An Experimental Investigation of consumer Spatial Allocation Behavior.

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ABSTRACT

The purpose of this paper is to investigate patterns exhibited by consumers allocating their grocery expenditures in surrounding shopping alternatives. Within that spatial context, there are two major objectives. The first objective attempts to experimentally control the influence of size and distance by holding them constant in a "Laboratory Situation". The second objective aims at identifying relevant variables which best describe and explain the various patterns of Shopping preferences. The objectives are related to some concepts in Central Place Theory. The study was carried out in a carefully selected area located in Tioga County in the eastern part of Western New York State.

The final evaluation of the results indiates that multi-purpose trip variables are the most important predictors of the variation in the criterion variable, followed by the perceived attributes of the shopping place, and finally, by the variables that describe the socio-economic status of the consumer.

Various aspects of central place theory have been questioned or criticized in the four decades that have elapsed since its initial formulation by Walter Christaller. One of the foremost of these criticisms concerns the "explicit extremization behavior in the distribution and consumption of goods (e.g., goods are purchased from the closest place)" (5, p. 109). Indeed, Reilly's "law of retail gravitation," which was published four years before Christaller's

seminal work, provides evidence which directly contradicts the notion that consumers purchase only from the closest center offering goods (33). That is, Reilly clearly established that large centers have a greater drawing power than smaller centers and that, therefore, some of the consumers who are located between a large and a small center will be willing to travel a further distance to shop at the larger center, thus ignoring the smaller but closer one.

Not only does Reilly's law, or more generally the gravity model, provide direct evidence which contradicts the nearest neighbor assignment principle, but it also identified the two major variables that have been used to "explain" or "predict" consumer behavior. That is, he identified the size of a center as exerting a positive influence on consumer movement and the friction of distance as exerting a negative influence.

It is noteworthy, however, that gravity formulations have fallen somewhat short of perfect prediction and various researchers, from many disciplines, have posited factors other than size and distance that influence consumer movements. The bulk of the studies undertaken, however, have not clearly demonstrated the effect of factors other than size and distance on consumer movements. This may be in part due to the fact that the size and distance variables are so important that they tend to obscure the influence of other important but less significant variables, either because of their significance or because of collinearity.

The Research Problem

The main purpose of this study is to investigate the different patterns of spatial allocation of grocery expenditures in surrounding shopping alternatives. Within that context there are two major objectives. The first objective includes an attempt to experimentally control the influence of size and distance by holding them constant in a "laboratory situation". The second objective is to identify the relevant variables which best describe and explain the problem of spatial allocation. The first objective draws its significance from the fact that size and distance proved to be highly important variables in explaining consumer spatial behavior, and that in order to examine the influence of other variables while holding size and distance constant, a sound experimental design becomes a necessary procedure for achieving this objective. The term "laboratory situation" is used to refer to the careful selection of a study area that will enable us to hold the effect of

both size and distance constant. It is unfortunate to note that despite the fundamental role of experimentation in scientific research, goegraphic research has been lacking sound experimental designs (King, 1970). The neglect of experimentation in geography has led to the development of a gap between that subject and other fields similar to the quantitative gap which separated geography from other disciplines for many years.

The importance of the second objective derives from the arguments of many studies which have suggested that consumer spatial behavior can best be understood in light of three basic sets of variables; those which characterize spatial relationships between consumers and nearby shopping places, socio-economic status of consumers, and central place characteristcs (Huff, 1960; Warner, 1962).

To elaborate on the first objective, the need for experimentation in geography has been realized recently when it was noted that several statistical techniques "apear to be of rather limited value in most geographic research efforts which are typically lacking in any strong theoretical frameworks and properly designed experimental bais" (King, 1970: 367). This is not to deny, however, that there have been no experimental attempts in geographic analysis, but rather to point out that experimental attempts have been few and almost always based on statistical control and manipulation of experimental data such as in analysis of variance and partial regression analysis. Geography, in its unique emphasis on space, needs "laboratory situation" experiments so that the collected data will be adequate for reliable analysis. The need for such experiments has been recognized not only in geography but in other social sciences:

> There are excellent books dealing with the statistical manipulation of experimental data, but there is little help to be found on the methods of securing adequate and proper data to which to apply statistical procedure. (Campell, 1963:1)

There have been several attempts to use "laboratory situations" in geographic investigations. For example, the selection of Southern Germany by Christaller and the selection of Iowa by American geographers were attempts to find "laboratory regions" whose spatial relationship fits the domain of central place theory (6, p. 238).

The necessity for the inclusion of three sets of variables in this study has been realized in geographic research of consumer behavior which developed in three stages. In the first stage, the variables that have been emphasized most often are those characterizing spatial

relationships such as distance and multipurpose trips and the characteristics of the shopping place. In the second stage, the emphasis shifted from the place's characteristics to the consumer's characteristics. The third stage is characterized by the emphasis on incorporating the behavioral aspects of both the individual and location. Nystuen points out that "the movement or travel behavior is in part determined by the arrangement of facilities and in part determines that arrangement." (Andersen, 1970:54)

A similar view has been expressed on other occasion:

> In the long run, a central place system must evolve through a complex process of mutual adaptation of the behavior patterns of two principal actors involved; businessmen whose decisions alter the distribution of alternatives, and consumers who by giving or denying their patronage control the validity of various elements in the spatial system. (Curry, 1967:219).

These arguments tend to imply that the best available alternative to understanding consumer behavior is to follow an interdisciplinary approach which emphasizes marketing and psychology, as well as geography. Rushton comments on such a need:

> The pre-emptive task of the geographer in the spatial allocation problem -- a problem which requires the efforts of many disciplines for its satisfactory solution -- lies in defining a consumer spatial situation, in finding significant definitions for spatial consumption patterns, and in identifying those variables with which different expenditure patterns are associated. (Rushton, 1966:68).

Further support to Rushton's argument came from other fields. For example, Sheth concluded after an extensive review of buyer behavior that "various formulations for understanding consumer behavior is at best interdisciplinary and that more research is needed since the discipline of buyer behavior has not yet reached the stage of a mature science." (Sheth, 1967:739)

Variables Identification

To examine the spatial allocation of grocery expenditures, the following sets of variables are selected for analysis:

a) a set of four multipurpose trip variables, such as journey to work, which describe and offset the spatial relationships

between consumers and shopping locations. Multipurpose trips save consumes extra distances and costs since on a multipurpose trip a consumer can get several types of goods;

b) a set of ten variables that describe the socio-economic characteristics of the consumer such as age, income, education, type of residence, and the previous place of living; and
c) a set of ten variables describing the perceived attributes of the shopping place as evaluated subjectively by the consumer such as price, quality, and quantity of goods. These variables will be referred to as the belief variables.

The importance of multipurpose trips to consumers has been recognized for a long time in geography. Bell (1970:10) refers to multipurpose trips as "one of the most pervasive regularities in consumer shopping behavior." In fact, two basic relationships in central place theory are formulated around the role of multipurpose trips despite the fact that the behavior of consumers in the theory was concerned with a single-purpose trip. Berry and Garrison (1958:108) noted that the relationships specified in the theory included

a) inner and outer limits for the range of distance over which central goods may be sold; and
b) relationships between the number of goods sold from a central place and the population of that place.

On another occasion, Berry and Horton (1970:172) elaborated on this point by stating:

> Central goods offered at a large place have a larger range than those offered at smaller places, and the fact that a central place is larger or smaller has an immediate influence on the range of a central good because more types of central goods are offered at a center of higher order. The possibility that on a single trip several types of goods may be offered simultaneously has the same effect on a general price decline in goods offered by the larger towns.

This argument suggests that since the aim of the consumer is to reduce the price paid for the good by reducing the travelled distance, the multipurpose trip can be viewed as another way of reducing transportation cost. This point is further suggested by another author who argues that the effect of a transport rate change on a buyer's consumption depends on the buyer's distance from the consumption

point (Long, 1971:49). Other studies such as those of Black (1971) and Bucklin (1966) has referred to the importance of multipurpose trips, in particular those shopper's trips attached to journeys to work and social visits (Black, 1971:11)

The second set of variables deals with socio-economic characteristics which have been posited as important factors that influence consumer expenditure behavior. Davies (1969:111) commenting on the influence of socio-economic characteristics on consumer shopping behavior states:

> Differences in shopping movements may be perceived between consumers of varied ethnic-racial strains, age structures, and income levels according to their particular tastes, needs and preferences, and also their facility to travel to various retail centers.

It is also hypothesized that "variations in pruchasing power within the city occur through disproportions in the socio-economic conditions of consumers (Davies, 1969). Huff (1960) argues that socio-economic characteristics play an important role in determining or conditioning a consumer's spatial behavior. In fields other than geography, socio-economic characteristics are basic components of the models of consumer behavior (Kassarjian, 1968).

The selection of the ten socio-economic variables follows the suggestions of different conceptual and empirical studies. For example, it is found that external factors that influence the structure of retailing are dominated by income factors (Agergard, 1970:56). Huff (1961:26) hypothesized that consumers of high economic status travel further distances for shopping purposes than do consumers of lower economic levels. In addition, the social status of the individual tends to affect his purchasing decision, and in turn his shopping behavior. Schiller (1972:291) notes that "one of the most important factors affecting journey patterns is social class. High social class, for example, has been shown to be associated with larger than average preference for larger shopping centers." Other studies have indicated the importance of family size, education, and age factors in influencing shopping behavior (Golant, 1972 and Zwick, 1957). For example, Andersean (1966:145) points out that the purchasing power of the geographic ability of consumers are positively associated with their occupation and educational status. The influence of the automobile, the type of residence, the place of living, and years in residence have been investigated in several studies. For example, Cox (1972:214) has noted that "the use of automobile for shopping means

that more stores are equally convenient and accessible for shoppers." Nader (1969:235) suggested that "the type of house may be successful incorporated as a socio-economic variable in shopping models."

The third set of variables describe the characteristics of the shopping place as evaluated subjectively by the consumers. That is the selection of a shopping place depends not only on the objective data but rather on the subjective evaluation of the attributes of that place by consumers. Pocock (1971:324) elaborates on this point by arguing that:

> --- Spatial behavior is to be interpreted, not on the basis of objective data and conventional matrices, but from their subjective evaluation --

Subjective evaluation implies that consumers make their decisions within the framework of their image of the shopping place. Boulding (1956:11) has noted that

> There is a certain difference between images which (we) have of physical objects in space and time and the valuations which we put on these objects.

These arguments suggest that different patterns of consumers' shopping trip behavior may be atrributed to the beliefs held by the consumers about shopping alternatives. The variables incorporated in this study draw their rationale from many conceptual models and investigations. For example, a basic component of Huff's model of consumer behavior is based on the notion that the perception of the consumer about a shopping place is affected by five attributes; the price of the product, service rendered, breadth of merchandise, personal amenities, and its reputation (Huff:1960). Spence adds three more characteristics: diversity of goods, quality of goods, and parking facilities (Spence, 1971:33). Other studies have dealt with other attributes related to the friendliness of store personnel, and store atmosphere. For example, Berry (1969:11) found that the most important image components of a shopping place are the quality of goods, assortment of merchandise, sales personnel, and store atmosphere. Fisk (1961:1) added two more concepts, convenience factors and price variation. Studies such as those of Andersen and Scott (1970) and O'Farrel and Poole (1972) have dealt with further types of image attributes.

Research Design

Given the objective of this problem and the restrictions imposed upon some of its aspects, i.e., holding size and distance constant, the

approach to the investigation faces some difficulties that need to be overcome. In the spatial allocation problem, it is indeed easy to visualize, but difficult to control, the geographic conditions upon which the setting of the problem is structured. Thus, the major task that faces this investigation is to construct a research design in which several requirements have to be spelled out and satisfied.

In scientific investigation where the need arises for holding some variables constant, two broad classes of design procedures are usually followed. They are the natural experimental designs and the controlled experimental designs. The distinction between the two is based on the extent of intervention by the researcher in the investigated situation. A natural experiment or what is referred to as an "observational design" may not require the intervention of the researcher in the examined situation at all or, at most, will intervene only to the extent required for measurement (Campbell and Stanley, 1963; Frank et.al., 1962). A controlled experiment requires the intervention of the investigation to control and manipulate the effect of one or more variables (Green and Tull, 1970).

The manipulation and controlling of variables can be made in either a laboratory situation or by using statistical techniques such as partial regression and analysis of variance. In this study, a controlled experimental design based on a "laboratory situation" is used to test the influence of the previously mentioned variables on the grocery expenditures of consumers. To construct the laboratory situation, the characteristics of the selected areas should meet several requirements. First, the study area should be confined to a location so that ony the large and the small center between which consumers reside will be reasonable alternatives for grocery purchases. Thus, consumer movements will be channelled toward either one or both centers. Second, to control for the effect of distance, consumers should be selected from small areas where the influence of distance differences between consumers is of little importance to their shopping decision. Third, to control for the influence of the size of shopping center, it becomes necessary to select consumers from areas where the influence of opposing shopping centers tends to be equal.

The fulfillment of these requirements means that the selected consumers are residing in restricted locational positions. By selecting consumers from areas with such characteristics, we became restricted in choosing the size and the locations of consumers. The restrictions tend to endanger the design of this study by the risk arising from the possibility of selecting consumers with similar socio-economic

characteristics. This is particularly important since a basic part of this study is to investigate the influence of variations in socio-economic characteristics on the grocery expenditure patterns. Thus, consumers are expected to have heterogeneous socio-economic characteristics. Another risk that may arise as a result of such restrictions is the possibility of not finding a population large enough for reliable statistical infernece. To overcome this risk, consumers are expected to be selected from more than one area.

However, to select consumers from more than one area implies that the tracts from which the consumers are to be selected should have similar relationships with the high-order and low-order places. In other words, the spatial relationships between these tracts and the shopping places, and among the shopping places themselves, should not be different to the extent that it may jeopardize the structure of the research design. The similarity of the spatial relationships between the selected tracts and tne shopping places is important since consumers from all these tracts are to be combined in one model. This suggests that in addition to the above requirements, the study area should include other characteristics:

a) The size of the low order centers and the ranges of their grocery offerings should be similar so that the influence of one center on nearby consumers will not be different from the influence of other centers on consumers in nearby tracts.
b) The selected tracts should be at similar distances from both the high-order and low-order centers so that distance differences will not be too great to affect the consumer's decision.
c) The selected tracts of consumers should enjoy similar accessibility to both the high-order and low-order centers. Again, great differences in accessibility may affect consumer movements and subdue the influence of other factors. Thus, the fundamental task facing this research is to find an area where such characteristics can be secured.

The Study Area

The selected study area is located in Tioga County which is in the eastern part of Western New York State (Figure 1). The area includes one large place, Owego, and the smaller centers of Newark Valley, Candor and Nichols. It was necessary to sample from several tracts since no single tract could provide a sufficiently large population to allow for analysis. Tioga County was selected because it has the

characteristics which meet the above-mentioned requirements. The following characteristics are found to mark the study area.

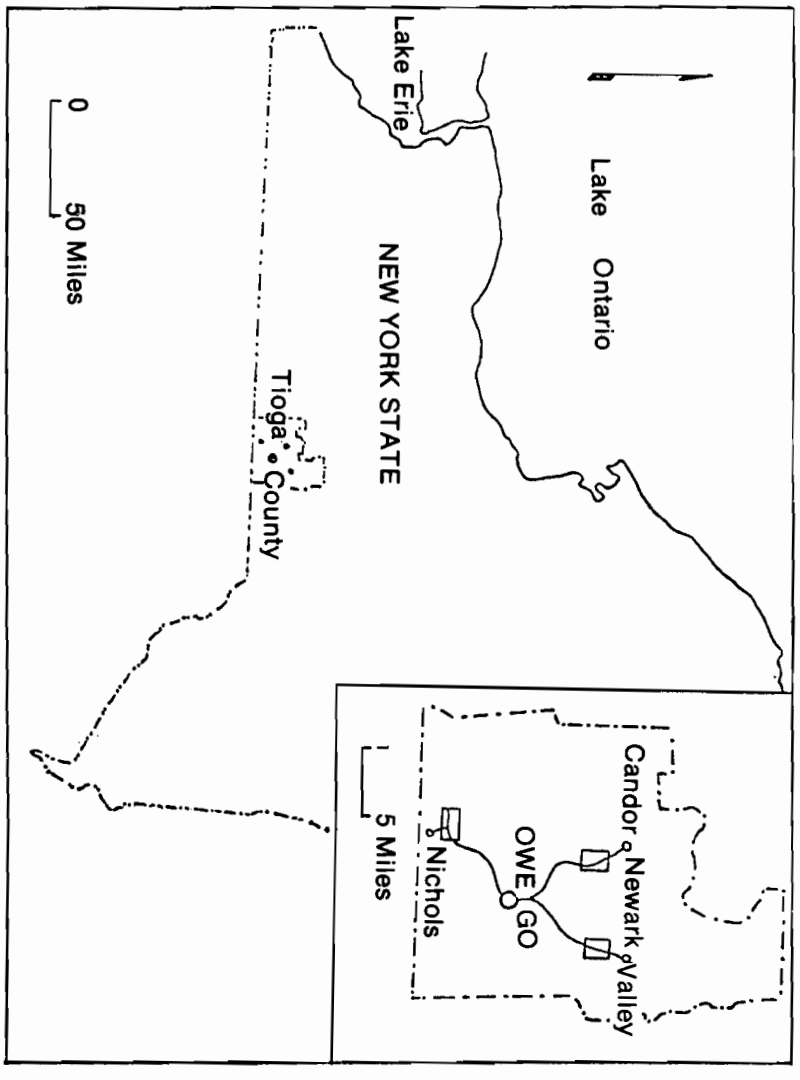

Figure 1 The study area and selected tracts of consumers' locations

First, the consumers investigated reside in tracts between the large center and the smaller centers. The locations of the consumers are at about one to two miles from the small centers and at about eight to nine miles from the large center. The tracts are located close to the approximate line of indifference between the large center and the small ones as defined by the breaking point formula (23, p. 82),

$$\text{The Breaking Point (miles from center B)} = \frac{\text{miles between A and B}}{1 + \sqrt{\frac{\text{total size of stores in A}}{\text{total size of stores in B}}}}$$

where A and B are respectively the large center and the small one

Second, the selected tracts are relatively small with negligible distance differences since each tract covers an area of about two square miles. However, the fulfillment of this requirement will be further tested by including two distance variables, perceived distance and linear distance, in the employed analytical model.

Third, there is an absence of nearby centers which might have an influence on consumer shopping patterns. In fact, there are no intervening shopping opportunities between the large center, Owego, and the small centers. In addition, other centers in the surrounding areas are at relatively far distances from the locations of consumers.

Fourth, the low-order centers are of similar size and much smaller than the higher-order one. Also, the low-order centers offer similar ranges of grocery services since their grocery stores are of medium size.

Fifth, the selected tracts enjoy similar accessibility to the available shopping alternatives since they are all located adjacent to major traffic routes.

Finally, the socio-economic characteristics of the consumers appear to be heterogeneous. Information from census data tends to confirm the heterogeneity of such characteristics. In addition, it has been noticed, through personal observation, that the types and quality of the residential units, which are a mixture of conventional and mobile homes, are further indications of the heterogeneity of the socio-economic characteristics. However, further examination of these characteristics will be carried out in subsequent analyses of the collected data.

Data Collection and the Measurement of the Variables

The collected data were gathered through "structural direct-circulating interviews". This procedure is based on circulating the questionnaire forms among the interviewees and collecting them at a later time. The questionnaires were distributed among 237 consumers who were told about the objectives of this study. The final total number of households who responded to the survey came to 186 or about 78.5 per cent of the total subjects. Using 50 per cent as a cut-off point to determine the most preferred alternative, it is found that 89 respondents allocated most of their grocery expenditures in the high-order place, i.e. Owego. On the other hand, it is found that 88 respondents preferred the low-order centers since they spent most of their grocery expenditures in these places. That is, those consumers who allocated most of their money for groceries either in the high-order center or in the low-order centers totaled 177 respondents. The remaining nine split their grocery expenditures evenly between the two-level centers. The spatial distributions of consumers are shown in figures 2, 3, 4, 5 and 6.

Three measurement methods are used to measure the values of the three sets of variables. Depending on the nature of the variables, the measurements were based on interval, nominal and ordinal scales. Since most of the variable measurements concerning the multi-purpose strips and the socio-economic characteristics follow standard methods, they hardly warrant further discussion. However, further discussion is needed to clarify the measurement on the occupation variable and the belief variables. The occupation variable was measured and rated according to the Prestige Ratings of Occupation Index (20, p. 324). The Index was prepared in a national survey in which respondents were asked to rate 90 different types of occupations in the United States. The measurements on the belief variables were scaled on a conventional seven-point semantic differential scale. The respondents were asked to rate their beliefs regarding the ten attributes of the grocery shopping centers.

Method of Analysis

For the purpose of data analysis, the spatial allocation of grocery expenditures are identified dichotomously according to where consumers spend most of their expenditures. The discriminant model seems an appropriate technique to analyze the collected data since it fits the situation in which the criterion variable is measured dichotomously. In specific terms, the employment of the discriminant model aims at:

a) testing for significant differences that may exist between the average score profiles of two groups of consumers identified

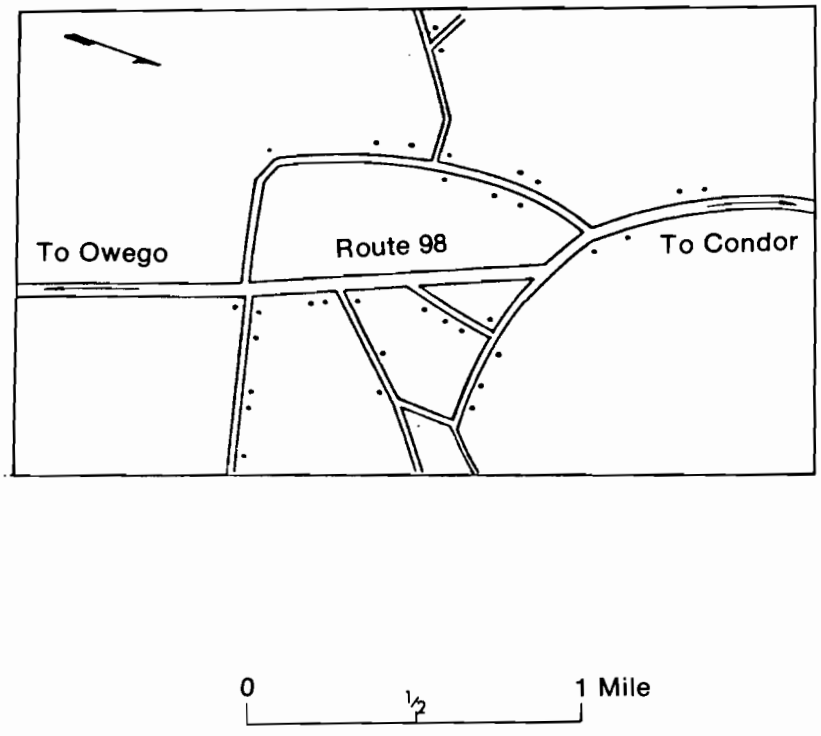

Figure .2 The Spatial distribution of the consumers who allocated most of their grocery expenditures in Owego

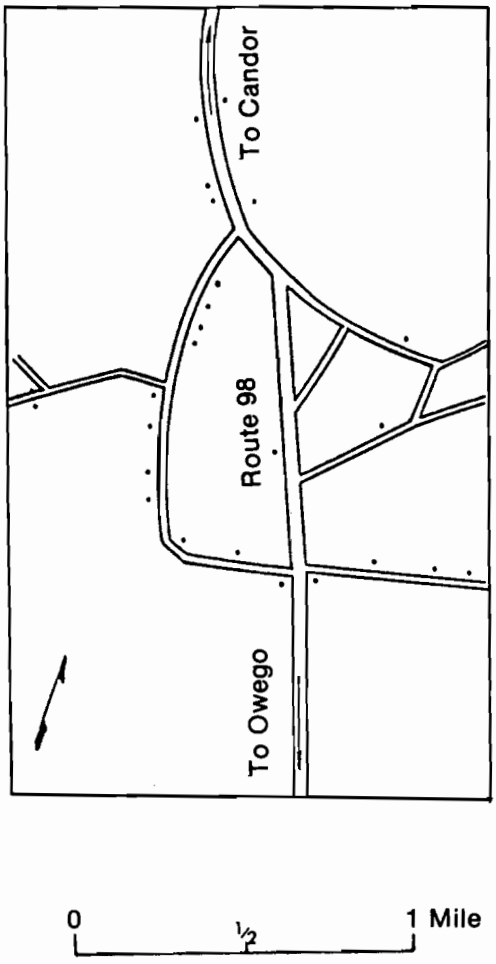

Figure .3 The Spatial distribution of the consumers who allocated most of their grocery expenditures in Candor

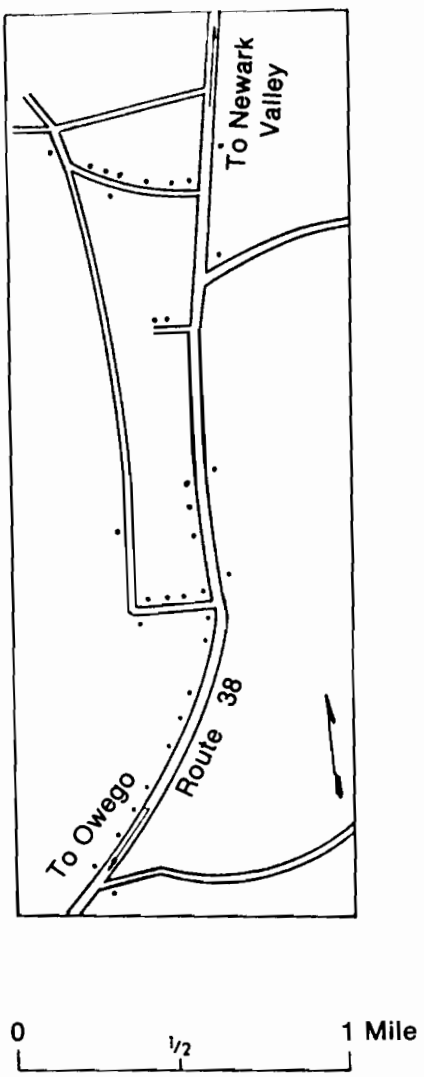

Figure . 4 The Spatial distribution of the consumers who allocated most of their grocery expenditures in Owego

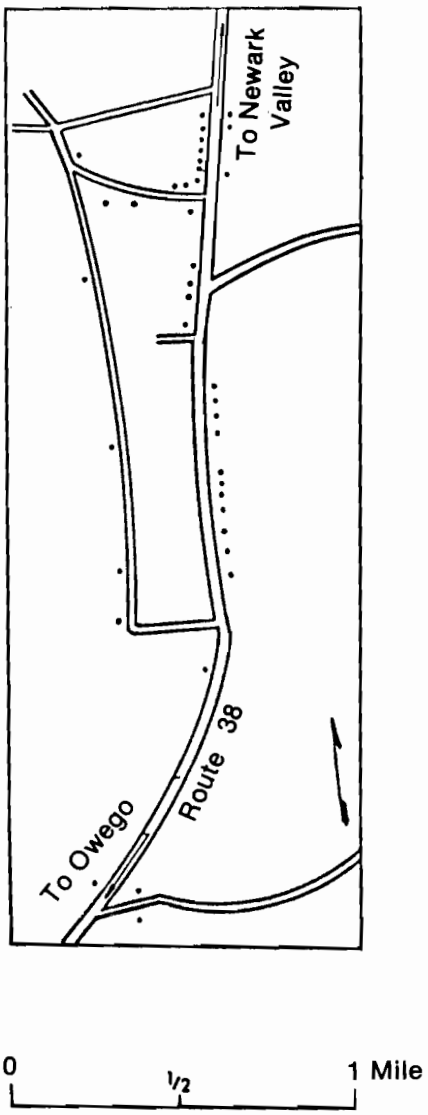

Figure .5 The Spatial distribution of the consumers who allocated most of their grocery expenditures in Newark Valley.

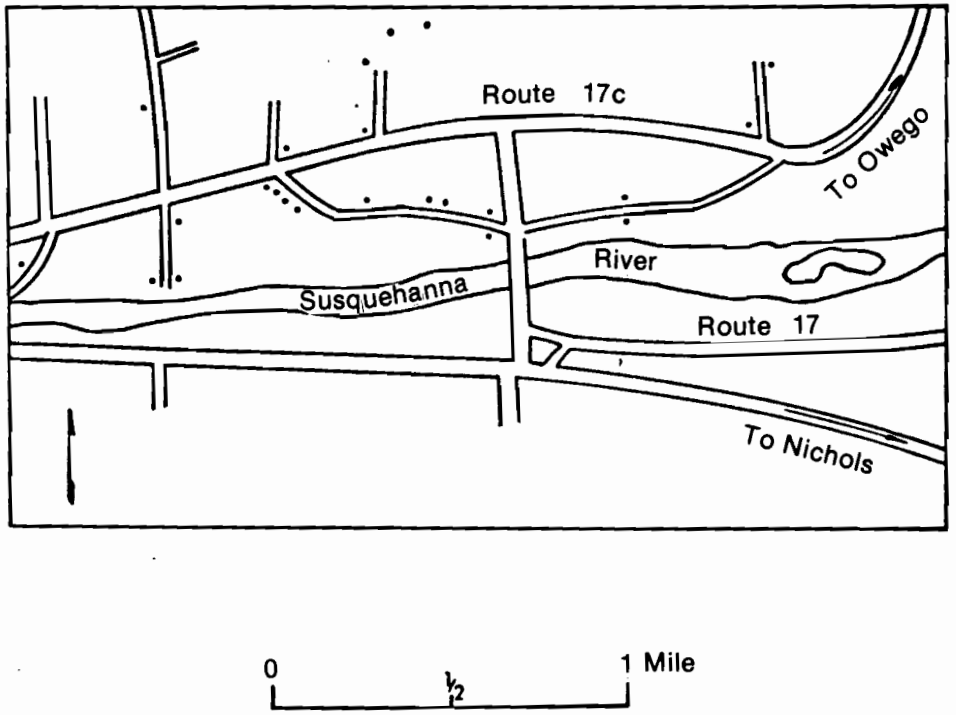

Figure .6 The Spatial distribution of the consumers who allocated most of their grocery expenditures in Owego.

according to their spatial allocation of grocery expenditures. The first group allocates most of its expenditures, i.e., more than fifty per cent, in the high-order place, while the second group spends most of its expenditures in the low-order places. In other words, it aims at testing the statistical significance of the magnitude and the direction of the relationships between the criterion variable Y which identifies the spatial allocation of grocery expenditures, and the three sets of predictor variables X_1 --- X_n.

b) finding the linear discriminant function of the predictor variable that would enable us to predict or assign consumers to one of the two groups on the basis of their scores on the sets of tested predictor variables. In addition, the relative importance of each predictor variable will be examined in terms of the magnitude of its standardized discriminant coefficient.

The discriminan model has been used as a successful analytical technique in several geographic studies such as those of Warner (1962) King (1967), and Bell (1970).

Analysis

The analysis of the data was performed in two stages. In the first stage a separate discriminant analysis was performed for each of the three sets of predictor variables, the multiple purpose trip variables, socio-economic characteristics, and the perceived attributes of the shopping alternatives.

In the second stage, only the significant variables from the first stage were analyzed. Thus, we were able to ascertain the importance of the three sets of variables as well as the overall importance of the combined sets. Two distance variables, straight line distance between consumer and the high-order place, and perceived driving time, were also analyzed with the multiple purpose trip variables to serve as a check to see whether or not distance was being "held constant".

Multiple Purpose Trip

The results presented in Table (1) indicate that three of the four multiple purpose trip variables are significant as well as the four variables taken as a whole. "Whether or not the grocery shopping is a multi-purpose trip" proved to be the most important variable as

evaluated by the individual F-ratios and the standardized discriminant coefficients. It was followed, in order, by "money spent on other items," and "whether or not the place of shopping is a place of work". It is therefore clear that the consumers view their grocery trips as opportunities to make other purchases thus resulting in savings in travel costs and time. This view is backed by the fact that the consumers going to the larger town, Owego, spend an average $6.26 per week on items other than groceries, while those going to the smaller towns spend $1.98 per week. The consumers also displayed a marked tendency to shop in the town of their employment. The magnitude of the F-ratio and standardized discriminant coefficients indicate that this variable is of lesser importance than the previous two. They did not, as a general rule, however, attach any social significance to their grocery shopping. Neither of the two distance variables proved to be significantly related to the purchase of groceries thus confirming that the attempt at "holding distance constant" had been successful.

In terms of "predictive" ability, the discriminant model performed fairly well when applied to the problem data. The four multi-purpose trip variables were able to correctly classify 73 consumers out of 89 who spent most of their grocery expenditures in the high order place, and 59 out of 88 who allocated the largest amount of their grocery money in the low-order center (Table 2). In other words, the model correctly classified 132 out of 177 consumers; i.e., about 75% of the total number.

Socio-Economic Characteristics

The results of the analysis of the ten socio-economic characteristics indicate that, as a whole, they are significantly related to grocery expenditures, (Table 3). However, only four of the ten variables proved to be significant; "had previously lived in Owego," "had previously lived in the small center," "level of education," and "years in the present residence" in that order. Thus, a consumer is likely to trade at a town in which he had previously lived and apparently the longer he lives between the large and small center, the more likely he is to trade at the small center. In addition, the higher the education, the more likely he is to trade at the large center. The dominant theme influencing the purchase of groceries is obviously one of familiarity, while traditional variables such as "income" and "age" are shown to have little effect on purchase in the setting of this study.

The predictive power of the discriminant function yields about the same results as the multi-purpose trip variables, i.e., about 70% of the consumers are correctly allocated. (Table 4).

Table 1

STATISTICS FROM THE DISCRIMINANT ANALYSIS WITH "SHOP/NOT SHOP" IN THE LARGE PLACE MOST OF THE TIME AS THE CRITERION VARIABLE "Y"

	Predictors	Among Mean Squares	Within Mean Squares	Mean for 1st Group	Mean for 2nd Group	Mean Differences	F-Ratio	Standardized Discriminant Coefficients
X_1.	Wether or not the grocery shopping is a multi-purpose trip	09.69	0.19	0.82	0.35	0.47	51.07*	0.00495
X_2.	Money spent on other items	811.00	21.61	6.26	1.98	4.28	37.54*	0.00267
X_3.	Whether or not the place of shopping is the place of work	1.78	0.18	0.36	0.16	0.20	9.64*	0.00187
X_4.	Whether or not the grocery shopping is attached to a social visit trip	0.19	0.13	0.19	0.13	0.06	1.44	0.00008
X_5.	Linear distance to the large place	2.14	1.61	8.94	9.17	0.23	1.50	0.00001
X_6	Perceived distance	5.24	19.70	17.72	17.37	0.35	0.27	0.00001

*Significant at 0.01 level (overall F-Ratio for six variables and 170 observations is 16.54 which is significant at 0.01 level).

Table 2

CONSUMERS PREDICTED BY THE MULTI-PURPOSE TRIP VARIABLES AND CLASSIFIED ACCORDING TO THE LINEAR DISCRIMINANT FUNCTION

Group	**Correctly** Classified	**Incorrectly** Classified	Total
First	73	16	89
Second	59	29	88
Total	132	45	177

The following linear discriminant function was used to classify consumers:

$$Z = 0.01006X_1 + 0.00053X_2 + 0.0042X_3 + 0.00021X_4$$

* The first group refers to consumers who allocated most of their grocery expenditures in the high-order place, while the second group refers to those who allocated most of their expenditure in the low-order place.

Table 3

MEAN DIFFERENCES BETWEEN THE SOCIO-ECONOMIC CHARACTERISTICS OF THE TWO GROUPS OF CONSUMERS AS DERIVED FROM THE DISCRIMINANT MODEL

Variable	Among Mean Squares	Within Mean Squares	Mean for Large Place Consumers	Mean for Small Place Consumers	Mean Differences	F-Ratio	Beta Coeffi-cients
Residential type	0.900	0.182	0.7416	0.7865	-0.0449	0.49	0.00004
Family Size	5.639	2.578	3.41573	3.77273	-0.35700	0.19	0.00145
Occupation	81.650	277.635	50.46067	49.10227	1.35840	0.29	0.00021
Age	102.651	202.895	44.03371	45.55682	-1.52311	0.51	0.00014
Education	5.769	1.496	3.22472	2.86364	0.36108	3.86+	0.00261
Income	25.153	93.933	12.65169	11.89773	0.75396	0.27	0.00057
Number of cars	0.001	0.607	1.50562	1.51136	-0.00575	0.01	0.00080
Years in house	722.697	191.815	10.64045	14.68182	-4.04137	3.77+	0.00261
Lived in Owego before	1.240	0.146	0.26966	0.10227	0.16739	8.47*	0.00204
Lived in the small place before	1.338	0.233	0.30337	0.47727	-0.17390	5.74+	0.00198

* 0.01 level of significance.
\+ 0.05 level of significance.

Table 4

PREDICTION GENERATED BY THE DISCRIMINANT MODEL

	First Group	Second Group	Total
Correctly classified	66	58	124
Incorrectly classified	23	30	53
Total	89	88	177

The following discriminant function is used to predict the above consumers:

$$Z = 0.001X_1 - 0.00151X_2 + 0.00001X_3 + 0.0001X_4 + 0.00214X_5 + 0.00006X_6 + 0.00104X_7 - 0.00019X_8 + 0.00518X_9 - 0.00416X_{10}$$

At first blush the failure of the bulk of the socio-economic characteristics to be significant is somewhat vexing since this does not substantiate the arguments of the bulk of the theoretical and empirical studies indicated previously which emphasized the importance of these variables in influencing consumer behavior. However, it is noticed that some of these studies are of a theoretical nature and thus their hypothesized relationships were untested. On the other hand, many of the empirical studies dealt with different types of commodities in different spatial contexts. That is, one expects to find that results of consumer studies may tend to be different due to the type of commodity investigated and the spatial context within which behavior was examined. For example, it may be more likely to find that the influence of socio-economic status is more obvious in dealing with shopping behavior that is related to a high-order commodity than in the case of a low-order good. In other words, the influence of socio-economic level on consumers shopping for furniture may be more important than on consumers shopping for groceries. This may be due to the fact that groceries are a relatively homogeneous good while furniture is of many different types. In addition, the influence of socio-economic status may not be important when the travelled distance is

relatively short. This is usually the case with groceries which are purchased from places at relatively short distances from the locations of the consumers. On the contrary, it is more likely to find that the behavior becomes more obvious when the travelled distance is a long one, i.e., as in the case of furniture.

Thus, the interesting question may be raised as to what distance, with which type of goods, and under which conditions do socio-economic status play significant roles in influencing the different patterns of commodity expenditure? Further research may benefit more by being concerned with such questions rather than by dealing with individual commodities. Also, comparisons should be made between studies where the study areas are characterized by similar spatial relationships. Otherwise, to compare different types of studies for similar conclusions may tend to lead to inconsistent conclusions.

Subjective Evaluation of Central Place Characteristics

As indicated earlier, consumer choices among different shopping alternatives are usually made in regard to the evaluated attributes of the various shopping places. The ten belief variables listed in Tabe 5 describe ten attributes of the grocery stores in the high-order center as evaluated by the responding consumers. The general expectation is that those consumers who rate the high-order center, high on the seven point semantic differential scale, will spend most of their money at that center, while those who rate it low will spend more in a smaller center.

In general, the above expectation is borne out by the results displayed in Table (5). The ten variables, as a whole are significant with nine of the ten displaying individual significance. The lone non-significant variable is "grocery prices" even though it has the second highest standardized beta coefficient.

It should be noted that the inverse signs that describe the relationships between the predictor variables and the criterion variable are attributed to the way these attributes are rated. Low ratings refer to high preference toward the evaluated attribute while high ratings refer to low preferences. The conclusions that can be drawn from the results of the nine significant tests indicate that consumers are more likely to adopt the shopping place where the grocery stores are characterized by a better quality of groceries, wider varieties of grocery goods, friendly personnel, convenient store hours, attractive store decor, convenient grocery display, convenient parking facilities, convenient roominess in the stores, and very clean stores.

Table 5

RESULTS FROM THE DISCRIMINANT TEST USING THE "BELIEF RATING" MEASUREMENT

Variable	Among Mean Squares	Within Mean Squares	Means for First Group	Means for Second Group	Mean Differences	F-Ratio	Beta Coeffi-cients
Grocery prices	3.124	1.309	3.61798	3.35227	0.26570	2.39	0.00287
Grocery quality	29.409	1.833	2.74157	3.55682	-0.81525	16.04*	0.00133
Grocery variety	29.032	1.801	2.28090	3.09091	-0.81001	16.12*	0.00027
Personnel attitudes	85.046	1.856	2.00000	3.38636	-1.38636	45.81*	0.00443
Store hours	59.186	1.835	1.77528	2.93182	-1.15654	32.26*	0.00276
Store decor	21.615	1.958	2.50562	3.20455	-0.69893	11.04*	0.00174
Grocery display	35.125	1.941	2.40449	3.29545	-0.89096	18.09*	0.00087
Parking facilities	61.522	2.096	1.76404	2.94318	-1.17914	29.36*	0.00266
Available space	42.625	1.788	2.37079	3.35227	-0.98149	23.84*	0.00152
Cleanliness of store	32.237	1.804	2.11236	2.96591	-0.85355	17.87*	0.00103

*0.01 level of significance (Overall F-ration (10,166) is 6.86607, which is significant at 0.01 level).

In terms of the predictive ability of the discriminant model, it could classify 137 consumers out of 177 or about 77.4 per cent of the total number of consumers. In othe words, the model succeeded in classifying 68 consumers out of 89 in the first group which allocates most of its grocery expenditures in the high-order place. On the other hand, the model correctly classified 69 consumers out of 88 in second group that allocates the majority of its grocery expenditures in the low-order places.

Results From the Final Model

The analyses in the last three sections dealt with the influence of three separate sets of variables, on the different patterns of grocery expenditures in surrounding shopping alternatives. In this section, the important variables from the three sets are combined into a final model so as to assess their combined influence on consumer behavior.

A total of 18 variables out of an original 24 are included in the final model (Table 6). The analyzed variables include 16 predictors which proved in the previous analyses to be significantly associated with the criterion variable on the basis of their simple relationship, i.e., the individual F-ratios. In addition, two more predictors were included based on the magnitude of their Beta coefficients. The included variables are distributed among three sets of predictors; three multi-purpose trip variables, five socio-economic variables and ten variables describing the attributes of the grocery stores in the shopping place.

Table 6

VARIABLES INCLUDED IN THE FINAL DISCRIMINANT AND REGRESSION MODELS

X_1. The perceived aspects of the grocery trip
X_2. Money spent on items other than groceries
X_3. Place of work
X_4. Family size
X_5. Educational level
X_6. Years in present house
X_7. Was the previous place of residence the high-order center?
X_8. Was the previous place of residence the low-order center?
X_9. Grocery prices

X^{10}. Grocery quality
X_{11}. Grocery variety
X_{12}. Friendliness of store personnel
X_{13}. Store hours
X_{14}. Store decor
X_{15}. Grocery display
X_{16}. Parking facilities
X_{17}. Roominess of store
X_{18}. Cleanliness of store

In addition to the discriminant analysis, a simple correlation matrix for all of the variables is displayed to identify the relationships between the variables of the three different sets. The results derived from the application of the discriminant model indicate that similar and consistent conclusions can be drawn regarding the significance of the magnitude and direction of relationships between the criterion and the predictor variables. Of course, the individual F-ratios in Table (7) replicate the previous results for the relationships between the criteria and the predictor variables. In addition, the correlation matrix indicates that the strongest intercorrelations occur among the multi-purpose trip variables, followed by the attributes of the shopping place variables and the socio-economic variables. It is also interesting to note that the variable that describes the perceived aspects of the grocery trips (X_1) is highly associated with the perceived attributes of the grocery stores. This suggests that consumers who evaluate the characteristics of the grocery stores in the high-order place as highly attractive tend to shop extensively in this shopping place.

The Beta coefficients from the discriminant model indicate that the friendliness of the store personnel is the most important variable, followed by the variable that describes the perceived aspects of the grocery shopping trip, the amount of money spent on items other than groceries, the educational level of the consumer, and the number of years spent in the present house. On the other hand, the decor of the grocery stores and the variety of the grocery items are the least important variables. It is interesting to note that the variable that describes the roominess of the grocery stores in the shopping place appeared to be a relatively important variable. In fact, this variable showed to be more important than two previously significant variables, parking facilities and grocery prices. This can be ascribed to the change in the interrelationships which occured as a result of the inclusion of the 18 variables in one model.

Table 7

Results From the Discriminant Model in Which Only Significant Variables are Included in the Analysis

	Means for 1st group	Means for 2nd group	Mean Differences	F-Ratios	Beta Coefficient
X_1	0.92022	0.45227	0.46795	51.07*	0.00450
X_2	6.95843	2.67727	4.28115	37.54*	0.00499
X_3	0.45955	0.25909	0.20046	9.64*	0.00235
X_4	3.42573	3.78273	-0.35700	2.19	-0.00257
X_5	3.25472	2.89364	0.36108	3.86+	0.00226
X_6	10.66045	14.70182	-4.04137	3.77+	-0.00289
X_7	0.46966	0.30227	0.16739	8.47*	0.00189
X_8	0.70337	0.87727	-0.17390	5.74+	0.00154
X_9	3.69798	3.43227	0.26570	2.20	-0.00245
X_{10}	2.81157	3.62682	-0.81525	16.04*	-0.00120
X_{11}	2.28090	3.09091	-0.81001	16.12*	-0.00013
X_{12}	2.00000	3.38636	-1.38636	45.81*	-0.00502
X_{13}	1.77528	2.93182	-1.15654	32.26*	-0.00194
X_{14}	2.50562	3.20455	-0.69893	11.04*	-0.00066
X_{15}	2.40449	3.29545	-0.89096	18.09*	-0.00072
X_{16}	1.76404	2.94318	-1.17914	29.36*	-0.00244
X_{17}	2.37079	3.35227	-0.98149	23.84*	-0.00254
X_{18}	2.11236	2.96591	-0.85355	17.87*	-0.00100

* 0.01 level
+ 0.05 level

A final evaluation of the predictive power of the discriminant model shows that the technique correctly classified 147 or 83% of the total number of 177 consumers (Table 8). In particular, the model correctly classified about 85% or 76 out of 89 consumers who patronize the high-order place most of the time, while it correctly predicted about 81% or 71 out of 88 consumers who patronize the low-order places most of the time.

Conclusions and Suggestions for Further Research

This study represents an experimental analysis and investigation of the spatial allocation of grocery expenditures in surrounding shopping alternatives. The investigation is based on examining the influence of three sets of predictor variables, i.e., multi-purpose trip variables, socio-economic variables, and variables describing the attributes of the shopping place, on the different patterns of grocery expenditures while holding size and distance constant.

The final evaluation of the results from discriminant analysis indicates that multi-purpose trip variables are the most important predictors of the variation in the criterion variable, followed by the perceived attributes of the shopping place, and finally, by the variables that describe the socio-economic status of the consumer. Although the results of the multi-purpose trip variables seem to agree with previous arguments, such as studies of Berry and Pred (1970), Bishop and Brown (1969) and Black (1971), the results concerning socio-economi characteristics were somewhat disappointing. This is because the major socio-economic factors such as income, occupation, and age with which many theoretical and empirical studies have been concerned, show little influence on the different patterns of grocery expenditures. These results suggest that the influence of socio-economic characteristics may vary from one commodity to another under different spatial situations. That is, it is possible to find that different results may be obtained from the examination of different types of goods and the different spatial contexts within which the different patterns of expenditure were examined. For example, it is likely to find that the influence of the socio-economic status of the consumer may be stronger in the case of a high-order good such as clothing than in the case of a low-order good such as groceries. Also, further research should be concerned with the range of the distance at which socio-economic characteristics start to pay a substantial role in influencing the different patterns of expenditures. It is possible to find that a significant relationship exists between the influence of socio-economic characteristics and the

range of the travelled distance. In other words, the influence of the socio-economic status of the consumer may not be important when the travelled distance is short, while it is more likely to find that the influence of such status is more obvious when the travelled distance is a lengthy one. Therefore, further research should be concerned with the travelled distance, the type of investigated commodity and the spatial conditions under which socio-economic characteristics start to influence significantly the different patterns of commodity expenditures.

Table 8

Predicted Consumers As Derived from the Discriminant Model

Group	Correctly Classified	Incorrectly Classified	Total
First	76	13	89
Second	71	17	88
Total	147	30	177

The following discriminant function is used to classify consumers:

$$Y = 0.00489\ X_1 + 0.00093\ X_2 + 0.00529\ X_3 - 0.00158\ X_4 + 0.00187\ X_5 + 0.00021\ X_6 + 0.00232\ X_7 - 0.00313\ X_8 + 0.00212\ X_9 - 0.00085\ X_{10} + 0.00009\ X_{11} - 0.00329\ X_{12} - 0.00133\ X_{13} + 0.00046\ X_{14} - 0.00049\ X_{15} - 0.00064\ X_{16} - 0.00247\ X_{17} + 0.00159\ X^{18}$$

The results concerning the influence of the perceived attributes of the grocery stores in the shopping place seem to agree with the results of previous studies (Andersen, 1970; Berry, 1969; Fisk, 1961). The importance of these variables is of particular interest to both consumer behavior and the strategies of store managers. In terms of the importance of these variables to consumer behavior, the results are strong indications of the fact that the different patterns of grocery expenditures in surrounding shopping places are affected by the psychological and material satisfaction that the stores offer to their customers. This has immediate relevance to the strategies employed

by grocery managers in that they may be abe to control and intervene in the influence of these variables by changing and improving the characteristics and images of their stores. The special emphasis of the importance of these variables arises from the fact that while it is relatively easy to control the influence of these variables by changing and improving the stores' characteristics, it is difficult to affect or change the influence of the other variables, i.e., the multipurpose trip variables and the socio-economic characteristics of the consumers.

Finally, this study has followed an experimental approach which has been lacking in geographic research (Long, 1971:67). The experimental approach of this study was based on a "laboratory situation" in which the influence of both size and distance was held constant. The laboratory aspects of the design were further examined through statistical tests. The importance of this experimental approach can be further appreciated when it is stressed that most of the studies that have dealt with the influence of distance and size have shown that these two factors are the most important predictors of consumer spatial behavior. Keeping in mind the importance of these two factors, it can be concluded from the results obtained that this study is successful in identifying and detecting those variables that seem to further expand our understanding of the spatial allocation of grocery expenditures in surrounding shopping alternatives.

However, since geographic research has been lacking in properly designed experimental designs, further analyses should take into account the importance of such an approach in analyzing the different types of purchased goods, consumers, and the spatial relationships between consumers and nearby shopping alternatives.

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