different moods or circumstances. Taken together, these findings indicate that a spatial environment characterized by uniform structure and non-varying elements would be inequitable. For example, a road network comprised solely of one road type would most likely offer benefits only to a particular group of individuals and only for part of the time. A spatial environment offering only parkways would therefore be as undesirable as an environment consisting solely of expressways. This suggests that a more satisfactory general solution would be a network characterized by a moderate level of diversity. It is only in this way that the road user can be provided with the opportunity for different trip experiences. Such a design would expose the urban motorist to roadsides having natural scenery; it would allow for distance-minimizing payoffs, and would provide slower roads distinguished by their lower driver attention requirements, etc. Such a prescription of variety would likely prove more equitable in the sense that a larger proportion of drivers would be exposed to route payoffs which they personally preferred.

The argument that a route network should provide diversity is buttressed by an additional finding. Thus a portion of the trip decisions appeared to be affected by the driver's conscious need for variety. The implication here

is that a spatial environment should not only have differentiated road types, but that it should also offer the driver opportunities to choose between them. It is appropriate to note that expressways invariably diminish the number of route alternatives, particularly in directions perpendicular to the expressway right-of-ways. It would of course be quixotic to suggest that there should be an alternate choice for every route in a spatial environment. Indeed, very high levels of choice availability and diversity would probably be burdensome to drivers. Nevertheless, it is a feasible planning principle to provide opportunities for choice, and to consciously design a moderate level of variety into the travel network.

The above remarks are not without implications for geography. It was emphasized in the introductory chapter that most spatial theories rely on the same behavior assumptions as the theory of the firm. These assumptions view behavior as being oriented towards the goal of optimizing profits or utility. When extended to a spatial context, these goals become equivalent to minimizing the disutility of distance. As a consequence, geographic theory is largely normative and optimizing. The theories specify how facilities should be located, and how individuals should behave in space.

Recalling the earlier discussion about urban/regional planning, it is appropriate to contemplate the

character of a spatial environment designed strictly according to the principles suggested by prevailing geographic theory. In short, such an environment would be an expression of deterministic functionalism. In terms of distance-minimization, there would be, for example, a single, optimal solution for each highway or highway network. The characteristics of every road in this hypothetical environment would be similar, reflecting a design objective of high-speed direct movement paths. Taken to the normative-economic extreme, these design principles would result in an environment of very high uniformity in which there would be no provision for the individual to exercise his personal preferences with respect to spatial opportunities. Such a conception is in direct conflict with the planning principle advocated earlier.

That a discipline may benefit in a number of ways by developing a body of theoretical constructs--including unrealistic constructs--is undisputed. Nonetheless, it should be disquieting for geographers to realize that a spatial environment planned according to existing intuitive design principles would almost certainly serve the needs of its population better than an environment prescribed by current spatial theory. Moreover, it may well be that even haphazard, unplanned spatial structures would meet human needs better than a real-world translation of the strict normative-economic formula. These points allow us to return to the

initial premise of the study, which argued that our existing spatial theories and aggregate descriptions should be complemented with a more thorough understanding of individual behavior.

Finally, this research has suggested that geographers would profit by demonstrating a more explicit concern for visual landscapes. The findings indicated that attractive physical environments have positive utility, and in that sense can be expected to affect spatial behavior. It appears, therefore, that the visual landscape should be a consideration in attempts to formulate realistic behavior assumptions. Also, the findings suggest that landscapes should be evaluated in terms of their visual "resources." The fact that it was possible to identify coherent domains of landscape content underlines the feasibility of developing objective procedures for the assessment of landscapes. Some optimism in this regard also seems justified in view of the finding that there may be agreement among large groups of individuals on preference for visual environments.

# APPENDIX A

# QUESTIONNAIRE

No.____

I.

a. male____ female____

b. Do you ever shop at Arborland Shopping Center?

No___ Yes___ If yes, how frequently? ___ time(s) per week

___ time(s) per month

c. When you drive to Arborland from your home, which route do you take?

| | Percentage of Time |
|---|---|
| Huron Parkway | _____ |
| Expressway | _____ |
| other (specify) | _____ |

d. Are you likely to have children in the car with you when driving to Arborland?

Yes____ No____

e. Regarding the car you drive to Arborland-- what year is it?

19___

If you never take the Huron Parkway to Arborland, omit Part II and go on to Part III.

II. On those occasions when you choose to drive the Huron Parkway to Arborland, how important do you consider each of the following as advantages or disadvantages characterizing the Parkway route-- relative to the Expressway route? Please circle the number in the margin where:

1= very important disadvantage
2= important disadvantage
3= slight disadvantage
4= slight advantage
5= important advantage
6= very important advantage

| Variable No. | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | the driving speed on the Parkway (as compared to the Expressway). |
| 2 | 1 | 2 | 3 | 4 | 5 | 6 | the view |
| 3 | 1 | 2 | 3 | 4 | 5 | 6 | access from my home to the Huron Parkway |
| 4 | 1 | 2 | 3 | 4 | 5 | 6 | access from the Parkway to Arborland |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | 1 | 2 | 3 | 4 | 5 | 6 | access from Arborland to the Parkway |
| 6 | 1 | 2 | 3 | 4 | 5 | 6 | condition of the pavement |
| 7 | 1 | 2 | 3 | 4 | 5 | 6 | traffic density |
| 8 | 1 | 2 | 3 | 4 | 5 | 6 | length of time required for the trip |
| 9 | 1 | 2 | 3 | 4 | 5 | 6 | curviness of the Parkway |
| 10 | 1 | 2 | 3 | 4 | 5 | 6 | hilliness of the Parkway |
| 11 | 1 | 2 | 3 | 4 | 5 | 6 | number of stoplights |
| 12 | 1 | 2 | 3 | 4 | 5 | 6 | traffic congestion at some stoplights |
| 13 | 1 | 2 | 3 | 4 | 5 | 6 | degree of safety of the Parkway |
| 14 | 1 | 2 | 3 | 4 | 5 | 6 | accessibility to stores other than those in Arborland |
| 15 | 1 | 2 | 3 | 4 | 5 | 6 | police patrols and speed traps on the Huron Parkway |
| 16 | 1 | 2 | 3 | 4 | 5 | 6 | trip distance |

III. To what extent do each of the following reflect your feelings about aspects of the Huron Parkway? Please circle the number in the margin where:

1= strongly disagree
2= disagree
3= slightly disagree
4= slightly agree
5= agree
6= strongly agree

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17 | 1 | 2 | 3 | 4 | 5 | 6 | The roadside scenery is attractive. |

The curves in the Huron Parkway . . .

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 18 | 1 | 2 | 3 | 4 | 5 | 6 | are dangerous |
| 19 | 1 | 2 | 3 | 4 | 5 | 6 | add unnecessary time to the trip to Arborland |
| 20 | 1 | 2 | 3 | 4 | 5 | 6 | open up views of the roadside environment |
| 21 | 1 | 2 | 3 | 4 | 5 | 6 | make the appearance of the road itself more attractive |
| 22 | 1 | 2 | 3 | 4 | 5 | 6 | add an unnecessary burden to the driver's task of car control |

The hills in the Huron Parkway . . .

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 23 | 1 | 2 | 3 | 4 | 5 | 6 | are dangerous |
| 24 | 1 | 2 | 3 | 4 | 5 | 6 | add unnecessary time to the trip to Arborland |
| 25 | 1 | 2 | 3 | 4 | 5 | 6 | open up views of the roadside environment |
| 26 | 1 | 2 | 3 | 4 | 5 | 6 | make the appearance of the road itself more attractive |
| 27 | 1 | 2 | 3 | 4 | 5 | 6 | add an unnecessary burden to the driver's task of car control |

The police radar traps on the Huron Parkway . . .

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 28 | 1 | 2 | 3 | 4 | 5 | 6 | prevent me from driving as fast as I'd like |
| 29 | 1 | 2 | 3 | 4 | 5 | 6 | make me feel safer because speeding is reduced |

The traffic density on the Huron Parkway . . .

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30 | 1 | 2 | 3 | 4 | 5 | 6 | frequently makes driving dangerous |
| 31 | 1 | 2 | 3 | 4 | 5 | 6 | often makes the trip undesirably slow |
| 32 | 1 | 2 | 3 | 4 | 5 | 6 | requires that a high level of attention be paid to driving |

Driving speed on the Huron Parkway . . .

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 33 | 1 | 2 | 3 | 4 | 5 | 6 | allows the roadside environment to be adequately viewed |
| 34 | 1 | 2 | 3 | 4 | 5 | 6 | allows the driver to cope with in-car distractions |
| 35 | 1 | 2 | 3 | 4 | 5 | 6 | allows the driver to be in a thoughtful frame of mind |
| 36 | 1 | 2 | 3 | 4 | 5 | 6 | makes me feel safe |
| 37 | 1 | 2 | 3 | 4 | 5 | 6 | allows an efficient rate of travel to Arborland |
| 38 | 1 | 2 | 3 | 4 | 5 | 6 | is favorable for people with older cars |

If you never take the Expressway to Arborland, omit Part IV and go on to Part V.

IV. On those occasions when you choose to drive the Expressway to Arborland, how important do you consider each of the following as advantages or disadvantages characterizing the Expressway route-- relative to the Huron Parkway route? Please circle the number in the margin where:

1= very important disadvantage
2= important disadvantage
3= slight disadvantage
4= slight advantage
5= important advantage
6= very important advantage

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 39 | 1 | 2 | 3 | 4 | 5 | 6 | the driving speed on the Expressway (as compared to the Huron Parkway) |
| 40 | 1 | 2 | 3 | 4 | 5 | 6 | the view |
| 41 | 1 | 2 | 3 | 4 | 5 | 6 | access from my home to the Expressway |
| 42 | 1 | 2 | 3 | 4 | 5 | 6 | access from the Expressway to Arborland |
| 43 | 1 | 2 | 3 | 4 | 5 | 6 | access from Arborland to the Expressway |
| 44 | 1 | 2 | 3 | 4 | 5 | 6 | condition of the pavement |
| 45 | 1 | 2 | 3 | 4 | 5 | 6 | traffic density |
| 46 | 1 | 2 | 3 | 4 | 5 | 6 | length of time required for the trip |
| 47 | 1 | 2 | 3 | 4 | 5 | 6 | straightness of the road (as compared to the Parkway) |
| 48 | 1 | 2 | 3 | 4 | 5 | 6 | flatness of the road |
| 49 | 1 | 2 | 3 | 4 | 5 | 6 | number of stoplights |
| 50 | 1 | 2 | 3 | 4 | 5 | 6 | degree of safety of the Expressway |
| 51 | 1 | 2 | 3 | 4 | 5 | 6 | trip distance |
| 52 | 1 | 2 | 3 | 4 | 5 | 6 | accessibility to stores other than those in Arborland |

V. To what extent do each of the following reflect your feelings about aspects of the Expressway? Please circle the number in the margin where:

1= strongly disagree
2= disagree
3= slightly disagree
4= slightly agree
5= agree
6= strongly agree

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 53 | 1 | 2 | 3 | 4 | 5 | 6 | The roadside scenery is attractive. |
| 54 | 1 | 2 | 3 | 4 | 5 | 6 | The big trucks on the Expressway make me feel unsafe. |
| 55 | 1 | 2 | 3 | 4 | 5 | 6 | Merging onto the Expressway makes me feel unsafe. |
| 56 | 1 | 2 | 3 | 4 | 5 | 6 | I prefer the Expressway because I like to drive fast. |

The traffic density on the Expressway . . .

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 57 | 1 | 2 | 3 | 4 | 5 | 6 | frequently makes driving dangerous |
| 58 | 1 | 2 | 3 | 4 | 5 | 6 | often makes the trip undesirably slow |
| 59 | 1 | 2 | 3 | 4 | 5 | 6 | requires that a high level of attention be paid to driving |

Driving speed on the Expressway . . .

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 60 | 1 | 2 | 3 | 4 | 5 | 6 | allows the roadside environment to be adequately viewed |
| 61 | 1 | 2 | 3 | 4 | 5 | 6 | allows the driver to cope with in-car distractions |
| 62 | 1 | 2 | 3 | 4 | 5 | 6 | allows the driver to be in a thoughtful frame of mind |
| 63 | 1 | 2 | 3 | 4 | 5 | 6 | makes me feel safe |
| 64 | 1 | 2 | 3 | 4 | 5 | 6 | allows an efficient rate of travel to Arborland |
| 65 | 1 | 2 | 3 | 4 | 5 | 6 | is favorable for people with older cars |

VI. To what degree do you associate the following moods with choosing to drive the Huron Parkway (rather than the Expressway) to Arborland? Please circle the number in the margin where:

1= not at all; 2= very slightly . . . . . 6= very much

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 66 | 1 | 2 | 3 | 4 | 5 | 6 | in a hurry |
| 67 | 1 | 2 | 3 | 4 | 5 | 6 | not in a hurry |
| 68 | 1 | 2 | 3 | 4 | 5 | 6 | feel like taking a break |
| 69 | 1 | 2 | 3 | 4 | 5 | 6 | want to change routes for variety |
| 70 | 1 | 2 | 3 | 4 | 5 | 6 | feel like viewing nature |

VII. To what degree do you associate the following moods with choosing to drive the Expressway (rather than the Parkway) to Arborland? Please circle the number in the margin where:

1= not at all; 2= very slightly . . . . . 6= very much

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 71 | 1 | 2 | 3 | 4 | 5 | 6 | in a hurry |
| 72 | 1 | 2 | 3 | 4 | 5 | 6 | not in a hurry |
| 73 | 1 | 2 | 3 | 4 | 5 | 6 | feel like taking a break |
| 74 | 1 | 2 | 3 | 4 | 5 | 6 | want to change routes for variety |
| 75 | 1 | 2 | 3 | 4 | 5 | 6 | feel like viewing nature |

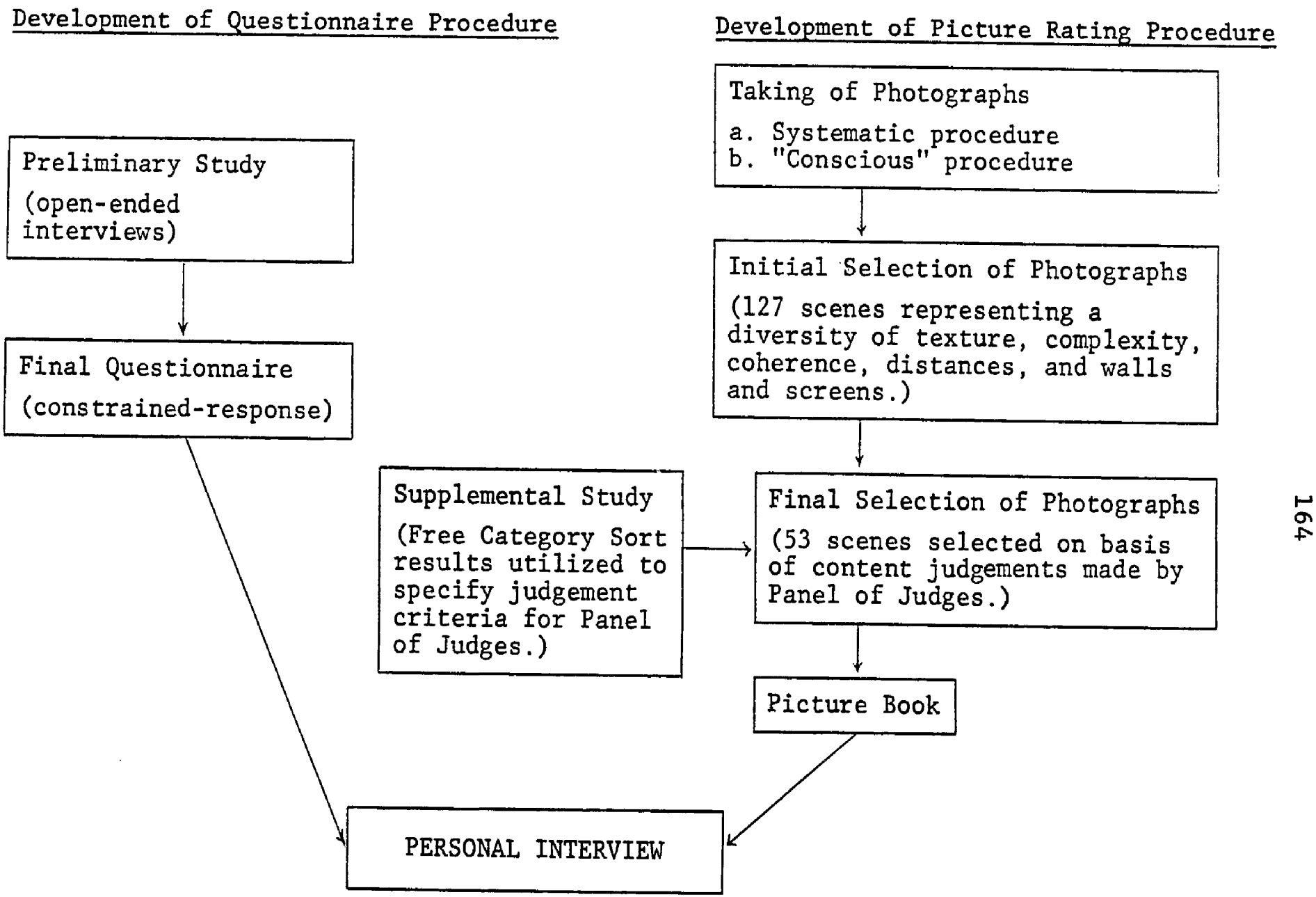
VIII. Please indicate your preference for choosing either the Huron Parkway or the Expressway under the following conditions, where:

1= strongly prefer Parkway
2= prefer Parkway
3= slightly prefer Parkway
4= slightly prefer Expressway
5= prefer Expressway
6= strongly prefer Expressway

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 76 | 1 | 2 | 3 | 4 | 5 | 6 | at night |
| 77 | 1 | 2 | 3 | 4 | 5 | 6 | when it's raining |
| 78 | 1 | 2 | 3 | 4 | 5 | 6 | when it's snowing |
| 79 | 1 | 2 | 3 | 4 | 5 | 6 | during rush hours |
| 80 | 1 | 2 | 3 | 4 | 5 | 6 | when there are children in the car |
| 81 | 1 | 2 | 3 | 4 | 5 | 6 | in the summer |
| 82 | 1 | 2 | 3 | 4 | 5 | 6 | in the winter |
| 83 | 1 | 2 | 3 | 4 | 5 | 6 | for the trip from home to Arborland |
| 84 | 1 | 2 | 3 | 4 | 5 | 6 | for the trip from Arborland to home |

# APPENDIX B

## DEVELOPMENT OF QUESTIONNAIRE AND PICTURE RATING PROCEDURE


Development of Questionnaire Procedure
Development of Picture Rating Procedure
Preliminary Study
(open-ended interviews)
Final Questionnaire
(constrained-response)
Taking of Photographs
a. Systematic procedure
b. "Conscious" procedure
Initial Selection of Photographs
(127 scenes representing a diversity of texture, complexity, coherence, distances, and walls and screens.)
Supplemental Study
(Free Category Sort results utilized to specify judgement criteria for Panel of Judges.)
Final Selection of Photographs
(53 scenes selected on basis of content judgements made by Panel of Judges.)
Picture Book
PERSONAL INTERVIEW

# APPENDIX C

## PICTURE RATING RESPONSE SHEET

No.____

The photographs in the book all depict "natural" roadside scenes in the sense that man-made objects are not readily visible. You will probably find that you like certain pictures more than others. Please indicate how much you like each of the roadside scenes, where:

1= not at all . . . . . 6= a great deal

| | | | | | | |
|---|---|---|---|---|---|---|
| 1/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 2/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 3/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 4/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 5/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 6/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 7/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 8/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 9/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 10/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 11/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 12/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 13/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 14/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 15/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 16/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 17/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 18/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 19/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 20/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 21/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 22/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 23/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 24/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 25/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 26/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 27/ | 1 | 2 | 3 | 4 | 5 | 6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 28/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 29/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 30/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 31/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 32/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 33/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 34/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 35/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 36/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 37/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 38/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 39/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 40/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 41/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 42/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 43/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 44/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 45/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 46/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 47/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 48/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 49/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 50/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 51/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 52/ | 1 | 2 | 3 | 4 | 5 | 6 |
| 53/ | 1 | 2 | 3 | 4 | 5 | 6 |

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