INTRAURBAN CONSUMER BEHAVIOUR

# AN EXPLANATION

# OF

# INTRAURBAN CONSUMER BEHAVIOUR

By

DAVID ANTHONY BEESON, B.A. (Hons.)

A Thesis

Submitted to the School of Graduate Studies

in Partial Fulfilment of the Requirement

for the Degree

Master of Arts

McMaster University

June 1981

MASTER OF ARTS (1981) McMASTER UNIVERSITY

(Geography) Hamilton, Ontario

TITLE: An Explanation of Intraurban Consumer Behaviour

AUTHOR: David Anthony Beeson, B.A. Hons.
(University of Sydney, Australia)

SUPERVISOR: Dr. M.J. Webber

NUMBER OF PAGES: ix, 90

ABSTRACT

Intraurban consumer behaviour is explained in this thesis by a conventional scientific method - a hypothesis about why we shop where we shop is empirically tested by observation and model calibration. A dynamic theory of individual relative choice and a description of the spatial context of the perceived retail structure of Hamilton, Ontario, form the groundbase for hypothesising a set of areal generalisations for single-stop, single-purpose shopping trips. The generalisations are 'general' statements about why people shop where they shop; specifically, grocery trips should be to an outlet located in the nearest shopping centre to place of residence, while non-grocery trips should be either to an outlet located in a nearby shopping centre when shopping for low-value goods, or to an outlet located anywhere in the city when shopping for high-value goods. The reason why these destinations should be chosen is so as to either maintain acquired utility levels over time when grocery, or low-value non-grocery, shopping or maximise acquired utility at one finite time period when high value non-grocery shopping. The areal generalisations are then tested by constructing trip flow maps and calibrating a multinomial logit model, using an observed aggregate shopping trip data set for Hamilton, Ontario. Both the flow maps of single-stop, single-purpose shopping trips and the estimated logit model coefficients and elasticity statistics, verify the areal generalisations. Thus the observed shopping trip flows for Hamilton, Ontario can be explained by the hypothesised areal generalisations; however, the mode of explanation can be spatially transferred to any city as the temporal

relative choice theory of individual behaviour is universal. All that is required is a description of the spatial context in which the choice theory continues to operate. The thesis has thus shown how a conventional scientific method can explain rational behaviour, where to be "rational" is to be human, not deterministic.

## ACKNOWLEDGEMENTS

I would like to take this opportunity to thank my supervisor, Dr. M.J. Webber and also Drs. Lonegran, Brummell and Hall, for their timely comments on earlier drafts of this thesis. Maureen Bieder expertly typed the thesis.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

# CHAPTER 1

## INTRODUCTION

This thesis attempts to explain intraurban consumer behaviour by empirically testing a set of shopping destination choice hypotheses. The hypotheses are normative areal generalisations predicated on a temporal relative choice theory, a theoretical domain within which the areal generalisations reside. The explanatory framework is a probabilistic one in which the set of generalisations - hypotheses pertaining to a specified event - is tested using a shopping interaction matrix. The origin-destination shopping matrix gives data pertaining to how and where a sample of people living in Hamilton, Ontario, shop for grocery and non-grocery goods.

The observed shopping event is described in this thesis at a steady-state level of resolution using cartographic and modelling techniques. The data, a longitudinal set of shopping trips and a description of the retail spatial structure for Hamilton, Ontario, are mapped, and collated into origin-destination tables, to discern raw consumer spatial patterns. A disaggregate multinomial logit model is calibrated upon this data to ascertain those variables that are significant in describing how the sampled population shopped during the sampling period.

An attempt at explaining the set of these observed shopping events is provided by a theory of temporal utility, a "theory" which presents a relativistic treatment of consumer behaviour. The theory deals with human rationality over time and is essentially a temporal version of the probabilistic choice theories of Luce (1959) and McFadden (1972). Given this theoretical domain relative to the knowledge of the retail spatial structure of Hamilton, a set of areal generalisations is formulated. Thus, the aim of the thesis is twofold: firstly, to describe the spatial structure of a shopping data set and, secondly, to explain the aggregate behaviours exhibited by a sample of consumers.

To explicitly relate the empirical description and theoretical explanation of intraurban consumer behaviour a functional relationship is proposed using the temporal choice theory, areal generalisations and retail spatial structure/shopping trip pattern data as components within a cause-effect framework.

## 1.1 Thesis Structure

Chapter 2 places the thesis in historical context by giving a critical literature review of choice theory, utility concepts and shopping models. A temporal relative choice theory, hereafter referred to as TT, is introduced in Chapter 3 as a temporal extension to the essentially atemporal choice theories discussed in Chapter 2. Chapter 3 also gives a set of areal generalisations, hereafter referred to as $\underline{\underline{G}}$, of shopping destination choice, which is principally derived from the literature on consumer behaviour. However, $\underline{\underline{G}}$ could also be considered a logical outcome of the interaction of economically minded consumers with a particular retail spatial structure, $\underset{\sim}{C}_s$. Chapter 4 "tests" $\underline{\underline{G}}$ by describing the shopping destination choices for a sample of consumers living in Hamilton, Ontario during a two-week period in May , 1978. A multinomial logit model gives an explicit description of how these consumers choose shopping destinations. Chapter 5 gives a relativistic interpretation of intraurban consumer behaviour, the proposed relationship being a succinct summary of the preceding chapters' ideas in that $\underline{\underline{G}}$ is temporally related to $\underset{\sim}{C}_s$

and TT in one function. To conclude, Chapter 6 discusses additional issues concerning human interaction with retail structures over time, while Chapter 7 summarizes the thesis.

Figure 1.1 gives a schematic diagram of the structure of the thesis.

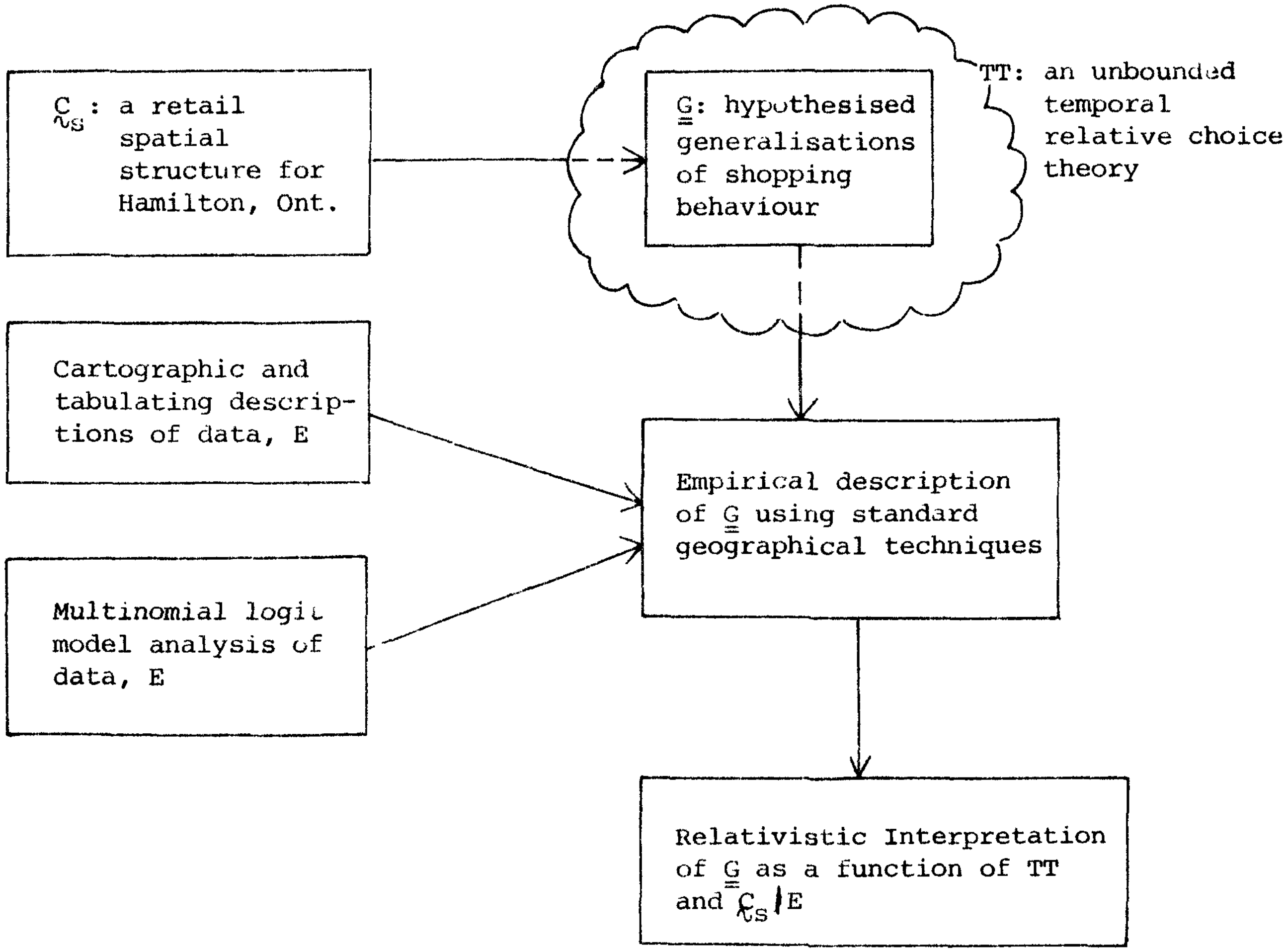



Figure 1.1 A Schematic Diagram of the Proposed Explanation of Intraurban Consumer Behaviour.

# CHAPTER 2

## A REVIEW OF LITERATURE ON PREFERENCE, CHOICE AND UTILITY

Behaviour occurs when things traverse space over time. Many geographers have treated human behaviour as intrinsically complex (c.f. Wilson, 1980), needing simplifying assumptions to discern aggregate regularities (e.g. Wilson, 1970), while others have looked upon the individual as the fundamental behaving unit (c.f. Webber, 1980), a truism that formed the basis for disaggregate theories of choice (e.g. McFadden, 1973). These two juxtaposed viewpoints of human behaviour are elucidated in this chapter - prior to these discussions, however, a brief sketch of choice theory is outlined in the following section.

### 2.1 Choice Theory: Fundamentals and Criticisms

An individual traverses space because a benefit hopefully accrues by doing so. Actual benefit derived from an overt act is utility in this thesis, and is considered a post-preferential entity. Houthakker (1960) regards the overt act, associated with perceived utility, as 'choice', and potential choice as 'preference' i.e., a person prefers a to b if, when confronted with a choice between a and b, he chooses a (Houthakker, 1960, P. 194). Houthakker deals with preference leading to choice, but as his arguments are couched logically, no causal mechanism is alluded to i.e., why a person prefers a to b. He scantily mentions 'utility' and deems that if utility is assumed to be measurable by one-dimensional attributes, then conclusions about choice become "a source of needless confusion" (Houthakker, 1960, P. 194). He deems that preference is "primordial" implying that utility is more susceptive to ad hoc assumptions.

To reiterate, potential choice could be realised when the individual decides to traverse space to acquire a desired ("preferred") good. Thus, 'preference' has a possibility of being realised while 'choice' is the actual act of acquiring. A temporal interval is involved here. Assume $[t]_o^a$ to be the time interval[1] between potential choice (preference) and choice i.e., o = preference and a = choice; then two things can occur over time:

preference = choice

preference ≠ choice,

also, it is assumed that the consumer prefers the former to the latter. A temporal explanation of consumer behaviour is required which explicitly deals with changing utilities over time - from initial utility formulations (preference) to resultant utility maintenance (preference = choice), utility evolution (preference ≠ choice and consumer happier) or utility devolution (preference ≠ choice and consumer unhappier). A temporal relative choice theory given in Chapter 3 attempts to explain, in a temporal vein, consumer behaviour.

Houthakker (1960) gives three axioms of preference and choice: transitivity axiom - if $x_1$ is preferred to $x_2$ and $x_2$ is preferred to $x_3$, then it logically follows that $x_1$ is preferred to $x_3$; irreflexibility axiom - $x_1$ cannot be preferred to $x_1$, antisymmetry axiom - if $x_1$ is preferred to $x_2$, then $x_2$ is not preferred to $x_1$. The transitivity axiom is obscured by Time's Arrow - at $t_o$ a consumer may prefer $x_1$ to $x_2$ and, if the shopping environment is stable over time, $[t]_o^a$, $x_1$ will be chosen at $t_a$. If the same consumer prefers $x_2$ to $x_3$ at $t_o$ then, if the shopping environment is stable over time, $[t]_o^a$, $x_2$ will be chosen at $t_a$. A problem arises when both trade-off

[1] $[t]_o^a = t_o$ to $t_a$.

statements are made atemporally interdependent, so that $x_1$ is preferred to $x_3$ at $t_o$. It is not possible, without the assumption of timelessness, to have two preference statements which include the same product i.e., if $x_1$ is preferred to $x_2$ at $t_o$ then $x_2$ can only be preferred to $x_3$ at $t_{o+\alpha}$, where $\alpha$ is a positive time increment; so it does not logically follow that $x_1$ is preferred to $x_3$ at $t_{o+(\alpha+\gamma)}$, where $\gamma$ is a positive time increment, as the consumer's cognition of $x_2$ may alter relative to $x_1$ and/or $x_3$ between $t_{o+\alpha}$ and $t_{o+(\alpha+\gamma)}$. Temporal flux thus adds "error" to the transitivity axiom. Of course, if the consumer was both Rational and Logical then positive theories of behaviour would be error-less reflecting a "Brave New World"; therefore, perfect recall is required for the transitivity axiom - actually, recall involves re-evaluation of past experiences by weighing the relative utilities of past to present phenomena - the utility of $x_1$ at $t_o$ may not be the utility of $x_1$ at $t_{o+(\alpha+\gamma)}$. Thus, the process of allocating preferences to goods can be altered when perceptions and experiences change - the transitivity axiom, together with the other axioms, should be made relativistic, taking into account Time's Arrow.

Samuelson (1947, 1958) tries to find an axiom that characterizes choice as preferential. He considers choosing two elements, $x_1$ and $x_2$, from overlapping subsets, $\underset{\sim}{x}_1$ and $\underset{\sim}{x}_2$, where $x_1$ belongs to both $\underset{\sim}{x}_1$ and $\underset{\sim}{x}_2$ and $x_2$ belongs to $\underset{\sim}{x}_2$ only, but is different to $x_1$. His argument states that $x_2$ must be preferred to $x_1$ for, since $x_1$ belongs to $\underset{\sim}{x}_2$ it could have been chosen instead of $x_2$, but was not. The argument relies on overlapping subsets for individuals. It is hard to envision "overlapping subsets" in the consumer world as Venn diagrams dictate that intersecting variables be a combination of features of $\underset{\sim}{x}_1$ and $\underset{\sim}{x}_2$. Thus, what is $\underset{\sim}{x}_1 \cap \underset{\sim}{x}_2$? $\underset{\sim}{x}_3$?

Only several authors are mentioned in this section as other papers (e.g. Georgescu-Roegen, 1936; Fishburn, 1973) tend to follow the same axiomatic discourse offered by Houthakker (1960) and Samuelson (1947, 1958); it has been gleaned, though, that the fundamental natures of preference, choice and utility are not easy to explicate.

The following two sections take on a more geographic guise dealing with the literature on consumer theory and models. They deal mainly with currently used shopping models which are of two classes: aggregate allocation models and disaggregate choice models. Theory elucidation is given only as a means to explicate the models.

## 2.2 Aggregate Allocation Models

These models are of two types; firstly,

$$S_{ij} = A_i \ (e_i P_i) \ W_j^{\alpha} \exp \ (-\beta c_{ij}) \tag{2.1}$$

where $A_i = \left[\sum_j W_j^{\alpha} \exp \ (-\beta c_{ij})\right]^{-1}$

(Wilson, 1970; c.f. Lakshmanen and Hansen, 1964)

These symbols in equation (2.1) are defined by Wilson (1970, P. 65) as:

$S_{ij}$ = flow of expenditure from residents of zone i to shops in zone j,

$e_i$ = average expenditure of residents of zone i on shopping goods,

$P_i$ = the population of zone i,

$W_j$ = the weight to be associated with zone j as a proxy for shopping attractiveness,

$C_{ij}$ = the 'cost' of travel from i to j,

$\beta, \alpha$ = two parameters to be estimated.

One constraint is used:

$$\sum_j S_{ij} = e_i P_i,$$

making equation (2.1) a production-constrained spatial interaction model (Wilson, 1974, P. 65).

This model can be derived by a maximum-entropy statistical method (Jaynes, 1957), with the impedance parameter, $\beta$, and the destination 'attractiveness' parameter, $\alpha$, being estimated by the maximum-likelihood method (Edwards, 1972) using an acquired data set. A 'behavioural' interpretation is given $\beta$ by Wilson (1967), but it is an atemporal interpretation which is spatially restrictive due to the model's reliance on encapsulating 'flows' through the artificial construction of delimitated zones for the system of interest, usually a city. The behavioural unit is thus the 'zone' but, as Webber (1980, P. 140) points out,

"---individuals behave, zones do not."

The second type of aggregate allocation model is,

$$P_{ij} = q_{ij} A_i O_i B_j D_j \exp \left(-\beta^* c_{ij}\right) \tag{2.2}$$

where $A_i = \left[ \sum_{j=1}^{n} q_{ij} B_j D_j \exp \left(-\beta^* c_{ij}\right) \right]^{-1}$

$B_j = \left[ \sum_{i=1}^{n} q_{ij} A_i O_i \exp \left(-\beta^* c_{ij}\right) \right]^{-1}$

Webber (1979a) defines equation (2.2) as

$P_{ij}$ = the estimated probability that an individual is located in zone i and interacts with zone j,

$q_{ij}$ = prior probability that an individual is located in zone i and interacts with zone j,

$A_i B_j$ = balancing factors,

$O_i$ = the 'size' of zone i,

$D_j$ = the 'size' of zone j,

$\beta^*$ = an estimated parameter,

$C_{ij}$ = a 'cost' of interaction between zones i and j.

Equation (2.2) can be derived by an axiomatically-based minimum information methodology (after Kullback, 1959).

One improvement on the Wilson-type spatial interaction model is that by explicitly considering the individual shopping trips in the modelling process, the model could be said to be intrinsically behavioural; however, it is a spatial behaviouralism only - the temporal dimension is omitted. Webber (1979a, P. 247) gives, however, a restricted temporal articulation to this model by considering shifts in classes by individuals from one time period to another time period - it is a "restrictive" temporalisation because it is comparative static in nature.

These two models exemplify the cautiousness of some urban geographers confronted by what is seemingly a conglomerate of intraurban shopping trips made at different times over different spaces. This conservatism in consumer behaviour analysis is sometimes justified by geographers when they consider their work as unbiased means of explaining a system's structure at any one time (e.g. Webber, 1976, P. 286).

## 2.3 Disaggregate Probabilistic Choice Models

These models are "disaggregate" because the unit of analysis is the individual (e.g. person, household) and are "probabilistic" because the mode of explanation is via a probabilistic dependent variable. A model that has found wide application is the multinomial logit model (Stopher and Meyburg, 1976), a model that is used to explicate the observed explanandum in Chapter 4. The structure of this model is:

$$P_{it} = \frac{\exp\left[\sum_{k=1}^{m} Z^k \ (\underset{\sim}{X}_i,\ \underset{\sim}{S}_t)\beta_k\right]}{\sum_{j=1}^{n_t} \exp\left[\sum_{k=1}^{m} Z^k \ (\underset{\sim}{X}_j,\ \underset{\sim}{S}_t)\beta_k\right]}$$

where $P_{it}$ = the probability that alternative i is chosen by individual t,

$Z' = Z^k\ (\underset{\sim}{X}_i,\ \underset{\sim}{S}_t)$, k=1,--, m ; m empirical functions defined by the vector of attributes of the ith alternative ,$\underset{\sim}{X}_i$, and a vector of attributes of the tth individual ,$\underset{\sim}{S}_t$,

$\beta_k$,k=1,--,m = m unknown parameters, and where the denominator is summed over all alternatives ,$n_t$, available to individual t.

By assuming the empirical functions, Z', are linearly additive, then this leads to a definition of the differences in characteristics of alternatives as the comparative mechanism in choice decision-making (Stopher and Meyburg, 1976, P. 7). However, the linearity assumption cannot apply to the traveller's characteristics, $\underset{\sim}{S}_t$, as these cancel out during model calibration. This problem can be solved by treating personal variables, like income and age, as "specific" to an alternative (Domencich and McFadden, 1975). It must be noted that the multinomial logit model is only one of numerous structural forms that can be used as a choice model. The others include a truncated linear probability model (Domencich and McFadden, 1975, P. 79), and a probit model (Aitchison and Silvey, 1957); but the multinomial logit model has advantages of computational flexibility, elasticity and structural tractibility that makes its operationalization a relatively easy task.

All these disaggregate probabilistic choice models have a relative deterministic utility framework based on the recent microlevel choice theories of Luce and Suppes (1965) and McFadden (1973), succinctly elucidated by Sheppard (1978). O'Sullivan and Ralston (1978) aptly delineate these two theories when they state:

> "they postulated either random utility with deterministic choice behaviour [McFadden, 1973] or deterministic utility with random choice behaviour [Luce and Suppes, 1965]"
> (O'Sullivan and Ralston, 1978, P. 365).

Both these theories have the same premise: an individual (person or household) ,t, has a shopping destination choice set, $C_t$, all alternatives $i,j,k,-- \varepsilon C_t$, being located within a known bounded area. The individual is observed to choose one alternative, i, from the choice set for any one trip. Thus, both theories are concerned with the same human environment but different human minds. The strict utility theory (Luce, 1959) states that the probability of choosing an alternative is exactly correlated to the utility of that alternative, the choice being that alternative that has the greatest utility. Thus, utilities are defined deterministically while the choice decision is made by a non-optimising decision maker. The random utility theory (McFadden, 1973) states that an individual has incomplete knowledge of the utility of each alternative in his/her choice set and will choose that alternative that maximises utility. Thus, utilities are defined probabilistically while the choice decision is made by a rational individual.

Structurally, both these theories have different underlying assumptions which nevertheless can lead to the same multinomial logit model. For the strict utility theory the assumptions are: the Independence of Irrelevant Alternatives axiom (Luce and Raiffa, 1957), the direct correlation of utility and probability, and the assumption that the vector of empirical functions are linear additive. For the random utility theory, the assumptions are mathematically more elegant and concern the assumed distribution of the random error terms, together with the assumption of the linear additiveness of the empirical functions.

Critically speaking, the probabilistic behavioural models have weaknesses. Burnett (1978) outlines some of these weaknesses with a primary criticism being the unrealistic choice process conceptualisation whereby the choice set (destinations, for example) is the same for all the individuals of a subgroup of the population at the same time. For example, McFadden (1972) and Adler and Ben-Akiva (1976) derive a choice set by including all non-zero interzonal matrix elements for the individual's zone of residence in the choice set. Conversely , Becker and Kostyniuk (1978) and Ansah (1977) deem that classes of shopping centres are the intrinsic determinants of an individual's choice set. Both measures of $C_t$ are functions of the modeller's perceptions of the shopping environment, which may or may not coincide with an individual's perception. However, as informational levels and environmental perceptions differ between individuals spatially, and within individuals temporally, then models of human behaviour should incorporate these spatio-temporal uncertainties, which can also be referred to as space-time constraints. The incorporation of "space-time constraints" in human behaviour analysis has been attempted by Hägerstrand (1970), paving the way for developmental papers and books by Hägerstrand (1975), Lenntrop (1976), Carlstein, <u>et.al.</u> (1978) and Burns (1979). All these works emphasise that choice-making is limited by our lack of mobility within a constrained spatial-temporal environment, the "environment" consisting of both external (manifest structural) variables and internal (life pattern) variables, at any one time.

## 2.4 Market-Oriented Disaggregate Theory

Consumer choice theories, which attempt to discern how people make choices when shopping, have formed a major portion of marketing research - the theories of Nicosia (1966), Howard and Sheth (1969), Hansen (1972), Howard (1977), Engel, et.al. (1978) and Bettman (1979) all come under this category of a theory of what consumers do before, during and after shopping. These theories are thus temporal in nature, elucidating the way people process information over time; also, these theories are intrinsically psychological in that the consumer makes the decisions, rather than a model environment 'determining' a consumer's choices of action (c.f. normative theory, such as Central Place Theory — Christaller, 1933 - which assumes that individuals should act in a certain manner). For example, Bettman (1979) gives an "information processing theory of consumer choice" which delineates the choice process into processing capacity, motivation, attention and perception, information acquisition and evaluation, memory, decision processes, and learning (Bettman, 1979, p. 2). Several choice "scenarios", that Bettman gives as examples of realistic consumer temporal actions, i.e. typical everyday shopping intraurban behaviour, are clarified in Chapter 3 by using them as examples to elucidate a temporal relative choice theory - a psychological theory that gives a reason for why we assign different utilities over time to different types of shopping trips.

A basic criticism of these market-oriented disaggregate theories of human behaviour is that they are aspatial. They give considerable evidence for why people shop for particular types of goods, but little or no reasons why people shop where they shop. This thesis attempts to address this limitation by explaining consumer behaviour via a set of areal generalisations.

## 2.5 Post-Discussion and Introduction to the Remainder of Thesis

It is envisaged that if the decisions regarding the shopping trip phases (or stages) are sequential for a time interval, $[t]_o^a$, then the two-stage process is:

(i) why and what to buy at $t_o$, and

(ii) when and where to buy at $t_a$,

where the "why-what" is considered interdependent with the "when-where", but sequentially interdependent - not simultaneously interdependent. That is, (i) leads to (ii) but (ii) does not necessarily lead to (i). (i) followed by (ii) is usual for grocery shopping, but this sequence may be reversed by comparison non-grocery shopping. Hägerstrand (1970), in his time-space "prism" encapsulates the "when-where" quite well, but fails to give a <u>causal</u> mechanism, i.e. the "why-what". Geography, on the whole, has delved into (ii) while economic and marketing studies have delved into (i) - this thesis attempts to fuse the two "stages" by deriving a comprehensive explanation of intraurban consumer behaviour.

# CHAPTER 3

## EXPLICATORS OF AN OBSERVED SHOPPING EVENT

This chapter gives a set of explanatory statements explicating intraurban shopping behaviour. Initially, the definition and clarification of an aspatial, psychological theory of evolving relative utility preferences is presented. Next, the retail structure of a medium-sized city in southern Ontario, Hamilton (population: 313,000), is described. From these two pieces of factual information, a set of areal generalisations of consumer behaviour are logically derived, each 'generalisation' being a normative statement about where people should shop. Thus, the areal generalisations are predicated upon an aspatial within-person theory and spatial observation. The choice theory and the generalisations help explain the observations and comprise the explicators - the information that explains an observed shopping event; the intraurban shopping matrix is described in the next chapter.

### 3.1 Definition of a Temporal Relative Choice Theory: TT

The choice theory expounded in this section is a theory of human choices of action over time. By learning from past experiences, humans consciously formulate the relative utilities associated with sequential events. Given the human capacity for recall, present and projected experiences ("choices of action") can be influenced, without too much mental effort, by former relative utility data. Events like eating and drinking become almost reflexive as one gets older, but shopping may require periods of almost reflexive choices of action (e.g. "deciding" to buy milk when milk runs out at home) interspersed with periods of relative thought (e.g. deciding to buy a T.V. or a house). Thus, any theory which purports to give a probabilistic statement of why we shop should be able to envelope the multitude of causal mechanisms which trigger our desire to shop over time. The following relationship could be such a 'statement':

$$\text{subjectively} \begin{array}{c}\text{maximise}\\ \text{or}\\ \text{maintain}\end{array} U_b[t]_o^a \text{ r.t. } U_\beta[t]_\alpha^o \qquad \text{(TT)}$$

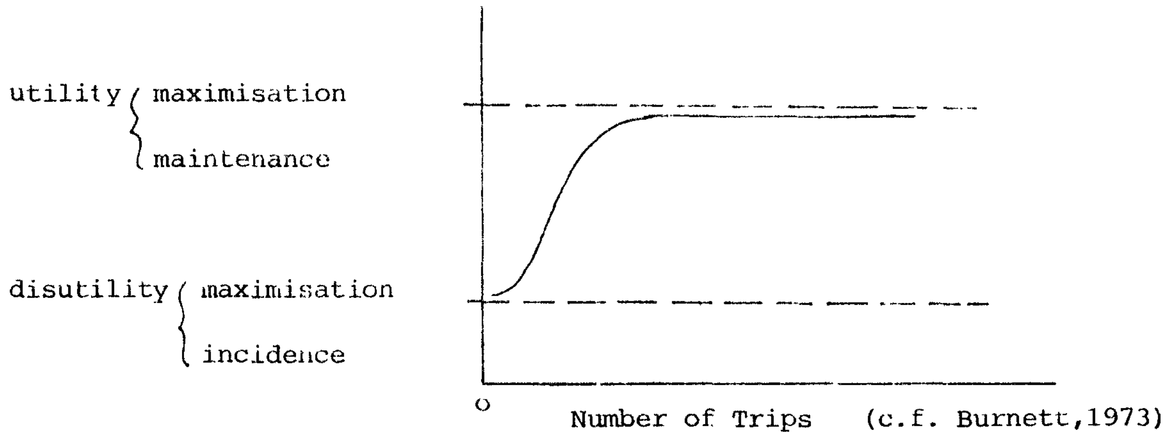
which says: subjectively maximise or subjectively maintain the utility of a choice of action, b, for a projected time interval, $[t]_o^a$, relative to ("r.t.") the subjectively known 'utility' of an action of choice, $\beta$, for a previous time interval, $[t]_\alpha^o$ . O is the experienced present, while $\alpha$ and a are past time instances and future time instances, respectively. 'Utility', for $[t]_\alpha^o$, is framed by apostrophes because it is conjectural whether a person gets satisfaction or not after the event, b; i.e., the "new" $\beta$. If the effect of b is disutility then the 'next' b might be a reaction that may (subjectively) alleviate the disutility of the just experienced b. Therefore, due to Time's Arrow, we cannot know for certain the effect of our b's - however, learning helps to restrict the incidence of disutilities. In essence, then, $U_b$ is always positive or neutral while $U_\beta$ may be negative or positive or neutral. "r.t." (relative to) in TT is an intermediary phase, replacing the deterministic symbols, > and =, which gives TT a relativistic, subjective, structure - the human being subjectively uses past utilities (or disutilities) of $\beta$ actions to ascertain whether a future choice of action, b, will hopefully give similar, or more, utility.

Given this explication of TT, it is proposed that TT be called a temporal, relative choice theory. Further, it could be said to be a positive theory in flux: a theory which claim's to describe the human world as it continues to be (c.f. an atemporal positive theory which "claims to describe the world as it is," and an atemporal normative theory which "claims to describe the world as it ought to be"; Gregory, 1978, P. 64). The theory, to be somehow 'truthful', is carried "around" with us during our waking hours; it paints a picture of what humans do and what they think when they do. TT is essentially a learning model and Markovian in nature. It could be thought of as an expected utility model.

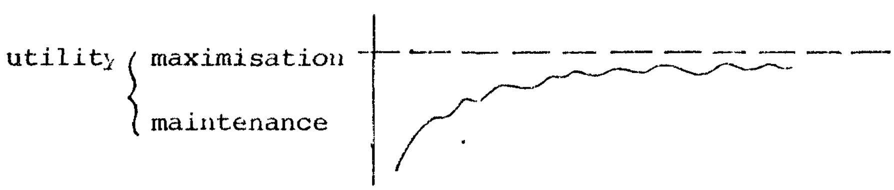
To put TT into perspective, it is necessary to say here that the time "intervals" are temporally flexible, i.e., they can be as near to a zero interval, or as far from a zero interval, as one continues to think, given that the thinker envisages a level of resolution at which the action of choice is considered. For example, β may be a previous grocery trip on the α date, and b may be the next grocery trip at an, as yet, undetermined date, a. Or, β may be the act of choosing a brand of soap powder on a shopping trip, and b may be changing the brand of soap powder, after β has been experienced, during the same shopping trip. Due to the flexibility of actions over time, "last minute" choices could refute a theoretically 'viable' deterministic model - it is this psychological (idiosyncratic?) level of thinking that constitutes human "error": the stochastic component of life.

TT may qualify as a viable hypothesis due to its "generality" and "conservatism" (Quine and Ullian, 1978). It is "general" because of its wide-reaching exemplification of human reality, and "conservative" because it is quite bare of extraneous variable articulations that try to unrealistically mirror reality. Quine and Ullian consider these two "virtues" necessary for a hypothesis to be successful. It is considered that the choice theory should also be "virtuous" - these "virtues", that are considered essential to a workable hypothesis, are "simplicity", "modesty" and "refutability" (Quine and Ullian, 1978). TT is a theoretical domain which encompasses a broad spectrum of behaviours - however, validation of TT is difficult as longitudinal data sets must be of a substantial temporal length so as to encompass evolving behaviour.

To conclude this explication of TT, it is deemed that TT, as a <u>theoretical statement of relative consumer utility over time</u>, is both temporally discontinuous and asymptotically invariant. "Temporally discontinuous" because if shopping implies traversing space to procure (by money exchange, bartering, or other means) food staples and/or durable non-grocery goods, then people with vegetable plots or with a ready supply of wood may forgo a "normal" shopping trip when a desire for tomatoes or timber, for example, come about. "Asymptotically invariant", or <u>approaching</u> uniformity, as not all people (excluding very young children) "shop" e.g. drifters, beggars, unemployed all may live off restaurant leftovers, or out of garbage cans. Thus, TT cannot be said to be applicable every time a good is desired, but the anomalies are very few and far between and would not adversely affect empirical research of urban system regularity. Moreover, TT is considered to be <u>a priori</u> asymptotically invariant as the "a priori" takes into account the temporal uncertainty of the shopper <u>and</u> the modeller, hopefully nullifying a modeller's "conceit" about the way people think - the following diagram gives a hypothetical sketch of learning via evolving relativistic utility mechanisms:




This figure indicates that individuals learn quickly about their shopping environments, the "quickness" being a function of the number of trips undertaken. Thus, given a relatively stable environment, "error" (or incidence of disutility) decreases at a decreasing rate. However, the "second derivative" is not, in reality, continuous but is beset with "noise" i.e.,




The contention made here, that evolving behaviour is a function of increasing knowledge about one's shopping environment so as to minimise the likelihood of disutility, is consistent with the viewpoints of Burnett (1973) and Golledge (1967).

3.1.1 Clarification of TT

How does TT answer the question: why do we shop, per se? The question concerns a within-person, mind thing - the mechanism which triggers learned desires for physical (and mental) sustenance. It is debatable whether instinct can be "triggered" by desire, but it would seem ludicrous to say that we inherit an "instinct" to shop - rather, the way we shop is culturally determined, but the desire to eat would seem intrinsically tied in with a fundamental animal, life-force.

Be this as it may, the answer provided by TT states why we process information before, during and after shopping trips. Bettman (1979), by delving into the psychological aspects of shopping, empirically "supports" TT by looking at the shopping-related outcomes and/or hopes of the individual. To clarify the statements regarding the comprehensibility of TT, various shopping "scenarios" given by Bettman (1979) are now analysed via TT. Each "scenario" is first stated in full - then analysed.

Choice Scenario 1

"Jane Jones notes that she has used up a jar of mayonnaise. She puts mayonnaise on her shopping list. She has bought a particular brand for a long time and intends to buy that same brand again when she goes shopping again."

(Bettman, 1979, P. 14)

Analysis of 'Choice Scenario 1', via TT

Three time intervals are implied - a tripartiate time span could be envisaged after Jane has written "mayonnaise" on her shopping list, i.e.,

$$U_{[illegible]}\,[t]_{o}^{a} \text{ r.t. } U_{\beta_2}\,[t]_{\alpha}^{o} \text{ r.t. } U_{\beta_1}[t]_{\gamma}^{\alpha},$$

where, from right to left (progressive time),

$[t]_{\gamma}^{\alpha}$ is the interval of time within which Jane notices she has run out of mayonnaise,

$\beta_1$ is the "noticing" of above: a thought,

$[t]_{\alpha}^{o}$ is the interval of time between a past $\alpha$ time and the experienced present, o within which Jane writes "mayonnaise" on her shopping list,

$\beta_2$ is the intended (or preferred) "action" (i.e. writing) of choosing to buy the same brand of mayonnaise,

$[t]_o^a$ is an indeterminant future interval of time between the experienced present, o, and a future time, a.

b is the potential choice of the same brand of mayonnaise.

<u>Comments</u>: because the shopping trip is an intended trip at $t_o$, then a possibilistic element creeps into the choice of the same brand of mayonnaise. Jane will buy this same brand of mayonnaise, that she knows to be "good", given the temporal stability of the known shopping environment between $t_o$ and $t_a$ i.e. $[t]_o^a$. It is a possibility - not a certainty. Jane will strive to <u>maintain</u> her experienced utilities by shopping at a time when she hopes, to a certain degree, that the particular shop is open and which is more than likely to contain the desired brand of mayonnaise. The success of the intended trip could be couched in a subjective probabilistic framework by Jane herself calculating the number of times the potential choice has been chosen. Usually this probability will approach one as grocery outlets are customarily well-stocked with foodstuffs during normal economic conditions i.e., no strikes, accidents, etc., and thus it is highly probable that Jane will be able to procure the same brand of mayonnaise during $[t]_o^a$.

Three distinct behaviours have been related via a relativistic utility theory. Now, is Jane subjectively <u>maximising</u> or subjectively <u>maintaining</u> her utilities over time, i.e., is this brand of mayonnaise, which has been bought for a long time, associated with <u>novelty</u> or <u>mundaneness</u>. I deem that Jane is <u>maintaining</u> her utilities as learned behaviour has got her to a stage whereby her actions become almost reflexive - she has got room in her mind for other thoughts and the choices in this scenario are almost reflexive and mundane, certainly not inspirational or stressful. However, it could be argued that her manifest actions are maximising - actions which "maximise" the incidence of procuring the desired good.

The next scenario has a mixture of maintenance and maximisation of temporal utilities in that learned choices are interspersed over time with new unlearned choices. However, the novelty of new choices may induce within-person stress - to alleviate this "stress" it is shown that analogies to past behaviour are used in the new choice situation. Thus, even though new environments may induce new choice decisions, the 'new' choices of action are deemed to be quasi-learned decisions. The person hopefully maximises the utility of these psychologically based choices of action; but, due to the confidence in the more mundane things of life, like buying the same brand of mayonnaise, he/she subjectively maintains the utility of these more mundane choices of action.

Choice Scenario 2*

"Jerry Baker and his family have just moved to a new home and the family needs to purchase a washing machine. Since they will be moving into the house from their apartment in a few weeks, they must make a decision fairly quickly. Jerry and his wife have never purchased a washing machine before. They discuss the features desired, particularly the cycles available and color. Since Jerry approaches most choices with a great deal of thoroughness and prides himself on his ability to get the "best" brand at the best price, he decides to get some information about washing machines. He remembers that a friend, John Haskell, has recently purchased a washing machine, and also recalls that a recent Consumer Reports issue rated washing machines. Since the Consumer Reports issues are stored in the basement and he is upstairs, he decides

*Bettman's (1979) "choice scenario 3".

to first call his friend. John is not there when he calls, so he leaves a message and goes downstairs and finds the Consumer Reports issue instead. He is reading the article when John calls him back. They discuss John's experience with his choice and also stores where discounts are available. In particular, John tells Jerry about two retailers who offer substantial discounts. Jerry returns to the Consumer Reports and spends a good deal of time looking at the table in the article which summarizes the brands and their features. He decides that one brand looks best, based upon rough criteria about prices, service record and water usage. He shows this brand to Mary, who notices that the tub size is relatively small, which would lead to more washes. This feature leads them to reject this brand. Jerry then shows Mary another brand that he had felt looked good, and they decide on that brand.

Jerry now shifts to finding the brand they have chosen at the best price. He knows from previous experience that one discount store has very good prices and he has found two other possible sources from his call to John Haskell. He calls these two and finds that one does not carry the brand he and his wife have chosen. He writes down the price and warranty terms for the other retailer. He and his wife now go to the discount store and see that their price is slightly more than that of the other retailer. They are about to leave when his wife notices that this store offers a two-year warranty in contrast to the one-year warranty offered by the other retailer. They decide to pay slightly more to get the longer warranty and order the machine from the discount store."

(Bettman, 1979, PP. 14/15)

Analysis of Choice Scenario 2 via TT

The elongated time span implied by this scenario could be abbreviated into a multi-temporal TT:

subjectively maximise or maintain $U_i[t]_o^a$ r.t. $U_j[t]_{\alpha_j}^o$, j=1,2--,n.

where i = purchase of washing machine,

a = perceived time, when washing machine arrives at Jerry's new home.

o = present time, when Jerry and Mary decide to order washing machine.

j=1: Mary's observation of a 2-year warranty.

j=2: Jerry and Mary go to Discount Store to "compare" prices.

j=3: Jerry's phone calls to the "two possible sources" alluded to by John.

-
-
-

j=n: Jerry and Mary know they need a washing machine for their new house.

$\alpha_j$: are the times at which the jth action of choice was propagated.

Comment: not only is the relativistic temporal theory "general" in its application to life situations, but also the theory is "flexible" regarding relativistic experiences over time. In the above scenario, $U_i[t]_o^a$ could be related to j=1 or j=n; i.e., actions over time do not necessarily have to be sequential as the mind can think of prospective events ahead of the next "event"; further, it is considered that actions of choice are impossible to be consciously ordered sequentially due to constantly changing environments. However, for Jerry and Mary's case, their collective actions will ultimately lead to the purchase of a washing machine. Also, once again, it is a matter of debate whether Jerry and Mary are maintaining $U_i$ r.t. $U_j$ over time (e.g. learning from past experiences that "driving" to the Discount Store offers "cheapest" form of transport available) or maximising $U_i$r.t.$U_j$ over time (e.g. Jerry's careful preanalysis of many avenues of source material regarding washing machines).

Aside: Joseph and Sumption (1979) give an example which illustrates the universality of TT; they cite the phenomena of "large queues which form in the Soviet Union wherever durable consumer goods are on offer suggest that the preferences of reasonably well-educated consumers are much the same the world over." Jerry and Mary, it is envisaged, would still desire a washing machine, whether they lived in Donetsk or Baltimore. One modification which leads to the deeper issues of truth and goodness is the substitution of "well-educated" by "intrinsically selfish". But this human trait is one that cannot be dissected in this thesis.

### 3.1.2 Concluding Comments

The analyses and comments of these two scenarios by Bettman (1979) raise several points regarding consumer behaviour.

At a most fundamental level, we shop because we don't want to starve (excluding subsistence farmers, nomads, gatherers, etc.) - at a less life-and-death level of resolution, we shop, not to alleviate hunger, but to acquire material possessions for ulterior purposes; e.g., status acquisition. Therefore, it is envisaged that the "shopping" trip is intrinsically bi-partiate, but the difference between "grocery" and "non-grocery" goods is becoming obscured in our consumer-dominated society. The grocery trip is essential for our physical well-being, but because of a surplus value-embedded culture, food has a relatively low priority - even a mundaneness - about it; and the non-grocery trip is "essential" for our mental well-being. The temporal, relative choice theory, TT, should therefore be bipartitioned for the shopping trip into (a) utilities relating to foodstuffs e.g., subjective maintenance utility for well-off consumers; (b) utilities relating to non-essential foodstuffs and "essential" non-foodstuffs e.g., subjective maximisation utility for well-off consumers or a 'rare treat' for poor consumers. This second category, (b), includes transitional shopping trips (e.g. procurement of fast-foods, beer or exotic foodstuffs) which Guy (1976) accommodates as a distinct category in a three-level classification of shopping trip types. Table 3.1 gives this "classification". Thus, TT has an embedded hierarchial utility structure - at each level a household or individual would have different perceived pursuits of happiness relative to a given shopping trip; differentials in tastes, ideas, information processing, status and available surplus income would seem to affect shopping choices of action over time - this thesis contends that human endeavours continue to follow TT's "example": a simple attainment of "more" utility over time - the "steady-state" dream - with or without complex viable camouflaging "noises".

In essence, the preceding rather detailed exposition to the explanation of consumer behaviour leads to the following denouements:

(i) that people regard the grocery shopping trip in terms of maintaining potential or derived utility, depending on experienced grocery trips. They have time to heuristically evolve habitual, utility maintenance behaviour.

TABLE 3.1

CLASSIFICATION OF SHOPPING TRIP TYPES
ACCORDING TO STORE FUNCTION

| | |
|---|---|
| I | Accessibility Functions |
| | GROCERY |
| | FAST FOOD, GAS, STATIONERY |
| | BEER |
| | HAIRDRESSING |
| II | Intermediate Functions |
| | HOUSEHOLD APPLIANCES |
| | CAR REPAIRS |
| | BANKING, FINANCIAL SERVICES |
| | SPORTING EQUIPMENT |
| III | Comparison Functions |
| | CLOTHES |
| | APPLIANCES |
| | FURNITURE |
| | JEWELLERY |
| | CAR PURCHASES |

Adapted from Guy (1976)

(ii) that people regard the non-grocery shopping trip, with the notable exception of transitional shopping trips, in terms of maximising potential and derived utility due to inexperience in particular non-grocery trips. People have relatively little time, compared to grocery shopping, in which to heuristically evolve habitual utility maintenance behaviour in the procurement of high-value goods. However, the transitional non-grocery goods, e.g., beer, toothpaste and exotic foods, are also "transitional" between maintenance and maximisation of utility - thus, TT is socio-economic specific in that utility maintenance for upper income people may be utility maximisation for lower income people.

(iii) A general, albeit indirect, theme regarding people's thoughts and actions is exhibited by the choice scenarios: as TT can't explicitly say why people shop where they shop, then TT can only be considered a simple, albeit clear, theory of people's thoughts upon potential, given past, actions. If an action at $t_o$ is a function of thoughts at $t_\alpha$, then TT is a theoretical domain containing a realistic explanation of consumer overt behaviour - the areal generalisations.

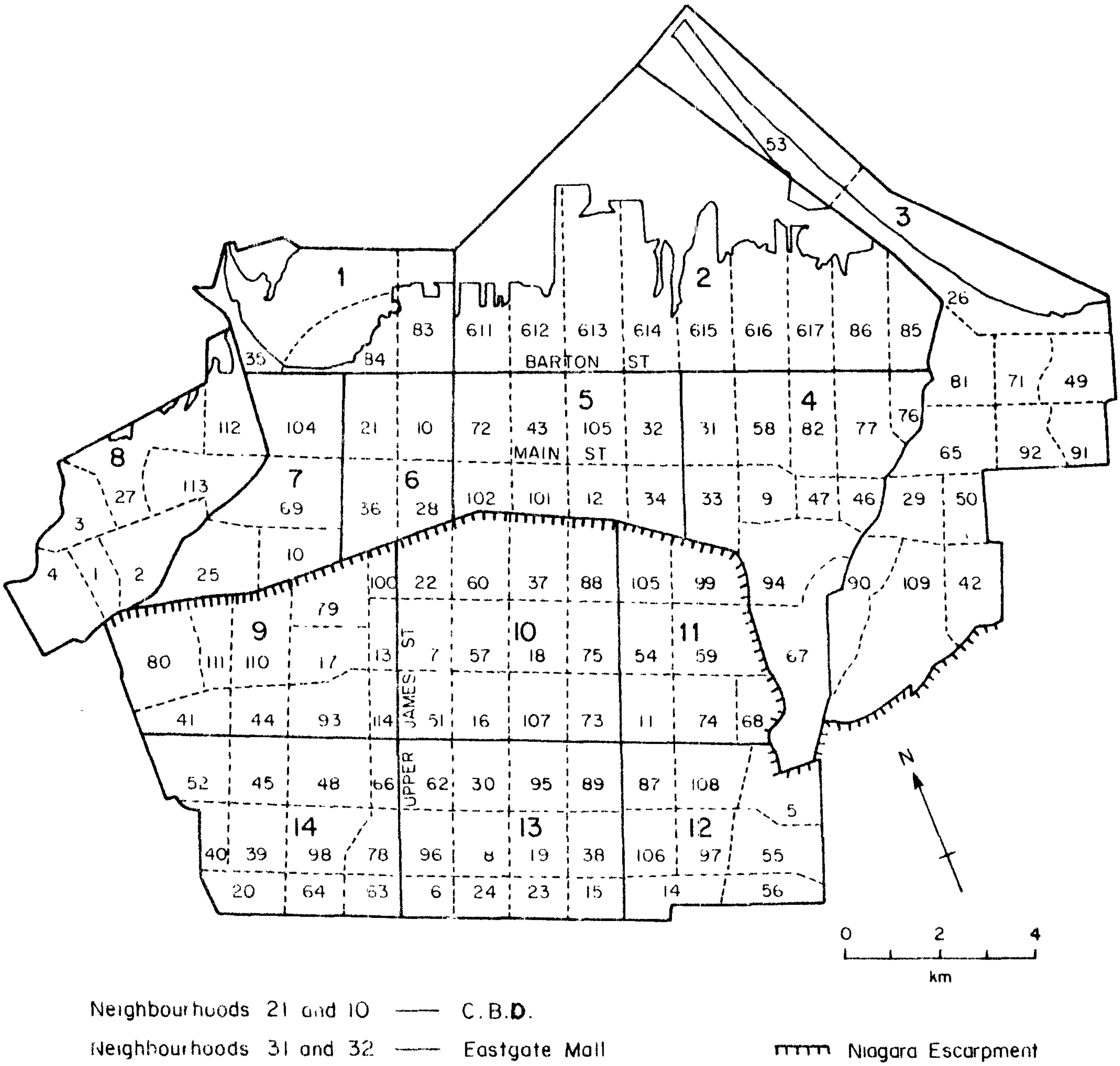
The next section presents facts of a shopping environment for a North American city, Hamilton. These observed facts, together with the aspatial theory, TT, lead to statements of areal generalisations associated with grocery and non-grocery trips.

## 3.2 Description of the Spatial Context of a Shopping Environment: The Case of Hamilton, Ontario

Whereas the previous section looked at within-person desires for utility from shopping, it is encumbent on this section to say something about the environment in which a sample population shops. The "sample population" is a group of people who participated in a survey conducted by the Geography Department, McMaster University, of intraurban trip movements for Hamilton, Ontario during May, 1978 - the resultant two-week longitudinal data set forms the basis for a description of shopping movements given in the next chapter. This section describes the location of the sample population and the location of retail outlets, i.e., the actors which enable the manifestation of the interactive shopping trip.

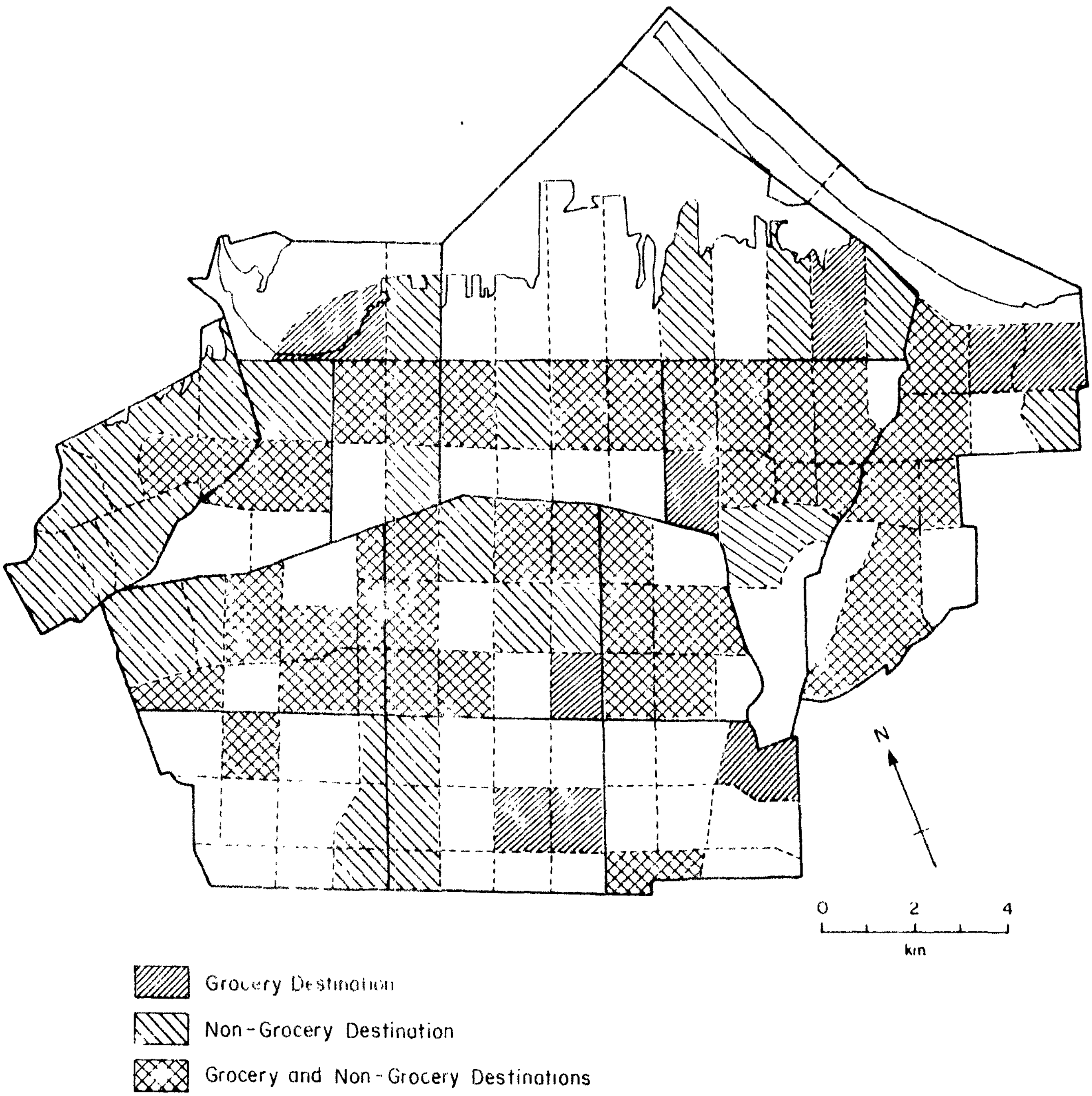
Despite the blurring of the grocery/non-grocery dichotomy, a reasonable classification of shopping goods, used to delineate trip purpose, is given in Table 3.1, which is extracted from Guy (1976). Whether this classification is adequate or inadequate is indirectly clarified when $\underline{\underline{G}}$ is tested. Given this delimitation of trip purpose, and noting that trips take place between zone centroids and neighbourhood retail outlets (Figure 3.1 gives a spatial delimitation of Hamilton), then a neighbourhood is defined to have a retail outlet, $S_i$, if a household adult member, i, (anyone older than 15 years of age), shops in that neighbourhood for grocery and/or non-grocery goods. By doing this for the whole sample population, comprising an average of 40 households per zone, then an approximate composite picture of Hamilton's retail structure, $\sum_i S_i$, is obtained. This "picture" is shown for both home-based trips (trips originating from home) and for work-based trips (trips originating from work), in Figures 3.2 and 3.3 respectively.

The data exhibit broad aggregate pictures of where the sampled population shopped during the survey period, the description of which is the purpose of this section. So, as $\sum_i S_i$ is the sum of shopping neighbourhood destinations visited by each household i during the survey period,



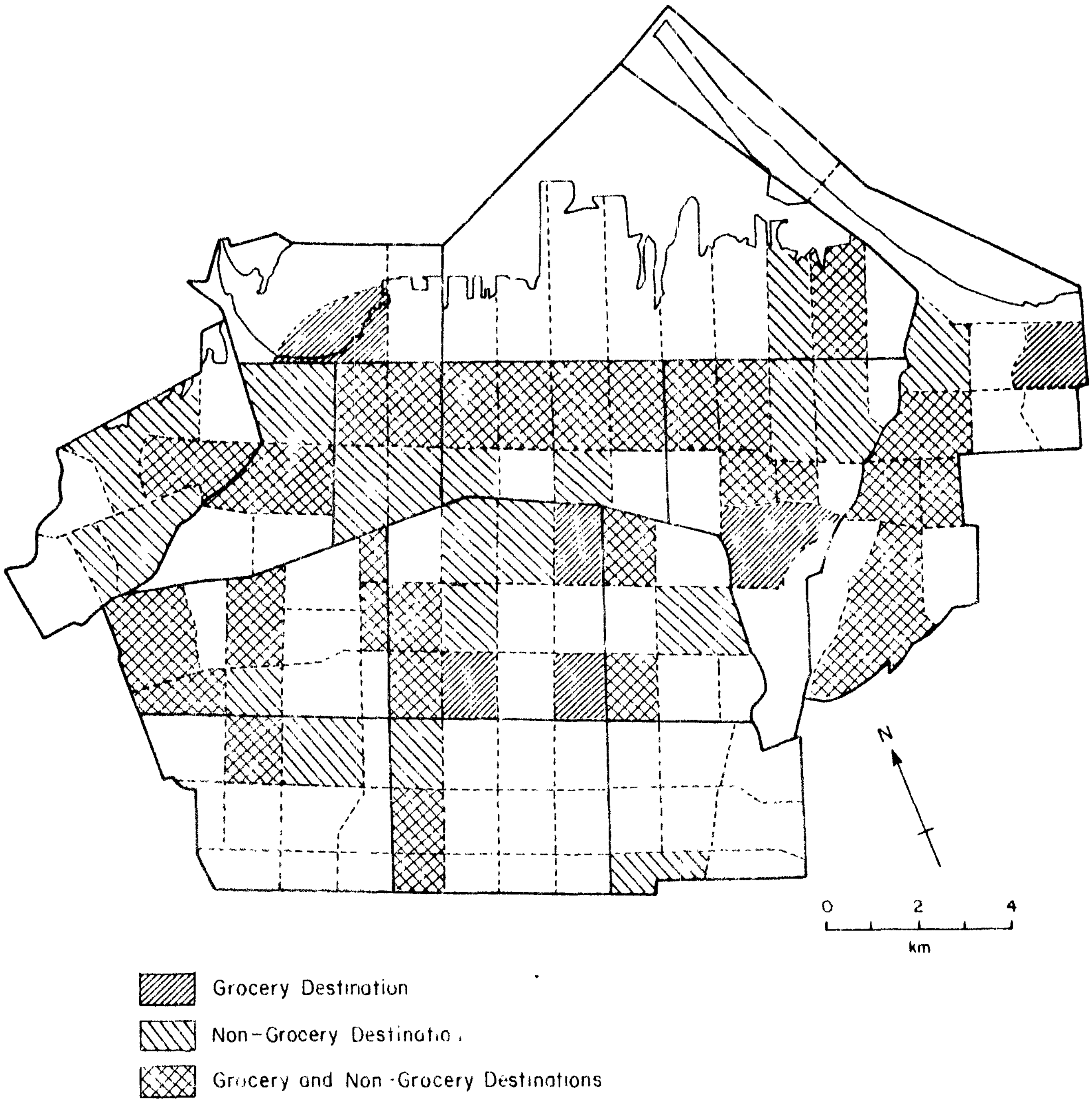

Source: RMHWPDD (1977 a,b).

Figure 3.1 A Spatial Delimitation of Hamilton, Ontario




Source: May, 1978, Trip Survey; Conducted by Geography Dept., McMaster University

Figure 3.2 The Known Retail Structure of Hamilton for Home-based Shopping Trips




Source: May, 1978, Trip Survey; Conducted by Geography Dept., McMaster University

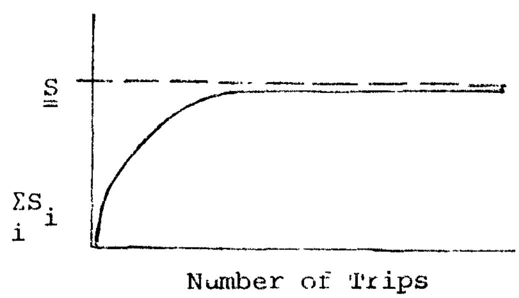
Figure 3.3 The Known Retail Structure of Hamilton for Work-based Shopping Trips

$[t]^2_o$, then Figure 3.2 gives $\sum_i S_i$ for home-based grocery and non-grocery trips, and Figure 3.3 gives $\sum_i S_i$ for work-based grocery and non-grocery trips. The neighbourhoods with both grocery and non-grocery outlets imply shopping centres, which provide a multipurpose, uni-neighbourhood stop for shoppers. It could be inferred from $\sum_i S_i$ that the retail facility structure for Hamilton, $\underline{\underline{S}}$, is approximated by $\sum_i S_i$ (home-based grocery and non-grocery) $\cup \sum_i S_i$ (work-based grocery and non-grocery). If this is so, then the spatial retail composition for Hamilton is an asymmetrical T-structure closely following the Main/King east-west arteries and the James St. north-south artery, with ample filling under the "armpits".

From Table 3.1 and Figures 3.2 and 3.3, it could be concluded that grocery outlets, offering essentially similar convenience goods, are spatially ubiquitous, while non-grocery outlets, even though aggregatively ubiquitous, are actually spatially localised (sometimes in agglomerations) due to the wide variety of goods offered. However, the non-grocery category contains some goods and services, e.g. drug stores, shoe shops, barbers, etc. which could be said to be located throughout the city - consumers may visit these shops habitually every week or may only visit them every month; moreover, a consumer may habitually visit the same outlet or "shop around". It is clear that the boundary between grocery and non-grocery trips is transitional - not abrupt.

### 3.2.1 Trip Frequency and Spatial Structure

The picture of grocery trip and high value non-grocery trip utility differentials as espoused in Section 3.1 is reinforced by the description of the retail structure of Hamilton, Ontario. Grocery utility maintenance is associated with grocery outlet ubiquity, while non-grocery utility maximisation is associated with high value, durable, non-grocery outlet localised agglomerations. Further, TT attempts to give a temporal context to individual decision making, while $\underset{\sim}{C}_s$ gives a spatial context in which individual decision-making evolves. Golledge (1967, 1969), realised that the perception of $\underline{\underline{S}}$ is not static, but evolves - Figure 3.4 gives such a temporal meaning to $\underline{\underline{S}}$ in which the asymptote is $\underline{\underline{S}}$, i.e., the complete retail structure. Table 3.2 gives a two-by-two classification of trip type - the hypotheses of "class" and "trip frequency" reflect the hypothesis of shopping trip purpose type in Table 3.1. The following section gives general statements which take into account these hypotheses.




(c.f. Golledge, 1967, 1969)

Figure 3.4 A Simple Picture of Evolving Spatial Knowledge

The next section presents a set of areal shopping generalisations, $\underline{\underline{G}}$. These generalisations are spatial hypotheses of shopping destination choice behaviour.

## 3.3 A Set of Areal Generalisations of Intraurban Grocery and Non-Grocery Trip Behaviour: $\underline{\underline{G}}$

To restrict ambiguity, the shopping trip types referred to in this section are now defined. Trip purpose is delineated into grocery and non-grocery categories. Trip origins are signified by the activity, either residing at home or working at place of emanation. Given these presumptions, then the following definitions describe the trip flows that

TABLE 3.2 A TWO-BY-TWO CLASSIFICATION OF SHOPPING TRIP TYPES

| | | Hypothesised Trip Frequency | |
|---|---|---|---|
| | | Bought frequently | Bought infrequently |
| CLASS | Homogeneous | Groceries | Fast Food, Beer<br>Liquor, Stationery |
| | Inhomogeneous | Sporting Goods<br>Hobby equipment<br>Garden supplies<br>Records | Clothes<br>Appliances<br>Furniture<br>Jewellery |

are analyzed in the following section:

Definition 1: A trip is a temporal set of space traversals between a zone of origin and a neighbourhood of destination.[1]

Definition 2: A single-stop, single-purpose trip involves a one-stop trip for a single purpose, thence a return home.

Thus, the empirical study of single-stop, single-purpose trips involves a two-way cross-stratification of trip types as a function of trip origin and trip purpose, given that Definitions 1 and 2 delineate physical trip entities (i.e., realistic, bounded, shopping trip flows). Unless otherwise stated, the areal generalisations allude to single-stop, single-purpose trips. Multistop, multipurpose shopping trips are qualitatively discussed in the next chapter.

The areal generalisations offered, $G_{21}$, $G_{22}$, $G_{31}$ and $G_{32}$, where $G_{21}$ is a home-based grocery generalisation, $G_{22}$ is a work-based grocery generalisation, $G_{31}$ is a home-based non-grocery generalisation, and $G_{32}$ is a work-based non-grocery generalisation, are relatively brief in context, as it is deemed people view the single-stop, single-purpose shopping trip as a function of one, or a few, dominant variables, "variables" mirroring spatial - temporal constraints on individual data assimilation (c.f. Hägerstrand, 1970). Human error may result when people have incomplete information regarding the shopping environment, and so the max-min generalisations, even though applicable to many shoppers, are sometimes falsified by individual 'noise' - idiosyncratic behaviour. A subjective modification

---

[1]For Hamilton, the study area is delimitated into 14 zones and 120 neighbourhoods.

of the generalisations hopefully aids in nullifying deterministic overtones, which may accrue when statements are couched in the rigid framework of Economic Man.

The generalisations $G_{21}$, $G_{22}$, $G_{31}$, and $G_{32}$ all are predicated upon $\underset{\sim}{C}_s$ given TT; each generalisation "spatialises" TT given $\underset{\sim}{C}_s$, i.e., relative temporal utility maintenance and maximising behaviour is considered a function of where shops are perceived to be located and depending on the value placed upon a good, the consumer then chooses a destination that hopefully gives the desired utility level. It is shown in each of the following areal generalisations how a knowledge of the spatial context in which TT "operates" can lead to concise statements of consumer behaviour.

It is noted here that $\underline{\underline{G}}$ is couched in a spatial-temporal guise - a "guise" explicitly proposed by Hägerstrand (1970) to try and give geography a wholeness which was missing in prior theoretical work on human behaviour (c.f. Gregory, 1978).

$G_{21}$: <u>A home-based grocery generalisation</u>

Given: the grocery environment for most Western cities is one of relatively ubiquitous shopping centres, or subcentres, located in the suburbs, offering essentially the same types of grocery goods over long hours of opening. Also, if it is (realistically) assumed from TT that consumers would rather spend less time than more time doing the grocery shopping trip, i.e., maintaining utility derived from habitual behaviour within a very well known shopping environment, then a home-based grocery generalisation could be the following:

$G_{21}$: each individual consumer (household, individual) subjectively minimizes transport costs by patronizing the perceived nearest grocery outlet or a grocery outlet in the same propinquitous shopping centre over time.

For people who shop in shopping centres, the theoretically nearest destination - a shop - may not be chosen, but rather a shop located in the nearest shopping centre. Thus, a hierarchy of destination choices is envisaged by $G_{21}$: firstly, a macro-shopping centre choice and secondly, a micro-individual store choice. (Note: The two-stage process is an empirical elaboration and does not relate directly to TT). Fotheringham (1980) made a similar conclusion: that destination choice is initially influenced by perceived environmental macro-structure and given a regional destination choice, it is then influenced by individual preferences for particular micro-locations within the regional destination choice. However, Fotheringham (1980) analyzed interregional airline travel while this thesis deals at an intraregional scale - however, scale differences are considered to not hinder the preceding corollary. Moreover, it could be envisaged that an individual has maximum "thresholds" of transport cost endurance, below which a set of near destinations all have some likelihood of being chosen - and where the set of destinations are located in nearby shopping centres. Above the (subjective) cost "threshold", no grocery destinations outside the nearby, or nearest, shopping centre would be chosen. However, given that consumers are satisfied if each grocery shopping trip yields similar utilities to previous trips, via TT, and that most grocery outlets offer essentially the same types of grocery good, then the "set of destinations" are deemed to be very small - possibly one or two supermarkets for example.

To conclude, people on the whole choose a nearby grocery outlet located in a nearest shopping centre - given that the trip is home-based.

It is noted here, however, that a nearby grocery outlet may be a corner store, in which case the choice decision is not two-stage. On the whole, though, grocery outlets are located in shopping centres. (c.f. Guy, 1976), as witnessed by the demise of corner stores.

$G_{22}$: <u>A work-based grocery generalisation</u>

Assuming the $\underset{\sim}{S}_i$ for the work-based trip is slightly larger than, or equal to, the $\underset{\sim}{S}_i$ for home-based grocery trips, then it seems that workers can either choose nearby-to-work destinations or nearby-to-home destinations. Moreover, if the individual is particularly observant during the journey-to-work, then an outlet anywhere along the chosen route could be chosen for grocery purchasing after work. However, considerations of good perishability and a knowledge of previously frequented grocery outlets may constrain the grocery destination choice set to those outlets propinquitous to home. This hypothesis accords with Classical Location Theory.

As many grocery goods have relatively low perishability thresholds, i.e., goods that interact detrimentally with the environment - for example, milk kept in a car may sour quite easily - and given a usually good rapport with local-to-home grocery store owners, then the above hypothesis could be expanded into a work-based grocery generalisation:

> $G_{22}$: each individual consumer (a worker) chooses a propinquitous-to-home grocery outlet, given that the worker would rather have "fresher" groceries than "deteriorated" groceries, and that he/she would prefer to deal with known grocery outlet proprietors, rather than experiment with other, unknown, outlets.

That destination is chosen which gives a satisfactory level of utility to the consumer, who decides whether the acquired utility is "sufficient" relative to past shopping trips. $G_{22}$ is thus a variant of $G_{21}$ in that similar destinations may be chosen on the work-based trip as those chosen on the home-based trip - so, destinations chosen for home-based trips may predetermine the destinations chosen during work-based trips. $G_{21}$ and $G_{22}$ may seem "only" common sense statements, but human decision making for grocery destination choice may indeed be as straightforward as the generalisations infer.

$G_{31}$: A home-based non-grocery generalisation

The non-grocery trip is complex to analyse as the trip can be associated either with utility maximisation from a high value purchase, such as a T.V., or with utility maintenance from a low value purchase, such as toothpaste. For the former, inertia-of-habitual behaviour is not applicable as this type of trip is undertaken irregularly both in time and over space. Also, much more pre-shopping search (scanning newspapers, journals, etc., and interhuman communication) and within-shopping search, which agglomerations take advantage of, are usually associated with this type of non-grocery trip. The low value non-grocery trip, in contrast, is similar to a grocery trip in that habitual behaviour can evolve due to the regular occurrence of these trips. Taking these thoughts into consideration, then a home-based non-grocery generalisation could be the following:

$G_{31}$: For high value non-grocery trips, each individual consumer (household, individual) maximises trip utility by choosing retail outlets, which have been usually pre-searched for, located in spatially localised agglomerations. For low value non-grocery trips, each individual consumer (household, individual) maintains trip utility over time by patronizing retail outlets in a propinquitous shopping centre.

To conclude, a nearby non-grocery outlet, which offers a low value desired good, is chosen while any non-grocery outlet, which offers a desired high value good, is searched for over relatively lengthy time periods. In all cases, a non-grocery outlet is chosen which will hopefully give the desired utility to the consumer.

$G_{32}$: A work-based non-grocery generalisation

Much the same could be said of $G_{32}$ that has been said for $G_{31}$. However, $G_{32}$ may be influenced by the locational inflexibility of both home-and work-places (c.f. $G_{22}$), and so less time may be available for extensive search for high value goods - conversely, enough time is usually available for low value purchases. Also, decisions made at home at a previous time period may mean that a worker has compiled a set of possible destinations to go to after work - this method of destination choice would seem to minimize the temporal constraint somewhat. Taking these thoughts into consideration, then a work-based non-grocery generalisation could be the following:

$G_{32}$: For high value non-grocery goods, each individual consumer (worker) maximises trip utility by patronizing retail outlets, which have been usually pre-searched for, located in spatially localised agglomerations. For low value non-grocery goods, each individual consumer (worker) maintains trip utility over time by patronizing retail outlets in a propinquitous-to-home shopping centre.

Thus, $G_{32} = G_{22}$: high value non-grocery trips are minimally spatially constrained - any retail outlet in a city has some likelihood of being patronized. Low value non-grocery trips are quasi-grocery trips in that time is available for habitual behaviour to evolve - as the shopping centre nearest to home is used for home-based low value non-grocery purchases, then shops in this shopping centre have a greater likelihood of being chosen than outlets in other shopping centres.

## 3.4 Conclusion

The aspatial, psychological theory of consumer behaviour attempts to give a temporal guise to individual decision making; decisions are usually not made in isolation each time a trip is undertaken, such "decisions" being made relative to imperfect information of the shopping environment together with a knowledge of previous shopping experiences. Therefore, people are subjective utility maximisers, or maintainers, over time and as evidenced by the areal generalisations, the means of achieving satisfaction differ between trip purpose and trip frequency (see Table 3.2).

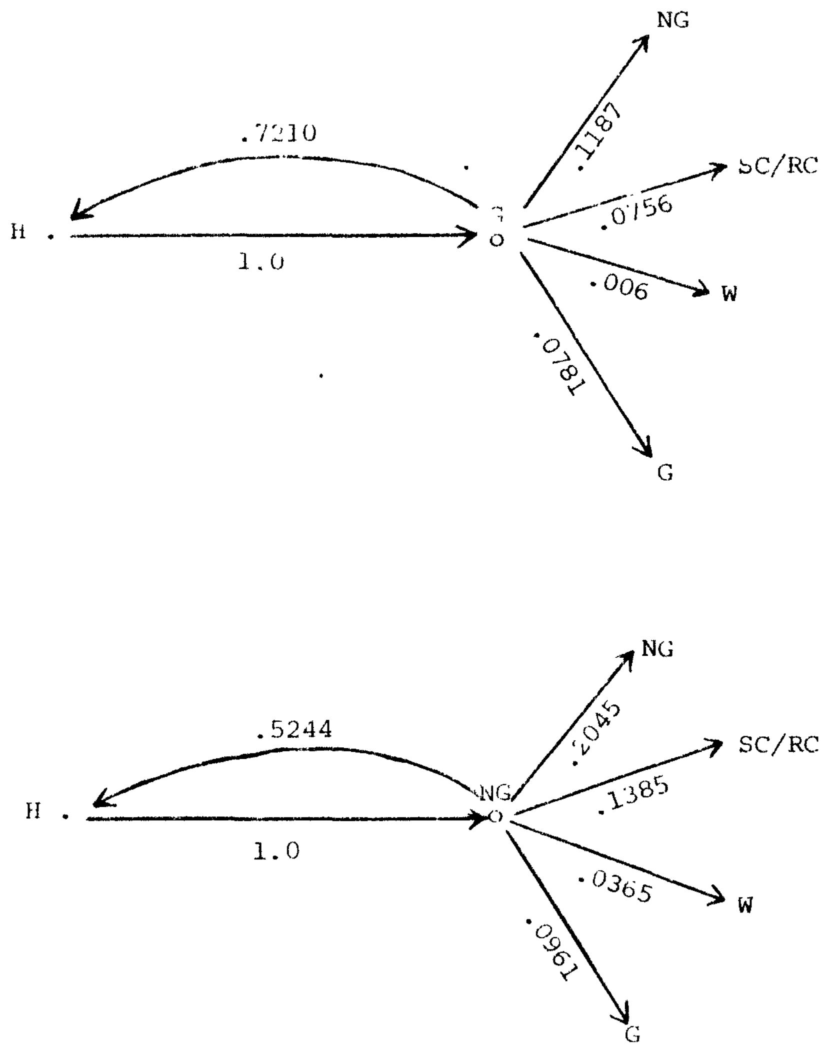
A criticism that could be aimed at the areal generalisations proposed in this chapter is that they are "too simple" - that something more conceptually esoteric is called for. In answer to this relevant criticism, it is considered that to try and formulate a law or generalisation, one must be careful not to embellish the law or generalisation with excessive empirical articulations applicable to a particular country, region or area - the law or generalisation, however, can be specific to all countries, regions or areas that exhibit similar physical, social and cultural environments.

The next chapter gives a description of an observed shopping event.

# CHAPTER 4

## EMPIRICAL TESTS OF THE AREAL GENERALISATIONS

This chapter describes E, a picture of where a sample population shops for grocery and non-grocery goods. It is most necessary to note here that the temporal relative choice theory <u>cannot</u> be validated by E as E is a 'steady-state' data set in which evolving behaviour is not encapsulated - the data set is thus 'located' near $\underline{\underline{S}}$ in figure 3.4. Relevant data comprised home-based grocery trips, home-based non-grocery trips, work-based grocery trips, and work-based non-grocery trips; the "trips" being classified by the main purpose at the first stop. These four trip types correspond to the subject matter of the areal shopping generalisations - $\underline{\underline{G}}$. A few relevant statistics elucidate the data: Figure 4.1 indicates that home-based, single-stop trips predominate over home-based multi-stop trips; 72% of all home-based grocery trips and 52% of all home-based non-grocery trips were single stop. Work-based shopping (grocery and non-grocery) trips only accounted for 2% of all trips. The data were pruned by omitting non-auto trips; this was done as it is thought that the structural differences between auto and non-auto transport systems create differing mobility constraints (c.f. Burns, 1979), which in turn affect destination choice. Households were also constrained to one-trip frequencies per destination for the two-week sample period i.e., the data only comprise destinations where people shop, not how many times (>1) they visit a destination - this was done to enable the (atemporal) multinomial logit model of destination choice to have meaningful results. Trips were made by adult (>15 years) members of any sampled household (where a 14-zone areally stratified sampling schema derived an average of 40 households per zone). The next section describes the



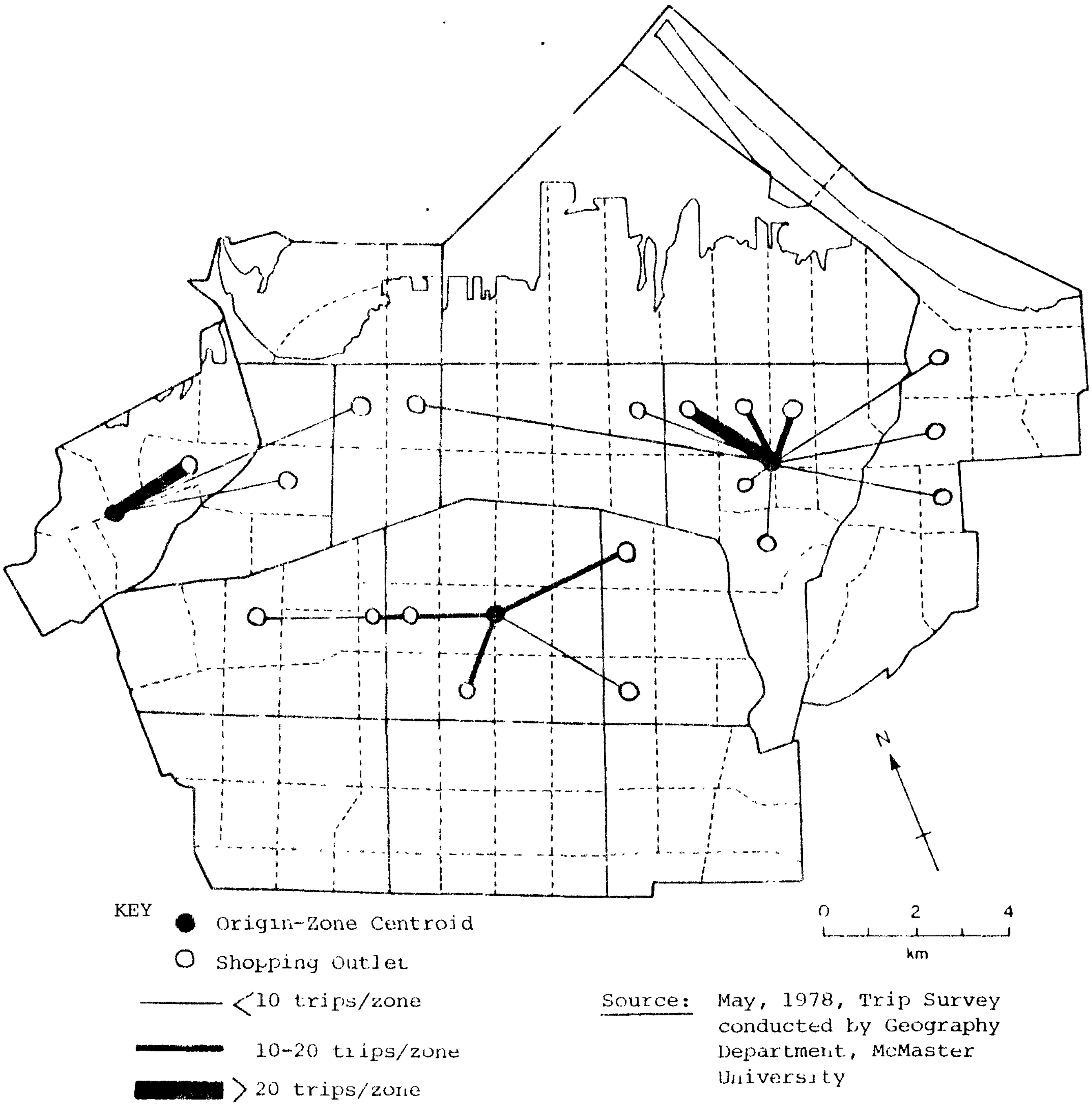

where H = home
G = grocery outlet
NG = non-grocery outlet
SC/RC = social/ recreating
W = workplace

Source: O'Kelly (1980)

Figure 4.1 Comparison of First Stop Grocery and Non-Grocery Trip Proportions with Multi-Stop, Multipurpose Trip Proportions shopping events for Hamilton.

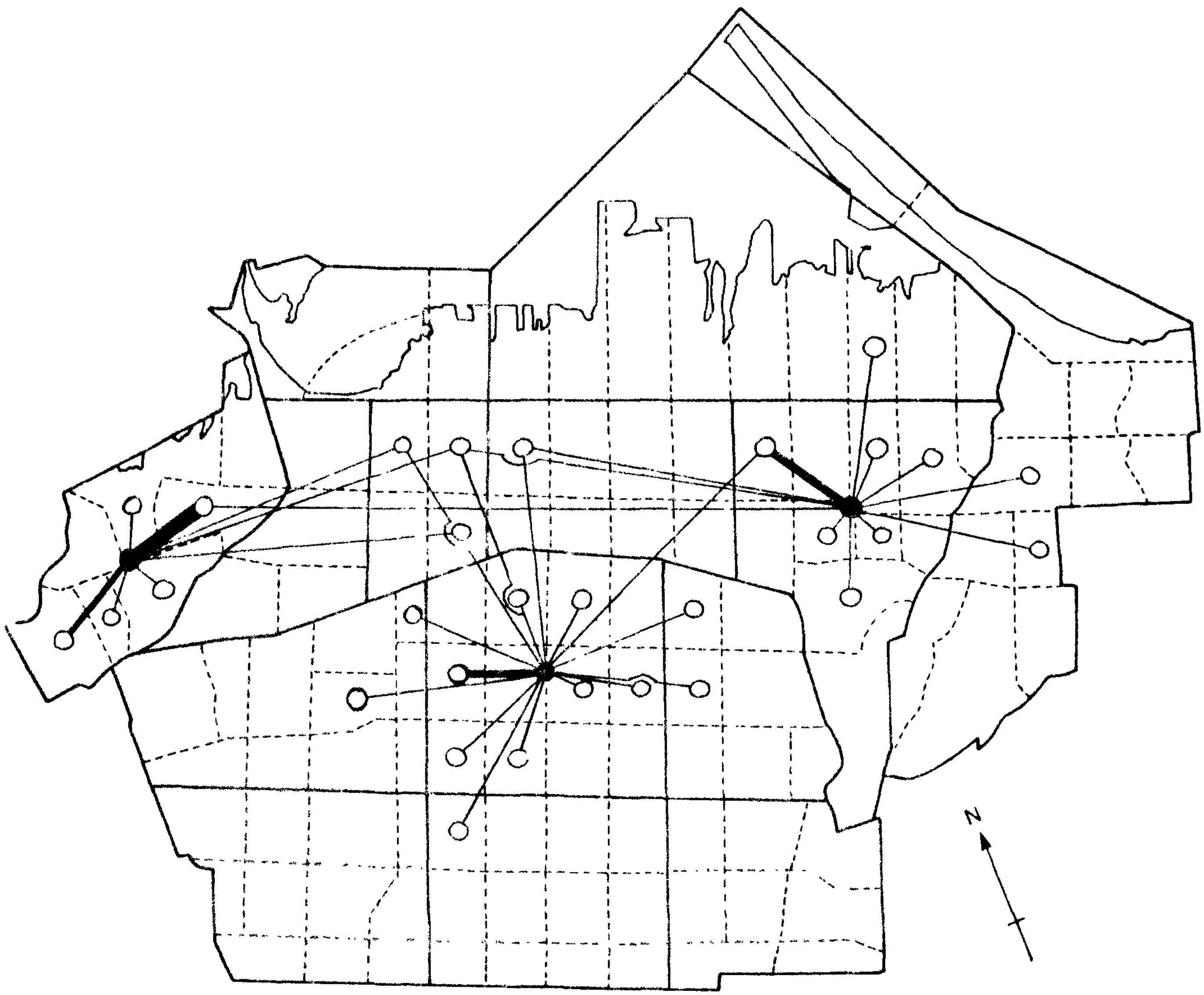
## 4.1 Description of the Observed Shopping Event: E

To facilitate elucidation of E, E is mapped. Figures 4.2 and 4.3 give the frequency of home-based grocery ($H^G$) and non-grocery ($H^{NG}$) trips, respectively, for three selected zones (zones 4, 8 and 10). It can be observed from Figure 4.2 that destinations for most $H^G$ trips are to within-zone of origin or contiguous-to-zone of origin neighbourhoods. Figure 4.3 indicates that $H^{NG}$ trips are more spatially diverse for a given zone, but in which many $H^{NG}$ destinations are located in the same neighbourhoods used to purchase groceries. This fact implies propinquitous shopping centre patronisation for the purchase of convenience goods - both grocery (food staples) and non-grocery (toothpaste, dry cleaning, fast foods, etc.). High value, comparison, non-grocery trips occurred very discontinuously during the survey - this is one reason why Figure 4.3 looks similar to Figure 4.2; the other reason is that high value non-grocery trips usually involve multistop search behaviour, which is not mapped. Figures 4.4 (a, b, c) and 4.5 (a, b, c) give the destinations for work-based grocery ($W^G$) and non-grocery ($W^{NG}$) trips, respectively, for one zone per figure; this made explication of work-based trip flows easier to portray. It can be observed from figures 4.4 (a, b, c) that destinations for $W^G$ trips are to within-home of zonal residence, or contiguous-to-home of zonal residence, neighbourhoods. Figures 4.5 (a, b, c) indicate that $W^{NG}$ trips are more spatially diverse compared to $W^G$ trips, with more destinations per household being patronised over the two-week survey period. One reason why there are more $W^{NG}$ trips than $W^G$ trips is that home-based grocery trips may take care of most of a household's weekly food requirements, thus alleviating the




Source: May, 1978, Trip Survey conducted by Geography Department, McMaster University

Figure 4.2 Frequency of Flows of Home-based Grocery Trips for Three Selected Zones




KEY

● Origin Zone Centroid

○ Shopping outlet

< 10 trips/zone

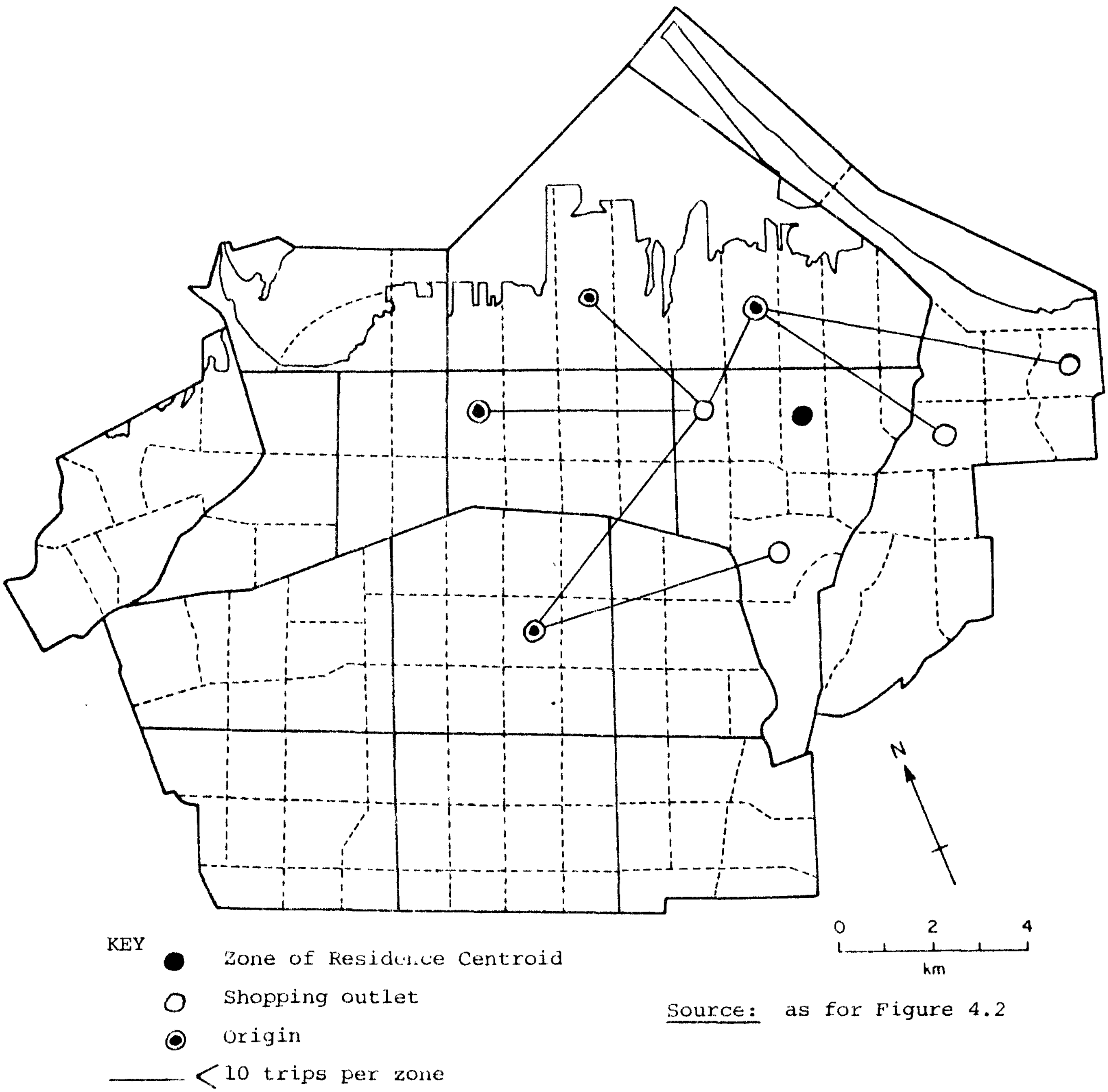
10-20 trips/zone

> 20 trips/zone

0 2 4
km

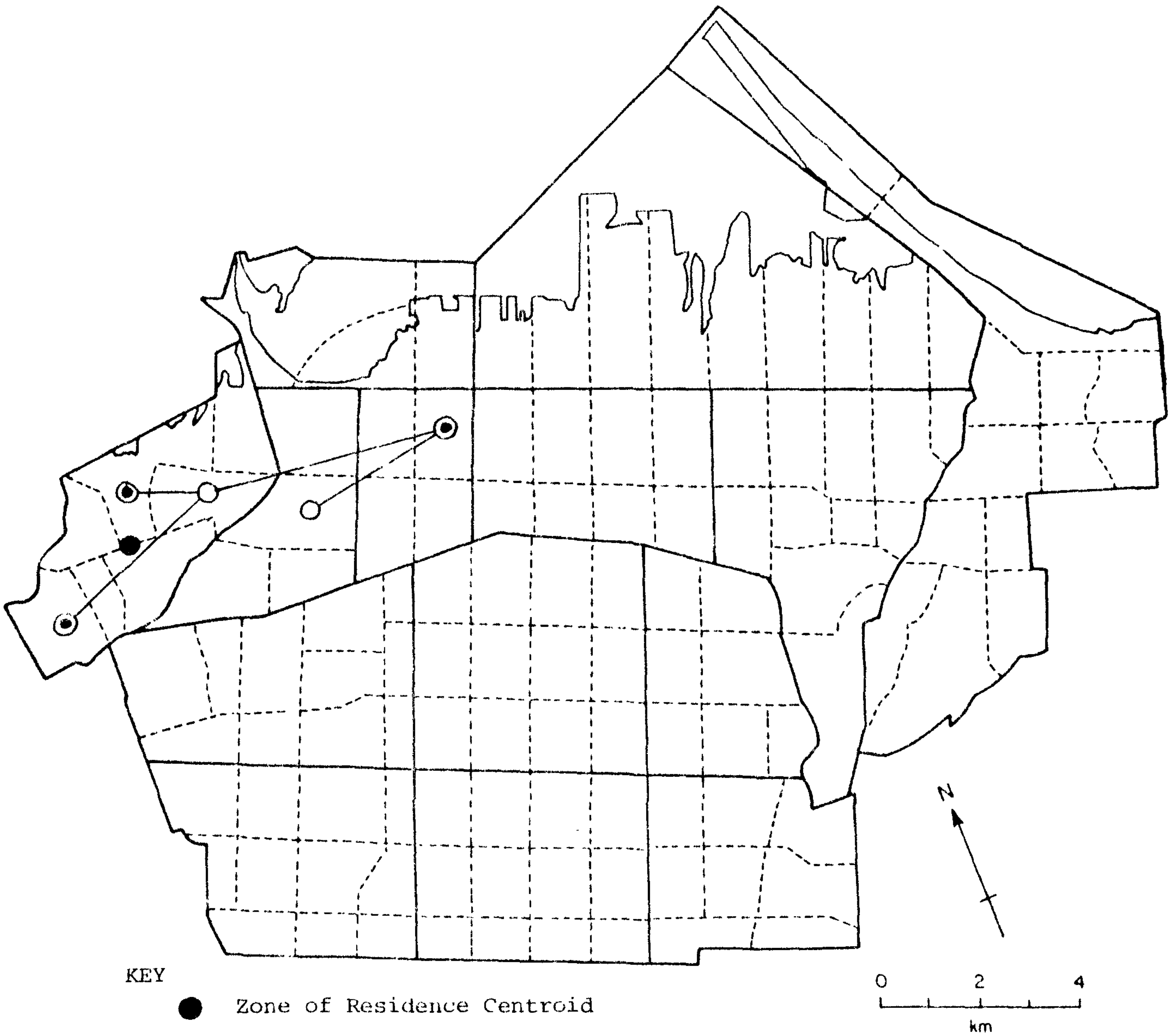
Source: as for Figure 4.2

Figure 4.3 Frequency of Flows of Home-based Non-Grocery Trips for Three Selected Zones




Source: as for Figure 4.2

Figure 4.4a Work-based Grocery Trips for Zone 4 Home of Origin




KEY

● Zone of Residence Centroid

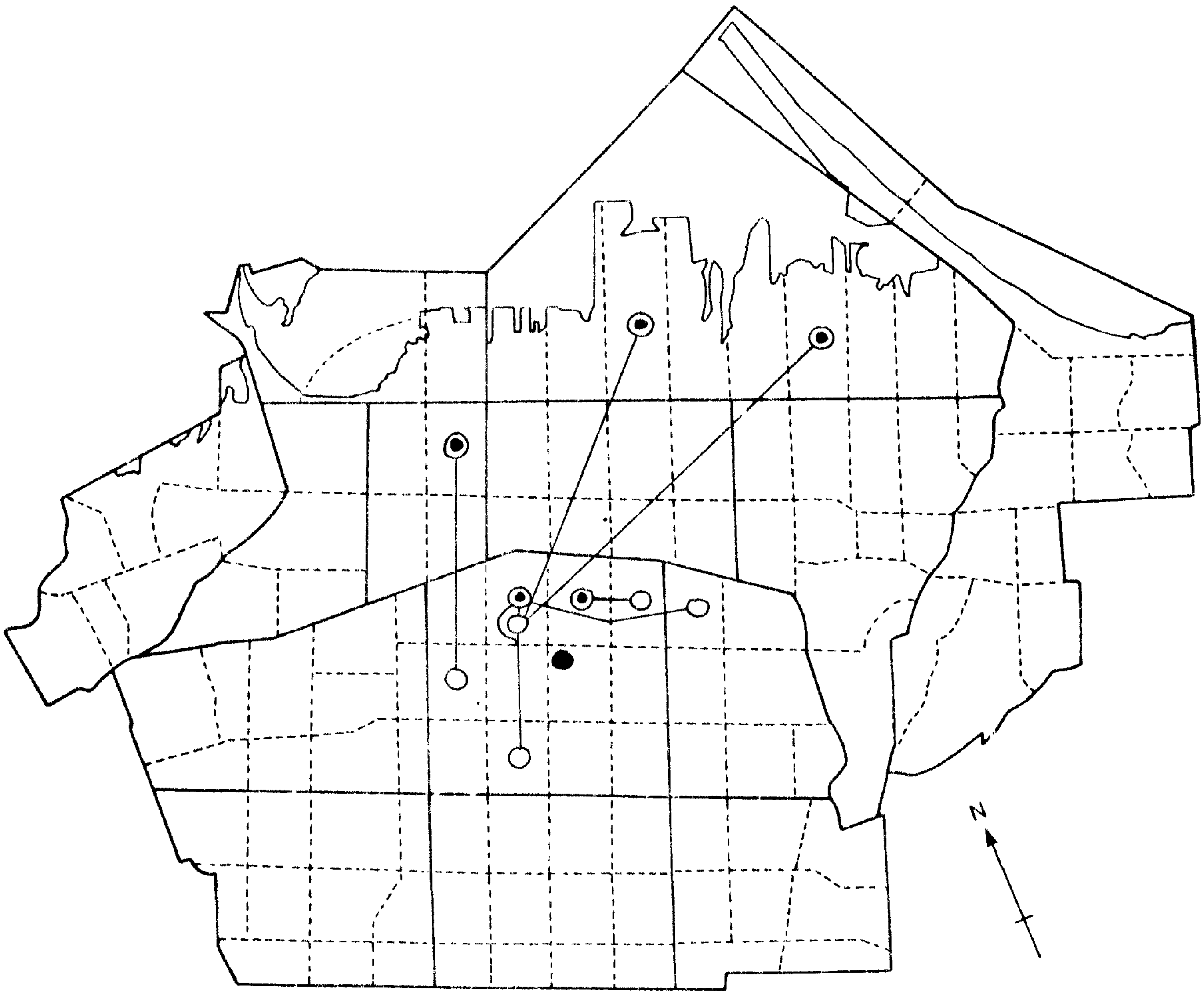
◉ Origin

○ Shopping Outlet

——— <10 trips per zone

Source: as for Figure 4.2

Figure 4.4b Work-based Grocery Trips for Zone 8 Home of Origin




KEY

Zone of Residence Centroid

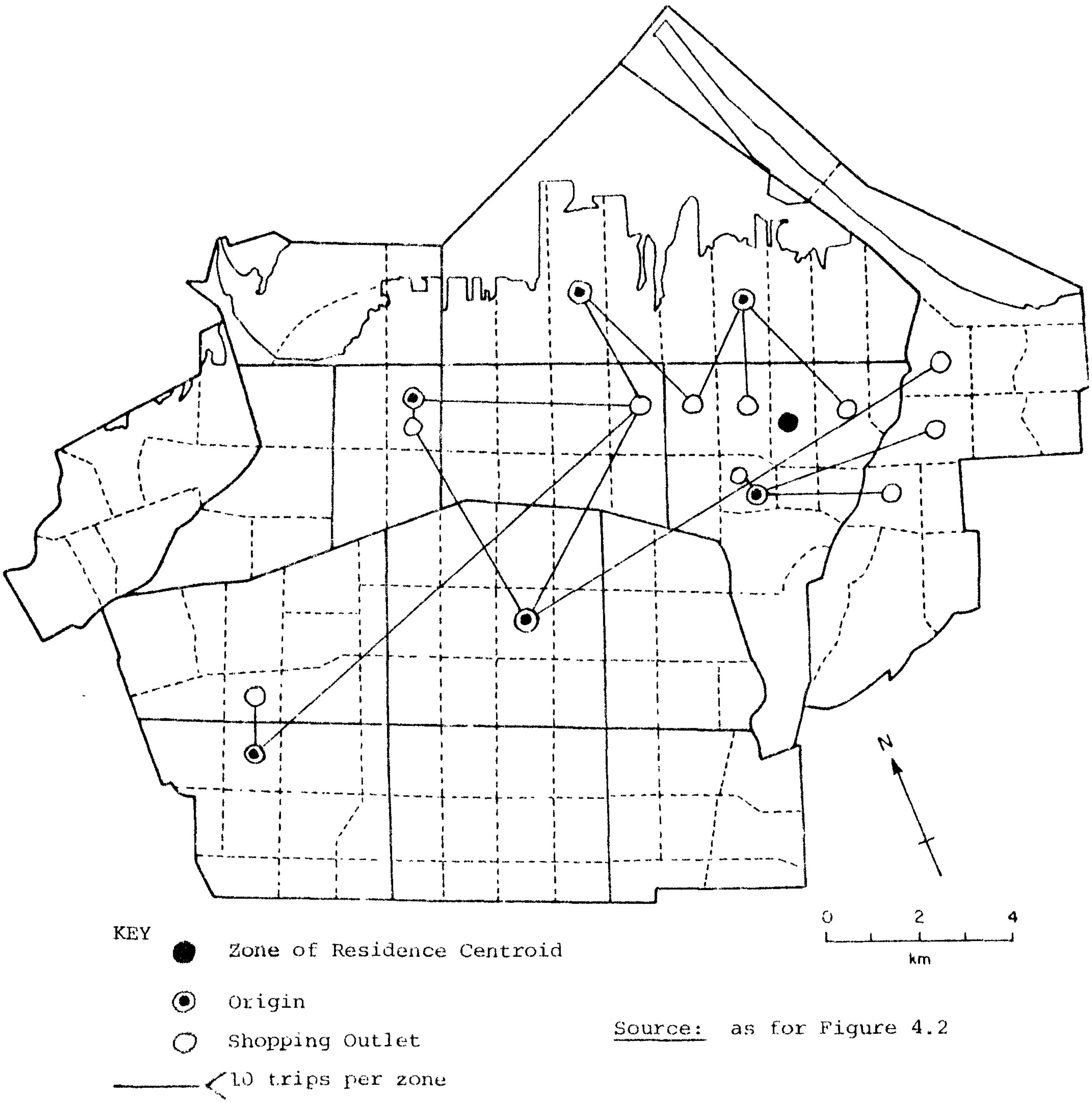
Origin

Shopping Outlet

< 10 trips per zone

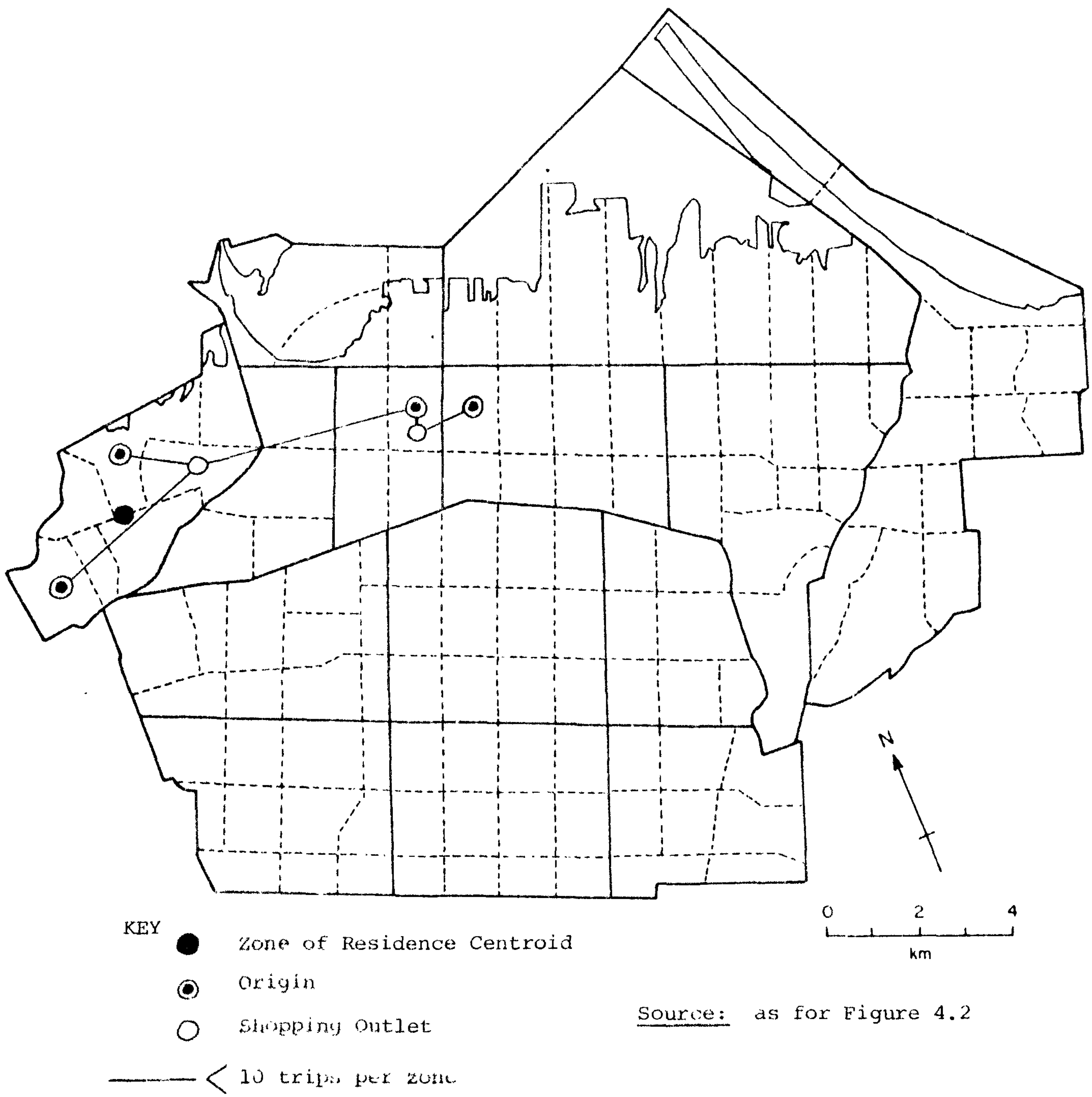
Source: as for Figure 4.2

Figure 4.4c Work-based Grocery Trips for Zone 10 Home of Origin



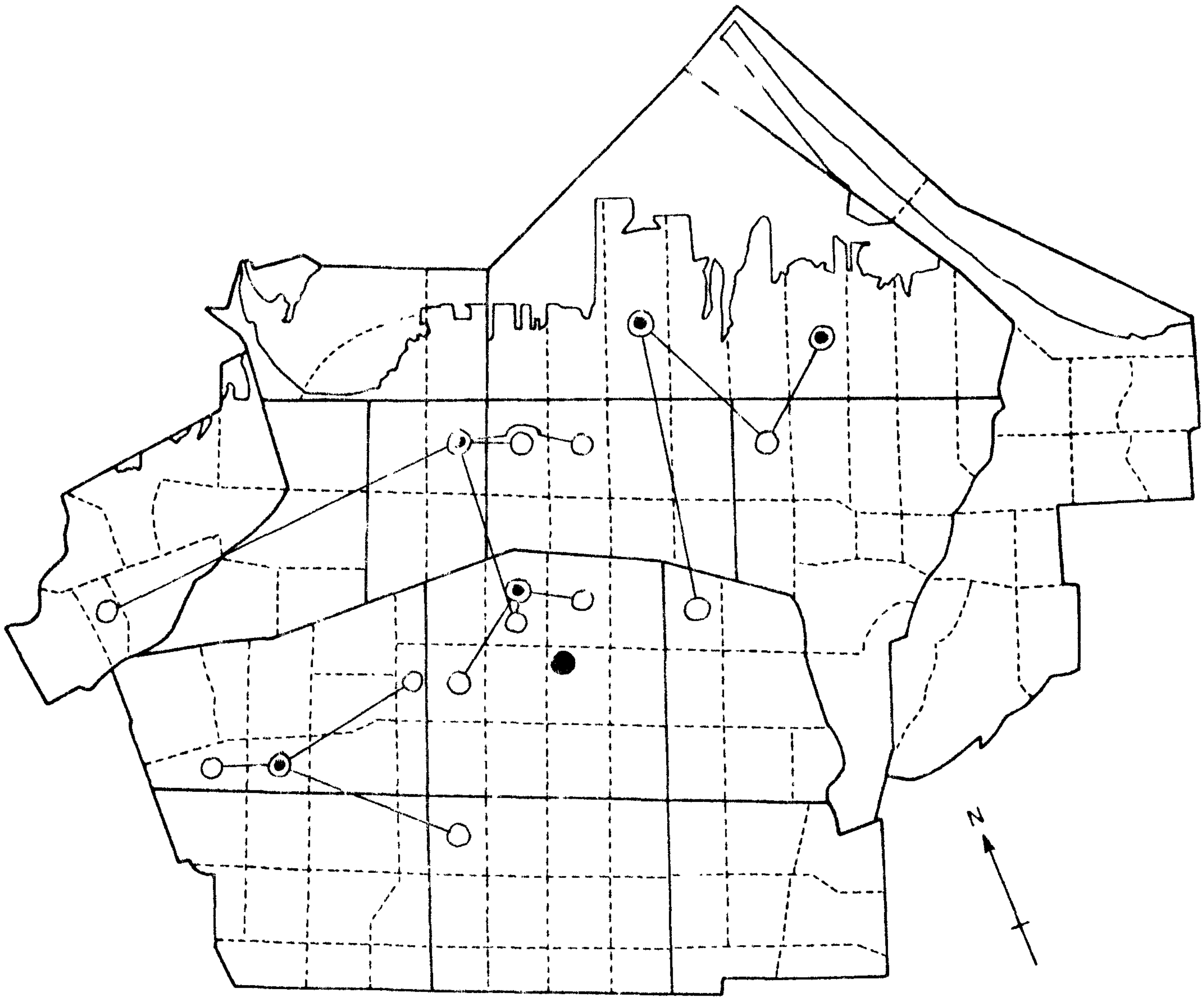

Source: as for Figure 4.2

Figure 4.5a Work-based Non-grocery Trips for Zone 4 Home of Origin




Source: as for Figure 4.2

Figure 4.5b Work-Based Non-grocery Trips for Zone 8 Home of Origin




KEY

Zone of Residence Centroid

Origin

Shopping Outlet

<10 trips per zone

Source: as for Figure 4.2

Figure 4.5c Work-based Non-grocery Trips for Zone 10 Home of Origin necessity of a work-based consumer to shop for groceries. Conversely, non-grocery goods, usually of low relative value, e.g., stationery, fast foods, hardware, etc., may be procured each day as the need arises - the total number of $W^{NG}$ trips is thus usually larger than the total number of $W^{G}$ trips, given trip is single-stop.

To reiterate, single-stop grocery trips, whether home-based or work-based, are to destinations spatially propinquitous to home and where individual destinations may be highly frequented by many households. These observed grocery events support the view that people's spatial perceptions are more exhaustive for areas contiguous to home, and more aggregate (or incomplete) as distance from home increases (c.f. Adler and Ben-Akiva, 1976, P. 141). Single-stop non-grocery trips, whether home-based or work-based, tend to be more spatially diverse with low frequency levels for most outlets due to the spatial variety of these outlets. These trips, especially for low value goods, may be to destinations similar in location to grocery destinations, indicating patronisation of familiar shopping centres - even though the same shopping centre may be chosen for both grocery and non-grocery purchases, different stores are usually chosen.

The preceding facts are for three zones - however, they are "average" facts as all the other zones[1] exhibit similar 'observed shopping events', as can be seen in Table 4.1. Except for zones 1 and 12, which have relatively few grocery outlets, all other zones are well served by a fairly ubiquitous number of grocery shops. Zones 3, 4 and 11 have an accentuated proportion of people who shop within their zone-of-residence, suggestion that regional shopping centres can create an enclosed market area of regular customers. Other zones have a relatively equal proportion

[1]With the possible exception of Zone 12.

TABLE 4.1 TRIP FREQUENCY RELATIVE TO ZONE-OF-RESIDENCE FOR HAMILTON, ONTARIO

Trip Frequency as % of Total Trips

| Zone | Within Zone-of-Residence Trips | | | | Contiguous to Zone-of-Residence Trips | | | | Other Trips | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11.53 | 17.65 | 33.34 | 0.00 | 69.23 | 52.94 | 66.66 | 50.00 | 19.24 | 29.41 | 0.00 | 50.00 |
| 2 | 22.85 | 5.00 | 18.18 | 11.11 | 54.27 | 90.00 | 81.82 | 88.89 | 22.86 | 5.00 | 0.00 | 0.00 |
| 3 | 90.16 | 60.00 | 38.46 | 25.00 | 9.84 | 24.70 | 53.85 | 18.75 | 0.00 | 15.29 | 7.69 | 56.25 |
| 4 | 82.61 | 55.56 | 72.73 | 40.74 | 11.60 | 31.93 | 27.27 | 55.56 | 5.80 | 12.50 | 0.00 | 3.70 |
| 5 | 51.36 | 50.84 | 66.66 | 0.00 | 48.65 | 45.75 | 33.34 | 60.00 | 0.00 | 3.39 | 0.00 | 40.00 |
| 6 | 57.14 | 53.34 | 50.00 | 14.29 | 42.86 | 0.00 | 0.00 | 42.85 | 0.00 | 46.66 | 50.00 | 42.85 |
| 7 | 54.55 | 10.20 | 80.00 | 37.50 | 25.46 | 75.52 | 20.00 | 50.00 | 20.01 | 14.28 | 0.00 | 12.50 |
| 8 | 68.97 | 69.84 | 75.00 | 33.34 | 6.90 | 7.94 | 25.00 | 0.00 | 24.14 | 22.21 | 0.00 | 66.66 |
| 9 | 62.51 | 28.93 | 50.00 | 9.10 | 37.50 | 59.12 | 50.00 | 81.82 | 0.00 | 11.95 | 0.00 | 9.10 |
| 10 | 47.37 | 65.22 | 50.00 | 40.00 | 52.63 | 28.99 | 25.00 | 46.67 | 0.00 | 5.79 | 25.00 | 13.33 |
| 11 | 85.94 | 33.00 | 40.00 | 16.67 | 7.05 | 50.00 | 40.00 | 55.56 | 7.05 | 17.00 | 20.00 | 27.77 |
| 12 | 3.23 | 2.74 | 0.00 | 0.00 | 62.90 | 63.01 | 100.00 | 66.67 | 25.81 | 34.25 | 0.00 | 33.33 |
| 13 | 46.55 | 20.88 | 14.29 | 30.00 | 46.55 | 70.33 | 71.43 | 10.00 | 6.90 | 8.79 | 14.28 | 60.00 |
| 14 | 25.40 | 7.00 | 61.54 | 10.53 | 71.43 | 61.00 | 38.46 | 42.11 | 3.17 | 32.00 | 0.00 | 47.36 |
| Trip Type | HBG | HBNG | WBG | WBNG | HBG | HBNG | WBG | WBNG | HBG | HBNG | WBG | WBNG |

Source: May, 1978 Survey Conducted by Geography Dept., McMaster University.

Where: HBG = Home-based Grocery
HBNG = Home-based Non-Grocery
WBG = Work-based Grocery
WBNG = Work-based Non-Grocery

of people who either shop within the zone - or contiguous to the zone-of-residence.

Due to the relatively high incidence of low to medium value non-grocery goods being purchased by the sampled population, destinations relatively near to the place of residence were chosen by the sampled population. Zones 1, 6, 12 and 14 have, however, substantial incidences of HBNG trips to zones external to contiguous zones. Zone 6 has a very small sample and so its "proportions" may not be a realistic assessment, while Zones 1, 12 and 14 are relatively ill-served by 'nearby' non-grocery outlets.

Generally, trips to areas external to zones contiguous to the zone-of-residence were low in incidence during the survey. WBNG trips for Zones 1, 3, 5, 6, 8, 13 and 14 are exceptions, suggesting that these types of trips are not constrained by 'nearness-to-home' variables like, for example, home-to-shop travel time.

Generally, then, each household exhibits spatial inflexibility for grocery trips, spatial flexibility for high value, non-grocery trips, and a transitional flexibility between these poles for low value non-grocery trips.

The observed event, E, is now quantitatively described through the calibration of a destination choice multinomial logit model based on the Hamilton trip survey data. A following section shows how E can be explained by the areal generalisations of consumer behaviour.

4.2 A Quantitative Elucidation of E

To further elucidate E a destination choice multinomial logit model is calibrated so as to discern any quantitative distinctions in E. The maps of trip flows described in section 4.1 are "geographical image[s] of the environment", (Muehrcke, 1978, P. 2) and as 'image' implies incompleteness, then the calibrated logit model may fill in the holes by discerning, via statistically significant coefficients, variables that describe how individuals choose destinations. The variables used were chosen after screening both the literature (esp. Domencich and McFadden, 1975; Adler and Ben-Akiva, 1976; Horowitz, 1979; O'Kelly, et.al., 1979) and the grocery flow maps, figures 4.2 and 4.4 (a, b, c). Only grocery trips are modelled as a relative dearth of "similar" (same good) non-grocery trips would make non-grocery logit model results spurious.

The multinomial logit model of destination choice is predicated upon a theory of rational choice behaviour, which "asserts that a decision maker can rank possible alternatives in order of preference, and will always choose from available alternatives the option which he considers most desirable, given his tastes and the relevant constraints placed on his decision-making, such as his level of income or time availability. Suitably modified to take account of the psychological phenomena of learning and perception errors, this theory has been used successfully in analysing and forecasting economic consumer behaviour in a wide variety of applications, and it forms the foundation of modern economic analysis" (Domencich and McFadden, 1975, P. 34). It could be said that this theory could have formed the basis for the explanation of intraurban consumer behaviour. However, the theory used by Domencich and McFadden (1975) is static in nature - learning and perception are "errors" to be incorporated into the random utility derived model via a stochastic component, which is then (unsuitably) Weibull distributed. Conversely, TT is considered to be intrinsically dynamic in nature, explicitly incorporating idiosyncratic behaviour ("error"). Also, there is no reason to believe that consumers can "rank" possible alternatives every time a trip is made, and so it is deemed that the random utility theory of "economic" consumer behaviour is not a solid basis for a conceptual theory of (subjectively) rational consumer behaviour. However, even though the inadequacies of the theoretical foundation of the multinomial logit model restrict its use as an explanatory tool, its empirical construction can show how the behaviour of a randomly chosen consumer can be described by significant variables.

The following sections give variable and model definitions and model results.

4.2.1 Variable Definition and Model Specification

Variable definition and sources for home-based and work-based grocery trips are given in Tables 4.2 and 4.3, respectively. The vector of variables includes a proxy transportation level-of-service variable, destination descriptor variables, alternative specific constants and alternative specific variables. Given that i is the ith individual and x the xth shopping alternative, then $tt_{xi}$, $s_{xi}$ and $a_{xi}$ are all generic variables, i.e. defined for all alternative destinations. $tt_{xi}$, the travel time, is extracted from a 120 x 120 interneighbourhood impedance matrix (Webber, 1979b), which was constructed using the Manhattan metric technique - a technique that presumes that the distance between two points in urban space are relative measures of the impedance individuals experience when travelling between places. Only Rushton, et.al. (1967) and Webber (1979b) have used this concept in the geographic literature (c.f. King, 1969, P. 231). $S_{xi}$, the number of supermarkets in x,

TABLE 4.2

VARIABLE DEFINITION AND SPECIFICATION

FOR HOME-BASED GROCERY TRIPS

| Name | Definition |
|---|---|
| tt | One-way in-vehicle time in minutes between origin and shopping destination |
| n | 1 if destination is nearest shopping neighbourhood, 0 otherwise |
| s | 0, 1 or 2 depending on the number of supermarkets at the destination |
| z | 1 if income (gross family) exceeds $30,000 and if household chooses nearest destination, 0 otherwise. |
| a | retail acreage of shopping destination/total retail acreage of all shopping destinations |

Sources: (i) Webber (1979b);
(ii) RMHWPDD publications;
(iii) Survey data, collected and collated by Geography Dept., McMaster University, May, 1978.

TABLE 4.3

VARIABLE DEFINITION AND SPECIFICATION

FOR WORK-BASED GROCERY TRIPS

| Name | Definition |
|---|---|
| tt | One-way in-vehicle time in minutes between shopping destination and place of residence. |
| n | 1 if destination is nearest shopping neighbourhood to place of residence, 0 otherwise. |
| s | 0, 1 or 2 depending on the number of supermarkets at the shopping destination |
| z | 1 if income (gross family) exceeds $30,000 and if worker chooses nearest destination to home, 0 otherwise |
| a | retail acreage of shopping destination/total retail acreage of all shopping destinations |

Sources: (i) Webber (1979b);
(ii) RMHWPDD publications;
(iii) Survey data, collected and collated by Geography Dept., McMaster University, May, 1978.

and $a_{xi}$, the retail acreage of x, are straightforward numbers and need no further elaboration. $n_{xi}$, the 'nearest' shopping alternative to individual i's neighbourhood of residence, is an alternative specific constant (dummy variable) and is included in the multinomial logit model as an attempt to both ratify the flow maps denouement - that consumers choose nearest shopping centres - and to account for the bias towards the nearest alternative not explained by the generic variables. It must be noted that this constant can only be used for those alternatives which are available to all households and are termed "ranked" alternatives, while "unranked" alternatives are not available to all households. The operationalising of this constant for destination choice modelling, where destination choice sets vary between households, creates a problem; but, by definition, every household has a "nearest" alternative and so $n_{xi}$ can describe a "ranked" alternative (O'Kelly, et.al., 1979). Lastly, $z_{xi}$ is a nearest alternative, income specific variable, in which the only difference between $z_{xi}$ and $n_{xi}$ is that, if a nearest alternative is chosen then the income variable will "vary" according to the income class of the household. This variable tries to elucidate any bias by higher income classes towards nearest destinations.

All these variables and constants are expressed as differences in the logit transformation of the multinomial logit model:

$$\log \frac{P_{xi}}{P_{yi}} = \sum_{k=1}^{K} (g_{xk} - g_{yk}) \hat{\theta}_k, \forall y. \qquad (4.1)$$

Equation (4.1) is referred to as a linear logit model for the household at locality x (Wrigley, 1976, P. 10) where $g_{xk}$ is the xth observation for the kth explanatory variable, and $(\hat{\theta}_1,--,\hat{\theta}_K)$ is a maximum-likelihood estimate for the unknown set of K parameters.

A set of goodness-of-fit statistics are used to test model performance; these are,

(i) $\rho^2$: a quasi-coefficient of determination

$$\rho^2 = 1 - \frac{L(\hat{\theta})}{L(O)} \quad , \tag{4.2}$$

where $L(\hat{\theta})$ = maximum likelihood, given $\hat{\theta}$

$L(O)$ = log likelihood, given $\hat{\underset{\sim}{\theta}} = O$.

It has the property of ranging from $-\infty$ to 1 (McFadden, 1973, P. 121) - if $L(\hat{\theta}) \approx O$ (the extreme case) and $L(O) \rightarrow 1.0$, then $\rho^2 \rightarrow 1.0$ indicating a significant explanatory model; conversely, as $L(\hat{\theta}) \rightarrow 1.0$ and $L(O) \rightarrow O$, $\rho^2 \rightarrow -\infty$, indicating a poor explanatory model. However $\rho^2$ usually lies between O and 1.0 and $L(O) > L(\hat{\theta})$ in most cases, i.e., the $L(O)$ model is the maximally noncommittal model, and is considered the function most likely to occur, given the modeller's uncertainty about a set of observations, while $L(\hat{\theta})$ usually has "less" likelihood of occurring due to the greater improbability of $L(\hat{\theta})$ relative to $L(O)$.

(ii) $\chi^2$, a chi-square statistic, defined as:

$$\chi^2 = -2 \, [L(O) - L(\hat{\theta})] \quad , \tag{4.3}$$

which has been shown by Thiel (1969) to be asymptotically distributed as chi-square with degrees of freedom (df) equal to the number of parameters. $\chi^2$ tests the null hypothesis; $H_O: \underset{\sim}{\theta}' = O$, where $\underset{\sim}{\theta}'$ is a vector of parameters.

(iii) Individual coefficients are tested for significance by a t - statistic, given by:

$$t = \frac{\hat{\theta}_k}{\sqrt{\text{var } \hat{\theta}_k}} \tag{4.4}$$

where $(\text{var } \hat{\theta})^{\frac{1}{2}}$ is the square root of the variance of $\hat{\theta}_k$ and has been shown by Thiel (1969) and McFadden (1968) to be equal to the kth diagonal element of the inverse of the second partial derivative of the likelihood function.

Choice sets, $C_{ti}$, $t = 1, \_\_\_, x, \_\_\_, y$, were defined for each household i by including all those neighbourhoods, t, that were visited for shopping purposes by any sampled household in household i's zone-of-residence (c.f. Adler and Ben-Akiva, 1976).

The source of these data are a travel diary and questionnaire conducted in May, 1978 by the Geography Dept., McMaster University, giving both trip and household characteristic data, and published data, most of which were published by the Regional Municipality of Hamilton-Wentworth Planning and Development Department (RMHWPDD). The characteristics of these data are given in Webber (1979b). Essentially, trip data were extracted from the travel diary, household data from the questionnaire, and retail facility data from published RMHWPDD studies (Webber, 1979b).

### 4.2.2 Model Results and Discussion

A number of models were calibrated using different combinations of variables. A notable feature of all models was the similarity in their goodness-of-fit statistics. As a consequence, the model results have all the variables described in the previous section - however, it turned out that the "best" model ($\rho^2$ nearest to 1.0) had all the variables.

For home-based grocery trips the "best" ($\rho^2$ nearest to 1.0) multinomial logit model is:

$$\log \frac{P_{xi}}{P_{yi}} = \underset{(6.295)}{.003} (tt_{xi} - tt_{yi}) + \underset{(3.620)}{.536} (n_{xi} - n_{yi}) + \underset{(4.51)}{.328} (S_{xi} - S_{yi}) +$$

$$\underset{(.204)}{.069} (z_{xi} - z_{yi}) + \underset{(.021)}{.018} (a_{xi} - a_{yi}), \forall y \qquad (4.5)$$

where numbers in brackets are t- statistics and

$\log \frac{P_{xi}}{P_{yi}}$ is the log-odds of choosing neighbourhood x by individual i given

$C_{ti} = 1, --, x, --, y$. Also,

$\rho^2 = .1$; $\chi^2 = 161.12$; $L^* (\theta) = -818$; $N = 429$.

$\rho^2$ is a modified $R^2$ statistic, $\chi^2$ a likelihood statement, $L^* (\theta)$ a log - likelihood ratio statistic and N is the number of observations.

The significant $(tt_{xi}-tt_{yi})$ coefficient, t = 6.295, indicates both spatial preference for grocery destinations within a propinquitious shopping centre, and also that auto-trip shoppers are not particularly concerned with increments to present <u>interstructural</u> (home-to-retail outlet) distances for grocery trips. An increase in "impedance", for example via increased congestion or closure of a main artery (e.g. O'Kelly, <u>et.al.</u>, 1979), may have little effect on choice of grocery destination, as the 'nearest' shopping centre still remains the same 'nearest' shopping centre regardless of minor impedance exacerbation. Thus, the relatively small magnitude of the travel time coefficient, $\theta_{(tt_{xi}-tt_{yi})} = .003$, combined with the significant "nearest" alternative variable, support the view that transportation level-of-service variables have little effect on intraurban macro-destination choice (c.f. Fotheringham, 1980), but that structural changes in $\sum_i S_i$ may induce changes in spatial interaction. For example, the efficacy of the proposed Mountain Plaza may be realised by substantial shopping behaviour alteration for many Hamiltonians, but mostly people living on the mountain. People may forgo their usual shopping centre so as to try out the new Plaza - a homeostasis-type period of uncertainty may ensure in which the consumer decides whether to shop at this new destination or revert back to pre-Plaza behaviour. However, change in a transportation variable, given a static structural environment, is unlikely to induce a change in shopping behaviour, at least at the macro-shopping centre level of resolution. This important conclusion is expanded in the next chapter. Other conclusions inferred from equation (4.5) are that people prefer more rather than less supermarkets at a given destination; that income is not relevant in grocery destination choice; and that retail acreage is a non-dimension in people's perception of a grocery destination.

To further substantiate the claim that travel time is not a factor in potential change of grocery destination, an elasticity of demand statistic is computed:

$$E_{tt}\left[\frac{\log P_{xi}}{\log P_{yi}}\right] = -0.21 \tag{4.6}$$

which indicates that the demand for destination x by household i is relatively inelastic to a 1% increase in $tt_{xi}$ relative to $tt_{yi}$, $\forall_y$.

For work-based grocery trips, the "best" ($\rho^2$ nearest to 1.0) multinomial logit model is:

$$\log \frac{P_{xi}}{P_{yi}} = \underset{(5.12)}{-.101}\ (tt_{xi}-tt_{yi}) + \underset{(2.32)}{.621}\ (n_{xi}-n_{yi}) + \underset{(2.62)}{.123}\ (s_{xi}-s_{yi})$$

$$+ \underset{(.021)}{.003}\ (z_{xi}-z_{yi}) + \underset{(.312)}{.309}\ (a_{xi}-a_{yi}) \tag{4.7}$$

where numbers in parentheses are t- statistics, and where

$\log \frac{P_{xi}}{P_{yi}}$ is the log-odds of choosing neighbourhood x by worker i given $C_{ti}$ = 1, --, x, --,y, but where $C_{ti}$ in this case includes both the zone-of-residence choice set and a zone-of-workplace choice set. The zone-of-workplace choice set is the same as the zone-of-residence choice set for the people who live in i's zone of workplace.

$\rho^2 = .12$, $\chi^2 = 145.24$; $L^*(0) = -797$; $N = 724$

For these trips, the travel time coefficient is slightly larger in magnitude relative to the home-based grocery trip model, but is still quite small and significant. The "nearness" to household variable ,$(n_{xi}-n_{yi})$, is also significant. Thus, work-based grocery trips display a spatial consistency with home-based grocery trips, which is probably a result of the work-based shopper thinking, "I may as well get my milk and bread near to home so they will keep fresh, because I won't have to carry them around with me for a long time, and because I know what to expect from my local shopkeeper," ($G_{22}$). An elasticity of demand statistic supports this inertia-induced, destination choice 'stagnation':

$$E_{tt}\left[\frac{\log P_{xi}}{\log P_{yi}}\right] = -0.24 \qquad (4.8)$$

which indicates relative insensitivity to a 1% change in travel times ($tt_{xi}$ relative to $tt_{yi}$).

Other estimated "travel time" (impedance) coefficients for a multinomial logit model given by other people tend to substantiate the claim made here, and by Fotheringham (1980), that transportation-associated variables are not of importance at most times when consumers make a choice of shopping destination. These other travel times θ's are:

Domencich and McFadden (1975): -1.06

Ben-Akiva (1974) : -0.0227

Richards and Ben-Akiva (1974): -0.174

O'Kelly, et.al. (1979): -0.24

In addition, it may be necessary to consider relative accessibility to perceived destinations for new immigrants and relative accessibility to destinations after a retail structural change occurs for long-term residents. This would entail much detail on temporal disequilibrium associated with changes in people's psychological makeup concerning shopping which would be very difficult to obtain. Rushton (1969) and Burnett (1973) have gone some way in determining evolving preferential choices, and Fotheringham (1980) seems to have broken the conceptual stranglehold that impedance variables determine spatial interaction incidents.

The next section decides whether the areal generalisations, $\underline{\underline{G}}$, explain the observed shopping event, E.

4.3 <u>$\underline{\underline{G}}$ and E: Equatable?</u>

Qualitatively, the maps of observed shopping events (the explanandum) can be explained via the set of areal generalisations, $\underline{\underline{G}}$. Quantitatively, the estimated coefficients and elasticity of demand numbers indicate that people's shopping behaviour for groceries is quite rigid, both spatially and temporally, and again, the four areal generalisations explain why this could be so.

Specifically, $G_{21}$ and $G_{22}$ for grocery trip events are verified by both Figures 4.2 and 4.4 (a, b, c), and the logit model coefficients and associated elasticity of demand number. So, it seems that consumers <u>do</u> prefer proximity to grocery outlets, a fact which is highlighted by the "non-intersecting market areas" for each of the three zones in Figure 4.2 and Figures 4.4 (a, b, c). Thus, it may be fruitful to use market area analysis to delineate a city into grocery 'central place systems', as its accessibility to retail facilities rather than travel time, <u>per se</u>, that is the most influential "variable" for home-based grocery trips (c.f. Fotheringham, 1980, Preface); also, a knowledge of grocery outlets from the home-based trip seems very influential in deciding choice of destination for work-based trips.

Now, $G_{31}$ and $G_{32}$ for non-grocery trips are more generally couched - uncertainty regarding one's shopping environment seems to be the ruling factor in the relatively indeterminant nature of non-grocery (especially for expensive goods, e.g. T.V.'s) trip flows. It must be stressed that many shopping centres cater for a wide variety of multi-purpose shopping events, making it possible for someone to purchase non-grocery goods at the same shopping centre where grocery goods are purchased. Figures 4.3 and 4.5 (a, b, c) do show some relatedness with choice of nearby shopping centres, usually associated with relatively inexpensive durables such as small household appliances. Also, as more expensive durable goods, e.g., refrigerators and T.V.'s, are seldom purchased by any of the sampled population during the sample period, so the spatial indeterminancy associated with these trip types is not well represented by the non-grocery trip flow maps. Nevertheless, it is deemed that given a very extensive longitudinal data set (e.g. a data set of one year's duration), then non-grocery trips would be explicitly shown to be more spatially diverse than grocery trips; moreover, even though a nearby shopping centre may be chosen, non-grocery goods are purchased at a number of retail outlets c.f. unistop supermarket choice for grocery purposes. So, with qualifications, $G_{31}$ and $G_{32}$ are consistent with Figures 4.3 and 4.5 (a, b, c).

The next chapter gives a conceptual theorem of the temporal relationship between E and $(TT, C_{\sim s})$, where $\underline{\underline{G}}$ is not explicitly incorporated due to its hypothesised derivation.

# CHAPTER 5

## A CONCEPTUAL INTERPRETATION OF THE EXPLANATION OF INTRAURBAN CONSUMER BEHAVIOUR

This chapter gives a conceptual interpretation of the explanation of intraurban consumer behaviour. The components of the "interpretation" are TT, $\underset{\sim}{C}_s$ and E, with $\underline{\underline{G}}$ being used to clarify implications arising from the argument.

Given that $\Delta$ is a symbol denoting change and that $\underset{\sim}{C}_s$ is approximated by $\sum_i S_i$[1], then a realistic, albeit simple, equation relating TT, $\underset{\sim}{C}_s$ and E is:

$$\Delta E_{t_a} = f \left[ (\Delta \underset{\sim}{C}_s)_{t_\alpha} \middle| TT \right] \qquad (5.1)$$

which says that a change in the observed aggregate shopping event, $\Delta E$, at a future time, $t_a$, is a function of a change in the retail structural environment, $\Delta \underset{\sim}{C}_s$, at a previous time, $t_\alpha$, conditional upon explaining $E_{t_a}$. As $\underline{\underline{G}}$ is a logical hypothesis from a set of premise statments of TT and $\underset{\sim}{C}_s$, then $\underline{\underline{G}}$ cannot enter into equation (5.1) explicitly as it is a normative comment on what people should do at $t_a$; moreover, as $E_{t_a}$ has not been observed at $t_\alpha$, then $\underline{\underline{G}}$ is a logical construct explaining $E_{t_a}$, though couched in general enough terminology to be applicable to future time periods if $\underset{\sim}{C}_s$ is relatively static during these times. However, two implications for intraurban consumer behaviour can be inferred when $\underline{\underline{G}}$ and E are interrelated; if $e_{t_a}$ is an observed individual shopping event, then

$$\Delta e_{t_a} \quad \not\Rightarrow \quad \Delta \underline{\underline{G}} \quad \underline{\text{for an individual,}}$$

$$\text{but} \quad \Delta E_{t_a} \quad \Rightarrow \quad \Delta \underline{\underline{G}} \quad \underline{\text{for a population.}}$$

[1] $\sum_i S_i - \aleph_1$

At the individual level of resolution, $\Delta e_{t_a}$ is not conditional upon $\Delta \underset{\sim}{S}_i \varepsilon \Delta \underset{\sim}{C}_s$, i.e., the change in individual i's retail facility knowledge is not necessarily a "member" of a change in the total retail facility environment. This condition may seem obvious and inessential to the argument, but it is important to realise that $\underset{\sim}{C}_s$ does not have to change physically - mental perceptions of $\underset{\sim}{S}_i$ change over time and may be caused by either physical changes in, or psychological changes in perception of $\underset{\sim}{C}_s$. So at a disaggregate level $\Delta e_{t_a}$ does not imply $\Delta \underline{\underline{G}}$; individual idiosyncratic behaviour may occur to "refute" an areal generalisation but on the whole an urban population uses rational arguments when choosing shopping destinations, i.e., $E_{t_a}$ can be explained by $\underline{\underline{G}}$. A change in $\underline{\underline{C}}$ at an aggregate level would only occur when substantial changes to $\underset{\sim}{C}_s$ occur - for example, the opening of the Mountain Plaza in Hamilton, Ontario. At such times, disequilibrium behaviour by an area's population may refute $\underline{\underline{G}}$; however, after the homeostasis period of 'misbehaviour' succumbs to a post-period of steady-state behaviour, it may be observed that the new plaza is indeed the most rational choice available, as all previously "nearest" shopping outlets to place of residence may have since gone into liquidation.

The preceding interpretation of human behaviour is analogous to Wilson's (1970) discussion of trip-distribution macrostates as a function of a locational-distribution/total-cost macrostate composed of individual-assignment microstates - the "macrostates" are E, the "total-cost macro-state" is TT and the "micro-states" are the same in both Wilson's and my research.

To conclude, it seems that in our contemporary urbanised communities, intraurban consumers will continue to behave according to TT. It is deemed that a major change to the areal generalisations is unlikely to eventuate and that explanations of intraurban consumer behaviour may be probable at a macro-scale level of resolution due to the static nature of both TT and $\underset{\sim}{C}_s$ (at a zonal level). The next chapter gives qualitative comments regarding other aspects of consumer behaviour not alluded to in the previous chapters.

# CHAPTER 6

# MORE ON INTRAURBAN CONSUMER BEHAVIOUR

People learn to associate different material objects with different utility levels and as Bettman (1979) states;

> Man is viewed as using simple heuristics to adapt to a choice environment.
>
> (Bettman , 1979, P. 9)

Bettman reiterates Simon's (1969) viewpoint that fundamental human behaviour is not as complex as some people, e.g. Wilson (1980), contend: "complexity" is essentially a manifestation of a multivariate, materialistic society in which "the apparent complexity of (Man's) behaviour over time is largely a reflection of the complexity of the environment in which he finds himself" (Simon, 1969, P. 25). Moreover, I contend that a relative temporal utility mechanism is a fundamental "heuristic" of spatial behaviour, i.e. TT is a theoretical domain within which different spatial behaviours 'reside'.

The following sections deal with issues relating to consumer behaviour. As shopping centres are fast becoming the dominant shopping structures in Western cities (Guy, 1976), the focus of attention is upon them - corner stores are not mentioned due to their relative decrease in importance to urban consumers.

## 6.1 Spatial Structure, Time and Behaviour

### 6.1.1 Distance-Structure Interaction

A substantial portion of the comments in this section are tied in with Fotheringham's (1980) work on spatial structure and spatial interaction. He contends that spatial structure influences interaction to the extent that distance may be subservient to accessibility (Fotheringham, 1980, Preface). Compare a common interpretation of spatial interaction as inversely proportional to intervening distance (e.g. Lakshmanen and Hansen, 1965; Wilson, 1970), where spatial structure is considered a passive bystander. Wilson (1970) contends that the distance-decay parameter $\beta$, in equation (2.1) for example, should be interpretated as a measure of how distance affects interaction (ibid, pp. 26-27); but Fotheringham (1980) deems that spatial structure, rather than being a "passive bystander", can actually bias the estimated distance-decay parameter to such an extent that it no longer solely measures the perception of distance as a deterrent to interaction (pp.xii, xiii). He continues, "interaction-distance relationships, *ceteris paribus*, are constant over space but estimated distance-decay parameters are not since the latter are biased by spatial structure" (pp. xiv, xv). In relation to this thesis, the shopping spatial structure of Hamilton, $\underline{\underline{S}}$, implied by $\sum_i S_i$ for a $[t]_o^2$ in May, 1978, thus may influence the perception of distance by consumers; for example, if a zone is relatively accessible to grocery destinations, then consumers in this zone are more likely to choose similar destinations over time as they have time to evolve habitual patterns of behaviour - these habits only change if $\sum_i S_i$ changes substantially; however, intervening 'distance' incrementation, by congestion for example, would have little or no affect on grocery destination choice (c.f. O'Kelly, *et.al.*, 1979). Moreover, in support of Fotheringham's (1980) "two-stage decision process", grocery shopping is considered to be a bistage event: choose "nearest" shopping centre, then choose a shop within this shopping centre. The choice of shop in this case would be influenced by a multitude of personal biases towards brand-names, shop-owners, etc. So, distance plays a role when choosing a shopping centre; but, in contrast to this macro-scale choice decision, choice of a shop is not a function of impedance, but is determined by the structural characteristics (or, I suppose, "attractiveness") of individual outlets. The macro-scale "first-stage" choice was mapped in Chapter 4. Conversely, if the same zone is relatively inaccessible to non-grocery destinations, then this could mean that consumers will use search methods to procure desired durables, as relatively less time is available to learn about a particular non-grocery environment, e.g., T.V. outlet spatial distribution. Therefore, heuristic choice decision-making usually becomes manifest in this situation. It seems that distance plays little or no role at any stage of the highly durable, high-value, non-grocery trip - however, "distance" may play an indirect role, as that part of the information needed by the consumer concerning the location(s) of non-grocery outlet agglomerations - a "nearer" agglomeration may be chosen relative to "further" agglomerations. Advertising, via the mass media, plays a role in this trip as repetitive advertising of brand-names and the portrayal of the "goodness" of the product, can persuade even the most cynical of us to opt for a "known" brand when non-grocery shopping.

There are thus two types of shopping trips: the grocery or low value non-grocery trip, a bi-stage trip consisting of an initial macro-scale choice decision influenced by intervening distance between origin and shopping centre, and then a quasi-comparison process of choosing one or several outlets, all located within the chosen shopping centre, and for which intervening distance between origin and outlet is of little relevance. The second type of trip, the high value non-grocery trip, is a unistage trip consisting of search-type behaviour and for which intervening distance between origin and non-grocery retail agglomerations plays a minor role, except if more than one agglomeration offering similar goods exists within a city.

6.1.2 Travel Time - Structure Interaction

Does travel time affect shopping behaviour? Moreover if travel time is inelastic for shopping choice "demand" (see equations 4.6 and 4.8), then is this "inelasticity" similar for consumers who live in different locations and who shop at different times? In other words, are people relatively homogeneous or heterogeneous in their shopping behaviour.

Fotheringham (1980) contends that "... It is assumed that observed interaction patterns are an accurate reflection of the perception of distance as a deterrent to interaction and once the spatial structure bias is removed from the models or the calibration procedure, estimated distance-decay parameters will be constant over space" (p. xv). In support of this statement, it is deduced from the explanation of intraurban consumer behaviour given in this thesis, that within a region (a city, for example), increments in travel time will not change shopping destination choice, _ceteris paribus_; further, as the centripetal "force" of a nearby shopping centre increases with increasing proximity to the shopping centre (c.f. Angel and Human's (1972) 'urban velocity fields'), then, even if congestion became exacerbated, the nearby shopping centre is still usually chosen as $S_i$ remains static (the _"ceteris paribus"_). The inelastic statistics derived for the calibrated multinomial logit models attest to this lack of correlation between intraurban interaction and interstructural impedance. Moreover, consider people located at "mid-points" between two similar shopping centres; for an initial time period the people located in these areas are indifferent to the differing qualities of each shopping centre - a new immigrant would fit this category of "indifference". As their perceptions of their $S_1$ change, and evolve, via subjective maximising (or maintaining) behaviour, then after an initial period of fluctuation between shopping centres, one shopping centre may be chosen for all future shopping trips and it is mostly initial 'favourable impression' that determine where these peripheral people shop in the future. This is why there exists mutual co-operation between owners of different types of shops within a shopping centre - a uniform exte[illegible] 'prosperity' (i.e. a "pleasant-to-look-at" structural façade) may instill in the new shopper a pleasantness that goes some way in swaying their judgements. Shopping centres thus may compete against each other for a bigger share of the consumer market, but within a shopping centre and because of the material diversity of non-grocery goods, low-value non-grocery good stores (e.g. household appliances, cake shops, shoe shops and clothes shops) agglomerate so that a person who usually undertakes a multipurpose trip may, by chance, visit a shop not originally intended to be visited, i.e., contiguity of non-grocery shops in a shopping centre enhances potential patronage. However, due to the material uniformity of grocery goods, grocery stores attempt to locate discretely within a shopping centre, i.e., discontiguity of grocery shops within a shopping centre enhances potential patronage.

Summarising; the two-stage grocery choice process is used to choose a shopping centre, then a shop. Fotheringham's (1980) destination choice theory is certainly applicable in this case. However, during habitual behaviour periods, the macro-scale decision is "shelved" temporarily as the consumer goes to "his/her" shopping centre without conscious thought of evaluating different shopping centres; it would require a major structural change at the macro-scale (i.e. in $\underset{\sim}{C}_S$) to induce a change in shopping centre choice. A new shopping plaza could be an example of a "major structural change"; conversely a minor structural change at the microscale (i.e. at the $S_i$ level) is all that may be required to induce a change in individual shop choice. Differential milk prices over space could be an example of a "minor structural change". Conversely, the high-value non-grocery choice process is a continuum of trial-and-error search procedures: after acquiring relevant information regarding desired durable non-grocery goods, then there is still a likelihood that the consumer will patronise a T.V. store, for example, spatially contiguous to the store the consumer initially desired to purchase a T.V. from. The tendency for these types of non-grocery outlets to locate in agglomerations enables the "chance" choice indecision to pertain every time a high-value non-grocery trip is made.

The next subsection gives reasons for why shoppers may decide to undergo multistop, multipurpose trips. It gives a possible evolutionary explanation of how multistop, multipurpose trips relate to the location of retail outlets.

### 6.1.3 A Multistop, Multipurpose Trip Explanation

If the shopping environment changes structurally (e.g. a new grocery store) then a change by the consumer in favour of the new grocery store may or may not eventuate. Inertia-induced, "steady-state" shopping behaviour will tend to favour the status quo but over time the consumer may be lured to the new store by a sale or a favourable impression of the shop's façade - the consumer may then find some goods, that are usually bought at known shops, cheaper and so change of alliance may eventuate. However, the consumer may still frequent previously known stores for goods not available at the new store. Proximity of these retail outlets within the consumer's "nearest" shopping centre means that the evaluation of the multistop, multipurpose trip is possible. Three different types of behaviour are thus implied by the above scenario: firstly, prior to the new store opening for business, the consumer maintains utility by shopping at the same store(s) for the same good(s), i.e., maintaining relative temporal utility, TT. After the new store opens, a disequilibrium period of trial-and-error due to shopping at the new store and/or known store(s), induces a utility maximising shopping behaviour, i.e., maximising relative temporal utility, TT'say. If the new shop is incorporated in the consumer's "normal" trip pattern, then over time the consumer reverts to a steady-state, utility maintaining behaviour, i.e., maintaining relative temporal utility, T" say, where TT = TT", as the new shopping pattern is a function of TT'. The period of indecision associated with TT'could be equated with the disequilibrium of entropyic systems - if this is so, then because people have different tastes, desires, etc. their homeostasis period will differ over time, space and consciousness. No wonder Chorley and Kennedy (1971) said that the relaxation periods for urban systems were probably impossible to determine. Trade-offs between different choices is an ongoing process and people limit the stress induced by trade-off decision making by evolving temporally static patterns of destination choice behaviour, especially at the macro-shopping centre level. When trade-offs occur as during subjective homeostasis periods, then the agglomerating tendencies of shops to locate in relatively close proximity to other shops diminishes somewhat the trade-off induced stress associated with TT'.

## 6.2 Concluding Comments

The segmented qualitative discourse of this chapter offered ideas on different aspects of intraurban consumer behaviour. A general theme throughout the chapter was that an apparent temporal diversity of individual shopping trips masks an underlying temporal uniformity of population utility desires accompanied by resistance to trip disutility; these "desires" and "resistances" are manifested by people making rational destination choice decisions.

Retail facility location and consumer choice behaviour are considered interdependent; but a difficulty arises when one asks the question: does retail facility location determine the behaviour of consumers, or vice versa? This is a "chicken-and-egg" problem, a "problem" which has analogues in other geographic disciplines, e.g., the inshore bar formation/standing wave controversy in coastal morphodynamics (e.g. Suhayda, 1974; Short, 1975). It seems that sometimes retail facility location influences consumer behaviour and that sometimes consumer behaviour influences retail facility location - an example of the former is the construction of a new shopping plaza in an established residential area, and an example of the latter is the development of a housing estate in a rural area.

The spatial generalisations, $\underline{\underline{G}}$, give reasons for manifest consumerism (supply/demand interaction) at a single-stop, single-purpose level of resolution; it may be difficult to extend these "generalisations" to encompass multistop, multipurpose trips - possibly a "$\underline{\underline{G}}$" couched in an evolutionary nomenclature may be a good starting point.

The next chapter gives a summary of the thesis and some concluding comments.

# CHAPTER 7

## SUMMARY AND CONCLUSIONS

The thesis showed how both grocery and non-grocery trips are governed by a similar urge or desire to procure material objects so as to subjectively maintain or subjectively maximise utility given known utility experiences. It was shown via realistic examples of shopping trip movements in a city that consumers tend to "maintain" utility levels over time when grocery shopping and "maximise" utility levels at a finite time period when non-grocery shopping. The intrinsic value of the article desired plays a significant role in how a consumer views a particular shopping trip, so that the rigidity of grocery utility "maintenance" and non-grocery utility "maximisation" can, and should be, taken as a generalisation only.

In summary, a theory of temporal relative utility and a set of empirical observations about the spatial structure of Hamilton's retail environment, were used as a groundbase for the derivation of a set of areal generalisations of intraurban consumer behaviour - the "generalisations" were then tested by mapping and modelling actual intraurban shopping movements for Hamilton. The areal generalisations are normative statements as individual idiosyncratic behaviour lends a probabilistic element to the relative choice theory. Specifically, home-based grocery trips are governed by a desire to subjectively minimise time or transport costs incurred during the shopping trip. A knowledge that grocery outlets are both spatially ubiquitous and usually well-stocked with food staples adds fuel to the idea that people view grocery shopping as essentially mundane and that my minimising time spent grocery shopping by choosing the nearest shopping centre, then the individual can spend more time doing other activities. Utility maintenance is thus a function of the consumer's attitude to buying groceries - similar food products minimises 'novelty', a necessary condition for utility maximising behaviour. Familiarity with spatially propinquitous-to-home grocery outlets also influences grocery trips originating from a work-place, and so the work-based choice of grocery destinations is a function of the knowledge about the retail environment near home. Non-grocery trips are more difficult to explain; however, for low-value goods, trip behaviour is similar to grocery trip behaviour as items like tooth paste, beer and small household appliances are required regularly and as low-value non-grocery outlets are located ubiquitously, then transport costs are minimised for these trips by choosing an outlet in a nearby shopping centre. Conversely, transport costs are not a dominant factor for high-value non-grocery trips due to the inflated value Western consumers place upon non-edible durable products - we'll go "far-and-wide" for a car but may complain if we are inaccessible to a grocery outlet.

A factor in destination choice that was not closely perused was the "attractiveness" of a destination - all shopping centres contain similar grocery outlets whose goods are considered ubiquitous, both in spatial and temporal availability. As a consequence of this relatively equitable distribution of grocery outlets, "attractiveness" is really a ceteris paribus attribute for intraurban grocery trips - little thought is given to attractiveness differentials between shopping centres for grocery trips as consumers usually choose a nearest shopping centre, i.e., when desiring milk and bread we usually go to a local grocery outlet, "local" because we would rather have these convenience-type goods sooner rather than later, and so we subjectively minimise the impedance between where we are and where the milk and bread usually are. The static, small-in-magnitude travel time coefficient in the calibrated multinomial logit models ("static" because the magnitude was static for a number of different models comprising different combinations of variables), together with the inelastic travel demand statistics, support this "nearest-is-best" argument. Conversely, durable non-grocery outlets are relatively localised in spatial distribution - this inequitable locational distribution means that consumers may traverse considerable space to procure these goods but the high value placed upon such goods usually outweighs most considerations of trip "cost".

A usual explanation for consumer behaviour is that an individual maximises the utility of a choice of action, e.g., trying to buy the (subjectively) perceived "best buy". This is only part of the explanation - what the individual does is to try and buy the (subjectively) perceived "best buy" relative to previous shopping experiences, i.e., shopping is done and continues to be done via a weighing of utilities of choices of action over time. As such, the explanation of intraurban consumer behaviour given in this thesis is a normative explanation in flux - what people should continue to do when choosing destinations in a rational manner.

To conclude, future research on intraurban consumer behaviour should not steer away from scientific methods of explanation; couching an explanation of behaviour of any sort within a temporal framework, such as this thesis offered, can enable the discernment of definite patterns of aggregate behaviour which can then be given a rational-based explanation, for to be "rational" is not to be deterministic, only human.

## BIBLIOGRAPHY


Adler, T. and Ben-Akiva, M. (1976) 'Joint-choice Model for Frequency, Destination and Travel Mode for Shopping Trips', _Transportation Research Record_ no. 569, pp. 136-150.

Aitchison, J. and Silvey, S. (1957) 'The Generalisation of Probit Analysis to the Case of Multiple Responses', _Biometrika_, vol. 13, pp. 131-140.

Angel, S. and Hyman, G. (1972) 'Urban Spatial Interaction', _Environment and Planning_, vol. 4, pp. 99-118.

Ansah, J.A. (1977) 'Destination Choice Set Definition in Travel Behaviour Modelling', _Transportation Research_, vol. 11, pp. 127-140.

Ben-Akiva, M.E. (1974) 'Structure of Passenger Travel Demand Models', _Transportation Research Record_, no. 526, pp. 26-42.

Bettman, J.R. (1979) _An Information Processing Theory of Consumer Choice_ (Addison-Wesley, Reading, Mass.)

Burnett, K.P. (1973) 'The Dimensions of Alternatives in Spatial Choice Processes', _Geographical Analysis_, vol. 5, pp. 181-204.

Burnett, K.P. (1978) 'Choice and Constraints Oriented Modeling: Alternative Approaches to Travel Behaviour', _Final Draft: White Paper_ (Federal Highway Administration, Washington, D.C.)

Burns, L.D. (1979) _Transportation, Temporal and Spatial Components of Accessibility_ (Heath, Lexington, Mass.)

Carlstein, T., Parkes, D. and Thrift, N. (1978) _Timing Space and Spacing Time_, 3 vols. (Edward Arnold, London)

Chorley, R.J. and Kennedy, B.A. (1971) _Physical Geography: A Systems Approach_ (Prentice-Hall Int., London)

Christaller, W. (1933) _Die Zentralen Orte in Süddeutschland_ (Fischer, Jena) English edition translated by Baskin, C.W. (1966) _Central Places in Southern Germany_ (Prentice-Hall, Englewood Cliffs, N.J.)

Domencich, T. and McFadden, D. (1975) _Urban Travel Demand: A Behavioural Analysis_ (American Elseview, New York)

Edwards, A.W.F. (1972) _Likelihood_ (Cambridge University Press, Cambridge)

Engel, J.F., Blackwell, R.D. and Kollat, D.T. (1978) _Consumer Behaviour_, 3rd ed. (Dryden, Hinsdale, Ill.)

Fishburn, P.C. (1973) Mathematics of Decision Theory (Mouton, The Hague)

Fotheringham, A.S. (1980) 'Spatial Structure, Spatial Interaction and Distance-decay Parameters', unpubl. Ph.d thesis (McMaster University, Hamilton, Ontario)

Garfinkel, A. (1981) Forms of Explanation (Yale University Press, New Haven)

Georgescu-Roegen, N. (1936) 'The Pure Theory of Consumer's Behaviour', Quarterly Journal of Economics, August, 1936, pp. 545-593.

Golledge, R.G. (1967) 'Conceptualizing the Market Decision Process', Journal of Regional Science, Vol. 7, pp. 239-258.

Golledge, R.D. (1969) 'Process Approaches to the Analysis of Human Spatial Behaviour', mimeographed research paper (Ohio State University, Columbus Ohio)

Gregory, D. (1978) Ideology, Science and Human Geography (Hutchison, London)

Guy, C.M. (1976) 'The Location of Shops in the Reading Area', Geographical Paper No. 46 (Dept. of Geography, University of Reading, Reading)

Hägerstrand, T. (1970) 'What About People in Regional Science?' Papers and Proceedings of the Regional Science Association, vol. 24, pp. 7-21.

Hägerstrand, T. (1975) 'Space, Time and the Human Condition', in Karlqvist, A., Lundqvist, L. and Snickars, F. (eds.) (1975) Dynamic Allocation of Urban Space (Heath, Lexington, Mass.)

Hansen, F. (1972) Consumer Choice Behaviour: A Cognitive Theory (Free Press, New York)

Hempel, C.G (1966) Philosophy of Natural Science; Foundations of Philosophy Series (Prentice-Hall, Inc., Englewood Cliffs, N.J.)

Horowitz, J. (1979) 'Disaggregate Demand Model for Non-work Travel', Transportation Research Record, no. 673, pp. 56-71.

Houthakker, H.S. (1965) 'On the Logic of Preference and Choice', in Tymieniecka, A. (ed.) (1965) Contributions to Logic and Methodology in Honour of J.M. Bochenski (North-Holland, Amsterdam), pp. 193-207.

Howard, J.A. (1977) Consumer Behaviour: Applications of Theory (McGraw-Hill, New York)

Howard, J.A. and Sheth, J.N. (1969) The Theory of Buyer Behaviour (Wiley, New York)

H-WPDD (1975) Transportation: A Substudy of the Regional Official Plan, Report No. 2 (Hamilton, October, 1975)

Jaynes, E.T. (1957) 'Information Theory and Statistical Mechanics, Physical Review, vol. 106 (4), pp. 620-630.

Joseph, K.S. and Sumption, J. (1979) Equality (John Murray, London)

King, L.J. (1969) Statistical Analysis in Geography (Prentice-Hall, Englewood Cliffs, N.J.)

Kullback, S. (1959) Information Theory and Statistics (Wiley, New York)

Lakshmanen, T.R. and Hansen, W.G. (1965) 'A Retail Market Potential Model', Journal of the American Institute of Planners, vo. 31, pp. 134-143.

Lenntrop, B. (1976) 'Paths in Space-Time Environments: A Time Geography Study of Movement Possibilities of Individuals', Lund Studies in Geography No. 44 (The Royal University of Lund, Sweden)

Luce, R.D. (1959) Individual Choice Behaviour (Wiley, New York)

Luce, R.D. and Raiffa, H. (1957) Games and Decisions (Wiley, New York)

Luce, R.D. and Suppes, P. (1965) 'Preference, Utility and Subjective Probability' in Luce, R.D., Bush, R. and Galanter, E. (eds.) Handbook of Mathematical Psychology, III (Wiley, New York)

McFadden, D. (1968) The Revealed Preferences of a Government Bureaucracy, Technical Report W-17 (Institute of International Studies, Universities of California, Berkeley)

McFadden, D. (1972) A Disaggregated Behavioural Model of Urban Travel Demand, Charles River Associates, Inc., Final Report to U.S. Federal Highway Administration, USDOT, March, 1972)

McFadden, D. (1973) Conditional Logit Analysis of Qualitative Choice Behaviour, Working Paper No. 199/BART 10 (University of California Berkeley), in Zarembka, P. (ed.) Frontiers in Econometrics (Academic Press, New York)

Muehrcke, P.C. (1978) Map Use: Reading, Analysis and Interpretation (J.P. Publications, Madison, WI)

Nicosia, F.M. (1966) Consumer Decision Processes: Marketing and Advertising Implications (Prentice-Hall, Englewood Cliffs, N.J.)

O'Kelly, M.E. (1980) 'A Model of the Demand for Retail Facilities Incorporating Multi-stop, Multi-purpose trips', unpublished manuscript, Dept. of Geography, McMaster University, Hamilton, Ontario, L8S 4K1.

O'Kelly, M.E., McCafferty, D. and Webber, M.J. (1979) 'Comparison of the Predictive Power of Disaggregate and Aggregate Models of Choice of Destination for Shopping', unpublished research paper, Dept. of Geography, McMaster University, Hamilton, Ontario, L8S 4K1

O'Sullivan, P. and Ralston, B. (1978) 'Sensitivity to Distance and Choice of Destinations', Environment and Planning A, vol. 10, pp. 365-370.

Quine, W.V. and Ullian, J.S. (1978) 2nd ed. The Web of Belief (Random House, New York)

Recker, W.W. and Kostyniuk, L.P. (1978) 'Factors Influencing Destination Choice for the Urban Grocery Shopping Trip', Transportation, vol. 7, pp. 19-33.

Reilly, W.J. (1929) Methods for the Study of Retail Relationships, Bulletin 2944 (University of Texas, Austin, Texas)

Richards, M.G. and Ben-Akiva, M.E. (1974) 'A Simultaneous Destination and Mode Choice Model for Shopping Trips', Transportation, vol. 3, pp. 343-356.

RMH-WPDD (1977a) Selecting a Preferred Regional Development Pattern (Hamilton, February, 1977)

RMH-WPDD (1977b) 'Land-Use Data; Allocation to Traffic Zones', unpublished data (Hamilton, October, 1977)

Rushton, G. (1969) 'The Scaling of Location Preferences' in Cox, K.R. and Golledge, R.G. (eds.) Behavioural Problems in Geography: A Symposium, Studies in Geography, No. 17 (Dept. of Geography, Northwestern University, Evanston, Ill.)

Rushton, G., Golledge, R.C. and Clark, W.A.V. (1967) 'Formulation and Test of a Normative Model for the Spatial Allocation of Grocery Expenditures by a Dispersed Population', Annals, Association of American Geographers, vol. 57, pp. 389-400.

Samuelson, P.A. (1947) Foundation of Economic Analysis (Harvard University Press, Cambridge, Mass.)

Samuelson, P.A. (1948) 'A Note on the Pure Theory of Consumer's Behaviour', Economics, New Series 5 (with addendum in same volume)

Skeppard, E.S. (1978) 'Theoretical Underpinnings of the Gravity Hypothesis', Geographical Analysis, vol. 10 (4), pp. 386-402.

Short, A.D. (1975) 'Multiple Offshore Bars and Standing Waves', Journal of Geophysical Research, vol. 80, pp. 3838-3840.

Simon, H.A. (1969) The Sciences of the Artificial (MIT Press, Cambridge, Mass.)

Stopher, P.R. and Meyburg, A.H. (1976) (eds.) Behavioural Travel-Demand Models (Heath, Lexington, Mass.)

Suhayda, J.N. (1974) 'Standing Waves on Beaches', Journal of Geophysical Research, vol. 79 (2), pp. 3065-3071.

Theil, H. (1969) 'A Multinomial Extension of the Linear Logit Model', International Economic Review, vol. 10, pp. 251-259.

Webber, M.J. (1976) 'The Meaning of Entropy Maximizing Models' in Papagiergiou, G.P. (ed.) Mathematical Land Use Theory (Heath, Lexington, Mass.), pp. 277-292.

Webber, M.J. (1979a) Information Theory and Urban Spatial Structure (Croom Helm, London)

Webber, M.J. (1979b), 'Data Description: May, 1978 Hamilton Trip Survey', unpublished manuscript (Dept. of Geography, McMaster University, Hamilton, Ontario, L8S 4K1)

Webber, M.J. (1980) 'A Theoretical Analysis of Aggregation in Spatial Interaction Models', Geographical Analysis, Vol. 12 (2), pp. 129-141.

Wilson, A.G. (1967) 'A Statistical Theory of Spatial Distribution Models', Transportation Research, Vol. 1, pp. 253-269.

Wilson, A.G. (1970) Entropy in Urban and Regional Modelling (Pion, London)

Wilson, A.G. (1974) 'Urban and Regional Models in Geography and Planning (Wiley, London)

Wilson, A.G. (1980) 'Theory in Geography: A Review Essay', Working Paper No. 253 (School of Geography, University of Leeds, LS2 9JT)

Wilson, A.G., Hawkins, A.F., Hill, G.J. and Wagon, D.J. (1969) 'Calibration and Testing of the SELNEC Transport Model', Regional Studies, Vol. 3, pp. 337-350.

Wrigley, N. (1976) An Introduction to the Use of Logit Models in Geography, Concepts and Techniques in Modern Geography (CATMOG), no. 10 (Geo Abstracts, Norwich)