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Equipotentiality In Urban Recreation Opportunities

Bryan James Smale

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EQUIPOTENTIALITY IN URBAN RECREATION OPPORTUNITIES

by

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of the requirements for the degree of
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ABSTRACT

Equal opportunity in the provision of urban recreation resources has been the principal goal of most public leisure service agencies yet the reliance on the use of recreation standards in the planning of opportunities does not guarantee that equal opportunity in fact is being achieved. In order to assess equal opportunity of provision, a theoretical model is proposed that establishes an evaluative criterion based on the coincidence of same levels of the demand for recreation and of the supply of resources at the same points on a surface representing the community. The conceptual model of urban recreation that is proposed illustrates the interrelationship of the recreation supply and demand systems, the role of accessibility and perceptions in explaining the nature of participation, and the outcome of the relationship in terms of the selection of an appropriate site and the resultant experience. Using data drawn from a community survey of households (n=1163) conducted in the town of Oakville, Ontario and an inventory of the town's parks (n=114), an unconstrained gravity model was calibrated based on a structure suggested by the conceptual model. The model explained 66.1% of the variation in park use with the intervening opportunities index, park shape, and especially, park familiarity accounting for much of the variation. Measures of potential for the recreation demand system and for the recreation supply system were calculated directly from the gravity model employing regression coefficients as weights in the index. These measures were calculated for each system at reference points of a grid which had been overlayed on the coordinate space of the parks and neighbourhoods. Contour maps were then generated which reflected the variations in both the demand for and the supply of urban recreation opportunities in the community. By taking the ratio of the potential measures for the two systems at the same reference points in the grid, the recreation opportunity spatial system potential surface was created which, in theory, should be a smooth surface if equal opportunity is being achieved in the community. Incidences of "supply-rich" and "supply-poor" regions within the community are described and reasons for their occurrence offered. This surface was then compared to one generated by a traditional gravity model and differences between the two surfaces described. Implications of the conceptual model and the potential surfaces for urban recreation planning are discussed, and special attention is given to the importance of perceptions in explaining recreation behaviour in an urban context.

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But most of all, thanks to Laurie whose quiet confidence in me never waivered. It is to her I dedicate this thesis.

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EQUITY AND URBAN RECREATION OPPORTUNITY

1.1 PROLOGUE

Geographic interest in the distribution of public services has increased steadily over the past two decades (Kirby and Pinch, 1983). The principal focus of this work has been on accessibility issues due in part to the influential paper by Teitz (1968) on urban public facility location. More recently, the research has reflected a concern for equity considerations in distributions, and this has prompted debate regarding the underlying assumptions of location decisions with respect to public services (Dear, 1978).

The last twenty years has also seen the emergence of the study of leisure and recreation as an important area of research in the social sciences. Still in its disciplinary infancy, much of the work in the field has been contributed by sociologists, psychologists, and economists, and has been strikingly devoid of any spatial considerations. In particular, research on issues related to urban recreation has been severely lacking despite the significant proportion of leisure time that is spent in an urban environment (Pincombe, 1969; Hayward and Weitzer, 1984).

This study is an attempt to introduce a spatial perspective to the examination of recreation behaviour and the use of resources in an urban area with special emphasis on the provision, and its adequacy, of public recreation opportunities.

1.2 PROVISION OF URBAN PUBLIC RECREATION

The allocation of urban recreation resources has always adhered to the basic principle of equal opportunity. As a result, most Canadian communities have in place systems of public parks and facilities that are relatively evenly distributed and easily accessible to all residents. The precedence for this equity approach was initiated early in Canada as is reflected in such legislation as the 1883 Public Parks Act of Ontario which set out size guidelines for the purchasing of municipal parkland, and the recommendations made at the turn of the century by the Parks and Playgrounds Association of Montreal concerning the various sizes and spacing of parks (McFarland, 1970). Thus, by the 1920s, when social welfare concerns and the urban recreation movement were gaining momentum (Gold, 1973), the philosophy of equal opportunity was already firmly established. Today, in spite of years of rapid urbanisation and increasingly intensive land use, urban planners still base their decisions on the allocation of recreation resources on this principle (Burton, 1976b; Wilkinson, 1983).

In order to arrive at equitable distributions of parks and facilities, planners rely on the use of recreation standards of provision in the planning process. Based on traditionally held assumptions about what is "needed" to satisfy demand for recreation (Mercer, 1973; Torkildsen, 1983), standards provide objective measures that planners can employ in the design of a system of recreation resources. Although not usually applied rigorously, standards have given the means and direction to recreation planning. Burton (1976b) has suggested that about 75 per cent of Canadian towns and cities employ standards for open space planning, and Wilkinson (1983) states that the application of standards is the single most influential factor in the development of the urban recreation landscape.

The use of standards, however, has also been the focus of a considerable amount of criticism. The criticisms are primarily within three areas of concern. First, standards have no theoretical foundation. Based largely on tradition and the judgement of authorities from the early 1900s (Theobald, 1984), standards have taken on certain specified minimum limits of provision which have been arbitrarily set. No theoretical rationale exists for the roughly 5 hectares of parkland per 1000 population, or the 0.5 kilometre service radius, beyond the estimated judgements of what seemed reasonable at the time they were suggested (Torkildsen, 1983; Theobald, 1984). As time has passed, these tenets have come to be accepted as minimum requirements, and thereby enshrined in recreation planning (Gold, 1973, 1980).

Second, and related to the previous point, standards have not been empirically validated. Irrespective of the difficulties in trying to determine objectively the need for recreation, no research has been conducted in an effort to verify whether or not the recommended standards are in any way related to recreation need (Wilkinson, 1985). As a result, recreation standards have remained virtually unaltered from the time they were first set out 70 to 80 odd years ago (Theobald, 1984). Without such validation, standards should have remained within a theoretical context, but because of their widespread adoption in recreation planning, this criticism is much more cogent.

Finally, the third criticism, and the one that has the greatest implications with respect to equal opportunity in provision, concerns the underlying assumptions inherent in the use of standards. Standards assume that the demand for recreation, and more specifically, for recreation opportunities, is uniform for the whole population, and therefore, provision is subject only to variations in population density (Reid, 1973). Similarly, standards assume that the supply of recreation resources also is uniform in that each site provides the same level of opportunity. These assumptions, particularly with respect to demand, are entirely untenable and have been the target of most critics (Gold, 1973; Burton, 1976b; Gold, 1[illegible] Torkildsen, 1983; Wilkinson, 1983). Substantial research on recreation behaviour and perceptions has demonstrated the effect of a variety of demographic, personal, and locational factors on demand patterns (Maw, 1974), and this, coupled with the geographic research describing the spatial heterogeneity of urban areas (Herbert and Johnston, 1976; Lineberry, 1977a), points to the variability in demand that exists (Rodgers, 1973; Glyptis, 1981).

With regard to the supply of recreation resources, measurable differences in the size and attributes between sites and the less tangible perceived differences in their quality all reflect the obvious deviations from uniformity. More importantly, the revealed preferences for certain sites by recreationists demonstrate their lack of ability to satisfy demand equally. Hence, the likelihood of a misallocation of resources is, in effect, even greater under conditions where standards have been applied with any rigour (Gold, 1973; Burton, 1976b). Knetsch (1974) is especially adamant in this regard pointing out that strict adherence to the standards approach and the continued disregard for demand and supply considerations will inescapably lead to misallocation.

Recognition of this problem of trying to fit a relatively static system of diverse recreation resources to a dynamic population with variable demands for recreation (Smale, 1983b) has drawn attention to the importance of conducting an ongoing assessment of current provision (Cosgrove and Jackson, 1972; Lineberry and Welch, 1974; Beesley, 1983). Research interest in the examination of public services distributions has increased over the past decade, but it has lacked direction and remains at a largely exploratory stage. In fact, the most recent work has been concerned with clarifying the definitional problems and conceptual issues that have arisen (Rich, 1979, 1982; Jones and Kirby, 1982; Merget and Berger, 1982; Kirby, Knox, and Pinch, 1983), and many of these are of direct relevance to the assessment of distributions of recreation resources.

1.3 ASSESSMENT OF URBAN RECREATION DISTRIBUTIONS

1.3.1 Definitional Problems

The definitional problems surrounding the concept of "equal opportunity" are concerned principally with differentiating between equality, efficiency, and equity. Equality is the most easily defined and is the condition of being equal in quantity or amount. Crompton (1982) refers to equality as the distribution of "equal amounts of leisure services to all citizens regardless of need or amount of taxes paid" (p. 67). Equality, then, is most closely aligned with the use of standards, and as a planning rule, sets equal provision as the main objective in the distribution of recreation opportunities.

Efficiency, which has been the focus of much of the geographic work in the area, introduces an element of constraint to the equality objective in the search for an optimal solution to the problem of size and spacing of resources (McAllister, 1975, 1976). For public services such as recreation, the typical criterion for selection is the location pattern that meets some predetermined level or volume of services at the minimum level of costs (Morrill and Symons, 1977). The research in this area predominantly has assumed uniform population density and employed an objective function for demand (usually a variation of distance decay) in resolving the tradeoff between more smaller facilities separated by shorter distances and fewer larger facilities separated by greater distances.

McAllister (1975) has suggested that since equity is a subjective concept, an objective function of recreation demand which provides a solution based on efficiency will, in fact, achieve equity. In contrast, Richardson (1979) has argued that such an approach only addresses the equality issue and that efficiency is not compatible with equity under these constrained circumstances. Similar criticisms have been levied by Bigman and Revelle (1978) from a methodological standpoint, and by Rich (1979) from a conceptual one. The efficiency problem, then, can be characterised as the search for the <u>minimum</u> average distance anyone has to travel to a given number of facilities (McGrew and Monroe, 1975; Bigman and Revelle, 1979).

Equity presents the greatest definitional problem, and frequently has been confused with equality (Jones and Kirby, 1982). This confusion between equality and equity is reflected in McAllister's work (1975, 1976), and stems from the typically employed assumption that distance is the principal source of inequity in provision, and that variations in demand can be equated with the varying distances from existing services. It was this view that prompted most researchers to adopt the operational definition of equity as the condition that minimises the <u>maximum</u> distance anyone had to travel to a given number of facilities (McGrew and Monroe, 1975). Similar to the definition of efficiency, this expression of equity regards demand as tantamount to physical access, assuming proximity serves to satisfy demand for recreation opportunities.

While such definitions continue to ignore the complexities of the variations in recreation demand, and in the resources to meet it, they reveal the very real difficulties faced in establishing an objective, methodologically applicable definition of equity (Bigman and Revelle, 1978).

As many authors have noted (Lucy, Gilbert, and Birkhead, 1977; Crompton, 1984), identifying a condition of equity in public services provision is highly subjective, and has prompted some, like Morrill and Symons (1977), to suggest that a definition should not even be attempted. Yet, a return to the premise upon which equity is based -- equal opportunity -- provides the starting point for a meaningful definition. As discussed earlier, equal opportunity denotes that provision be responsive to "need", however defined. This does not mean that assumed uniform levels of demand must be provided with an unvaried system of recreation resources, but rather, that the varying levels of recreation demand across the community are provided with a congruous level of recreation resource opportunities. Thus, inequalities in provision are quite acceptable as long as they are in accordance with the fluctuations in demand (Smith, 1979).

Equity defined in this manner, as the balance between recreation supply and demand, is conceptually sound, but because of the relative relationship between the supply and demand components, it remains operationally elusive. That element which resists definition is the evaluative criterion -- the "evaluative starting point" in Jones and Kirby's (1982) terms -- from which an assessment of current provision of services can be made in a methodologically objective fashion. Offerings which still lack specificity, yet point to important aspects of equity, include "societally desirable" (Smith, 1974), "public value" (Merget and Berger, 1982), and "distributive justice" (Cook and Messick, 1983). For the provision of recreation resources, the critical concern is the balahce between demand for public recreation opportunities, and the supply of those opportunities across a heterogeneous community. Thus, an objective measure must be devised to serve as the evaluative criterion of equity that is sensitive to the independent variations in both the supply of and demand for recreation opportunities. And as Crompton (1982, 1984) has lucidly discussed, the assessment of the distribution of urban recreation opportunities for equity, and not equality, is crucial in order to determine if and where disparities in provision may be occurring.

1.3.2 Empirical Efforts and Criticisms

Empirical work that has attempted to assess urban public services distributions is relatively sparse, but even more so for work directed towards recreation resources. In this latter work, most researchers have employed social indicators which are indices borrowed from research on social well-being and the related concept of quality of life (Mercer, 1973; Knox, 1975; Andrews and Withey, 1976) that measure levels of provision for various municipal services. Typical examples of these indicators include -- on a per capita basis -- numbers of recreation personnel, numbers of recreation programmes offered, hectares of parkland, and hours of operation for each facility type (Lucy, Gilbert, and Birkhead, 1977).

When using social indicators, researchers assume a priori that these objective measures reflect real differences in a community's quality of life or well-being (Schneider, 1976). Thus, by determining these measures for each zone within an urban area, usually administrative units such as census tracts or enumeration areas, comparisons can be made, and areas being underserved identified. This approach has been used to assess distributional variations in library services, swimming pools, and parks (Lineberry and Welch, 1974; Lineberry, 1977a; Mladenka and Hill, 1977; Mladenka, 1978), as well as cultural facilities in selected cities across Canada (Shulman, Bond, and Nelson, 1979). In a similar manner, Farnham (1981) employed indices of recreation capital stock to examine changes in the distribution of services over a 15 year period in Oakland, and Gold (1974) analysed the distribution of recreation services in 49 neighbourhoods of Detroit.

In each of these two studies, disparities were identified in two ways. First, neighbourhoods (i.e. census tracts) with the lowest scores on the indices were regarded as being in the greatest need of additional recreation resources. Second, by examining the relationship between certain demographic characteristics such as average income or percentage ethnic composition, and the indices of recreation provision within each neighbourhood, specific groups were identified which were deemed relatively unprovided for.

Interestingly, little consistency in the results has been revealed in this research (Merget and Berger, 1982) as some studies indicated provision of recreation resources was randomly associated with different socio-economic groups (Lineberry and Welch, 1974; Lineberry, 1977a) while others demonstrated that provision favoured economically disadvantaged areas (Gold, 1974). Further still, these results contrasted with the distributions hypothesised by many authors, and empirically demonstrated by Good and Frankel (1973), who suggested that higher levels of provision would occur in the more affluent areas due largely to political influences (Gold, 1973). Overall, the lack of any recurrent patterns in this research has hindered development of theory in public services distributions (Newton, 1984).

A prevailing concern of each of these studies was with indicators that embraced some measure of accessibility to recreation resources. The importance of accessibility has been cited frequently (Clawson and Knetsch, 1966; Mitchell, 1969b; Maw, 1974; Ritchie and Mather, 1976; Robertson, 1978; Henderson and Wall, 1979; Kelly, 1980; Torkildsen, 1983; Smith, 1983a), and has been supported empirically as a main factor in a number of studies of urban recreation participation patterns (Bangs and Mahler, 1970; Dee and Liebman, 1970; Mitchell, 1973; Kelly, 1978a). Accessibility, usually defined in these studies as the distance to the nearest supply point (i.e. park), was regarded as the best index of distributional equality present in the community. Thus, neighbourhoods which were farthest from a park or other recreation resource, were identified as these areas demonstrating the greatest "need" (McAllister, 1976). Again, this interpretation is based on the assumption of uniform recreation demand in the population, and is the focus of the main criticism of these means of assessment.

By assuming uniform demand for recreation, the use of social indicators to evaluate distributions addresses only equality concerns. Hence, whether the results indicated complete equality of provision of recreation or massive discrepancies, the question of equity remains. Without knowing how, and to what extent, recreation demand varies across the community, no rationale exists for deducing if present provision is adequate in meeting that demand. Similarly, comparisons of the measures of provision between neighbourhoods, whether done directly or by converting the indicators to a standardised form that deviates from the community-wide norm, are only relative indices lacking a minimal acceptable limit to determine if "need" truly exists. Therefore, even the lowest scoring neighbourhood may be well provided for, or conversely, the highest scoring neighbourhood may still be deprived of adequate opportunities for recreation.

Further, by defining accessibility in terms of distance to the nearest park (an economic assumption of consumerism related to central place theory), researchers have assumed that only the nearest resource, and no other, presents an opportunity for recreation, thereby ignoring preferences and behavioural patterns of recreationists. The work of Booth (1975), Veal (1979), and Goodchild and Booth (1980) provides good empirical evidence to render this assumption untractable. Thus, even though accessibility is recognised as an important element in assessments, it has been treated in a superficial and highly restrictive fashion.

This is especially true for studies which use arbitrary administrative zones as the basic areal units of analysis since it is assumed that the opportunity for recreation for the residents of a tract exists solely within its boundaries -- boundaries which have little, if any, meaning to recreationists. This situation introduces the problem of <u>scale discordance</u> which, as Lee and Marans (1980) have pointed out, occurs when the subjective evaluation of available resources by the residents, as expected, does not correspond to the exogenously defined neighbourhoods.

Another means of assessing the provision of recreation resources has been through the use of standards as normative indices. As Smith (1982) has noted, even though standards have been disparaged as planning tools, they do provide useful monitoring devices for determining which areas have or have not achieved certain levels of provision. Most of the work using standards in this way, however, has made intercity comparisons (Burnett, 1969; Van Doren, 1973; Haley, 1979; Newton, 1984) rather than dealing with the analysis of intraurban patterns. Exceptions to the intercity dominance include Henderson and Wall's (1979) evaluation, based on census tracts and city standards, of residents' accessibility to different types of parks in Waterloo; DeGroat's (1980) examination of the distribution of parkland in census tracts in the city of Windsor; and the study by Jones, Kriesel, and White (1984) who compared actual service areas of parks and swimming pools in Edmonton to the standards reported in that city's master plan.

In each case, however, the interpretation of the results was limited by the conceptual weaknesses inherent to recreation standards and by the same problems confronting the use of social indicators. Their sole advantage is in having an index of a traditionally accepted minimum level of adequacy which can be used to identify those cities, or neighbourhoods within cities, that appear to be deficient. Yet, as Kirby (1983) points out, researchers will not be able to adequately evaluate current provision for equity since the concept responsible for both the existing distributions of recreation resources and the techniques employed here is based on equality considerations. Ironically, most of the completed research which has used standards as normative indices has failed to demonstrate that even equality concerns are being met in many cities much less equity concerns.

1.4 STUDY PERSPECTIVE

Essentially, then, there is a need for an appropriate means of assessing the distribution of urban recreation opportunities that overcomes the problems discussed above. In this study, an approach is examined that is responsive to the variations in the recreation demand system and to the diversity of the recreation supply system, as well as to the elements which comprise these two systems in an urban area. By integrating these related yet separable systems into a contiguous space, zones where the provision of recreation opportunities does not match demand are identified. Such an approach to the assessment of current provision places equity considerations ahead of those associated only with equality of distribution (Rich, 1979). In the latter case, no guarantees are present that ensure, even in distributions that are clearly equal in size and in spacing, that the community's demand for recreation is being met.

The definition of equity as the balance between the recreation demand and supply systems is conceptually sound and desirable (Crompton, 1982), but the difficulty in operationalising it has resulted in empirical efforts at evaluating existing distributions that drift towards more easily measured phenomena. Rather than adopt an inadequate definition of equity that compromises its conceptual basis, the focus here is on establishing an evaluative criterion that reflects the spatial dynamism of the urban recreation demand and supply systems.

The evaluative criterion is not constrained by a fixed minimum standard of provision, but is a relative measure responding to current conditions. The methodological approach taken uses the concept of <u>potential</u> in a modelling framework to define both the supply and the demand systems as surfaces each made up of interdependent components and delimited by the urban area. Each surface, then, is a function of the influence of the contributing elements in each system, and the integration of the two potential surfaces generates an urban recreation opportunity spatial system. Within this system, any point on the surface reflects the combined effect of all the recreation opportunities available in the community and the demand for them. The thesis here is that in a completely equitable distribution of urban recreation opportunities, this new surface should be represented as a relatively smooth surface, or equipotentiality, where the standardised ratio of the supply and demand surfaces at all points equals one. Further, the existence and location of disparities in provision are reflected in the "peaks" and "pits" which result from divergent measures of supply and of demand at the same point on the surface of the urban recreation opportunity spatial system.

Here, then, is the evaluative criterion necessary to assess equal opportunity in provision. Fixed levels of supply are less important than the opportunity they provide for recreation, and therefore, the absence of opportunity that is spatially coincident with negligible demand still can maintain equity within the system. Therefore, the locations where the value of the ratio is the lowest are not to be interpreted as optimal sites for new resources, but rather indicative of the relatively opportunity-poor nature of that locale. Thus, either diverted demand or enhanced supply at existing locations theoretically should serve to smooth the surface.

This approach is in keeping with the call of numerous researchers for a systems perspective of urban recreation opportunities that recognises the strong relationship between the two systems as well as the interdependence of the components that comprise each of them (Wright, 1974; Van Doren, 1975; Ellis and Homenuck, 1979; Goodale, 1980). Similarly, it draws from the theoretical contributions of geographers to this area by focusing on the spatial properties of these systems (Harvey, 1969; Huggett, 1980; Coffey, 1981). In particular, the use of the potential concept places this exploratory study within the realm of a "general spatial systems theory" perspective which provides, as Coffey (1981) has argued, a "philosophical basis for inquiry" (p. 238) that is distinct from either systems theory or systems analysis which are more specialised in function.

This perspective is peculiarly geographic with its emphasis on the spatial separation of the two systems, and thus by implication, the importance placed on <u>distance</u> as a factor in determining the use of urban recreation opportunities. By extension, should equal opportunity actually be achieved, and a smooth surface result, recreationists should use the nearest opportunity because there would be no advantage in bypassing it for another site. The implication of this is that each supply point in the recreation opportunity spatial system would have an equivalent "cost gradient"; that is, the distance decay curve for each location would be essentially the same albeit with some variations due to the distribution of the residents. This assumes, of course, that the model has been correctly specified by taking all relevant supply and demand factors into account, and by eliminating the variable effects of real and perceived barriers to the use of the available opportunities.

In the present study, this theory of equal opportunity as expressed through the recreation opportunity spatial system is examined empirically using the town of Oakville, Ontario (pop. 75,773) in a case study. In order to delimit the range of possible urban recreation opportunities which could comprise the supply system, the focus here is on the public parks in the town. Since equal opportunity is essentially a public sector mandate, recreation opportunities provided by the private and commercial sectors do not form a part of this supply system; and therefore, from the perspective of the public recreation agency, are of no real concern in the provision of public parks. Further, parks, unlike some other public recreation resources, do not compete with the private sector because this profit-motivated sector does not provide similar opportunities. Thus, non-use of parks is not a direct reflection of use diverted to other non-public areas, and the urban area can, as a result, be considered "closed" with respect to the parks and their use.

In the chapters that follow, those elements that are important in defining the supply and the demand systems are described as a preliminary step to the development and administration of the data collection phase of the study. From here, the basic model development and calibration are described prior to its testing under empirical circumstances.

Chapter II

A CONCEPTUAL MODEL OF URBAN RECREATION

2.1 INTRODUCTION

The realisation of the potential surface describing the recreation opportunity spatial system requires that a number of tasks first be completed. Foremost among these tasks is the specification of the urban recreation supply and demand systems which are the principal components defining the opportunity spatial system. Each of the component systems, however, has both conceptual and methodological problems associated with its definition which must be explicated. The most serious problem is the paucity of research on urban recreation (Hayward and Weitzer, 1984; Kirby, 1985) that has left the field virtually devoid of a theoretical base upon which to develop subsequent research. The work that has been done within an urban context reflects the influence of the results of research conducted at the regional or national level (Owens, 1984) and is, as a body of literature, quite fragmented. Most contributions are limited in scope and typically focus on distinct themes.

In this chapter, a conceptual model specific to urban recreation is postulated that is based on the propositions forwarded by others examining those aspects related to the broader notion of outdoor recreation.

2.2 A CONCEPTUAL MODEL OF URBAN RECREATION

Wolfe (1964) was the first to attempt to conceptualise a taxonomy of outdoor recreation as a means of synthesising its geographic aspects. His effort, which was more concerned with illustrating the interrelationships of those elements necessary for the study of outdoor recreation, set the precedent for later work by separating between the demand for and the supply of outdoor recreation. Wolfe emphasised especially the effect of mobility on the demand for outdoor recreation. Mobility was quite literally central to his model, and he stressed its importance to geographers because of its inherently spatial nature.

Wolfe's influence is recognisable in the next major offering to conceptualise outdoor recreation. Wall's (1970, 1979b) "theoretical framework for tourism and outdoor recreation" (1979b:6) identifies the factors comprising both recreation supply and demand, and their connectivity in giving rise to the decision to participate. As is shown in his linkage diagram (Figure 2.1), a number of specific factors influence the nature of the two principal components. While most of these factors, especially those on the demand side, have been shown to be important in the decision to participate, their collective effect is not always equal or consistent. The degree of influence each factor may have depends upon the activity involved, and the site where it occurs.

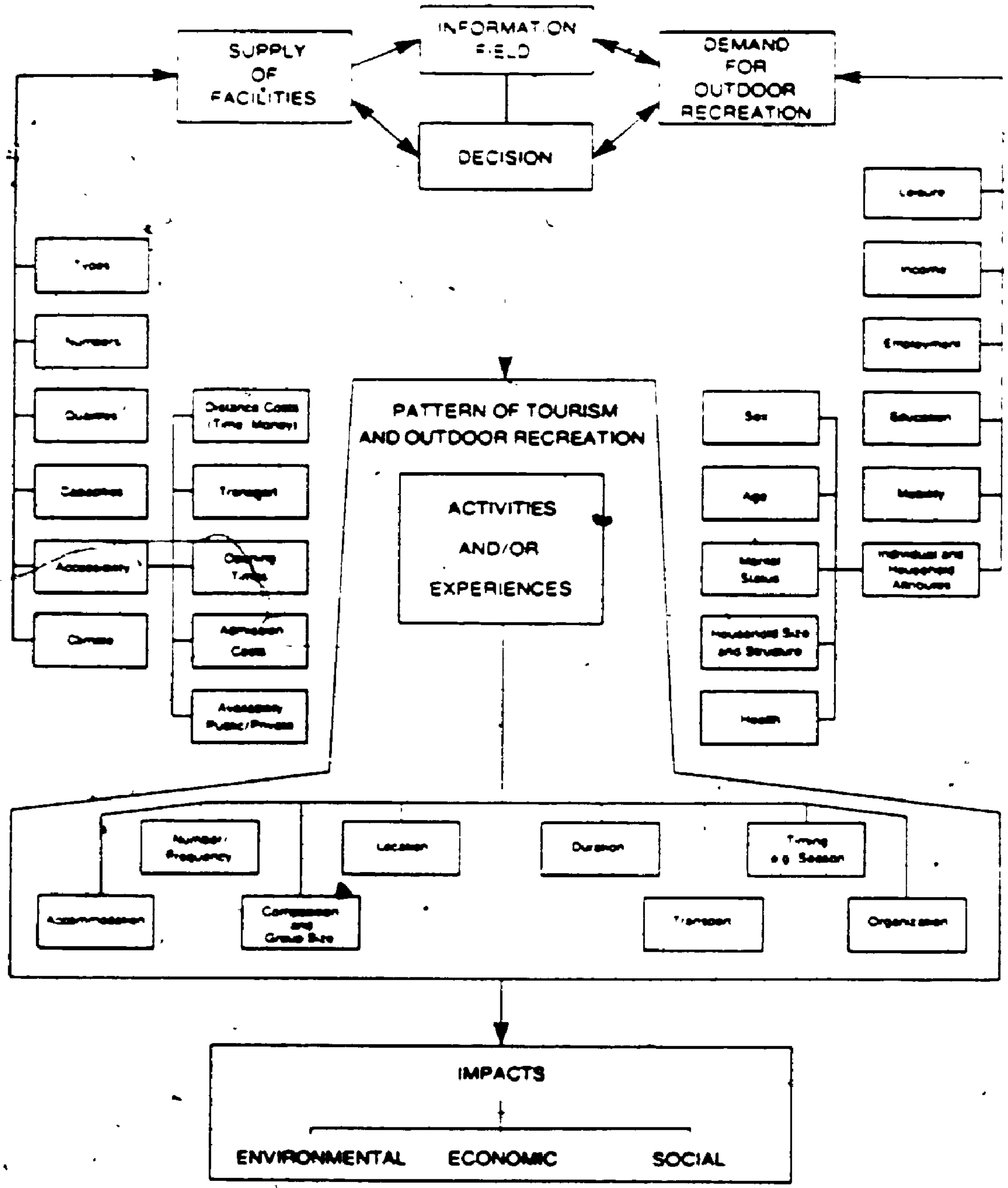


Figure 2.1

Wall's Theoretical Framework for Tourism and Outdoor Recreation

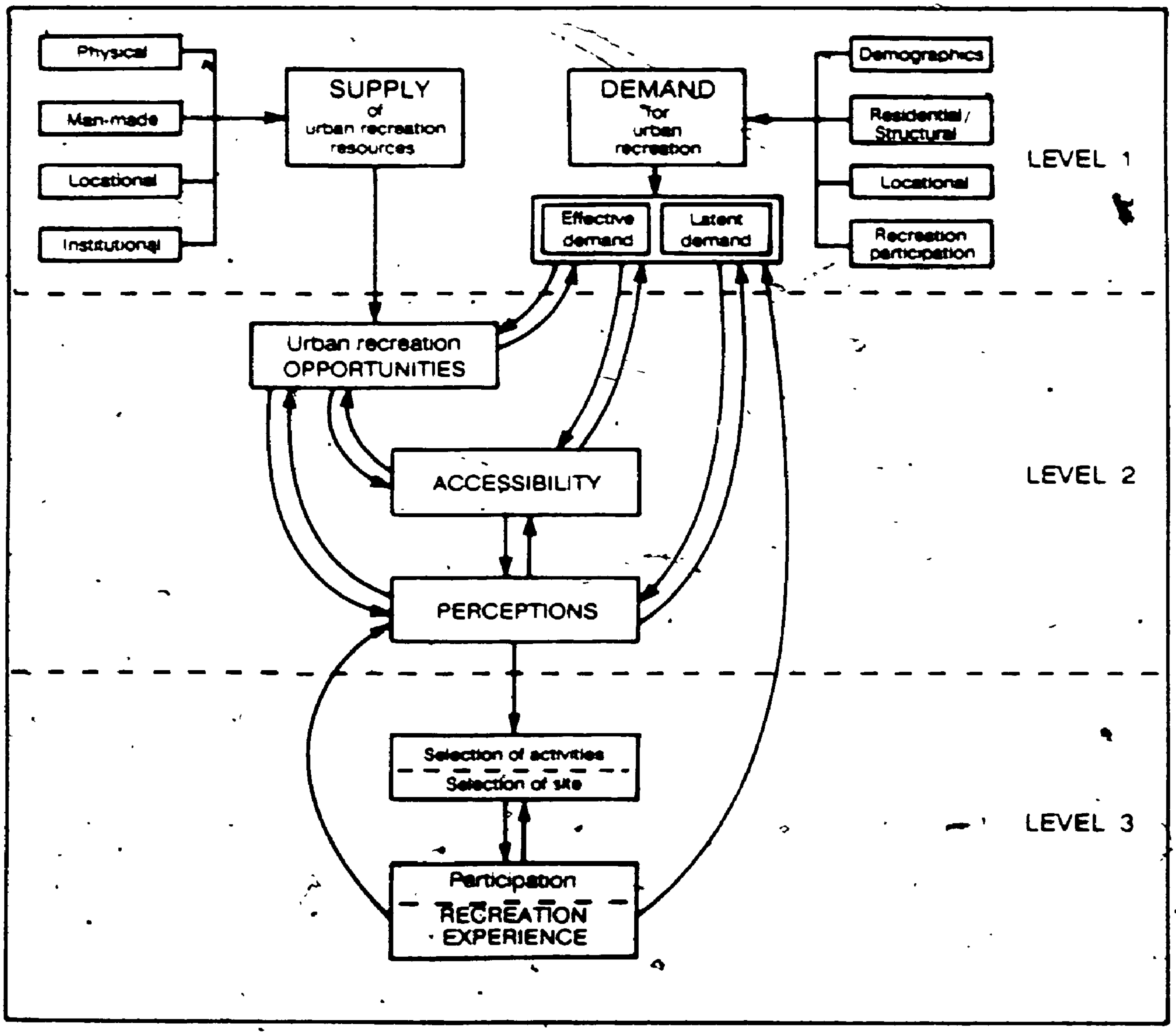
Ultimately, the contribution of supply and demand to the decision to participate is filtered through the "information field" which "incorporates both knowledge of outdoor recreation activities and the degree of awareness of the supply of facilities" (Wall, 1979b:10). Other than Mercer's (1975) detailed discussion of the role of perceptions in the recreation experience, this is really the first time that awareness was incorporated into a comprehensive theoretical model of recreation and it reflects the growing understanding of the importance of perceptions to recreation participation. In fact, Niepoth (1977) has proposed a model of recreation resource use and non-use that attributes the decision to participate solely to a function of motivation and of perceptions related to awareness and accessibility. Yet, despite this early emphasis, little attention has been afforded perceptions in the empirical literature although calls for their inclusion continue to be made (Patmore, 1983).

Wall's framework represents well the dominant view of recreation researchers over the past several years, and few refinements have been made to its basic structure. Pigram (1983) has offered a similar framework in his model of the decision process in outdoor recreation where he, too, separated between supply and demand systems, and identified general categories of factors which influence these systems. Characteristics making up the demand system include demographic factors, socio-economic factors, and situational factors, while resource factors and accessibility are regarded as those aspects effecting the supply system (Pigram, 1983:19-25).

Based largely on the schema put forth by the Bureau of Outdoor Recreation (1975) in the United States, Pigram's model differed from Wall's framework in one important way. While Wall places the perceptual influences in an intermediary position between supply and demand, Pigram indicates that perceptions are a function of supply factors ultimately giving rise to opportunities for recreation. In effect, perceptions are supply specific, he implies, because they do not exist in the absence of known recreation resources.

Even though the frameworks put forth by Wall and Pigram are oriented towards tourism and outdoor recreation, a conceptual model of urban recreation can be derived as a special case of those general models. In fact, the only necessary modifications are those that recognise the unique circumstances of the urban context. Emphasis still is placed on the separate functions played by the supply and demand systems, and as shown in Figure 2.2, the key roles of accessibility and perceptions are central to the model as argued by Wolfe (1964) and Wall (1970, 1979b). The three levels in the model describe shifts in the functional role of the components at each level. Level 1 is the objective, more tangible role played by the two systems.

Figure 2.2
A Conceptual Model of Urban Recreation



The supply system for urban recreation is comprised of arks and facilities which are characterised by the followng features:

- physical features such as size and shape;
- man-made features such as playground equipment, sports fields, and garden areas;
- locational features which are related to each component's position within the urban system; and
- institutional features which are related to programmes, timing, staffing, and scheduling of the various resources by the public recreation agency.

ll these factors distinguish each component in the supply ystem, and together, they define the objective character of he entire system within the community. At this stage in he model, the supply system can be regarded as a descripive inventory of resources designated as and available for ecreation.

The demand system for urban recreation is comprised of he community's population and is characterised by these actors:

- demographic factors such as age, income, and number of individuals in a household;
- residential/structural factors such as dwelling type, ownership of dwelling, and private ownership of recreational equipment (e.g. swimming pool);
- recreation participation which is a variety of activities functionally related to the community; and
- locational factors which are related to the contextual position of each household within the community.

hese factors give rise to the propensity to participate in rban recreation (Pigram, 1983), and collectively, distinuish between the various populations in the community.

The relationship between the supply and the demand systems is realised at Level 2 of Figure 2.2 through the effects of the accessibility between the systems, and the perceptions held by the population with respect to the available resources. This, then, is the subjective and more dynamic role played by the two systems. Accessibility operates in two forms. First, the physical distance between a supply point (e.g. park) and a demand point (e.g. household) has a demonstrated effect on the likelihood of participation (Oberg, 1976; Jansen-Verbeke, 1985). Second, the perceived distance between a household and known sites for recreation can modify the determining influence of the actual physical distance (Aldskogius, 1977). This latter view reflects the interdependence of these two elements in the model. While physical access must certainly effect the perceived accessibility of, say, an urban park, the perceived access is clearly influenced by the degree of familiarity that a household has, not only of that park, but of the entire supply system.

In addition to their modifying effect on the role of accessibility in the supply-demand relationship, perceptions also play a direct role in the relationship. Like Wall's (1970, 1979b) "information field", perceptions are shaped by the propensity to participate and by the resources known to be available for certain types of recreation. The degree of familiarity with the supply system is the key aspect of the relationship in that it transforms the supply of resources into a system of opportunities for recreation. Thus, the static roles of supply and demand at Level 1 have become meaningful at Level 2 through their dynamic and functional relationship.

Once the modifying effects of relative accessibility and perceptions have defined the supply-demand relationship, the selection of an activity and site occurs (the "decision choice" in Pigram's model) which gives rise to the participation, and hence, Level 3 in the model (Figure 2.2). The recreation experience resulting from this participation affects the perceptions of the participant which in turn could influence the subsequent selection of a site. Over time, the level of satisfaction generated by these experiences will modify the demand for urban recreation with respect to the propensity to participate. This is very much like the five phase recreation experience described by Clawson and Knetsch (1966) with its "recollection" phase which serves a similar feedback role. Recollections of the recreation experience will influence the perceptions held in the "anticipation" phase, and prior to the next recreation experience, will be drawn on in the selection of a recreation site and/or activity.

In summary, then, the independent systems of the supply of urban recreation resources and the demand for urban recreation which are products of a number of factors (Objective

Level 1) come together through the influence of accessibility and perceptions to produce a propensity to participate at known recreation opportunities (Subjective Level 2). The result of this process is participation in urban recreation which in turn generates experiences (Experiential Level 3) that influence both the perceptions held by the participants as well as their demand for recreation. Ultimately, it is this dynamic relationship between the urban recreation supply and demand systems which determine whether or not the recreation needs of the community are, in fact, being met by the existing public resources. This, then, is a question of equity as opposed to equality because opportunities are of concern rather than simply resources.

In the sections that follow, the literature related to supply and demand systems is examined to clarify the evolution of the conceptual model's Level 1 factors and their relationship brought about at Level 2. This overview is necessarily exploratory since the scarcity of research on these aspects specific to urban recreation (Dunn, 1980; Hayward and Weitzer, 1984) especially that concerned with its spatial properties (Smith, 1983a; Kirby, 1985) provides little definitive direction.

2.2.1 Aspects of Urban Recreation Supply

The delineation of urban recreation resources is ultimately an inventory of those parks and facilities that are defined to be a part of the supply system. While this seemingly does not present much of a problem, it is the character of those resources and not just their number that must be identified (Cushman and Hamilton-Smith, 1980). The public supply of recreation resources is a unified system of parks and facilities that is intended to equitably provide opportunities for various forms of recreation in the community. As such, each location contributes to overall provision, but to a different extent due to wide-ranging variations in their forms and functions (Whyte, 1968; Patmore, 1973). Further, physically similar resources frequently are regarded as having very different functions by users (Turner, 1985).

To capture this diversity in supply, researchers typically have used indicators such as size, presence of certain facilities, and other attributes of both a man-made and natural kind. Mitchell (1968) devised a "facility index" which assigned scores to the various features present in recreation areas as a means of specifying their relative attractivity. With this weighted index, he was able to account for a significant amount of the visitation to playgrounds. In contrast, Butler (1972) has argued that simply the presence of a site is more important in defining its role as a recreation opportunity than is an arbitrary measure such as area.

Underlying Butler's view is the importance placed on the distribution of sites, and hence their accessibility, in the community. The importance of locational aspects with respect to public services was pointed out by Lineberry (1977a), and Cowley, Fitzjohn, and Tungatt (1983) found that the locational pattern of recreation facilities affected the level of participation at them. In a study of selected facilities in London, England, Harrison (1983) reported similar findings, and also noted a directional bias to the selection of sites for use.

Only a few studies have looked at the patterns of distributions of recreation resources in urban areas in an attempt to understand the underlying processes affecting their locations. Lovingood and Mitchell (1978) contrasted the systems of public and private recreation resources in Columbia, South Carolina, and identified quite different patterns of provision. Their study was not, however, restricted solely to the urban area, and was confounded by differences in the functions the resources selected for study were intended to serve. Wall, Dudycha, and Hutchinson (1985) and Smith (1983b) have described the distribution of hotels in Toronto and restaurants in Kitchener-Waterloo respectively, to discern rationales for the distributions of these private sector services.

Although this research has provided useful insights into leisure service distributions, few studies have assessed such patterns for their approximation to a theoretically expected distribution, or even considered whether or not they should approximate one. In an early and often overlooked study, Rolfe (1964) compared the distribution of parks in East Lansing, Michigan, against a uniform distribution based on nearest neighbour analysis, presuming parks should be evenly distributed in a community. Smale (1983b) examined the differences in the distributions of municipal parks and of the population of London, Ontario, for the census years 1956 to 1976 using centrographic measures, and argued that the "spatial statistics" describing these distributions should coincide both statistically and graphically if equal opportunity is being achieved for a given study year. From a conceptual standpoint, Mitchell's (1969) theory of public urban recreation represents the lone effort to develop a normative model of the spatial distribution of urban parks and playgrounds based on central place theory and recreation space standards.

The principal weakness of all these types of studies is in the limited way that each site was defined as an opportunity for recreation. In most cases, each site was treated equally thereby assuming that all sites provided the same opportunity. In circumstances where a site was weighted by some objective measure (e.g. area), opportunity was assumed to be solely a function of some arbitrary physical attribute associated with each location. These approaches fail to make the important distinction between resources and opportunities (Burton, 1971, 1976a). Resources are the objectively defined physical locations designated for recreational purposes (Objective Level 1 in Figure 2.2). As such, they can be defined according to their form and function. Opportunities, on the other hand, are defined in terms of the ability of the resource to accommodate the demand for recreation (Subjective Level 2). Therefore, an opportunity, or "effective supply" as Burton (1971) has referred to it, is made up of not only the physical characteristics in its rôle as a resource, but more importantly, is also comprised of less tangible qualities in its role as a part of the recreation supply system. Clawson (1984) has proposed a means of defining a rural resource as opportunity through what he terms the "effective acreage equivalent". His index assesses the actual surface area of a resource in terms of its utility for recreation, or "effective area". Still in early development, Clawson acknowledges the difficulty in transforming this notion to an urban context where recreation sites have a broader range of potential uses.

The ability of a resource to accommodate recreation demand is, in fact, ascribed by the community's residents through the perceptions they hold of each site with respect to awareness, attractivity, accessibility, and potential uses (Cooksey, Dickinson, and Louvis, 1982), and their revealed preferences in the usage they make of the sites in the system (Allen and Brown, 1981). Without these additional subjective attributes, a resource's full capability as an opportunity remains hidden. Beaman and Do (1976) were among the first to recognise the greater importance of perceptions than physical attributes in defining recreation opportunities especially with regard to the site's attractivity. Further, Henderson and Voiland (1975) and Hayward and Weitzer (1984) were able to demonstrate the role of perceptions in determining not only site preference, but also potential site use.

The importance of perceptions in defining each recreation resource as an opportunity (at Subjective Level 2 in the conceptual model) also has been demonstrated in the work of Elson (1976), Aldskogius (1977), and Dahms and Wall (1979) all of whom found perceptions of and preferences for certain sites to be the key determinant in their use. In particular, perceptions of a resource's attributes (i.e. attractivity) and its overall functional ability have shown to play the greatest roles in site selection (Peterson, Dwyer, and Darragh, 1983; Jones, Kriesel, and White, 1984). However, the level of opportunity perceived by recreationists to be available at a site is typically less than intended given the physical resources in place (Airola and Wilson, 1982) and this may be contributing to the lower than expected amount of use of urban parks. Not unexpectedly, the demand for recreation expressed by <u>individuals</u> does not embrace all the possibilities offered by a park, and as a result, these individuals have somewhat limited expectations of that park. Therefore, even though the supply system may be providing all the necessary <u>resources</u> to accommodate a variety of recreational needs, the set of <u>opportunities</u> perceived to be available by a community's residents is likely quite variable and specific.

In summary, then, in order to reflect the recreation supply system in terms of its function as an opportunity system, not only the physical characteristics of the sites, but also the population's perceptions of them must be incorporated. This mix of physical and perceptual, as well as locational, indicators provides a better means of defining the true spatial nature of the supply system (Pacione, 1982b), and hence, its potential surface.

2.2.2 Aspects of Urban Recreation Demand

The concept of recreation demand, although traditionally based in economics, has come to be regarded in a variety of ways. In the neoclassical economic sense, demand is the "quantity or number of units of the good or service demanded at specific levels of price" (Clawson and Knetsch, 1966:115), and the assumption associated with this relationship is that as prices increase, the amount demanded decreases, all else being equal. However, most public recreation resources, such as urban parks, have no fees or charges associated with them and hence, there is no meaningful price schedule (Wennergren and Johnston, 1979). As a result, the majority of recreation researchers has used measures of participation or visitation rates, or in some cases preferences, as indicators of demand even though they reflect only that quantity demanded which has actually been "purchased" or "consumed" at a single point in time. However, such measures have been generally regarded as the best available indicators of recreation demand (Burton, 1971).

While studies of recreation participation and visitation are fairly abundant (e.g. most notably, the CORDS and TORPS series in Canada), few have been conducted at a specifically urban level. Numerous authors have bemoaned the lack of research on urban recreation participation patterns (Mladenka and Hill, 1977; Dunn, 1980; Collins and Patmore, 1981; Hayward and Weitzer, 1984; Kirby, 1985) and have called for increased activity to develop the understanding of demand for recreation. For the most part, the work that has been done has concentrated on user profiles (for example, Godbey and Blazey, 1983) or on general population surveys of participation patterns (for example, Kraus, 1983) in order to identify personal and demographic characteristics of the participants.

A number of studies of this type have shown the effect that demographics such as age, income, and family structure have on recreation demand, or more precisely, recreation participation at selected public facilities (Vickerman, 1974a, 1974b; Harvey, 1977). For example, Smale (1984, 1985) found a strong positive relationship between indicators of family affluence and membership at a community fitness facility as well as the effects of other demographic measures such as age and family size. And even more recently, Schroeder and Wiens (1986) showed that significant differences existed between the users and non-users of public recreation facilities in Tulsa, Oklahoma, with respect to several demographic measures such as number of children at home, educational level of the heads of household, and family income.

In general, these studies have ignored spatial considerations, and yet ironically, research that has attempted to determine those factors that help to explain the use of urban recreation facilities often has found some aspect of accessibility or proximity to play the most important part (Dee and Liebman, 1970; Mitchell, 1973; McAllister, 1977; Stopher and Ergun, 1979, 1982). However, since these studies have been site-specific, and frequently activity-specific, they fail to explain variations in recreation demand across the entire community. Thus, spatial patterns of the urban recreation demand <u>system</u> remain largely unknown. Therefore, depicting the recreation demand system should, in part, involve the mapping of the various intensities of participation in a selection of urban-oriented activities or the frequency of visitation to all parks and facilities. This implies, as Cooper (1981) has noted, that the relative location of residents in the community with respect to the supply system is a key factor in determining their use of recreation opportunities. Jones, Kriesel, and White (1984), too, have reported on the effects of the spatial structure of the community on participation patterns. They found that depending on the distribution of users, perceived barriers such as railways, main roads, and so on, frequently contributed to lower than expected levels of use at specific facilities.

A complete definition of recreation demand is not, however, restricted solely to the present participation or use patterns. Measures of these patterns represent only one aspect of demand, that being "effective" or "expressed" demand (Wall, 1979a). Another dimension of recreation demand is "latent" demand which under different circumstances would be effective, but is constrained by a variety of factors. These constraints are normally associated with personal and demographic characteristics, or with locational factors such as accessibility or awareness, or with both (TORPS, 1978). Wall (1981) has separated latent demand into two categories based on these constraints: (1) "potential" demand which is constrained by personal and demographic factors, and (2) "deferred" demand which is constrained by locational factors. In essence, latent demand in either of these forms could become effective demand should the constraints to its expression be removed.

The difficulty associated with latent demand, of course, is in measuring it when it does not take on a clear, observable form as does effective demand. In fact, because of its very nature, Patmore (1983) argues that latent demand cannot and should not be measured directly. Rather, latent demand can be inferred by identifying those segments of the population that share the demographic and residential-structural characteristics of current recreation participants (effective demand), but are not participating themselves.

It should be pointed out, however, that even under ideal conditions where all the constraints to demand have seemingly been removed, there will still remain a proportion of the community's population that will not make use of some or all of the recreation opportunities. A common misconception in the recreation literature is that there are "users" and "non-users", and that the non-users will become users once conditions permit. Rather, non-users are in reality that portion of the community that has no demand for recreation at public resources, and maybe never will, regardless of the opportunities made available (Romsa and Hoffman, 1980). Therefore, three, not two, basic groups can be identified: (1) <u>users</u> (effective demand) who are not experiencing or have overcome constraints to their participation; (2) <u>potential users</u> (latent demand) who would be users except they are experiencing varying degrees of constraint to their participation; and (3) <u>non-users</u> (no demand) who simply choose not to participate even though they may be aware or within easy access of recreation opportunities (Niepoth, 1973).

These distinctions are important in that they underline the weaknesses associated with the use of surrogate measures of recreation demand such as population density which is a frequently utilised standard. The measurement of demand, particularly latent demand, is difficult and is the main reason for the dominant use of effective demand alone in most analyses (Burton, 1971). Yet, as Beaman and Do (1976) have suggested, information about effective demand may be all that is needed since total use ultimately is the primary concern of researchers and managers. However, in order to properly represent the urban recreation demand system, these types of demand must be separated between so that different parts of the community may be more realistically represented. To do this, all factors associated with effective demand must be identified, and these used to infer patterns of latent demand in those neighbourhoods or zones where it is not currently expressed. In essence, this process identifies not only effective demand, but identifies where there may be a "propensity to act" (Bureau of Outdoor Recreation, 1975) on the part of a community's residents.

Apart from the aforementioned demographic and residential-structural factors, perhaps the most important factors affecting urban recreation demand are the perceptions held by the community's residents, and in particular, awareness (Maw, 1974). Awareness of available opportunities for recreation has been shown to be a key determinant of use in a number of recent studies (Butler and Booth, 1975; Stynes, 1982; Smale, 1983a; Spotts, 1983; Spotts and Stynes, 1984), and its inclusion in recreation demand models continues to be called for by many others (Knox and MacLaran, 1981; Iso-Ahola and Mannell, 1985). Since awareness necessarily precedes use, resident perceptions of the availability of recreation resources are key determinants of effective demand and indicators of latent demand (Cooper, 1981; Shin, 1982). These propositions are supported by the earlier work on consumer behaviour and cognition by Bowlby (1972) and Hanson (1976) which attempted to demonstrate how behavioural decisions are constrained by awareness of a limited set of opportunities. The implications of this research is especially important for recreation behaviour given its greater susceptibility to preferences and tastes (Rodgers, 1973). Related to this point, preferences for particular recreation sites are typically a function of the perceptions of the adequacy of known opportunities -- in other words, their attractivity and functional utility (Cooper, 1981; Ewing, 1983; Peterson, Dwyer, and Darragh, 1983).

The perceived functional utility of recreation sites is usually determined by the behavioural needs of the potential participants. The types of recreation activities in which individuals choose to participate will influence the perceptions they carry with regard to known opportunities, and ultimately, affect their choices and use of sites (Peterson, Dwyer, and Darragh, 1983; Hayward and Weitzer, 1984). As a result, knowledge of recreation participation preferences can further clarify the distincton between effective and latent demand by separating between segments of the population who may and may not be inclined to use the public recreation resources. Ironically, as Howell (1979) has observed, even though we typically have information on the activities in which a community's residents most frequently participate, and on what sites are most frequently used, we often do not know which activities are participated in at each site. Harrison (1983) has argued that such knowledge is not really necessary because she has shown that activity participation is unrelated to the site. She does point out, however, that the frequency of participation in site-related activities is influential in the determination of a propensity to use these sites; hence, latent demand.

Once the effects of each of these components have been integrated into a composite indicator of urban recreation demand (the transition from Level 1 to Level 2 in the conceptual model), a more responsive measure will have been devised that incorporates both effective and latent demand. Such a measure, when assigned spatial properties, would reflect the relative level of demand at any point in the community, and ultimately would provide a more comprehensive portrayal of the urban recreation demand system.

2.2.3 Urban Recreation Supply-Demand Relationships

Any consideration of the demand for recreation must include a consideration of the supply. Effective demand for recreation opportunities could not exist without the supply available where it is expressed. Most researchers agree that supply does effect demand, but they have not been able to determine the extent of the effect (Beaman, 1976b) nor do they agree on the relative importance of it.

Beaman, Kim, and Smith (1979) have demonstrated the significant contribution a measure of supply made to the explanation of participation in a selection of activities, a finding later validated by Smith and Lazarowich (1980). In contrast, Buckley, Petursson, Hallman, and McCleary (1979) concluded that the distribution of recreation resources did not appear to affect rates of use in their study of southern Ontario. Mercer (1973) also has suggested that observed patterns of recreation behaviour may be due to the presence of meaningful opportunities, but that these patterns are simply the overt expression of a need that already existed. Thus, the notion that the demand may have been "supply-induced" (Burton, 1971) does not change the fact that it is still "effective" demand. Further to the point, Moeller and Echelberger (1974) argue that supply-induced demand is still just "demand" since it is the expressed use of facilities and how it came about is of little real concern.

In contrast, Knetsch (1974) feels that the full meaning of demand must be kept separate from "consumption" (i.e. effective demand) arguing that a concentration on the latter will result in the allocation of more of the same types of resources which will perpetuate inequities. Further, responding solely to effective demand may mean that unprovided for areas will continue to be bypassed irrespective of important latent demand that may exist there.

The solution to this problem is not, however, to arbitrarily allocate resources to areas which currently are supply-poor. While this approach may ensure that previously unrecognised latent demand will be accommodated, it also may mean that limited resources will be located in areas where demand for them is negligible. As a consequense, unneeded supply would go unused. This non-use phenomenon has been observed by numerous researchers (Bangs and Mahler, 1970; Gold, 1972, 1973, 1976, 1977; Johnson, 1978; Johnson and Beaman, 1979) and is to a large extent the result of the application of standards, and the assumption of universal, equal demand.

Thus, some attempt must be made to separate between the effects of the supply of and demand for urban recreation opportunities. Without attempting to remove interaction effects of these two systems, the recreation opportunity spatial system becomes less meaningful.

An experimental approach conducted by Burton (1971) in Birmingham provides a conceptual starting point for the separation of the systems. Burton identified areas in the city which had very similar socio-economic compositions, but were quite different in levels of opportunities for recreation, and attempted to attribute any variation in recreation behaviour to the differences in provision. Although conceptually advanced for the time, the study was poorly executed. The primary reason for the failure was the use of individual activities and a facility-specific view of the recreation areas which, along with the relatively small sample size, provided very low percentages of participation, and made analysis untenable (Burton, 1971:262). However, an extension of the basic premise seems quite warranted.

The demand for recreation is expressed through participation in a number of activities. The activities in which people choose to participate are a function of their experiences, preferences, and a number of other personal characteristics. The satisfaction that they derive from their participation is, in large part, a function of the environment within which it occurs. The environments people select for their participation are chosen from a known set of opportunities, therefore, for their perceived capability to provide satisfaction. The supply of public recreation opportunities is intended to provide these environments, but because of their diverse nature, these environments have highly variable capabilities to satisfy the many recreation activities normally engaged in at these locations. This is due not only to the differences in their physical characteristics, but also in their perceived attributes and capabilities (Iso-Ahola and Mannell, 1985). Therefore, the proportion of the effective demand for these activities that is expressed at these public resources is a function the resources' ability to satisfy demand. Hence, participation not being expressed in familiar and available resources is demand independent of that supply.

The corollary of this rationale is that the demand and the supply systems can, in fact, be separated conceptually, and with the appropriate measures taken of each, can be expressed as distinct spatial systems operating within the recreation opportunity spatial system of the community. It is the integration of the two systems that should reveal any inequities in provision in the community under study and whether they are the result of misallocation or underprovision of opportunity vis-a-vis demand.

2.3 MODELLING THE URBAN RECREATION SYSTEM

The actual modelling of recreation supply and demand systems has been an area of research which has placed little emphasis on the urban context and has, rather, focused on rural recreation (Collins and Patmore, 1981). This work has attempted to describe, and sometimes explain, the systems by examining the observed use of recreation resources in terms of those factors which appear to be associated with it.

Much of this work has been conducted by economists and is characterised by two basic features: (1) it has relied on economic assumptions about the nature of the demand curve for recreation, and (2) it has typically emphasised either supply factors or demand factors, but rarely both (Moeller and Echelberger, 1974). The latter feature is especially ironic given that much of the theoretical literature has maintained that recreation demand (or "effective" demand essentially) is a function of the supply of recreation resources, the demand for those resources, and the "cost" associated with using them -- typically measured in terms of money, time, or distance (Clawson and Knetsch, 1966; Burton, 1971). However, the research also is characterised by site-specific studies where variations in supply are presumed absent or equal for all users.

2.3.1 Recreation Demand Modelling

The most influential work in reoreation demand modelling has been Clawson and Knetsch's (1966) Economics of Outdoor Recreation which remains the most comprehensive analysis to date of the demand for outdoor recreation (Archer, 1976). Clawson and Knetsch (1966) lay out the basic assumptions associated with an economic view of demand, the elements which make up demand for recreation, the factors which appear to contribute to demand, and the strategies for estimating demand for specific resources and for the recreation experience.

Essentially, recreation demand models have taken the following form:

$$U_{ij} = f(D_i, S_j, C_{ij}) \qquad [2.1]$$

where Uij (the use made of a recreation resource j by a population at location i) is a function of Di (the demand for recreation at location i), Sj (the supply of recreation resources available at location j), and the Cij (the "cost" associated with the use of supply j by population i). In its most basic form, demand is assumed to be related to the total population with variations in population reflecting variations in levels of demand. Costs (Cij) frequently are assumed to be associated with the distance between the recreation resource (Sj) and the population (Di). As mentioned, many studies have been site-specific so equation [2.1] can be generalised to this form:

$$U_{i1} = f(D_i, C_{i1}) \qquad [2.2]$$

where Ui1 is the use made of one recreation resource by a population at location i.

The two main issues associated with the use of this model and others like it are concerned, firstly, with what elements should be used to represent each component in the model, and secondly, with the structure of the model itself -- that is; the actual relationship between the components and their elements. With respect to the first issue, numerous examples exist in the literature where researchers have equated total population, annual average income, number of persons in a household, and so on with the demand component (Vickerman, 1974) arguing that these variables will reflect the relative degree of pressure brought about by a set of origins. Similarly, the supply component has come to be most frequently represented by variables such as total area of the destination, number of campsites, and/or proximity to water, and these are intended to provide an indication of the drawing power of the recreation sites. Unfortunately, no real attempt has been made to fully represent the demand or the supply component by means of a theory or conceptual model like that presented earlier.

With respect to the distance or "cost" component, the most frequently employed indicator has been a measure of Euclidean distance. In addition to its ease of calculation, empirical evidence has not conclusively shown -- at least for regional recreation models -- that any other measure will do significantly better at explaining the effect of distance on the relationship. However, numerous researchers have expressed doubts about the generalisability of Euclidean distance to all spatial systems (Ewing, 1980), and more recently, some empirical efforts have demonstrated improved results when employing alternative measures such as perceived distance or access (Staplin and Sadalla, 1981; Smale, 1982). With such limited definitive direction, especially at the urban level, some effort is needed to better understand the role of distance in determining the use of recreation opportunities.

The second issue concerning the actual relationship between the components in the general model of equation [2.1] is that attention has been focused more on the theoretical rationale for the relationship than on the nature of the contribution of each component (Ewing, 1980). For the most part, the model has taken the form of the "gravity model" which is a social science analogy to the physical model describing the gravitational pull between two objects. In effect, the gravity model is simply a special case of the general model, and is expressed as follows:

$$I_{ij} = k \frac{O_i D_j}{d_{ij}^b} \qquad [2.3]$$

where Iij is the interaction between an origin i and a destination j, and is function of the product of some measure of origin "emissivity" (i.e. recreation demand) and some measure of destination "attractivity" (i.e. recreation supply) divided by the distance between them (Cesario, 1973, 1974; Uysal and Crompton, 1985). The values of the constants k and b are estimated although in earlier efforts, b was typically set at 2.0.

Although the gravity model has seen innumerable applications in an enormous array of forms (especially in tourism forecasting), its basic structure has remained essentially unchanged (Archer, 1976). Despite the numerous criticisms of the model for its lack of a solid theoretical foundation (Sheppard, 1978; Ewing, 1980), it continues to be used because of its ease of application, its intuitive appeal, and its relatively successful ability at describing the interactions between origins and destinations.

2.3.2 . The Concept of Potential

The potential index has provided a meaningful mechanism for describing the spatial qualities of recreation supply and demand systems. As a measure of relative location or accessibility (Warntz and Wolff, 1971), it emphasises the relative degree of opportunity that exists at any location (Rich, 1981). This is particularly advantageous in describing recreation supply in that it avoids the theoretical weakness of assuming that opportunity extends only to the nearest resource irrespective of that site's capability to satisfy demand. Similarly, a potential index of the recreation demand system provides a relative measure of the "pressure" which the population exerts at any location. Thus, in a temporal context, any shifts in demand can be described in terms of their effect on the entire system -- where diverted or induced demand is increasing and where it has diminished.

The potential index can be derived directly from the gravity model and is based on the notion that if the gravity model describes the relationship between all pairs of origins and destinations in the system, then the relationship between all origins and one destination is a function of the aggregate weight of those origins constrained by their distance from the destination. This reflects the "propensity for interaction" (Pooler, 1982) in the system and can be expressed as follows:

$$\left[\frac{D_1 S_j}{d_{1j}^b}\right] + \left[\frac{D_2 S_j}{d_{2j}^b}\right] + \ldots + \left[\frac{D_n S_j}{d_{nj}^b}\right] = \sum_{i=1}^{n} \frac{D_i S_j}{d_{ij}^b} \qquad [2.4]$$

Since Sj is common to all origins in this form, it can be simplified to:

$$\left[\frac{D_1}{d_{1j}^b}\right] + \left[\frac{D_2}{d_{2j}^b}\right] + \ldots + \left[\frac{D_n}{d_{nj}^b}\right] = \sum_{i=1}^{n} \frac{D_i}{d_{ij}^b} \qquad [2.5]$$

And finally, this becomes the more familiar equation of potential:

$$V_j = \sum_{i=1}^{n} \frac{D_i}{d_{ij}^b} \qquad [2.6]$$

where Vj is the potential index for destination j for all origins i. Thus, Vj is a measure of the relative accessibility of destination j for all origins in the system under consideration, and is subject to variations in Di -- the demand system.

Similarly, the potential index for origin i can be expressed as:

$$V_i = \sum_{j=1}^{n} \frac{S_j}{d_{ij}^b} \qquad [2.7]$$

where Vi is the potential index for origin i for all destinations j. Here, the index describes the relative accessibility of an origin i to all destinations, and it is subject to variations in the supply system (Sj). For both indices, the parameter b has typically been assumed to be equal to 1.0 because of the difficulty in trying to estimate its value by treating the index like a model and fitting the data to it (Warntz, 1965). A complete description and explanation of the derivation of the potential index can be found in Rich (1981) and Pooler (1982).

Measures of potential have been used by researchers to describe spatial variations in systems under a variety of circumstances (Rich, 1981). Population and income potentials have received the greatest amount of attention (Warntz, 1965, 1978, 1979) although examples of the use of potential indices also exist for physicians (Schultz, 1975), dentists (Bradley, Kirby, and Taylor, 1978), scientists (Inhaber and Przednowek, 1974; Inhaber, 1975), and even fruit and vegetables (Warntz, 1959). The examination of potential surfaces of the ratio between related systems has been considered by a few researchers (Schultz, 1975; Coffey, 1977, 1978; Coffey and Matwijiw, 1979), but the intent of this work was generally to define regions of locational desirability. However, Coffey (1977) has speculated on the utility of this approach to address social welfare concerns.

With respect to the use of potential indices in recreation research, Choguill (1975) used potential indices to describe the demand for air travel in the New England area by business and pleasure travellers. In this work, he repeatedly calculated the potential indices with a range of different values for the b parameter (from 0.10 to 3.00) in order to arrive at the best fit as indicated by the correlation coefficient.

In a further advancement of the use of the index, Butler (1972) was the first to consider the interpretive advantages of contrasting population potential maps with maps of recreation-resource potential (e.g. provincial parks) as a means of describing relative accessibility to these opportunities. His propositions were extended in the work of Ross and Ewing (1976) who, rather than visually comparing the two potential surfaces, mapped the ratio of population and parks potentials along the Windsor-Quebec corridor. Even though they introduced the notion of calculating a ratio of the potentials, their interpretation was restricted to relative accessibility although they recognised the importance of further investigation into the nature of the parameters in the model.

Independent of earlier work, Smale and Butler (1982) hypothesised the structure and interpretation of the potential ratio, and expanded the theory by attempting to address the complexities of recreation supply and demand systems. Their attempt to devise more meaningful measures of these systems along the lines described earlier introduced a concern for equal opportunity of provision of public recreation resources which had not been considered previously.

2.3.3 Potential and the Recreation Opportunity Spatial System

As measures of relative accessibility, potential indices provide an intuitively worthwhile means of representing the dynamic character of both the urban recreation supply and demand systems. The concept of potential -- as an extension of the gravity model -- provides the process by which the interrelatedness of the components comprising the systems can be described effectively.

With respect to the recreation supply system, the specification of those features which describe the unique character of each resource as an opportunity for recreation can be reflected in a potential surface that describes more than just the location and size of each site. The surface allows for an interpretation that embraces the effects of each site's contribution to the entire system, and therefore, the overall level of provision of recreation opportunities. Similarly, the recreation demand system, when represented by a surface, will reflect the overall community "pressure" being placed on the available resources.

Even in these simple terms, there are real advantages to examining the urban recreation environment in this manner. Yet, by extending the theory to include a consideration of the derivation of potential measures directly from the gravity model, one moves away from the arbitrary assignment of weights to each of the variables to a process of estimating their values by operationalising the model. Therefore, with all the features described in the conceptual model of urban recreation taken into consideration in the fitting of the gravity model to the use of a community's urban parks, the "true" character of the two systems can be more closely approximated. Each surface will reflect, then, the increased and diminished levels of supply and demand at every location within the community relative to all other locations.

Once the surfaces of the two systems have been estimated, they can be integrated by taking the ratios of their standardised values at the same points in the surface. This process generates the <u>recreation opportunity spatial system</u> which, as described earlier, should be a smooth surface if equity -- or more precisely, equal opportunity -- is being achieved in the community. This surface reflects the influence of all the measures at every supply and demand point in the community; and the occurrence of peaks and pits reveals areas where supply is exceeding demand and where the demand is greater than the available supply.

In order to explore this thesis, a comprehensive data set covering both the supply and the demand systems was compiled for the Town of Oakville, Ontario, which included each of the components described in the conceptual model of urban recreation. With these data, a gravity model is applied to the users of the town's parks, and from this model, the potential measures derived for each system. The first step of this process -- the collection, organisation, and description of the data -- is described in the following chapter.

Chapter III

OPERATIONALISING THE CONCEPTUAL MODEL

INDICATORS OF URBAN RECREATION SUPPLY AND DEMAND

3.1 DATA COLLECTION PROCEDURES

Data for the study were derived from two principal sources: (1) a site-by-site inventory of the parks in the Town of Oakville, and (2) a comprehensive survey of residential households within the Town's administrative boundaries. Both sets of data provided the basic information which makes up the components of the conceptual model presented in the previous chapter, and were the primary focus of attention in the derivation of the recreation opportunity spatial system.

3.1.1 Study Area

The Town of Oakville, Ontario is situated on the shore of Lake Ontario between the cities of Burlington to the west and Mississauga to the east (see Figure 3.1). Although still a town, Oakville has a population of 75,773 people living in an area of 138.15 square kilometres (Statistics Canada, 1982). Virtually the entire population is located near the shoreline with the northerly parts of the town remaining undeveloped or devoted to agricultural use.

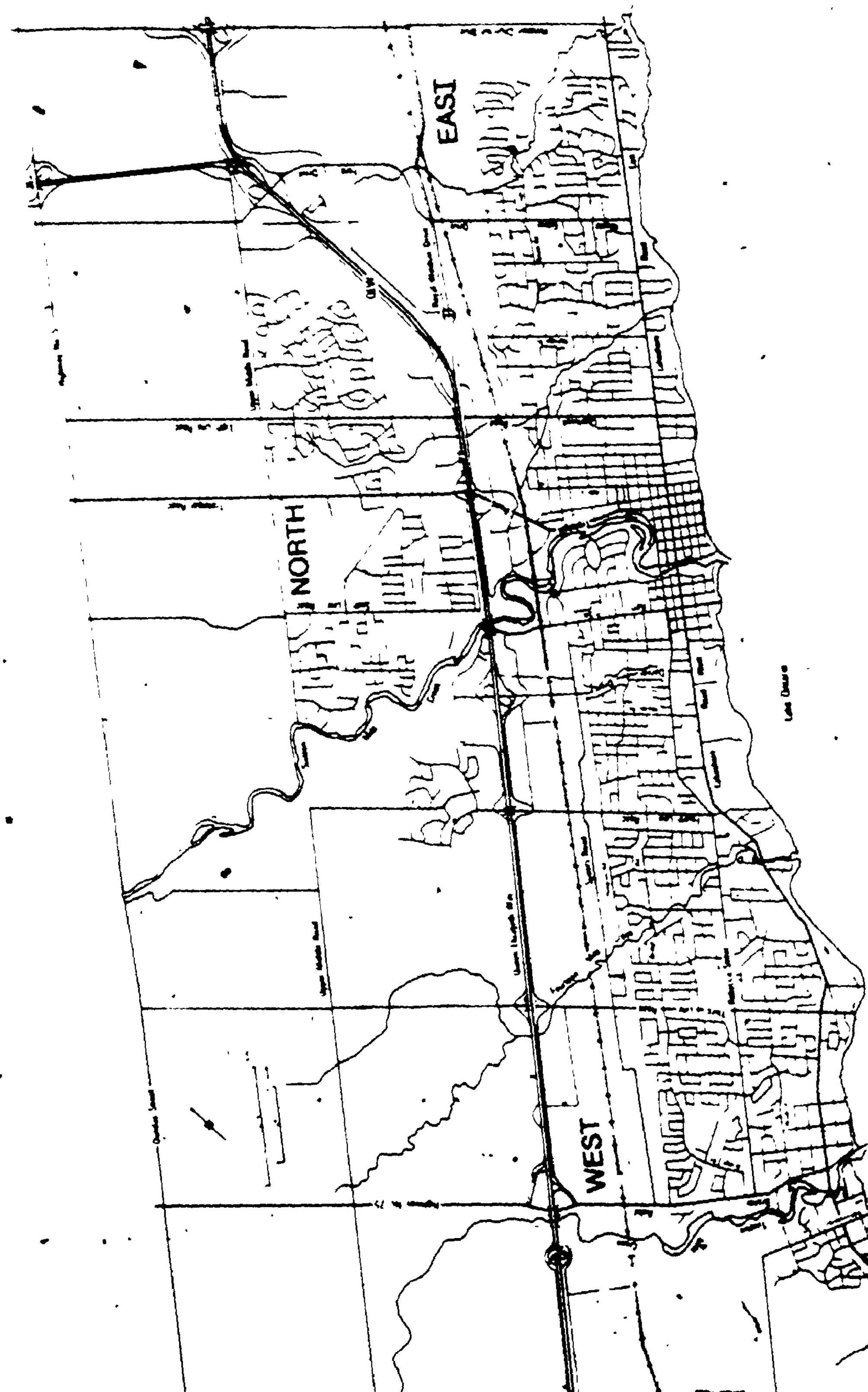


Figure 3.1

Study Area: Oakville, Ontario

The Town's Parks and Recreation Department maintains and operates a variety of public recreation facilities including three arenas, six outdoor swimming pools, two indoor swimming pools, a number of community meeting halls and recreation centres, and 114 public parks which are the focus of this study. For the most part, the parks and facilities have been planned and developed according to traditional planning approaches -- that is, the application of standards. As a result, these resources appear to be reasonably well distributed across the community when examined in terms of equality of provision.

The Town of Oakville was selected for this study for a number of reasons. Primarily, it provided a community of manageable size in terms of both area and population that had a well developed and operating parks system. The population is relatively diverse in demographic composition with quite distinct "sub-communities" identified with specific areas of the town. In addition, some interesting physical characteristics which may have an influence on both the recreation supply and demand systems include two large creeks (Sixteen Mile and Twelve Mile) and a major highway (Queen Elizabeth Highway) which serve to partition the town into fairly distinct regions. As indicated on Figure 3.1, these "boundaries" serve to divide the town into three well defined units -- the West, East, and North -- which are used as the planning divisions by the town.

On a more practical level, the Oakville Parks and Recreation Department provided some limited support in terms of both financing and field workers which allowed for a larger scale project than would have been possible otherwise. Further, the principal investigator is intimately familiar with the town and its development thereby avoiding the possibility of misinterpreting the meaning of some of the descriptive indicators used in and generated by this study.

3.1.2 Urban Recreation Supply: Parks Inventory

The parks inventory was carried out using two strategies for generating data. One strategy involved site visits to all 114 parks developed and operating in the town. The Parks and Recreation Department also owned several other open spaces within the town's boundaries which were designated to become parks, but because they had not as of yet been developed nor become a part of the routine schedule of maintenance, they were not included in the list of parks making up the recreation supply system. At the time of this inventory, these excluded areas were known to very few of the community's residents, and therefore, could not be part of most residents' perceived opportunity set.

The second strategy involved the use of large scale maps (1:400) of the town's polling subdivisions which illustrated the specific boundaries of each of the parks. These maps were used to derive other measures not obtainable through the inventory which assisted in reflecting each park's role as an opportunity for recreation.

3.1.2.1 On-site inventory

The on-site inventory involved the recording of the number of or presence of recreation facilities, park furniture, playground equipment, and selected physical attributes that characterised each of the parks. Table 3.1 shews the general categories of features which were recorded as well as the way in which they were measured.

The inventory provides a description of the resources present in each park and embraces the man-made and physical components of the conceptual model. The institutional component is not addressed here because public parks, unlike facilities such as swimming pools and arenas, do not have fixed schedules nor programmes dictating when the resource can be used. Rather, the use of the public parks is "self-determined" by recreationists and the institutional component has no real effect in this particular case.

Additional information about each park that was provided by the Parks and Recreation Department's official records included the park's <u>area</u> in hectares, and the park's <u>classification</u>. Four classes of parks are recognised in Oakville:

1. <u>Major parks</u> are the largest of the urban parks and are intended to serve the needs of the entire community;

2. <u>Community parks</u> are large urban parks frequently associated with a school yard or groupings of facilities, and are intended to serve the needs of two or more neighbourhoods;

3. <u>Neighbourhood parks</u> are smaller urban parks (approximately 1 to 4 hectares) situated in residential areas and are intended to serve the needs of a neighbourhood population; and

Table 3.1: Park Characteristics Recorded in On-site Inventory

Category	Feature	Measure*
FACILITIES	Washrooms	n
	Sports fields	n
	Tennis courts	n
	All purpose courts	n
	Baseball fields	n
	Swimming pool	p/a
FURNITURE	Picnic tables	n
	Park benches	n
	Barbeque pits	n
	Shelters	n
PLAYGROUND EQUIPMENT	Swings	n
	Slides	n
	Teeter-totters	n
	Climbers and "toys"**	n
PHYSICAL	Garden beds	n
	Parking	p/a
	On the lake shoreline	p/a
	Encompasses creek	p/a

* n = total number of each type of feature
p/a = presence (1) or absence (0) of feature

** e.g. small structures, animal rides, rope and tire constructions, and so on.

4. Parkettes are the smallest of the public parks and they serve specific functions both in neighbourhoods and in commercial areas. These parks are typically corner lots geared towards special needs defined by their location.

This classification is typical of the schemes employed by many communities, and is based on a standards approach to planning (Gold, 1980). Such a classification -- based primarily on the area of the park -- provides a means of facilitating the maintenance programme within the public recreation agency, and in fact, has little real meaning to the community's residents. As a feature within the institutional component of the conceptual model, it, too, has been excluded from the analysis, but is used later for descriptive purposes.

3.1.2.2 Derived indices of supply

Two other measures describing locationally related features of the parks were derived from the large scale base maps (1:400) of the town's polling subdivisions. These measures are the accessible perimeter of the park, and the shape of the park. The inclusion of these indicators was prompted by the work of Whyte (1968) who observed the tendency of park users to orient themselves towards the edges of parks. His often cited discussions of the importance of a park's perimeter and the possibility that linear parks provided greater opportunities for recreational use, provided the impetus for the two indicators of these concepts.

The accessible perimeter of each park was calculated by first measuring the total length of the park's perimeter from the outlines on the base maps. Then, the lengths of those portions of the perimeter which are freely and easily accessible to the public were summed, and divided by the total length. A park's perimeter was regarded as inaccessible if it bordered on private property, shorelines, or other natural barriers such as ravines. This measure, which ranges in value from 0.0 to 1.0, provides an indication of the "effective [area]" (Whyte, 1968:189) of a park; that is, that part of its edge which may be the most often used and familiar to the park's users.

The measure of shape of the park reflects the degree to which the park takes on a, more or less linear form. This, too, should emphasise the importance of the edges of the parks. The shape measure that is used here is one suggested by Austin (1984) which he derived from the work of Horton (1932 cited in Austin, 1984) and Gibbs (1961). Austin's measure is based on the "compactness" of the park's shape in relation to a standard shape -- the circle. His shape index has a range of values from 0.0 for a line to 1.0 for a circle, and is calculated using the following equation:

$$SI_j = 1.2732 \frac{a_j}{L_j^2} \qquad [3.1]$$

where SIj is the shape index for park j, aj is the area of the park, and Lj is the length of the major axis -- that is, the distance between the two most distant points on the park's perimeter. This measure is more suitable than the more frequently used Boyce and Clark (1964) index which has been criticised recently for its inability to capture certain dimensions of shape, and for its problems associated with selecting the appropriate number of radii, locating the perimeter contact points, and defining an appropriate centroid (Austin, 1984; Griffith et al., 1986). Each of these problems can lead to the misrepresentation of shapes either by assigning the same values to very different shapes, or by assigning quite different values to the same shape.

Austin's measure of shape, however, confines itself to determining the "compactness" or degree of circularity of a shape, and makes no attempt to establish a measure that allows for comparisons with a milieu of regular polygons. The interpretation of the index here is such that comparisons may be drawn between the relative compactness of the parks (i.e. how "linear" the park is) with those parks with values closer to zero having a greater degree of linearity, and therefore, being potentially preferred by recreationists (Whyte, 1968).

With respect to both indicators -- accessible perimeter and shape -- an attempt is being made to broaden the perspective taken to the parks which comprise the urban recreation supply system. These objective measures may come closer to defining a park as a perceived opportunity for recreation rather than simply a physical resource designated as such.

3.1.3 Urban Recreation Demand: Household Survey

In order to gather information pertaining to the urban recreation demand system, a comprehensive survey was designed and administered to a randomly selected sample of households in the town. The household was chosen as the unit of analysis for this study rather than the individual so that information on all age groups could be acquired. If individuals had been selected, the likelihood of missing major components of the community -- especially children -- would have been increased, thereby reducing the representativeness of the sample. The household as the unit of analysis allows for an adult member of the residence to respond on behalf of the entire household.

The survey gathered information on the demographic makeup of the household, the household members' use and perceptions of selected parks and facilities within the town, their participation in a number of recreational activities, and their participation in a selection of private and commercial recreational pursuits. Each of these sections within the survey captured aspects of the components of demand in the conceptual model (at Objective Level 1), and also provided information regarding the residents' perceptions of the available recreation resources in the town -- main features of Subjective Level 2 in the model.

3.1.3.1 Sampling procedures

The 1980 electoral lists for the town served as the sampling frame for the survey. These lists are organised according to polling subdivision each of which contains on average between 100 and 125 households. With the need to have all parts of community represented in the study, a stratified random sample of households was drawn from each of the polling subdivisions. This was done by numbering each household in the electoral list for each polling subdivision then drawing a sample through the use of a tables of random numbers.

To ensure complete areal coverage, and recognising the likely outcome of a fairly significant rate of non-response for such a general survey (Babbie, 1986), a sample of between 16 and 20 per cent was drawn from each polling subdivision. This resulted in a total sample of 3,963 households to be contacted to participate in the survey, and this approximated the arbitrary 4,000 household target sought at the outset of the survey planning. This represents, overall, a 16.3 per cent sample of total private households (n=24,295) in Oakville.

3.1.3.2 Questionnaire design

The questionnaire used in the survey was designed to gather data pertaining to the components of the recreation demand system as well as the perceptions of the household members with respect to the available resources in the town. The general categories of information sought were as follows:

1. <u>Demographics</u>: the variables in this category include number of individuals in the household; their sexes, ages, and occupations; the total combined annual income; and the type of family unit;

2. <u>Residential/Structural</u>: the variables related to residential aspects include length of residency; home ownership; type of dwelling; and previous other tenancy within Oakville; the structurally related variables are concerned with private ownership of recreational equipment which may serve to divert recreation demand from the public parks. These variables include ownership or access to a private yard, a swimming pool, and/or a vacation property; and ownership of boats.

3. <u>Recreation Participation</u>: the variables that make up this category concern participation in a selection of activities which are typically associated with parks (TORPS, 1978). These activities are responded to in terms of overall participation, and in terms of that portion of the participation which occurs at public parks. These activities are listed below:

   a. Walking/hiking for pleasure

   b. Recreational bicycling

   c. Jogging

   d. Swimming

   e. Tennis

   f. Cross-country/nordic skiing

   g. Tobogganning/sledding

   h. Ice skating

   i. Casual games and sports

   j. Picnicking

   k. Competitive league sports

4. <u>Recreation Perceptions and Use of Selected Parks</u>: the variables in this category pertain to each household's perceptions of a selection of the town's parks. Perceptions recorded included park familiarity, attractivity, and accessibility. The number of times each park was used by the household during a typical summer and a typical winter month also was recorded.

With respect to this final category, it was clearly unreasonable to expect that the respondents would be willing or able to provide information on all 114 parks in the town, hence a sub-sample of parks was identified to be included in the questionnaire. Due to the desire to maximise the amount of data concerning park <u>use</u> as well as non-use, and the recognition that urban parks tend to be little or underused (Gold, 1973; Johnson, 1978), a random sample of the 114 parks would not guarantee a reasonable indication of park use. The parks to be included in the questionnaire had to be those most frequently used by the town's residents. Therefore, following on a recommendation made by the Parks and Recreation Department, 20 of the most heavily used and maintained parks in the town were selected to which the sampled residents responded. Table 3.2 lists these parks along with some of their general characteristics. The expectation may have been that <u>all</u> these parks would be large, major parks, but in fact, the smaller parks listed here (i.e. Centennial Square, Lakeside) are highly visible and important areas within the urban park system.

The perceptions were measured along 7-point bi-polar scales which ranged between, in the case of familiarity, "do not know it" (value=1) to "know it very well" (value=7); for accessibility, the scale ranged between "very hard to get to" (value=1) to "very easy to get to" (value=7); and for attractivity, "not at all attractive" (value=1) to "very

Table 3.2: 20 Main Parks Included on Survey

Park Name	Class*	Area (ha)
Bronte Athletic	M	4.250
Bronte Beach	M	2.295
Busby	C	1.153
Centennial Square	C	0.202
Coronation	M	10.125
Fisherman's Wharf	M	1.640
Gairloch Gardens	M	4.695
Holton Heights	N	3.115
Hopedale	N	1.959
Lakeside	C	0.809
Lawson	N	2.040
Lion's Valley	M	41.490
Oakville	M	8.622
Optimist	C	6.070
Palermo	C	2.100
Pineridge/Henderson	C	7.377
Shell	M	21.230
Sunningdale	N	1.416
Trafalgar	M	3.339
Wallace	C	1.874

* Classes: M = Major Park
C = Community Park
N = Neighbourhood Park

attractive" (value=7). Respondents were asked to indicate where along the scale they viewed their household was situated with respect to their perceptions of each park.

This approach to measuring perceptions has increasingly been recognised as the technique which provides the most reliable indicators of the underlying dimensions associated with the concept of interest (Hanson, 1976, 1977; Hayward and Weitzer, 1984), and too, it has proven to be easier for respondents to answer than an open-ended question in self-administered questionnaires (Moser and Kalton, 1971; Babbie, 1986). Additionally, the type of data generated permits greater flexibility in the types of analyses which can be conducted. Spotts (1983) provides a thorough discussion of the issues concerning the measurement of perceptions especially as they relate to familiarity and knowledge of urban recreation resources.

With respect to the use made of each of the 20 main parks, responding residents indicated the average number of times household members had used a park in (a) a summer month, and (b) a winter month. The weighted sum of these reported uses are employed to generate an estimate of average annual park use which serves as the dependent variable in the gravity model. As discussed earlier, even though this measure can be described as the "effective demand" for parks in the town, it is a function of the combined influences of the recreation supply and demand systems as described in the conceptual model.

The questionnaire also provided additional space for residents to write in up to five other parks that household members were familiar with, and to respond in a like manner to these parks. Using the responses to the 20 main parks and any other parks which were added, estimates of the measures associated with the perceptions pertaining to all of the other 94 parks are subsequently calculated to complete the data set for both recreation systems. The questionnaire is reproduced in Appendix A, and includes questions not directly tied to this study, but present on the questionnaire for other projects.

The questionnaire was pilot tested on a small group of community residents prior to its administration in order to remove any difficulties associated with question wording, interpretation, or demands placed on the respondents.

3.1.3.3 Survey administration

As with any general population survey, the intent is to maximise the response rate of the presumed representative sample in order to reduce the probability of any significant non-response bias. With the cooperation of the Parks and Recreation Department's programme supervisor, the summer programme staff were enlisted to serve as field workers in the delivery of the questionnaires to the doors of the households in the sample as well as to collect them 3 to 5 days later. These steps were taken because personal contact has shown to increase the respondent's perception of the value of the survey, and to generate a sense of committment to completing it (Moser and Kalton, 1971; Babbie, 1986).

The addresses of the households in the sample were listed on record sheets and code numbers assigned to each. Each record sheet had, on average, 54 households listed which were drawn from a relatively compact area within the town. These areas -- which were defined by 3 to 4 contiguous polling subdivisions -- were illustrated on base maps (Scale 1:400) with the selected households identified. These maps were provided to the field workers along with the record sheets and an ample supply of coded questionnaires. The field workers were to ensure that each questionnaire was delivered to the address with the corresponding code number. This allowed for an easier followup process, and for the geo-coding of the households later in the study.

If unsuccessful after three attempts to make contact with the resident(s) of the household, the field worker was instructed to substitute the first household to the right as long as it was within his or her assigned area. The same rule applied for originally selected households which refused to participate, but in either case, only one substitution was attempted. After making contact, a questionnaire was left at the household and a convenient time within the next 3 to 5 days arranged when the field worker was to return to collect the completed questionnaire. In the event the household respondent had lost or misplaced the original form when the field worker returned, he or she was provided with another questionnaire. The corresponding code number was attached to the new questionnaire after it had been retrieved.

Two training sessions were held with the 73 field workers prior to the administration of the survey to ensure that these instructions were understood and would be carried out carefully. In addition to providing the workers with the record sheets, written instructions, maps of the area to be surveyed, and questionnaires, a number of suggestions were given concerning the best times to find people at home, what to wear and what to say, and how to plan out a strategy for delivery and collection.

The survey was administered in the late summer and early fall of 1982. A followup procedure was carried out later that same fall with the assistance of two local ratepayers associations when certain areas were not covered adequately by the field workers. This followup proceeded in the same manner as layed out for the original survey. Due to some difficulty in gaining access to three apartment blocks with security entrances, questionnaires were mailed in to the households in these buildings.

3.2 PARKS AND HOUSEHOLD PROFILES

3.2.1 Urban Parks: Distribution and Description

The 114 parks inventoried in the town of Oakville are categorised into four classes which, as described earlier, serve primarily an administrative role. Neighbourhood parks make up by far the largest number of the parks (n=75) representing 65.8% of all parks. This is in keeping with most urban park planning approaches which allocate a certain percentage of the land area in new residential developments to open space, and these areas exemplify the neighbourhood park definition provided earlier. And as can be seen in Figure 3.2, the neighbourhood parks are quite evenly distributed across the entire town demonstrating a certain equality in provision of these parks.

Major parks and parkettes are the fewest in number with 10 of each in Oakville. The major parks appear to be oriented towards the West region of the town although two of the three largest parks within this class are in the North region (Figure 3.2). The parkettes are somewhat more evenly distributed, but tend to be located along the lake's shoreline or near a creek.

The community parks (n=19), too, are reasonably well distributed across the town even though their definition does not necessarily suggest an expected orientation. Interestingly, two clusters of the community and major parks appear near the town's centre at the mouth of Sixteen Mile Creek, and in the vicinity of the mouth of Twelve Mile Creek in the West region.

Overall, the distribution of the parks in Oakville appears to adhere at least to equality of provision with all regions of the community having a park within a reasonable distance. However, each park possesses quite different features irrespective of its classification, and these features

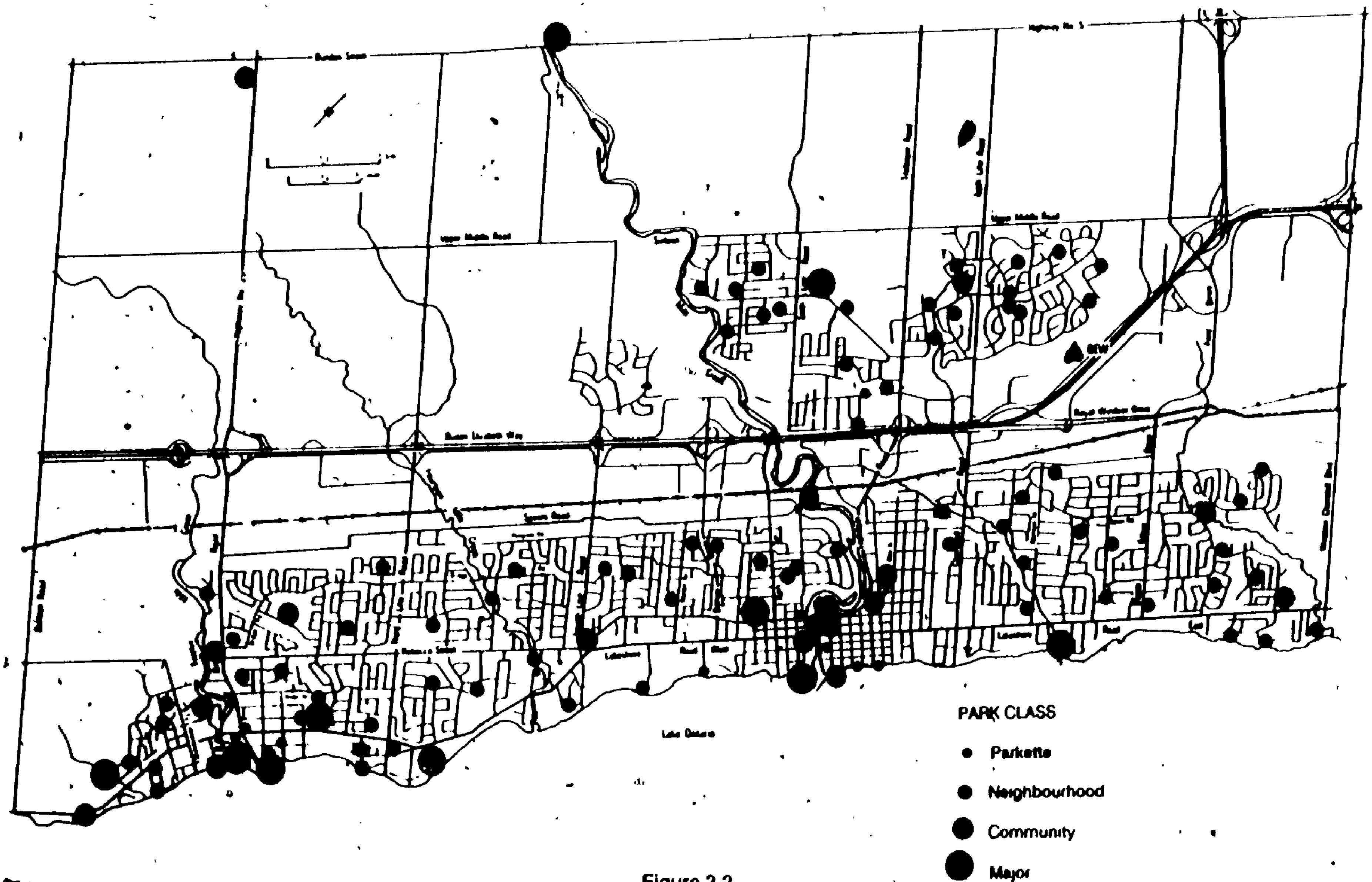


Figure 3.2

Urban Parks (n = 114)

also contribute to a park's capability as an opportunity for recreation.

The results of the inventory do illustrate the variability of resources found throughout the urban park system, and reaffirm the notion that two physically similar parks may not provide the same type of opportunity for recreation. Table 3.3 shows the total number of features found in the 114 parks in Oakville, and provides a breakdown of the proportion of the total parks which had these features, and the mean number of features which did occur in these latter parks.

Amongst facilities, tennis courts were the most numerous in number (n=42), but they appeared in only 13.2% of the parks. In fact, each of the features in the facilities category can be found in fewer than 20% of the parks. This is not too surprising given the space requirements of these large scale facilities as well as the relatively high capital cost associated with them.

As might be expected, picnic tables accounted for the greatest number of features in the furniture category (n=197). However, they were located in just 28.1% of the parks whereas park benches could be found in over 40% of the parks (see Table 3.3).

The total numbers of the types of playground equipment reveals both the continued popularity of certain forms (e.g. swings) and the decline of others (e.g. teeter-totters), as

Table 3.3: Total Number of Features in Parks

CATEGORY Feature	n	% of parks with feature	Mean number of features*
FACILITIES			
Tennis courts	42	13.16	2.800
Sports fields	29	16.67	1.526
Baseball fields	27	19.30	1.227
Washrooms	17	11.40	1.308
Swimming pools	6	5.26	1.000
All purpose courts	5	4.39	1.000
FURNITURE			
Picnic tables	197	28.07	6.156
Park benches	146	40.35	3.174
Barbeque pits	23	3.51	5.750
Shelters	14	7.90	1.556
PLAYGROUND EQUIPMENT			
Swings	223	35.96	5.439
Climbers, "toys"	98	42.11	2.042
Slides	60	36.84	1.429
Teeter-totters	14	4.39	2.800
PHYSICAL			
Garden beds	150	41.23	3.191
Parking**	71	62.28	-
With creek**	30	26.32	-
Lake shoreline**	17	14.91	-
TOTAL	1051		

* mean calculated just for those parks with the feature
** number of parks with this feature

well as the significant move towards the creative playground reflected in the advent of climbers and "toys" (i.e. wooden structures with old tires and ropes). Playground equipment in general shows the widest overall distribution with, on average, 38.3% of the parks having some form of this feature (excluding teeter-totters). Overall, park benches, garden beds, and climbers or "toys" are the features most likely to be found within the parks.

In Tables 3.4 through 3.8, the mean number of all features in each of the categories are reported for each class of park. In addition, the means and standard deviations for the two derived indicators -- accessible perimeter and shape -- are reported in Table 3.9 for each class.

The major parks in Oakville tend to be much larger than the other classes of parks ($\bar{X}$=9.087 ha) although there is a tremendous amount of variation within the class (Table 3.4). This is almost entirely due to one park -- Lion's Valley Park -- which is considerably larger than all the other parks in this class (41.5 ha). Without the area of Lion's Valley included, the major parks average 5.487 ha in size (s.d.=3.918).

The dominance of the major parks with respect to each of the other categories is demonstrated in Tables 3.5 through 3.8. In each case, the mean number of features possessed by the major parks is considerably greater than any of the other park classes. The one exception to this general rule is playground equipment which can be found on average in relatively equal numbers in neighbourhood parks (Table 3.7), and, their occurrence in neighbourhood parks shows much less

Table 3.4: Park Characteristics: AREA (ha)

Park Class	n	Mean	std.dev.*
Major	10	9.087	11.969
Community	19	2.452	2.449
Neighbourhood	75	1.443	1.673
Parkette	10	0.296	0.407
TOTAL	114	2.181	4.373

* standard deviation

variation (s.d.=4.882) than in the major parks (s.d.=7.068) where there was either a lot of equipment or none at all.

Table 3.5: Park Characteristics: FACILITIES*

Park Class	n	n with no facs.	Mean	std. dev.
Major	10	1	3.000	2.708
Community	19	11	1.316	2.358
Neighbourhood	75	49	0.920	1.566
Parkette	10	9	0.100	0.316
TOTAL	114	70	1.096	1.737

* sum of washrooms, sports fields, tennis courts, all purpose courts, baseball fields, swimming pools

2

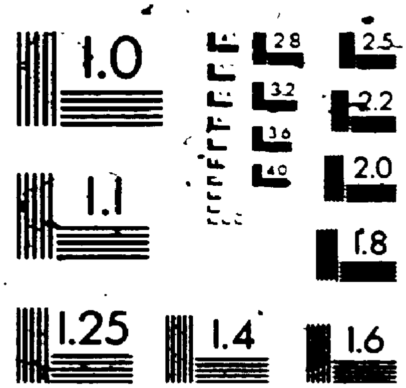


Table 3.6: Park Characteristics: FURNITURE*

Park Class	n	n with no furn.	Mean	std. dev.
Major	10	0	19.600	21.199
Community	19	7	4.158	7.448
Neighbourhood	75	41	1.093	1.552
Parkette	10	1	2.200	1.317
TOTAL	114	49	3.324	7.879

* sum of picnic tables, park benches, barbeque pits, shelters

Table 3.7: Park Characteristics: PLAYGROUND EQUIPMENT*

Park Class	n	n with no equip.	Mean	std. dev.
Major	10	6	4.200	7.068
Community	19	14	1.263	2.491
Neighbourhood	75	35	4.240	4.882
Parkette	10	9	0.700	2.214
TOTAL	114	64	3.430	4.164

* sum of swings, slides, teeter-totters, climbers, and "toys"

Table 3.8: Park Characteristics: GARDEN BEDS

Park Class	n	n with no beds	Mean	std. dev.
Major	10	3	5.400	6.867
Community	19	11	1.526	2.632
Neighbourhood	75	50	0.773	1.503
Parkette	10	3	0.900	0.738
TOTAL	114	67	1.316	2.935

It should be pointed out that the interpretation of these general indicators must be done with caution for two reasons. First, the standard deviations are quite large, and in fact, exceed the mean in most cases. This illustrates the enormous amount of variation that exists not only within each class of park, but also across all parks. It therefore appears that a park cannot be "typified" conclusively beyond some general observations, such as:

1. the larger the park in terms of area, the more likely it is to have a larger number of features in any category.

2. the larger the park in terms of area, the more likely it is to have a greater diversity of features in any category.

3. the larger the park in terms of area, the more likely it is to have a major facility such as a swimming pool or tennis courts.

Interestingly, several exceptions to these observations can be found, but as very general rules, they do reflect a pattern of distribution not unlike that found in many communities.

Second, and as was observed in Table 3.3, very many of the parks do not have any of the features described. For example, in Table 3.5, 49 of the 75 neighbourhood parks (65.3%) and 9 of the 10 parkettes (90.0%) do not have any facilities. And 14 of 19 community parks (73.7%) do not have playground equipment of any form in them (Table 3.7). Thus, the development that has occurred up to the point of this inventory appears to have been confined to only a few parks within each class, and indeed, to only a few parks overall.

The means of the two derived indices -- accessible perimeter and shape -- are shown in Table 3.9. The parkettes appear to be the most accessible with, on average, 39.7% of their perimeter open to the public. In contrast, the major parks are the least accessible with just 24.7% of their boundaries freely accessible to the public. This is the consequence of the major parks being along the lake's shoreline, ravines, and other physical barriers. Too, the parkettes tend to be situated on corners of intersections where at least two sides are open to public access.

With respect to the shape index (Table 3.9), the community parks appear to be the least "linear" in configuration

Table 3.9: Park Characteristics: ACCESSIBLE PERIMETER and SHAPE INDICES

Park Class	n	ACCESS. PERIM. Mean	ACCESS. PERIM. s.d.	SHAPE INDEX Mean	SHAPE INDEX s.d.
Major	10	0.247	0.186	0.322	0.158
Community	19	0.296	0.258	0.448	0.160
Neighbourhood	75	0.260	0.220	0.365	0.176
Parkette	10	0.397	0.224	0.346	0.217
TOTAL	114	0.277	0.225	0.374	0.177

with a mean value of 0.448. Not much distinction between the parks is evident when examined according to class, but with a range of values from 0.026 to 0.911 surrounding a mean of 0.374, this measure may still prove to be significant in the explanation of park use.

The 20 parks which are included on the questionnaire distributed to households in Oakville are, as mentioned, the most heavily used and maintained parks (from the perspective of the town's Parks and Recreation Department). Figure 3:3 shows where in the town these 20 parks are located -- each planning region is well represented with 8 parks in the West, and 6 each in the East and North. Two small clusters appear at the mouths of the two principal creeks in the town, and many of the parks are situated along a shoreline or creek.

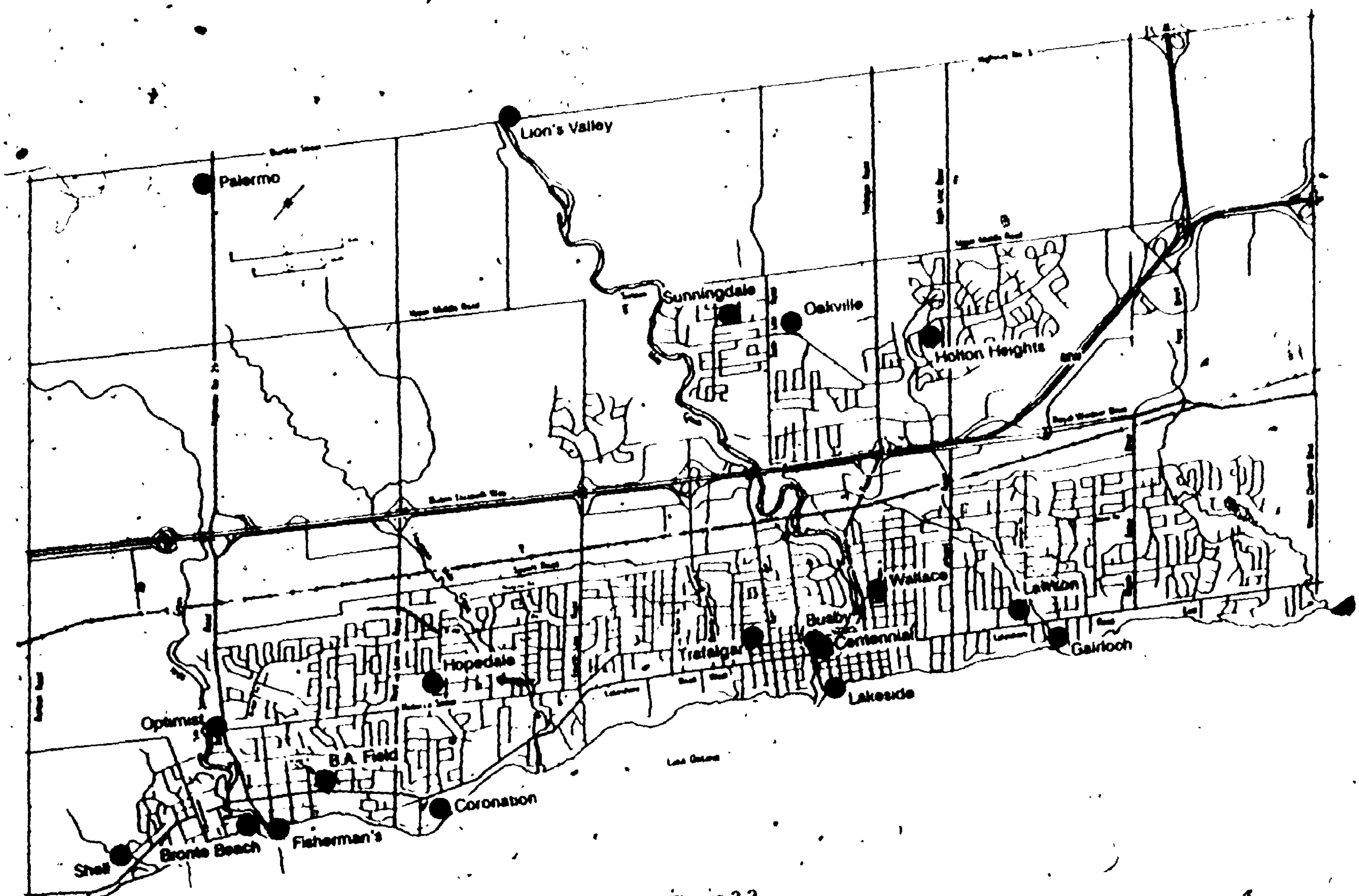


Figure 3.3

20 Main Parks on Survey

As shown in Table 3.10, which reports a summary on the categories for these 20 parks, they are clearly among the more well developed parks in the town with only the major parks, as a group, showing higher averages. In fact, 9 of the 10 major parks are included in this group, along with 7 community parks and 4 neighbourhood parks (refer to Table 3.2). Interestingly, these parks show a somewhat lower proportion of accessible perimeter and a less linear shape than all parks in general. This appears to be contrary to the presumed influence of these indices on park use which was the rationale for their selection for the questionnaire.

Table 3.10: Features in 20 Main Parks on Survey

Feature	Mean	std.dev.
Area (ha)	5.696	9.048
Facilities	2.800	2.546
Furniture	13.350	17.199
Play Equipment	5.100	6.307
Garden beds	3.400	5.335
Access. Perimeter	0.256	0.183
Shape index	0.421	0.165

The observations made here address only the incidence of the parks and their features, and not their nature as reflected in the type of opportunity for recreation each of them may provide. Essentially, this description has provided the information making up the Objective Level 1 of the conceptual model (Figure 2.2), and provides the groundwork for developing an understanding of these resources as opportunities at the Subjective Level 2. In the modelling of the recreation opportunity spatial system, the variable contribution of these aspects singularly and collectively assist in defining the opportunity potential of urban recreation supply and thereby reflect the underlying nature of this system.

3.2.2 Households: Distribution and Description

Of the 3963 households making up the sample, 3172 households (80.04%) were successfully contacted by the field workers and questionnaires deposited to be picked up 3 to 5 days later. The 791 households not contacted were the result of a number of reasons: (1) vacated homes, (2) addresses associated with businesses, (3) homes converted to commercial uses, (4) apartments not accessed due to security entrances, (5) refusals by originally selected and substitute households, and (6) incomplete areal coverage by field workers. A total of 1163 households returned completed and usable questionnaires which represents a 36.67% response rate -- good for a general population survey where 5 to 10% response rates are frequently obtained (Bailey, 1987).

The distribution of responding households did provide relatively complete areal coverage of all parts of the town as can be seen in Figure 3.4. In fact, those areas where the households are most concentrated are those where high density housing is most evident (i.e. sections of North region; western most sections of West region). Similarly, the dispersed households shown near the centre of the East region do represent reasonably well the larger residential lots of these older neighbourhoods.

In order to ensure that the sample did in fact represent the town's residents, a selection of demographic characteristics from the survey were compared to their equivalents reported in the 1981 Census (Statistics Canada, 1982). For the most part, the sample compares quite favourably to the census information with variations occurring in predictable, but not damaging, sectors of the population (see Table 3.11). The general pattern of age groupings corresponds reasonably well with younger households being slightly overrepresented and older households somewhat underrepresented. The largest differences occur in the 25 to 34 and the 35 to 44 years of age categories, yet once combined, the proportions are nearly the same (29.5% in the Census and 30.1% in the sample). The 159 "seniors" included in these households, while below the census expectation, is encouraging given this group's reluctance to participate in general population surveys (Bailey, 1987).

The differences in the numbers of individuals making up the household are attributable in large part to the subtle distinctions made in the Census as to what constitutes a

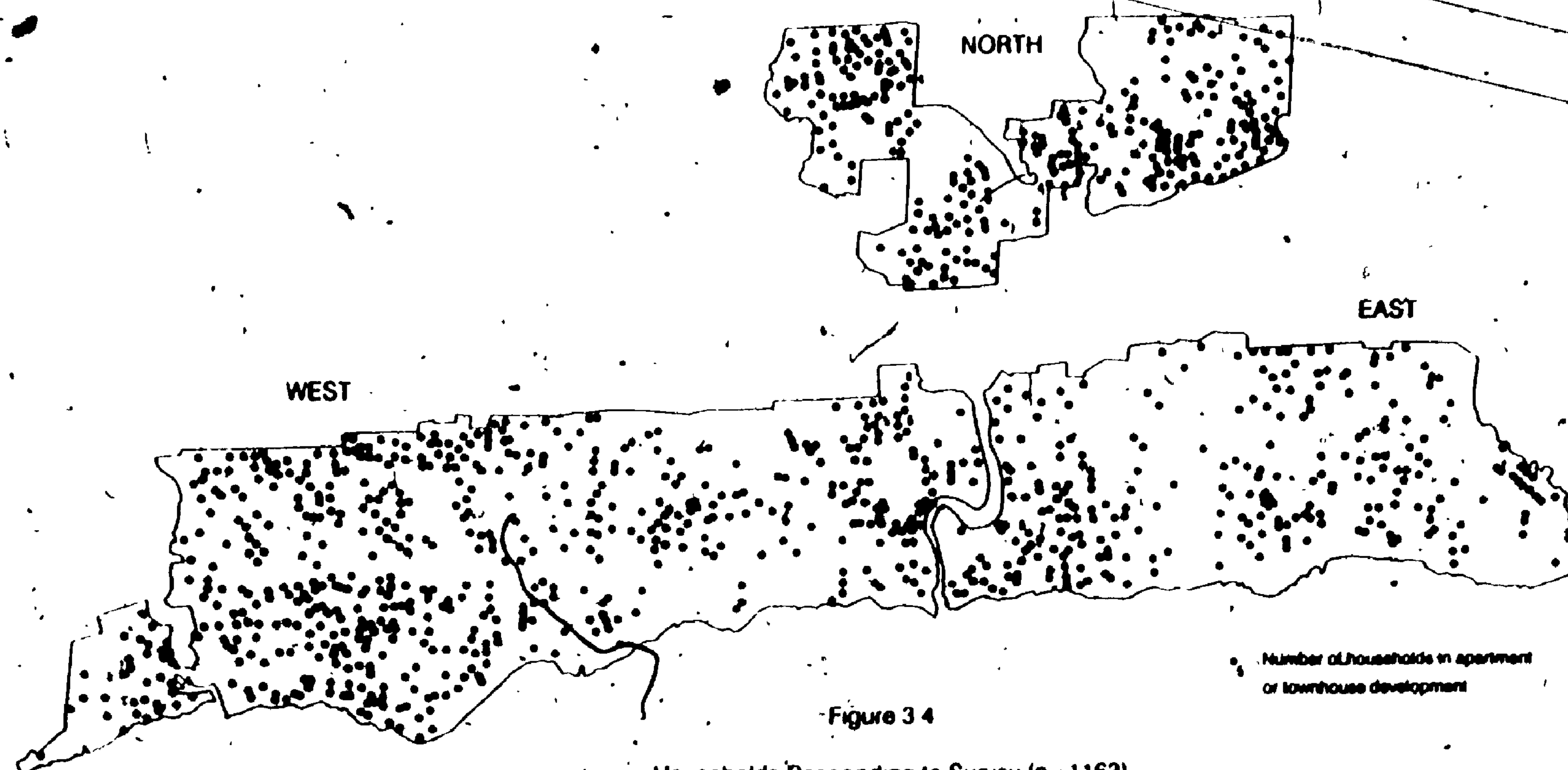


Figure 3.4

Households Responding to Survey (n = 1163)

Table 3.11: Comparison of Household Sample Characteristics to 1981 Census

Characteristic	CENSUS n	CENSUS %	SAMPLE n	SAMPLE %
AGE (years)				
0-4	4510	5.95	254	6.64
5-9	5600	7.39	346	9.05
10-14	6820	9.00	409	10.70
15-19	8035	10.61	432	11.30
20-24	6675	8.81	279	7.30
25-34	10735	14.17	441	11.54
35-44	11600	15.31	709	18.55
45-54	9935	13.11	545	14.26
55-64	6605	8.72	249	6.51
65-69	1960	2.59	70	1.83
70+	3285	4.34	89	2.33
SEX				
Males	37660	49.70	2019	50.34
Females	38110	50.30	1992	49.66
NUMBER IN HOUSEHOLD				
1	3445	14.18	49	4.21
2	6545	26.93	263	22.61
3	4480	18.93	236	20.29
4-5	8610	35.43	549	47.21
6+	1220	5.02	66	5.68
RESIDENCY				
Owned	17145	70.57	992	85.52
Rented	7150	29.43	168	14.48
DWELLING TYPE				
Single detached	16120	66.34	949	81.74
Single attached	2125	8.75	64	5.51
Apartment	5920	24.36	108	9.30
Duplex	135	0.56	40	3.45

"census family". The higher number of small households in the census results is a reflection of an undetermined number of households with more people being "disqualified" from a larger category because of the relationship of the adults living therein. With respect to residency and dwelling type reported in Table 3.11, the variations evident here are primarily due to the field workers' difficulties in gaining access to some of the security entrance apartment buildings. This inevitably resulted in not just one household being omitted, but potentially several. A subsequent mailing of the questionnaires into these buildings helped to offset a more serious underrepresentation, but this strategy could not completely overcome it.

Nevertheless, the differences in the sample are not so dramatic as to seriously undermine its representativeness, and, given the visually complete areal coverage reflected in Figure 3.4 as well as the results presented here, a fair degree of confidence in the validity of the sample can be assumed.

Selected other demographic characteristics of the sample are illustrated in Tables 3.12 to 3.14. The responding households were made up predominantly of nuclear families (two parents with children) and married couples which, when combined, accounted for almost 85% of the sample (Table 3.12). Single parent families are quite well-represented based on census expectations, and thereby provide input from a group frequently overlooked in social research.

Table 3.12: Type of Family Group in Household

Family Type	n	%
Nuclear family	755	65.48
Married couple	225	19.51
Extended family	52	4.51
Single parent family	52	4.51
Single person	51	4.42
Unrelated adults in a family unit	18	1.56
TOTAL	1153	100.00

The town of Oakville is among the more affluent communities in the province, and this relative wealth is reflected in Table 3.13 which reports the number of households in various categories of combined annual income. The majority of households fall within the $35,000 to $45,000 income range with a mean of $42,071 (s.d.=$20,553).

The mean length of residency by the responding households at their current addresses was 9.2 years (s.d.=7.818) which reflects a fairly well established community of residents (Table 3.14). Further, over 40% of the sample reported having resided at another Oakville location for, on average, 6.8 years (s.d.=6.684). Thus, the familiarity and knowledge of the types of public recreation opportunities available to these households should not in general be hindered by lack of time in the community.

Table 3.13: Combined Annual Income of Household

Income	n	%
Under $15,000	31	4.42
$15,000 to 24,999	83	11.82
$25,000 to 34,999	149	21.23
$35,000 to 44,999	162	23.08
$45,000 to 54,999	123	17.52
$55,000 to 74,999	105	14.96
$75,000 and over	49	6.98
TOTAL	702	100.00

Table 3.14: Years of Residency in Current Household

Years in Household	n	%
1 year or less	97	8.41
2 to 3 years	241	20.88
4 to 5 years	170	14.73
6 to 10 years	260	22.53
11 to 15 years	151	13.09
16 to 20 years	115	9.97
20 years or more	120	10.40
TOTAL	1154	100.00

3.2.2.1 Recreation participation by households

An interesting aspect arising out of the results associated with the households' participation in the 11 recreation activities included on the questionnaire is the relatively low rates of involvement in activities typically regarded as the predominant forms of recreation participated in at the park sites. Only "walking/hiking", "swimming", and "recreational bicycling" showed participation rates involving at least half the sample (Table 3.15).

Typically, approximately one-third of the households in the sample reported participation in these activities, and only about one-fifth of the respondents reported that this participation occurred in the public parks. These results are somewhat surprising in that the usual conclusion about the underuse or nonuse of the public parks is that it is a result of the inability of the parks to provide adequate opportunities to meet the demand for participation in these activities. In fact, these somewhat low levels of participation may suggest that the demand is not even present. In other words, there may be a greater than expected number of "nonusers" than "potential users" in the community.

Interestingly, some activities show much higher occurrences of overall participation within the parks suggesting that the parks do, in fact, provide opportunities for some forms of recreation, but not for others. For example, over 60% of all participation in "ice skating", "picnicking",

Table 3.15: Households' Participation in Selected Recreation Activities

Activity	Number of households participating n	%	Households partici. in parks n	%	Percentage of total partici. occurring in parks
Walking/hiking	829	71.28	435	37.40	52.47
Swimming	678	58.30	376	32.33	55.46
Rec. bicycling	596	51.25	171	14.70	28.69
Ice skating	551	47.38	385	33.10	69.87
Picnicking	407	35.00	268	23.04	65.85
Casual games	384	33.02	236	20.29	61.46
Tennis	364	31.30	238	20.46	65.39
Compet. sports	349	30.01	134	11.52	38.40
Tobogganning	342	29.41	213	18.31	62.28
Nordic skiing	322	27.69	156	13.41	48.45
Jogging	270	23.22	94	8.08	34.82

"casual games", "tennis", and "tobogganning" occurs within the parks whereas less than 40% of all participation in "competitive league sports" and "jogging", and less than 30% of "recreational bicycling" occurs there (Table 3.15). Clearly, the nature of these activities provides evidence as to the reasons for these differences as do the types of resources available in the parks.

With respect to the <u>frequency</u> of participation in the selected activities (Table 3.16), much the same pattern emerges. "Walking/hiking", "swimming", and "recreational bicycling" are the most frequently participated in activities as well as the activities participated in by the largest number of households. The general pattern of participation shown in Table 3.15 is evident in Table 16 with some exceptions. "Jogging", while participated in by the fewest number of households, is among the most frequently engaged in activity by those that do ($\bar{x}$=2.2 times per month). And, the number of times per month that "competitive league sports" occurs in the parks is much higher (73% of all times) than is suggested by the percentage of households participating there (38.4%).

A comparison of Tables 3.15 and 3.16 shows several of these differences where the percentage of households participating in an activity is notably higher or lower than the percentage of times per month that the activity is participated in at the parks. With the exception of "competitive league sports", "casual games and sports", and only just, "picnicking", the activities show a lower percentage of the number of times per month that participation occurs in the parks than the percentage of all households which participate there. This suggests that while participation typically does embrace the parks, they are not the most frequently used sites.

Some of the discrepancies between participation in these activities in general and in parks in particular can be attributed to the alternative locations that individuals may and do choose to carry out their activities. These alterna-

Table 3.16: Frequency of Participation in Selected Recreation Activities

Activity	Average times per month	Avg. times per month in parks	Percentage of all times in parks
Walking/hiking	6.082	2.159	35.50
Swimming	4.143	1.641	39.61
Rec. bicycling	3.945	0.691	17.52
Jogging	2.242	0.555	24.76
Compet. sports	1.909	1.393	72.97
Ice skating	1.693	1.168	68.99
Tennis	1.578	0.959	60.77
Casual games	1.023	0.902	88.17
Nordic skiing	0.845	0.336	39.76
Tobogganning	0.802	0.409	51.00
Picnicking	0.762	0.512	67.19

tives need not be part of a formalised offering from the private sector, but rather, may simply be available, functional space such as the street outside the home. This would certainly be the case for activities such as jogging and recreational bicycling, while for some of the others, the private yard or swimming pool may supplant the demand for the public parks.

These alternative locations or opportunities are certainly available to this sample. Almost 77% of the households (864 of 1125 reporting) indicated that they owned, shared, or had access to a private yard, and 56.4% of the households (n=634) owned or had access to a private swimming pool. In addition, 27% of the households (n=304) indicated that they owned a vacation property such as a cottage. Clearly, these alternatives may help to explain the relatively low proportion of participation in the parks for activities such as "swimming". Irrespective of where the participation is taking place, it does point to the fact that the parks do not provide the only opportunities for the expression of this demand. Thus, describing the variations in where this demand may ultimately be expressed can serve to further delineate the underlying nature of the demand for urban recreation.

3.2.2.2 Use and perceptions of 20 main parks

As has been noted by various researchers (Bangs and Mahler, 1970; Gold, 1972, 1973, 1977; Johnson and Beaman, 1979; Godbey, 1985), the nonuse of urban parks throws into question their viability as real opportunities for recreation. In this study, similar findings are illustrated in Table 3.17 which reports the use of the 20 main parks appearing on the questionnaire. When one considers that these areas represent the dominant parks in the town, the low levels of use are quite discouraging from a provider perspective. Only two parks were visited at least once in the previous year by over 50% of the sample: Coronation (63.6%) and Gairloch Gardens (52.93%). Overall, typically less than a third of the sample reported using these parks even once in the previous year; on average, a main park was used by approximately 21.32% (s.d.=15.79) of the households in the town.

Table 3.17: Use of 20 Main Parks by Households in Previous Year

Park	Percent. of all households	PERCENTAGE OF HOUSEHOLDS SUMMER month n	%	WINTER month n	%	W/S* %
		AT LEAST ONE PARK USE IN PREVIOUS YEAR				
Coronation	63.60	655	57.56	221	19.09	33.74
Gairloch	52.93	519	45.25	193	16.72	37.19
Bronte	33.87	347	30.12	121	10.44	34.87
Shell	33.19	328	28.52	79	6.81	24.09
Lakeside	30.21	306	26.54	113	9.76	36.93
Fisherman	27.37	285	24.63	133	11.47	46.67
Lion's V.	25.90	244	21.16	57	4.91	23.36
B.A. Field	25.45	216	18.73	71	6.13	34.26
Centennial	21.41	191	16.58	107	9.26	56.02
Oakville	13.93	131	11.36	19	1.64	14.50
Wallace	13.59	132	11.40	19	1.64	14.39
Holton Hts.	12.74	124	10.76	20	1.72	16.13
Optimist	12.73	123	10.63	33	2.84	26.83
Lawson	12.64	129	11.16	22	1.89	17.05
Hopedale	11.96	111	9.61	42	3.62	37.84
Trafalgar	10.75	102	8.81	20	1.72	19.61
Busby	9.11	77	6.62	45	3.87	58.44
Sunningdale	8.00	75	6.50	26	2.24	34.67
Pineridge	3.87	37	3.19	7	0.60	18.92
Palermo	3.18	31	2.67	4	0.34	12.90

* W/S is the ratio of the number of households using a park in a winter month over the number using it in a summer month (expressed as a percentage)

Most of the reported use occurs in the summer months with considerably fewer households indicating a visit to a main park during a winter month (Table 3.17). On average, 18.54% fewer househol[illegible] reported using a park during a winter month, and in almost every case, it was the same household using the park in the winter as in the summer. Busby (58.44%) and Centennial Square (56.02%) had higher proportions of households reporting winter month use largely because of their adjacent position to a large multi-use facility (an integrated central library, art gallery, and live theatre). In contrast, some of the parks oriented towards summer sports, such as Palermo (12.9%), Wallace (14.39%), Oakville (14.5%), and Holton Heights (16.13%), showed a considerably lower proportion of winter month use.

With respect to the <u>frequency</u> of use of the main parks (Table 3.18), there is much more of a balance between the average number of times that a household uses a park in a summer month and in a winter month. Therefore, even though the use of the parks in general declines by approximately two-thirds during the winter, the frequency or rate of use remains relatively constant or just slightly below those levels shown during the summer. Interestingly, in some cases (e.g. Holton Heights, Hopedale, Sunningdale) winter frequency of use actually increases. Here, the winter users are likely those households which make frequent use of the park throughout the year while those households which do not use the park in the winter months are less frequent users even during the summer months. Thus, when they drop out, the winter average increases.

Table 3.18: Frequency of Use of 20 Main Parks in Average Month

Park*	AVERAGE NUMBER OF PARK USES Summer month Mean	s.d.	Winter month Mean	s.d.
Coronation	3.527	3.776	2.394	2.394
Gairloch Gdns.	2.455	2.659	2.233	2.416
Bronte Beach	3.772	4.915	2.207	2.349
Shell	3.198	4.364	2.329	1.953
Lakeside	3.556	4.501	3.239	5.022
Fisherman's	4.060	4.917	2.759	3.224
Lion's Valley	2.385	3.066	1.702	0.981
B. A. Field	3.468	3.382	3.141	3.177
Centennial Sq.	3.089	3.324	3.112	3.380
Oakville	3.115	3.161	2.579	2.293
Wallace	3.424	3.634	3.158	3.804
Holton Heights	3.427	4.164	4.500	4.174
Optimist	2.789	3.240	2.515	1.839
Lawson	3.194	3.582	2.455	2.220
Hopedale	5.568	7.247	8.071	8.032
Trafalgar	3.598	4.379	1.950	1.605
Busby	3.065	2.617	2.289	1.687
Sunningdale	4.373	5.051	5.615	7.184
Pineridge/Hend.	3.811	5.147	1.571	1.134
Palermo	3.194	2.535	3.250	2.670

* parks in order of the percentage of households reporting at least one use in previous year.

Of particular concern here, however, are the changes which come about with respect to the demand for the parks as a result of these differences in revealed use of the parks during the summer and the winter months. Clearly, the overall demand for the parks drops dramatically during the winter months, but this apparently is not true at the disaggregate level. Certain individual households maintain their frequency of use of the parks throughout the year. This may be a reflection of neighbourhood variations in that proximal households to certain parks continue to use the park whereas park use community wide declines during the winter. The considerable amount of variation in the number of times a park is used by the households, as reflected in the relatively high standard deviations (Table 3.18), suggests such a pattern as well.

The perceptions of the 20 main parks provides valuable insights into the role that these resources play as opportunities for recreation. As described in the conceptual model, the parks serve no real function until they become part of the opportunity set of recreation site alternatives held by the recreationist. Thus, the degree of familiarity that an individual has of each park, as well as his or her perceptions of its accessibility and attractivity, contributes to defining the park as an opportunity, and ultimately, its selection for participation to occur.

Table 3.19 illustrates the degree of familiarity associated with each park as defined by the ratings of the households. By far the most familiar park to the community is Coronation which is familiar to almost 88% of the households in the sample. Gairloch Gardens ranks second with 76.7% of the sample having some degree of familiarity with it, and the other parks fall off quickly behind with Busby, Sunningdale, Palermo, and Pineridge/Henderson parks being familiar to less than 20% of the households. In terms of the ratings along the 7-point scale used, Coronation again was ranked as the most familiar with Gairloch Gardens ranking second.

Interestingly, if a value of "4" is regarded as a mid-point of familiarity on this scale with those values falling below indicating low levels of familiarity, these two parks are the only ones in this group (and perhaps the entire system) which could be regarded as potentially community-wide opportunities for recreation (Table 3.19). Of note, five of the six lowest ranked parks in terms of familiarity are in the North region of the town (the exception being Busby). While this is in part due to the lower number of households in the sample from this region, it does reflect the generally low overall familiarity with parks located in this part of town -- a part which is on the periphery of long-established development and is most distant from the lake-shore.

These results demonstrate the inappropriateness of the assumptions associated with the "rational man" perspective adopted by most recreation demand models; that is, the assumption that the recreationists have perfect information about the available opportunities to them (Stynes, 1982; Stynes, Spotts, and Strunk, 1985). Clearly, without knowledge of the existence of these other parks -- and ones as important to the system as these -- the recreationists included in this study could not be expected to have a demand for all parks. This provides further evidence as to

Table 3.19: Household Perceptions of 20 Main Parks: FAMILIARITY

Park	Households familiar with park (%)	Familiarity Rating Rank*	Mean	s.d.
Coronation	87.77	1	5.534	2.118
Gairloch Gdns.	76.70	2	4.638	2.449
Shell	70.78	3	3.913	2.371
B. A. Field	64.11	4	3.473	2.362
Bronte Beach	59.86	5	3.466	2.470
Lion's Valley	58.62	6	3.447	2.447
Lakeside	49.79	7	3.242	2.571
Centennial Sq.	49.65	8	3.134	2.478
Fisherman's	42.26	9	2.900	2.498
Wallace	40.66	10	2.694	2.339
Hopedale	35.28	11	2.456	2.279
Lawson	32.01	12	2.251	2.106
Optimist	31.87	14	2.161	1.982
Trafalgar	30.29	13	2.184	2.063
Oakville	27.45	15	2.121	2.054
Holton Heights	22.20	16	1.889	1.892
Busby	19.02	17	1.730	1.721
Sunningdale	18.76	18	1.720	1.723
Palermo	18.59	20	1.539	1.364
Pineridge/Hend.	18.33	19	1.614	1.519

* rank based on mean rating of familiarity

the variability in demand that exists in the community, and to the inadequacy of the application of standards for planning purposes.

In Table 3.20, the perceived accessibility and attractivity of the 20 main parks is reported for just those households which were familiar with the parks (i.e, reported a familiarity rating of 2 or higher on the 7-point scale). Although not entirely consistent with the rankings on familiarity (Table 3.19), the rankings of the parks on these two perceived characteristics are fairly similar suggesting that the perceptions of accessibility and attractivity held by the households are closely related to the degree of familiarity they have -- a finding consistent with the observations made by Spotts (1983).

Thus, while familiarity may be biasing the other perceptions to some degree, there is some evidence to suggest that the sample does discriminate between the parks. For example, Shell park is ranked tenth in terms of accessibility even though it was one of the most familiar parks to the sample. This perceived lower level of accessibility is consistent with its physical location in the town -- at the furthest edge of town in the West region. Similarly, B. A. Field ranks 14th in terms of attractivity despite it being among the most familiar of the parks (4th, Table 3.19) and one of the most accessible (5th). Similar patterns are evident for Lion's Valley and Hopedale parks.

This may therefore mean that familiarity is not necessarily biasing the perceptions associated with accessibility and attractivity, but rather, these latter perceptions may be a function of experiential factors and have subsequently influenced the demand for selected parks. Thus, the lower familiarity associated with parks perceived to be less

Table 3.20: Household Perceptions of 20 Main Parks:

ACCESSIBILITY and ATTRACTIVITY

Park	Ratings made by FAMILIAR households ACCESSIBILITY Rank	Mean	s.d.	ATTRACTIVITY Rank	Mean	s.d.
Coronation	1	5.989	1.541	3	5.793	1.256
Gairloch Gdns.	2	5.644	1.723	1	6.507	0.975
Shell	10	5.181	1.985	2	5.851	1.361
B. A. Field	5	5.356	1.948	14	3.968	1.592
Bronte Beach	8	5.212	1.960	8	4.857	1.549
Lion's Valley	16	4.165	2.023	7	4.899	1.608
Lakeside	3	5.471	1.796	6	5.242	1.461
Centennial Sq.	4	5.390	1.822	4	5.502	1.575
Fisherman's	7	5.341	1.973	5	5.321	1.526
Wallace	6	5.355	1.844	13	4.216	1.592
Hopedale	9	5.212	1.974	18	3.582	1.738
Lawson	12	4.885	2.139	9	4.856	1.561
Optimist	15	4.358	2.168	20	3.466	1.739
Trafalgar	11	4.986	1.970	10	4.608	1.569
Oakville	13	4.702	2.116	11	4.405	1.776
Holton Heights	18	4.034	2.373	16	3.784	1.568
Busby	14	4.436	2.187	12	4.314	1.744
Sunningdale	17	4.140	2.269	17	3.647	1.520
Palermo	19	3.409	2.139	19	3.494	1.546
Pineridge/Hend.	20	3.069	1.966	15	3.836	1.727

* parks are listed in rank order according to their familiarity to the households (only those households familiar with the park are included in the calculations of these values)

accessible and less attractive may be the result of experientially decreased interest in using these parks; and, this may be the consequence of a park's inability to adequately satisfy demand. A comparison of the rankings shown in Tables 3.19 and 3.20 with the ranking of the parks according to reported use shown in Table 3.17 (using Spearman's rank correlation) illustrates the consistent pattern of generally higher overall use being associated with higher ratings of familiarity (r=0.9218; sig.<.001), accessibility (r=0.7504; sig.<.001), and attractivity (r=0.7895; sig.<.001).

With this basic information in hand, the exploration of the relationships between the components of the conceptual model can be initiated in order to discover the best means of combining these indicators of urban recreation supply and demand in an integrated model reflecting the recreation opportunity spatial system. In conjunction with this exploration, the inclusion of the spatial perspective in the model is the subject of next chapter.

Chapter IV

SPATIAL ASPECTS OF URBAN RECREATION OPPORTUNITY

4.1 INTRODUCING THE SPATIAL PERSPECTIVE

An examination of the supply of urban recreation resources and the demand for them necessarily implies a spatial component. Unfortunately, the accessibility of recreation opportunities to potential users is a basic yet frequently ignored aspect in the study of urban recreation behaviour (Smith, 1983a; Kirby, 1985). The fact that recreationists must move across space in order to make use of these opportunities means that the distance between the user and the site will play a rôle in that relationship.

Essentially, every household in this study has a somewhat unique perspective of the parks available to it by virtue of its location relative to them. This perspective has inherently spatial qualities, and it is this perspective which is introduced here.

4.1.1 Geocoding of Parks and Households

In order to place the parks and the households into a spatial context where the relative position of each can be assessed according to the locations of the others, a process of defining their locations in space must be introduced. Perhaps the most commonly employed means of doing this is through the use of a Cartesian coordinate system which specifies the location of a point on a plane according to two reference axes -- an x and a y axis. This is the system which was adopted here.

A large base map of the town with all the parks and responding households identified on it was placed on a digitising tablet and each point geocoded according to an arbitrary coordinate system. The origin point, as is the convention, was situated in the lower left corner of the map and the x axis ("east") and the y axis ("north") were oriented to run parallel to the network of streets (Goodchild, 1984). The specific coordinates for a point (i.e. park or household) are unimportant in themselves -- they do, however, provide the spatial context for the urban recreation system and allow for the calculation of distances between points. While there has been some concern over the accuracy of the estimates of distance based on the projection of a part of the earth's surface onto a flat plane, the area involved in this study is sufficiently small that any bias would be inconsequential (Goodchild, 1984:34).

With the completion of the geocoding of the parks and households, the spatial perspective had been effectively introduced to the data. While a variety of disaggregate approaches are available to provide a comprehensive analysis of the households, the macroscopic perspective of the potential concept adopted here (especially as realised via the gravity model), called for an aggregate form of analysis.

Therefore, the households were grouped to form spatially contiguous and relatively homogeneous neighbourhoods which facilitated the calibration of the model and, as Herbert and Johnston (1976) have argued, provided spatial units to which planning in urban areas often is oriented.

4.1.2 Derivation of Neighbourhoods

The derivation of the neighbourhoods was based on the desire to define areas within the town which possessed the psychological aspects of the community as described by Herbert and Johnston (1976) and by Wireman (1984). These aspects are the social, economic, and political characteristics of an area which tie its residents together into a recognisable zone within the community. Such neighbourhoods provide their residents with proximity to one another, a sense of identity, and commitment to the area (Wireman, 1984:44-46). It is these areas to which urban recreation planners do and must respond -- not the administratively defined areas suggested by policy-makers (Carley, 1981).

In the absence of specific indicators to define neighbourhoods in the town of Oakville, a strategy was devised which drew upon available measures describing the households that would make up these areas. Essentially, the neighbourhoods identified for the purposes of this study had to meet certain criteria:

1. They should be as compact in area as possible so that the households within any one neighbourhood were all in relative proximity (Wireman, 1984).

2. They should be as homogeneous as possible with respect to a number of demographic, residential/structural, and locational features (Naroff, Madden, and Dillon, 1984).

3. There should be a sufficient number of households in each neighbourhood in order that the aggregate measures calculated could be assumed to be truly representative of the area's character.

4. They should respect major physical barriers in the town just as the residents would in their day-to-day activities (Pacione, 1984).

As a consequence, the specification of neighbourhood boundaries encompassing certain households in the town was based on the application of an objective procedure of aggregating the households into relatively homogeneous groups that were spatially compact. The procedure involved the use of cluster analysis which groups objects together -- in this case, households -- according to their similarity on selected attributes. The particular strategy adopted was an agglomerative hierarchical clustering technique which begins by treating each household as a single member cluster, then compares all possible pairings of clusters before "fusing" those two which minimise the sum of squared within-group deviations about the new cluster's mean on all the selected attributes (Everitt and Dunn, 1983; Lorr, 1983). This process continues until all the clusters are combined into one final cluster which, in effect, maximises the within-group sum of squares.

As a general rule, the best solution is that one which precedes a sharp increase in the within-group sum of squares from the subsequent fusion of two groups. It is here that, for the most part, the homogeneity of each cluster is maximised while the total number of clusters in the solution is minimised. This is regarded as the most appropriate solution because it typically also provides the greatest heterogeneity between clusters.

In this study, this optimal solution provided a starting point for the selection of the "best" solution for the delineation of neighbourhoods in the town. The "best" solution was the one which came closest to meeting the objectives laid out above; that is, the solution which not only provided internally homogeneous neighbourhoods according to selected demographic characteristics, but also the one which defined the most spatially compact neighbourhoods. To achieve this critical feature of compactness, a spatial constraint was required to maintain the locational contiguity of the households being fused at each step of the clustering procedure. This was done through the inclusion of the x and y coordinates of each household as attributes in the cluster analysis, and they were weighted, following standardisation, by an arbitrary factor of 10 to ensure that they were given higher priority in the combining of households and clusters. Thus, the proximity of the households to one another became the most important criterion in the cluster analysis with the demographic attributes serving to "fine tune" the composition of the neighbourhoods. And since proximal households typically share similar characteristics, this emphasis on compactness does not unduly violate the demographic homogeneity of the resultant neighbourhoods (Herbert and Johnston, 1976; Pacione, 1984). Nevertheless, by weighting the spatial coordinates after standardising each of the descriptors to be used in the clustering of households, the relative compactness of the neighbourhoods was ensured.

The following five descriptors were used in the derivation of the neighbourhoods by means of cluster analysis:

1. *x* coordinate of household (HX);
2. *y* coordinate of household (HY);
3. number of people in the household (NUM);
4. mean age of those people in the household (AGE); and
5. total combined income of household members (INC).

The generally accepted utility of number of people in the household and total household income as descriptive attributes has been argued by many researchers (Vickerman, 1974a; Naroff, Madden, and Dillon, 1984), and the inclusion of the mean age of household members serves as a "pseudo life cycle" indicator. With the predominance of nuclear families and married couples in the responding households (refer to Table 3.12), the calculation of the mean age of the members of the household provides a reasonable indication of the stage at which the household finds itself: young family, older couple, and so on. A random selection and examination of the composition of several households did, in fact, verify that stages in the life cycle generally were being captured by this measure of mean age.

Three separate cluster analyses were conducted -- one for each of the three planning regions in the town. This was done for two reasons. Firstly, the three regions are separated by well defined physical barriers which would have served as spatial constraints in any case. Secondly, the particular clustering algorithm employed (Ward's method in the CLUSTAN statistical software package) could not handle all 1163 households, so the three regions provided more manageable data sets. A total of 578 households comprised the West region, 327 households were in the North region, and 258 households made up the East.

Figure 4.1, referred to as a "scree diagram", illustrates the increases in the "error" (as indicated by the within group sum of squares) for each cluster solution in the three regions. For the most part, the increases are relatively consistent up to a particular point on the scree diagram where a relatively sharp jump in the amount of error occurs as a result of the fusing of two clusters. It is here that the selection of the best cluster solution was initiated.

In the case of the West region, 22 clusters proved to be not only the solution which preceded a sharp increase in the error term, but that which also met all the necessary criteria for selection. These 22 clusters, or "neighbourhoods", were all quite compact, respected recognisable bar-

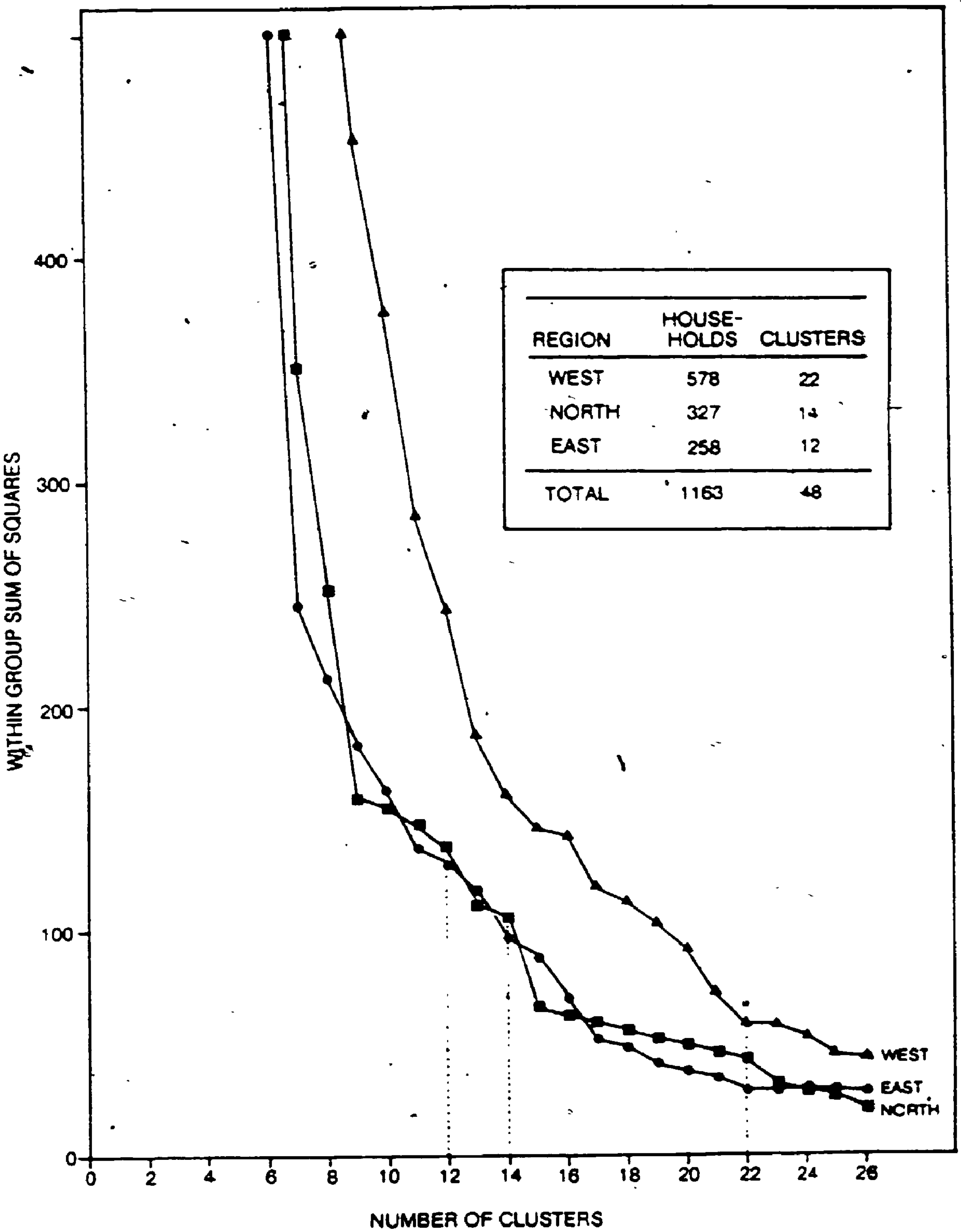


Figure 4.1

Scree Diagram for Cluster Solutions of Each Region riers, and possessed an adequate number of households within them ($\bar{X}$=26.273 households per neighbourhood; s.d.=8.675). For the East region, a fairly sharp increase occurred with the 16 cluster solution then again with the 11 cluster solution. Solutions with greater than 16 clusters proved to be inadequate, so following an examination of each solution within this range to determine which one best satisfied the established criteria, the 12 cluster solution was selected (Figure 4.1). These 12 neighbourhoods contained on average 21.500 households (s.d.=6.842). In the North region, a fairly significant increase in the error term occurred with the creation of a 14 cluster solution, but this set of 14 neighbourhoods was retained as the solution because it met the established criteria far better than a 15 cluster solution, selected under conventional rules, would have provided. An average of 23.357 households (s.d.=9.516) appear in the neighbourhoods of the North region, and overall, there are 24.229 households (s.d.=8.586) on average in the 48 neighbourhoods.

Figure 4.2 shows the 48 total neighbourhoods (NBRs) resulting from the cluster analysis. The code numbers associated with each neighbourhood correspond to the numbers employed throughout the rest of this study, especially in the Tables to follow.

ZONE	NBRs
WEST	1 to 22
EAST	23 to 34
NORTH	35 to 48

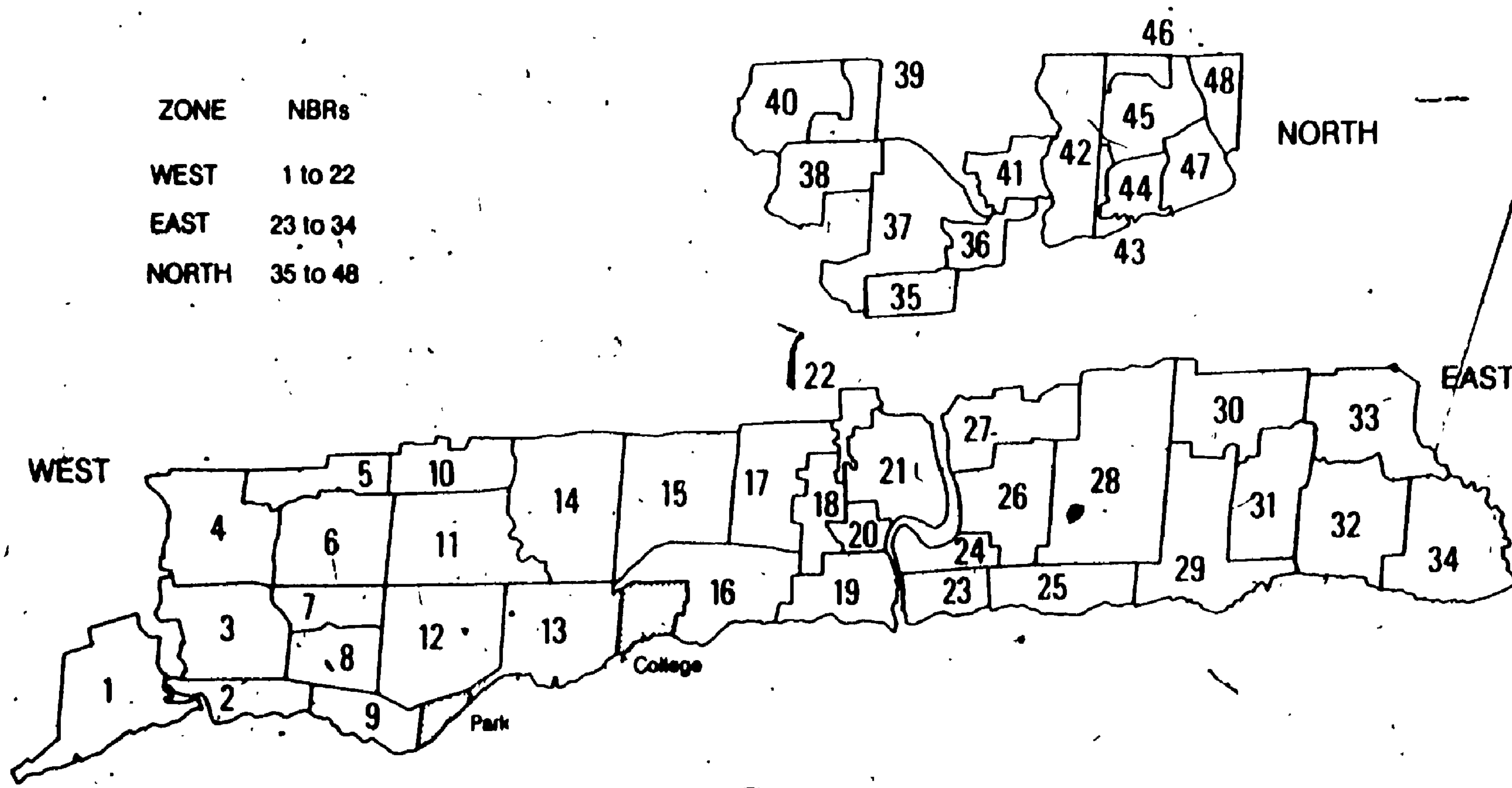


Figure 4.2

48 Neighbourhoods Derived from Cluster Analysis

4.1.3 Neighbourhood Descriptors: Spatial Aspects

The 48 neighbourhoods resulting from the cluster analysis can be described according to the three demographic attributes which served to discriminate between households: the number of individuals in the household, the mean age of those individuals, and the total combined income of the household. Now aggregated to the neighbourhood level, the mean of these attributes describe the character of each area.

Tables 4.1 to 4.3 report the t-values and F-ratios for each neighbourhood on the three attributes. The t-values, which essentially are standard scores, reflect the degree to which a neighbourhood's measure on an attribute departs from the mean of the population which is set at zero. The F-ratios provide an indication of the amount of internal variation that exists within a neighbourhood on a selected attribute. Calculated by dividing the variance on an attribute within the cluster by the population variance on that attribute, F-ratios lower than 1.0 reflect neighbourhoods with a higher degree of homogeneity (i.e. lower within group variation) than that found across the community. Therefore, the most desirable descriptors of the neighbourhoods are those attributes that combine t-values quite different from zero and F-ratios that are less than 1.0.

In order to characterise the 48 neighbourhoods, a summary table based on the results in Tables 4.1 to 4.3 was organ-

Table 4.1: Neighbourhood t-values and F-ratios: NUMBER IN HOUSEHOLD

NBR*	t-value	F-ratio	NBR*	t-value	F-ratio
1	.1680	.8090	25	- .2304	1.0940
2	- .7680	.4831	26	- .3401	.9358
3	- .2485	1.1262	27	.0000	1.4494
4	.4937	.5562	28	.4649	.6492
5	- .0240	.9518	29	.0000	1.1669
6	.0000	.6623	30	.0591	.8585
7	.4096	1.2007	31	.1415	.7908
8	.1536	.8206	32	.2909	1.1351
9	.2095	.7835	33	.0768	1.0798
10	.1513	1.0881	34	.2012	.6438
11	- .1920	1.0488	35	.2304	1.1561
12	.0914	.8917	36	-1.2374	.2007
13	.2659	.5050	37	.4088	.7277
14	- .1557	1.1110	38	.3456	.7132
15	.0116	.9641	39	.1986	1.3351
16	.2560	1.8073	40	.0886	.9514
17	.3840	.7381	41	- .3097	.8406
18	- .1011	1.3261	42	.5280	.5683
19	- .0480	.9422	43	- .0480	.5486
20	-1.0241	.5732	44	.0619	1.0933
21	- .5486	.7154	45	.2816	.4105
22	-1.1117	.6871	46	.4480	.5860
23	.0480	1.0998	47	.2021	.9076
24	-1.2673	.3900	48	.3142	.1718

Mean = -0.014   s.d. = 0.437

* NBR - neighbourhood code number (corresponds to map)

ised. Table 4.4 identifies neighbourhoods recording t-values departing notably from zero -- these neighbourhoods are indicated with "+" (above the community mean) and "-" (below the community mean) signs. Neighbourhoods that com-

Table 4.2: Neighbourhood t-values and F-ratios: MEAN AGE OF HOUSEHOLD

NBR*	t-value	F-ratio	NBR*	t-value	F-ratio
1	- .3710	.7360	25	.6264	1.3922
2	.6328	2.0524	26	.4311	1.5838
3	.3696	1.3028	27	- .0803	1.1206
4	- .4832	.1271	28	.1316	.8815
5	.1632	.7387	29	.4255	1.3874
6	- .1347	.5545	30	.1991	1.3339
7	- .2748	.4759	31	.2338	1.0966
8	- .1461	.4959	32	- .1824	.5502
9	.0245	.6768	33	- .1122	.9097
10	.1175	.5245	34	- .2555	.2418
11	.3951	1.0385	35	- .2266	.7523
12	.0618	.9961	36	.4123	1.3411
13	- .0833	.8504	37	- .4222	.2885
14	- .0019	.7417	38	- .3018	.6230
15	.1903	1.0299	39	- .4126	.7258
16	.2107	1.3493	40	- .2218	.8137
17	- .2460	.4118	41	- .4462	.6426
18	.4166	1.6338	42	- .3682	.2777
19	- .4525	.3532	43	- .7316	.2540
20	1.2294	2.0690	44	- .1839	.5043
21	.8849	2.0387	45	- .4423	.7198
22	- .0505	.6360	46	- .7832	.2836
23	.4639	1.9972	47	- .1424	.9741
24	.6931	1.7758	48	- .6425	.2693

Mean = 0.002 s.d. = 0.427

* NBR - neighbourhood code number (corresponds to map)

bine high t-values with low F-ratios are indicated by two of these signs.

Table 4.4 reflects the principal differences between the neighbourhoods illustrated in Figure 4.2. The higher than

Table 4.3: Neighbourhood t-values and F-ratios: TOTAL HOUSEHOLD INCOME

NBR*	t-value	F-ratio	NBR*	t-value	F-ratio
1	- .0086	.5140	25	.5990	1.4710
2	- .3100	.2182	26	.0103	1.1827
3	- .4355	.6490	27	.1219	1.3751
4	- .0099	.4622	28	.6076	1.5109
5	.0543	.5275	29	1.0964	2.8182
6	- .0985	.3552	30	.3656	1.6119
7	.5024	2.2304	31	.3604	1.3979
8	.3848	.7220	32	.9425	3.2783
9	.2387	1.1757	33	.2353	1.3694
10	- .1299	.5759	34	.1653	.2598
11	- .1659	.37[illegible]9	35	- .3411	.6026
12	.1609	.6901	36	- .3097	.6755
13	.3448	.9047	37	- .0734	.6622
14	- .2395	.5901	38	- .2032	.5038
15	- .0825	.7854	39	- .4583	.5560
16	.1547	.2972	40	- .2425	.4827
17	- .3673	.9687	41	.0172	.9030
18	- .3251	.8077	42	- .3153	.1983
19	- .1985	1.6428	43	- .4188	.5369
20	- .7086	.7641	44	.0650	.1729
21	- .4970	.7675	45	.2475	.4422
22	- .9983	.6955	46	- .1651	1.6195
23	.4949	1.7247	47	.0767	.2090
24	- .6315	.5615	48	- .0992	.3031

Mean = -0.012 s.d. = 0.407

* NBR - neighbourhood code number (corresponds to map)

average numbers of household members as well as the lower than average composite mean age of a household in NBRs 37 to 48 (the North region) suggests a predominance of young families in these neighbourhoods. Neighbourhoods with older res-

Table 4.4: Summary Description of Neighbourhoods (n=48)

NBR	NUM	AGE	INC	NBR	NUM	AGE	INC
1		-		25		++	+
2	--	+	-	26	-	+	
3		+	--	27			
4	++	--		28	++		++
5				29		+	++
6				30			+
7	+		+	31			+
8			+	32	+		++
9				33			
10				34			
11		+		35			
12				36	--	+	-
13			+	37	++	--	-
14				38	+	-	
15				39		--	--
16				40			
17	+		-	41	-	--	
18		+	-	42	++	-	-
19		--		43		--	--
20	--	++	--	44			
21	--	++	--	45	+	--	
22	--		--	46	++	--	
23		+	+	47			
24	--	+	--	48	++	--	

Key: ++ = neighbourhood with t-value well above the mean
+ = neighbourhood with t-value above the mean
- = neighbourhood with t-value below the mean
-- = neighbourhood with t-value well below the mean

NBR = neighbourhood code number (corresponds to map)
NUM = mean number of household members
AGE = mean age of household members
INC = mean total household income

idents such as NBRs 2, 20, and 21 match the locations of seniors' housing in the community. NBRs 17 to 22 near the centre of the town (see Figure 4.2) are the areas where the concentrations of subsidised housing are located and this is reflected in generally lower average household incomes. In contrast, NBRs 25 to 32 reveal the decidedly higher income residential neighbourhoods in the community which are coincidently typical in terms of mean age and number of household members.

In order to illustrate these spatial aspects of the derived neighbourhoods more dramatically, Figures 4.3 to 4.5 graphically show concentrations of these three attributes across the community. These maps are based on the t-values reported in Tables 4.1 to 4.3, and the class intervals are defined using standard deviations from the community-wide mean of zero. These intervals were selected to show general patterns rather than statistically significant differences among the neighbourhoods (Evans, 1977).

With the derivation of the neighbourhoods, all other measures associated with the demand system described in the previous chapter have been aggregated to this level. Therefore, such indicators as park familiarity, recreational participation in selected activities, and so on, now pertain to the neighbourhood rather than the household. In addition, the spatial coordinates defining each neighbourhood's relative location in the community are based on the mean of the

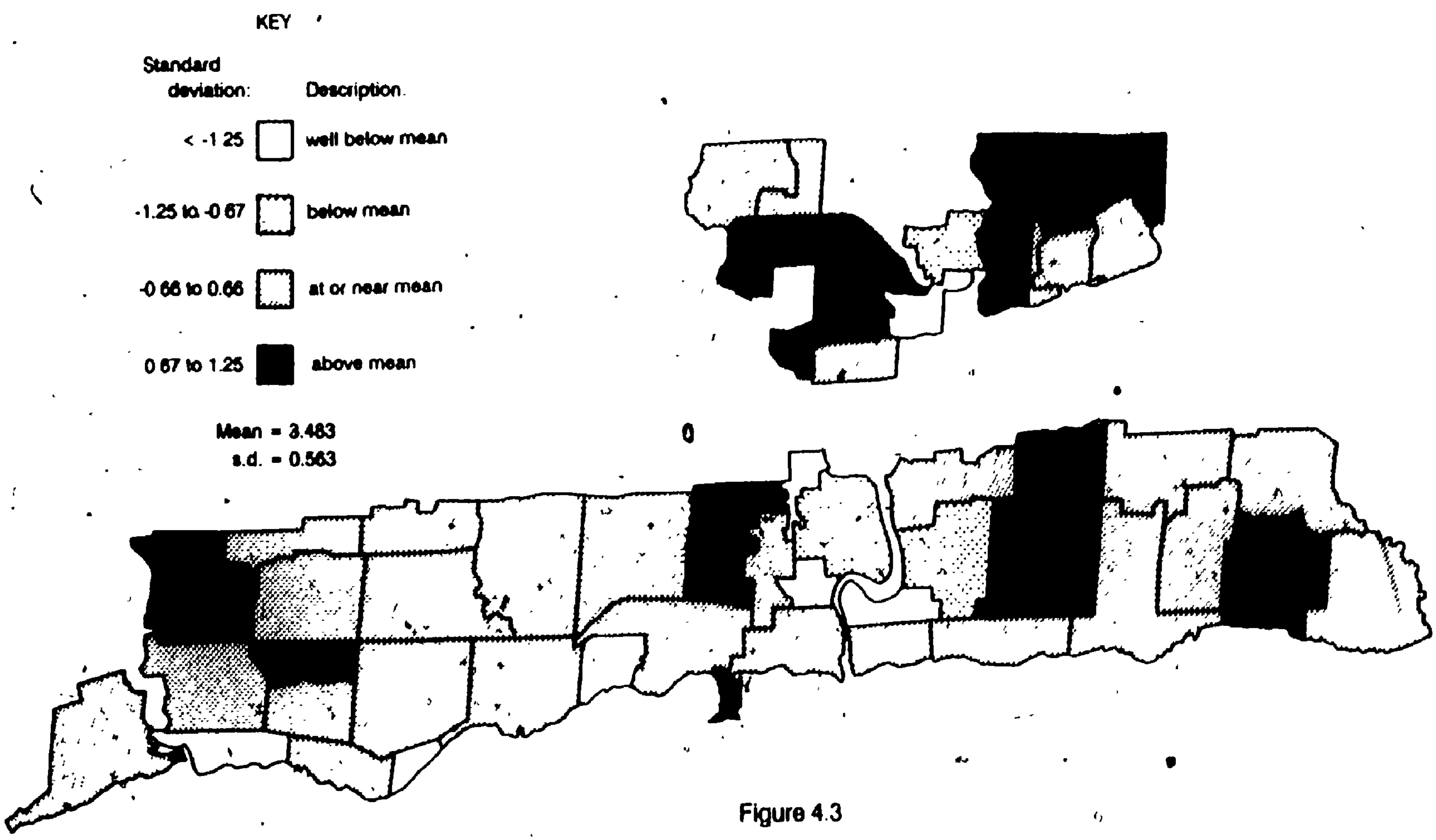


Figure 4.3

Mean Number of Persons per Household

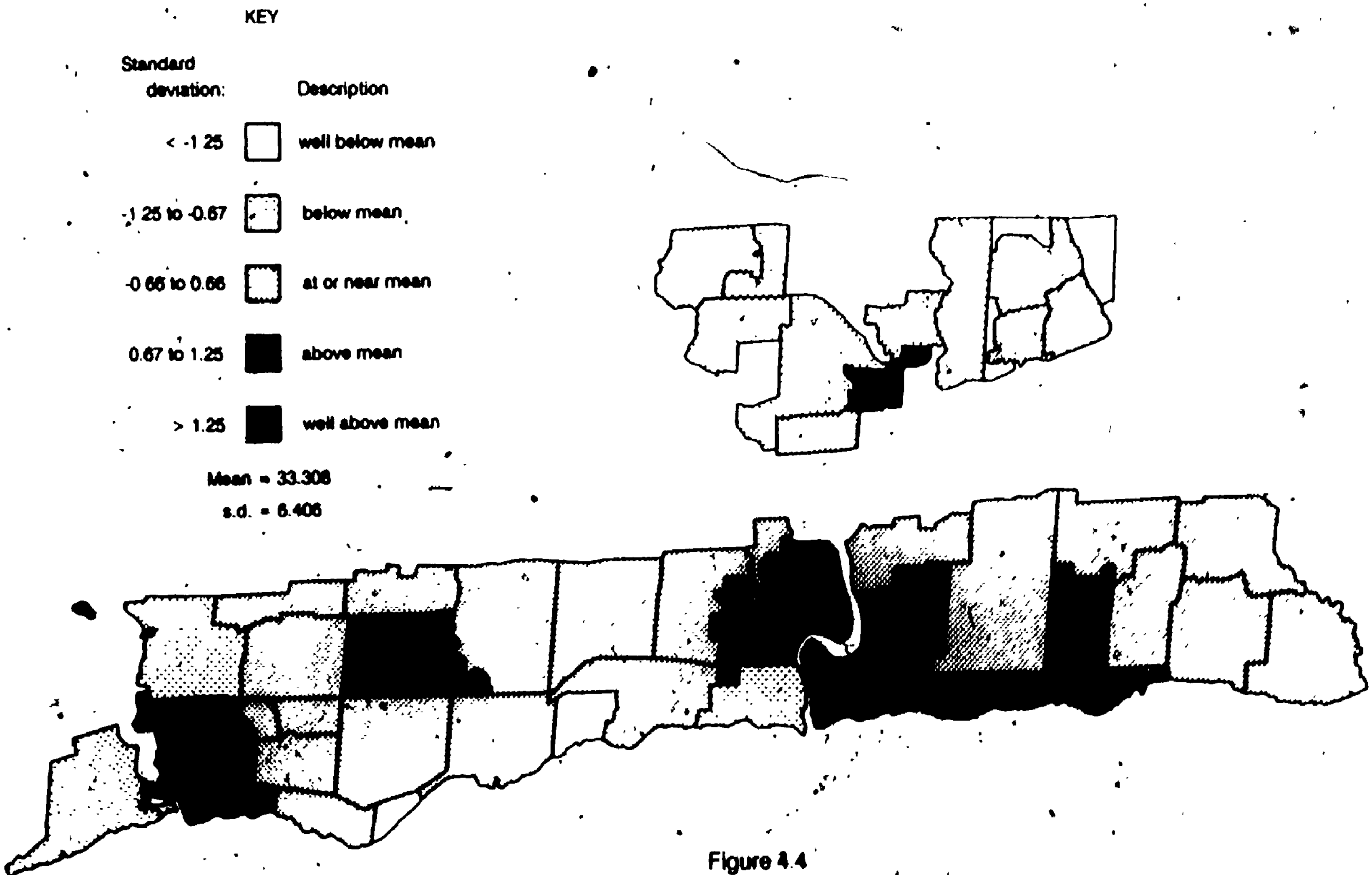


Figure 4.4
Composite Mean Age of Household Members

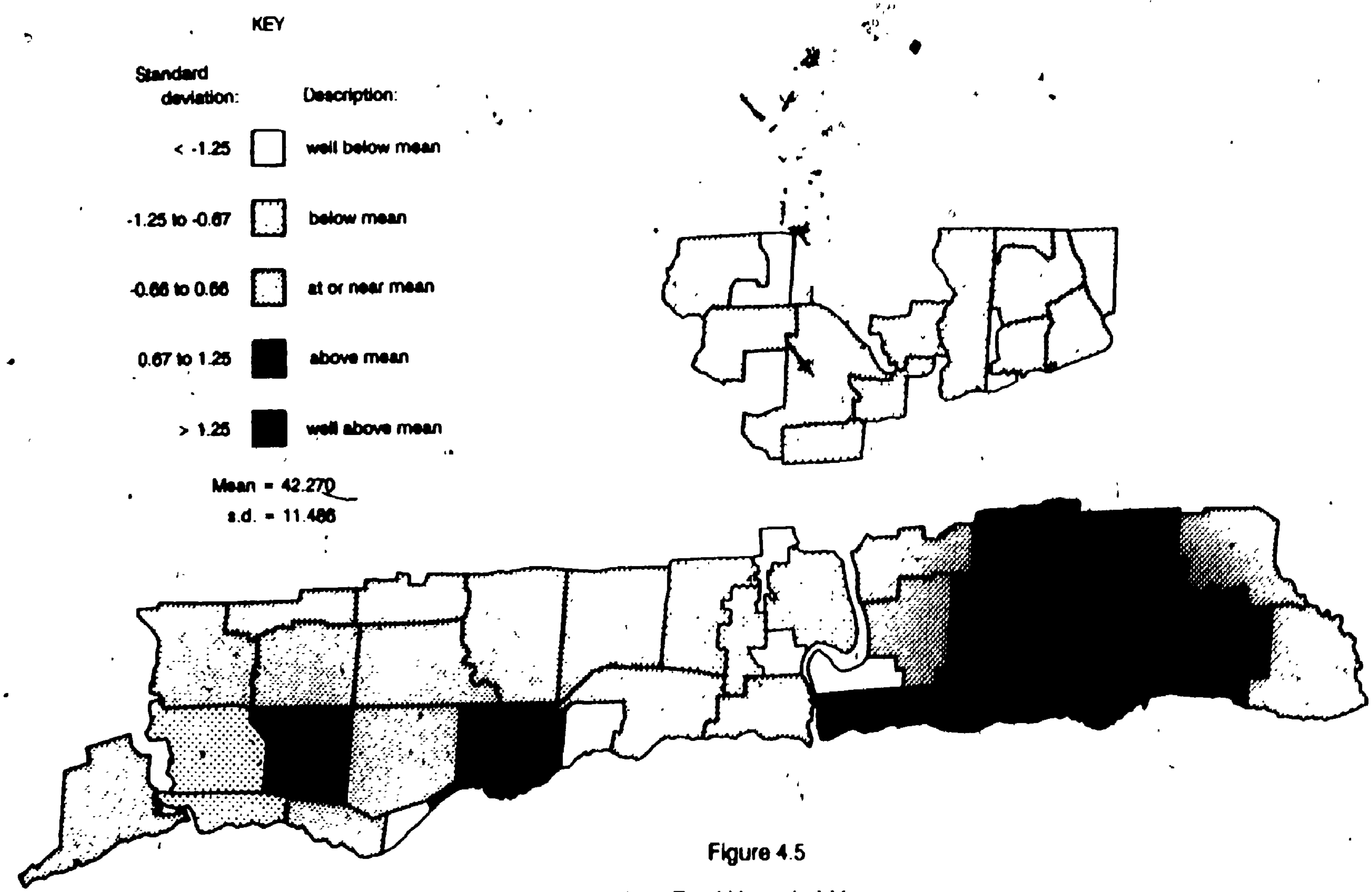


Figure 4.5

Mean Total Household Income

x and y coordinates of the households (HX and HY) making up a neighbourhood. These new mean coordinates (NX and NY) provide a more accurate description of the average location of the households within a neighbourhood than would the more commonly employed geographic centre that ignores concentrations of residential development in each zone. For example, in NBR 1, approximately 80% of the households are situated near Fourteen Mile Creek where the majority of the development has taken place (see Figures 3.1 and 3.4). While variations in the size of the neighbourhoods may introduce a small bias to the mean centres with respect to the actual proximity of individual households to adjacent neighbourhoods and parks, the mean centres employed here still provide the best measure of a household's relative location within the community.

4.2 SPECIFYING THE COMPONENTS OF URBAN RECREATION

With the derivation of the 48 neighbourhoods, a set of "origins" has been specified for inclusion in the gravity model describing the use of the 20 main parks (the "destinations") on the survey. Before this phase of the analysis is conducted, however, the interrelationships amongst the recreation supply variables and amongst the recreation demand variables is explored in order to arrive at a configuration of the general model which best represents the contribution of these factors. Also, and perhaps more importantly, the particular function of distance in the model must be specified.

4.2.1 The Gravity Model's Components and Structure

The first step in the process of delineating the model was to generate a data set that embodied all the information concerning the 20 main parks from the survey and the 48 derived neighbourhoods into a matrix which reflected every origin-destination pair (48X20). This resulted in a total of 960 "cases" each of which contained a unique combination of data about one neighbourhood and one park. The park use which occurred between neighbourhood i and park j was calculated by summing the mean summer month use and the mean winter month use then multiplying this total by 6 to arrive at an estimate of the neighbourhood's annual average use of the park. This measure reflects the variations which occur in the use of the parks during the summer and winter months (see Tables 3.17 and 3.18), and balances out the fluctuations which naturally occur from month to month within each of the two principal seasons. However, because this value is subject to the number of households making up the neighbourhood, this estimate of total use is divided by the number of households to arrive at an estimate of the mean annual use of the park by a household in the neighbourhood. Ewing (1976, 1983) has argued that this approach has more merit from both a practical and a statistical standpoint since mean use per household in neighbourhood i removes the bias associated with comparing neighbourhoods of different sizes, and therefore, with differing potentials to express use. As Ewing (1976) has noted, such an estimate produces a more uniform set of origins in terms of the variance in park use, and therefore, a measure less likely to produce misleading R^2 results when fitting the model.

Table 4.5 reports the mean total use of all 20 main parks by the neighbourhoods illustrating which neighbourhoods tend to be heavier users on average of these parks. Generally, neighbourhoods in the West region appear to be making heavier use of the parks than those in the other regions given the number with mean total use estimates well above the community-wide mean of 89.196 (s.d.=34.333). Further, the neighbourhoods in the North region appear to have lower than average patterns of park use with many of these areas falling below the community-wide mean. This table, even at this aggregate level, reflects the variations in demand which exist across the town -- variations which are also present when examining each park individually. The mean amount of park use that occurs for each neighbourhood-park pair (n=960) ranges from 0.0 to 79.5 with an average of 4.436 uses (s.d.=6.817). Clearly, park use at the neighbourhood level -- even of these 20 main parks -- appears to be quite low with several of the parks receiving no use at all by many of the neighbourhoods.

Table 4.5: Mean Total Use of 20 Main Parks by Neighbourhoods

NBR*	Total park use	Mean park use	NBR*	Total park use	Mean park use
1	5202	162.563	25	1356	67.800
2	2118	176.500	26	2928	83.657
3	4086	120.177	27	696	58.000
4	3600	128.571	28	1470	77.368
5	3144	98.250	29	1842	83.727
6	3600	94.737	30	3786	145.615
7	3804	126.800	31	1458	76.737
8	3054	101.800	32	1656	50.182
9	3090	140.455	33	540	36.000
10	3960	120.000	34	1110	52.857
11	2442	122.100	35	1416	70.800
12	4956	118.000	36	1356	75.333
13	2412	92.769	37	1554	50.129
14	4398	118.865	38	2340	117.000
15	3096	93.818	39	2364	81.517
16	498	41.500	40	2610	66.923
17	1356	79.765	41	2304	74.323
18	1782	93.789	42	1428	89.250
19	1794	112.125	43	1116	69.750
20	834	46.333	44	2208	71.226
21	1590	56.786	45	780	52.000
22	1326	69.789	46	552	46.000
23	2604	162.750	47	2262	59.526
24	1836	91.800	48	612	55.636

Mean total use = 2215.125 (s.d.=1199.440)
Overall mean use = 89.196 (s.d.=34.333)

* NBR = neighbourhood code number (corresponds to map)

Figure 4.6 illustrates the variations in mean total use of the 20 main parks, and affirms the observations made concerning Table 4.5. This estimate of a neighbourhood's mean use of a park (Iij), then, becomes the dependent variable in the subsequent analyses, and ultimately, in the gravity model leading to the derivation of the measures of potential for the urban recreation opportunity system.

The independent variables in the gravity model are those factors representing the urban recreation supply and demand systems, and the distance function, all of which were described in the previous chapter. In essence, the model's components are defined by the characteristics described in the conceptual model of urban recreation (Figure 2.2) and operationalised here through the park inventory and community survey. Therefore, the basic gravity model of the following form:

$$I_{ij} = a \frac{D_i S_j}{f(d_{ij})} \qquad [4.1]$$

can now be specified where Di represents the features of the urban recreation demand system; Sj represents the features of the urban recreation supply system; and f(dij) is a distance function to be determined. The two major components of the conceptual model can then be expressed as follows:

$$D_i = f(SE_i, RS_i, RP_i, L_i) \qquad [4.2]$$

where SEi are the demographic characteristics of the neighbourhood; RSi are the residential-structural features of the neighbourhood; RPi is the recreation participation in

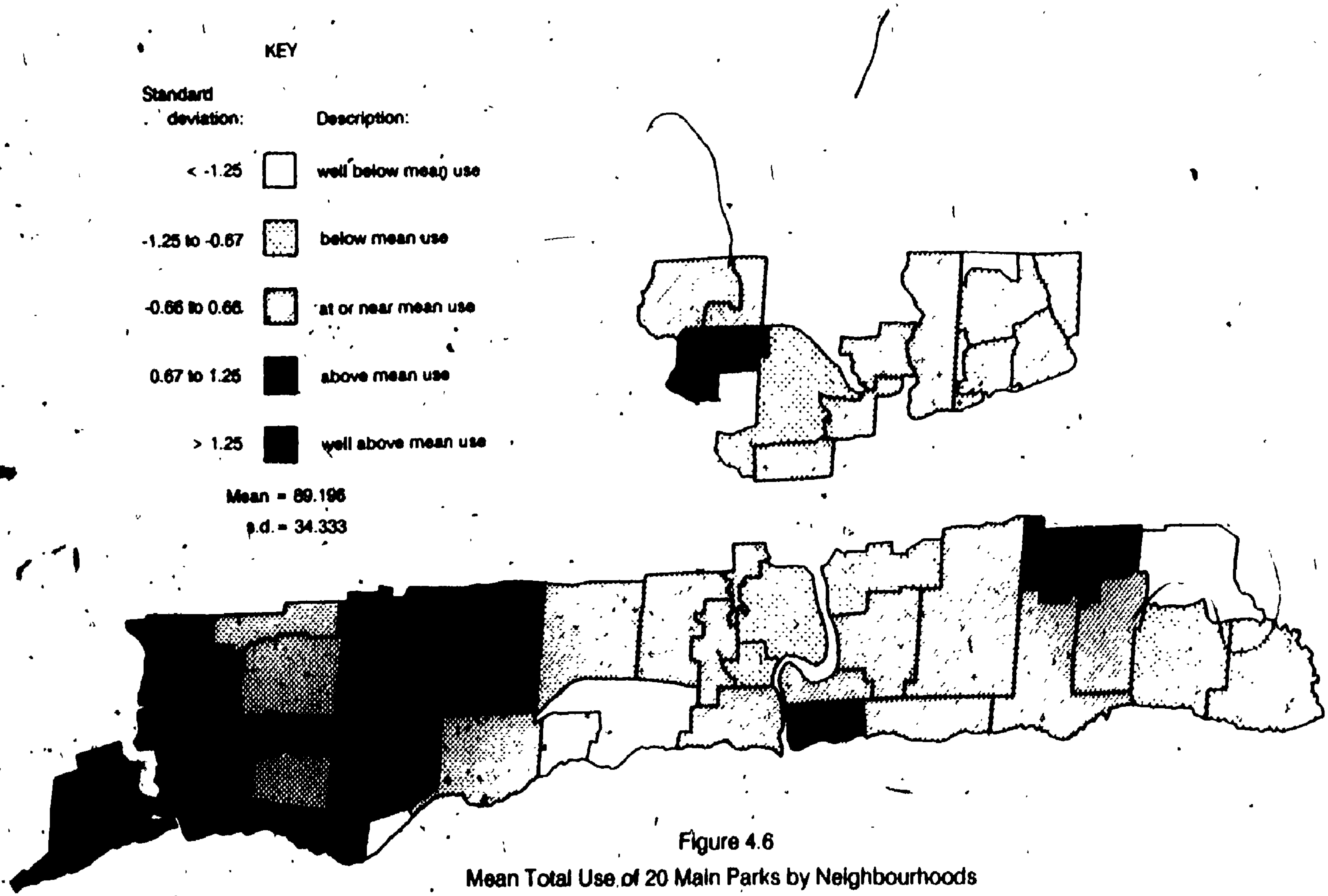


Figure 4.6
Mean Total Use of 20 Main Parks by Neighbourhoods

selected activities of the neighbourhood; and Li are the locational features of the neighbourhood; and

$$S_j = f(PH_j, MM_j, L_j) \qquad [4.3]$$

where PHj are the physical features of the park; MMj are the man-made features of the park; and Lj are the locational characteristics of the park. Among the physical features (PHj), accessible perimeter had to be dropped from further consideration because the base maps did not provide complete and detailed coverage of the parks. As a result, the reliability of the measures taken was in question. Collectively, the features combine to define the "emissivity" of the neighbourhoods (Di) and the "attractivity" of the parks (Sj) with respect to the urban recreation opportunity system.

Given these components to the model, its structure must be specified. In this study, because the potential measures are to be derived directly from the calibration of the gravity model, two key structural features are immediately established. First, the gravity model remains in its most basic form -- an "unconstrained" spatial interaction model because the derivation of potential assumes this form (Sheppard, 1979b). This means, too, that there is no theoretical upper limit on the amount of park use that could be generated (Ewing, 1980), and that the model remains descriptive in that it must be recalibrated with each change to either the supply or the demand system. This, however, is consistent with the contention of this study concerning the dynamism of these two systems. And on a more practical level, the simple gravity model has received both theoretical and empirical support from several researchers (Sheppard, 1979a; Baxter, 1983) although they do warn of problems associated with the misspecification of the model and with parameter estimation.

Second, it is assumed here that the gravity model can be transformed and be regarded as a linear function of its components. Again, sufficient theoretical and empirical support exists to render this assumption valid (Foot, 1981), so the question becomes how to place equation [4.1] into linear form which would allow for ease of calibration by means of ordinary least squares (OLS). The simplest approach has been to ignore the classic configuration and assume the model is additive; that is, that the sum of the components in the equation explains park use. However, the most common approach is to regard the model as multiplicative which assumes that the product of the elements is best able to explain park use. To put the multiplicative model into linear form, a logarithmic transformation is conducted allowing OLS to be used. Then, if desired, antilogs of the estimates can be taken to compare the observed values with the expected estimates of park use. Smale (1982) and Veldhuisen and Timmermans (1984) have compared the performance of additive and multiplicative models, and both found that a multiplicative structure performed better.

Consequently, the multiplicative model is adopted here meaning that each independent element is transformed logarithmically prior to calibration of the model. This then means that the observed park use by a neighbourhood (Iij) is also transformed, and it is this form of the dependent variable (lnIij) which is used in the analyses which follow.

4.2.2 The Cesario Model

In an effort to identify the best form which the recreation supply and demand variables should take in the model, a process of objectively assessing the structure of the model was required. The innovative approach taken by Cesario (1973, 1974, 1975, 1976), which has generated considerable interest in the literature, has several advantages at this stage of the study. The Cesario model provides a process that modifies the simple gravity model such that the neighbourhood "emissivity" (urban recreation demand) and park "attractivity" (urban recreation supply) are set as the parameters to be estimated in the model. Once the parameters have been estimated for each neighbourhood and each park, these estimates can then become the dependent variables in the subsequent evaluation of the supply and demand factors (Ewing, 1976).

The parameter estimates for the parks and neighbourhoods are arrived at through the calibration of the following equation:

$$I_{ij} = \left[\sum_{i=1}^{n} E_i^b \right] \left[\sum_{j=1}^{m} A_j^g \right] f(d_{ij}) \qquad [4.4]$$

where Iij is the use of park j made by neighbourhood i; Ei is the emissivity of neighbourhood i; and Aj is the attractivity of park j. In essence, each neighbourhood's emissivity (n=48) and each park's attractivity (m=20) is a variable in the equation with a value of either "0" or "1". With a data set made up of the 960 pairs of neighbourhoods and parks, the value of "1" is "switched on" only for the corresponding neighbourhood-park pair with all other variables taking on a value of zero. As a result, the coefficient estimated for park j is a function of that park's attractivity to the 48 neighbourhoods independent of the other parks. For example, the interaction between the neighbourhoods and park 5 can be expressed as:

$$I_{i5} = \left[\sum_{i=1}^{n} E_i^b \right] \left[\sum_{j=1}^{m} (1)_5^g \right] f(d_{i5}) \qquad [4.5]$$

with all other attractivity measures falling out of the equation due to their zero values. Thus, the parameter (i.e. coefficient) g becomes an estimate of the attractivity of park j to the neighbourhoods given the observed park use and distance function employed in the model (Cesario, 1976).

The Cesario model is used here for two principal purposes. First, because the estimates of emissivity and attractivity generated by the model have been shown to be independent of one another as well as of the distance function (Ewing, 1978), a variety of distance measures could be introduced to it in order to identify that function with the best "unaffected" fit. Second, by employing the estimates as dependent variables in subsequent analyses, the most appropriate model structure, with respect to the form that the supply and demand factors took, could be determined. With these results in hand, the specification of the gravity model leading to the determination of the potential measures could be carried out with a degree of confidence concerning the appropriateness of the model's structure.

4.2.3 Delineation of Urban Recreation Distance

There has been considerable discussion in the literature concerning which function of distance is most appropriate as an indicator of the presumed deterring effect that the separation between origins and destinations has on the interaction between them (Taylor, 1975; Smith, 1983a). For the most part, this discussion has not provided any definitive direction with regard to the choice of a distance function although certain forms have consistently shown to be better "fits" in gravity models than others. For example, the exponential form of the function (e-bdij) replaced the power function (dijb) as the preferred form in most simple applications of the model (Foot, 1981).

However, two issues especially important to this study remain unresolved. First, how should the physical distance between two points used in these functions be measured? As straight-line or rectangular distance? Or should perceived distance be used as has been suggested by Cadwallader (1975) and Canter and Tagg (1975)? And second, because most of the applications of the gravity models have been concerned with interurban or interregional travel, will distance have a different effect on intraurban recreation behaviour? In this section, six functions of distance -- some traditional and some innovative -- are examined within the context of the Cesario model to determine which form is best suited to explain park use by the neighbourhoods.

The six functions of distance selected are described below with a brief rationale for their selection:

1. Perceived accessibility (ACCPK): the perceived accessibility of a park by a neighbourhood (derived from the household survey) comes closest to satisfying the theoretical propositions of those researchers who have argued that cognitive distance may be a more appropriate indicator of the effect of distance on the behavioural decision. Cadwallader (1975, 1981) has demonstrated the utility of cognitive distance in gravity models of consumer decision making and spatial behaviour.

2. Euclidean distance (EUCLID): probably the most frequently employed measure of distance in spatial interaction models, Euclidean or "straight line" distance assumes a flat, linear plane without physical barriers to the movemment between points. Despite these apparently unrealistic assumptions, Euclidean distance has been shown to be a reasonably effective surrogate for other forms of distance. Several studies have shown high correlations between Euclidean distance and cognitive distance, and the relationship tends to be linear (Cadwallader, 1985; Saisa, Svensson-Garling, Garling, and Lindberg, 1986).

3. Manhattan distance (MANHAT): Manhattan or rectangular distance attempts to approximate the "street route" distance between a neighbourhood and a park, and in this way, provides some recognition of the physical barriers that may exist. By geocoding the parks and neighbourhoods on a plane with axes parallel to the streets in the community, this measure more closely approximates the actual routes that recreationists would take to get to a park. And while straight line distance is the distance most often estimated at a large scale, Canter and Tagg (1975) argue that at an urban scale, route distance is far more likely the distance perceived by individuals.

4. Pareto distance transformation (PARETO): the Pareto form of the distance function is perhaps the most common of the "double-log models" employed by researchers (Taylor, 1975). It often produces a relationship with the observed interaction of a "slightly 'concave-downwards'" (Taylor, 1975:26) pattern suggesting that the effect of distance is not severe when distances are short, but when they increase beyond a certain point, interaction -- or park use -- declines rapidly. This relationship certainly seems to be appropriate for an urban context where distances are relatively short. The Pareto distance transformation is brought about by the function:

$$e^{-bMad_{ij}}$$

where distance (dij) typically is a Euclidean measure (Taylor, 1975). In this study, for the reasons stated above, Manhattan distance is used instead.

5. Wolfe's inertia model (INERTIA): in one of the more innovative adaptations of the distance function, Wolfe (1972) proposed a measure of distance that was intended to reflect "the effect that distance itself has upon the perception of distance" (Wolfe, 1972:73). Essentially, Wolfe hypothesised that the "starting-up inertia" required for short trips kept the number of these trips few in number, but as the trips became longer, distance had less and less effect. In other words, once the starting-up inertia has been overcome, distance no longer deters the recreationist from going further. In an urban context, the analogy may be that once the individual has made the committment to use a park (started-up), given the relatively short distances within the community, no park would be regarded as "too far away". Wolfe's inertia model adds the following expression of distance as a function of distance to the basic gravity model:

$$d_{ij}^{-\left[\frac{\log\left(\frac{d_{ij}}{g}\right)}{k}\right]}$$

where g and k are parameters to be estimated (although Wolfe suggested values).

6. Smith's modified Boltzmann distribution (BOLTZ): in another innovative study, Smith (1980) suggested a modification of the Boltzmann distribution as a means of capturing a distance function responsive to the increasing number of recreation opportunities available at greater distances from an origin. Smith hypothesised that because the number of opportunities increased with distance, the number of trips would actually increase with distance until some maximum when the costs overcame the attraction (Smith, 1980:300). Smith tested this notion with the number of trips to urban recreation centres, and found a reasonably good fit for the distribution. Smith expressed his modified Boltzmann distribution in the following way:

$$g\, d_{ij}\, e^{\left[-k d_{ij}\right]}$$

where g and k are parameters to be estimated.

The first four of these distance functions could be calibrated directly in the Cesario model, but in the case of Wolfe's inertia model and Smith's modified Boltzmann measure, the distance functions could not be placed in linear form allowing the use of ordinary least squares (OLS) to estimate the parameters. Rather than rely on the values suggested by Wolfe (1972) and by Smith (1980), the distance functions were assessed on park use independent of the emissivity and attractivity factors using the NONLINEAR function of SPSSx. Essentially, in each case, park use was treated as strictly a nonlinear function of distance in order to generate the estimates of the parameters g and k in the models. These could then be inserted in the function when calculating the Cesario model. The resultant estimates are shown in Table 4.6.

Table 4.6 Nonlinear Parameter Estimates in Distance Functions

Distance Function	Parameters Estimated g	k
Wolfe (1972)	2.1247	1.0601
Smith (1980)	57.3004	1.3644

Comparisons of these estimates with Wolfe's recommended values are inappropriate because his values were intuitively derived and were concerned with interregional travel. Smith (1980) did estimate his parameters empirically and came up with values of 218.2 for the g parameter and 1.3 for the k parameter which is very similar to the value reported here (Table 4.6). This component of the function represents the costs associated with distance in much the same fashion as an exponential function so the comparable findings are encouraging with respect to model structure.

The results of the calibration of the six Cesario models with each distance function are shown in Table 4.7. In terms of their simple correlations with the natural logarithm of park use by the neighbourhoods, perceived accessibility achieved the highest correlation of 0.5912 (positive because higher ratings indicated greater access) with the Pareto function next at -0.4086. However, when the overall explained variance of the Cesario models is examined -- including the contribution of emissivity attractivity estimates to explaining park use -- the Pareto function appears to perform best achieving an R2 of 0.6168. In fact, perceived accessibility is surpassed in total explained variance by both the Euclidean and Manhattan distance measures as well (Table 4.7).

The performances of the distance functions associated with the inertia estimates and the Boltzman estimates are unclear. Despite the rigour with which these parameters were derived from the nonlinear functions prior to their reintroduction to the Cesario model, a number of concerns arose throughout this process which developed into serious questions about the validity of the estimates, and hence, the distance functions themselves. The results presented in Table 4.7, therefore, are more likely a reflection of the instability of these two measures under the particular circumstances of this study than a reflection of their contribution to the explanation of park use.

The principal criterion in the evaluation of these models is the percentage root mean square error (%RMSE) which provides an indication of the percentage error that exists in the residuals of the fitted model (Willmott, 1984). The

Table 4.7: Results of Various Distance Functions in Cesario Model

dij	r	s.e.e.	b	s.e. of b	R^2	%RMSE
[1]	.5912	0.7882	.39540	.0244	0.5584*	134.011
[2]	-.3534	0.7725	-.20423	.0116	0.5758*	150.764
[3]	-.3339	0.7876	-.15188	.0094	0.5590*	154.645
[4]	-.4086	0.7343	-.74337	.0355	0.6168*	117.227
[5]	.0095	0.8905	.05627	.0163	0.4364*	202.807
[6]	.3144	0.8032	.12281	.0083	0.5414*	176.004

* significant at 0.001 level

[1] f(dij) = accessibility rating
[2] f(dij) = Euclidean distance
[3] f(dij) = Manhattan distance
[4] f(dij) = Pareto (e -bln dij) with Manhattan dij
[5] f(dij) = Wolfe's inertia estimate
[6] f(dij) = Smith's Boltzman estimate

NB: R^2 is explained variance of park use with distance function, emissivity and attractivity estimates included

%RMSE is especially sensitive to percentage errors among the lower values which is most appropriate in this study given the high number of neighbourhoods with low levels of park use -- in fact, frequently zero. Therefore, a model with a lower %RMSE is judged to be better able to approximate these low levels of park use.

Once again, the Cesario model employing the Pareto function of distance proved to be the best fitting model according to the %RMSE (Table 4.7). It resulted in a %RMSE of 117.227 which was notably better than the model employing perceived accessibility (134.011). Interestingly, Smith's modified Boltzmann function of distance, despite a reasonable overall fit in the Cesario model (R^2=0.5414), showed a considerable amount of mean error in the residuals. Evidence such as this concerning other functions in the model lends confidence to the selection of a model structure based on the Pareto function.

As a simple check on Ewing's (1978) assertion that the Cesario model's parameters could be regarded as independent of one another, the estimates of emissivity for each neighbourhood and of attractivity for each park for the six distance functions were compared. The corresponding estimates in the models were not identical as would be expected, but collectively, they all were highly correlated. Correlation coefficients for the emissivity estimates averaged 0.8399 (s.d.=0.0928), and 0.9321 (s.d.=0.0377) for the attractivity estimates indicating that, despite which distance function was introduced to the model, the parameter estimates remained fairly consistent. Consequently, it may be inferred that this provides an indication of the separability of the distance function in the model (Ewing, 1978).

Given these results, the Pareto function of distance was adopted for all subsequent phases of the study. Even though the superior results of this function over those generated by the use of perceived accessibility were somewhat unexpected, this distance measure simplifies the calculation of the distances between the neighbourhoods and the other parks not included in the survey. While it would be premature to suggest that this indicator of distance as a deterrence function is the most appropriate measure for all intraurban recreation behaviour, it has demonstrated its superiority in this particular recreation system.

4.2.3.1 Intervening opportunities index

Haynes and Fotheringham (1984:20) have suggested that the distance function not be restricted solely to a single distance measure, but rather, be regarded as a composite measure which attempts to reflect the effect that the separation of origins and destinations has on the interaction between them. In the same way that a number of factors contribute to both the urban recreation supply and demand systems, so too may more than one measure of distance contribute to the constraining effect on the use of the parks by the neighbourhoods.

The most likely candidate for this coincident effect is the occurrence of intervening opportunities between the origin-destination pair in question. In fact, the "intervening opportunities model" developed by Stouffer (1940) has been employed in modified forms in several researchers' applications of the gravity model (e.g. Beaman and Smith, 1976; Cheung, 1976; Baxter and Ewing, 1979) with, in some cases, a "sizeable improvement of fit of the model's predictions" (Ewing, 1980:11). Typically, however, these models have used an index of intervening opportunities <u>in place of</u> a function of distance, and not in conjunction with it.

A number of forms of the intervening opportunities index have been suggested by researchers, but perhaps the most versatile is the generalised version offered by Beaman and Smith (1976) which takes the following form:

$$IO_{ij} = \sum_{k=1}^{m} \left[\frac{A_k}{d_{ik}^{b}} \right] \quad \textit{where } d_{ik} < d_{ij} \qquad [4.6]$$

where IOij is an indication of the intervening opportunity effect on the potential interaction between origin <u>i</u> and destination <u>j</u>; Ak is the attractivity of intervening opportunity <u>k</u>; and dik is the distance from origin <u>i</u> to intervening opportunity <u>k</u> which is less than dij. The particular form that Ak and the value of the distance parameter <u>b</u> take on has usually been subject to the assumptions made by each researcher (Smith, 1983a) about the nature of the interaction.

As with the gravity model, the intervening opportunities index assumes that the residents of a neighbourhood have perfect information about all the opportunities available to them, and those that fall between them and a specific destination will have an effect on their decision to use that destination. However, as was argued in the conceptual model of urban recreation, the residents must first be aware of these other parks before the effect can be felt. Consequently, if the households in a particular neighbourhood are not aware of the five parks which are located between them and the specific park in question, then those intervening opportunities play no part in the decision.

Therefore, a fundamental change to the generalised version of the index was made by the introduction of "familiarity" to the equation to reflect a neighbourhood's awareness of the intervening park, and ultimately, its response to it. The basic form of the index in this study took the following form:-

$$IO_{ij} = \sum_{k=1}^{m} \left[\frac{F_{ik} \; A_{ik}}{d_{ik}^{b}} \right] \quad where \; d_{ik} < d_{ij} \qquad [4.7]$$

where Fik was the familiarity which neighbourhood i possessed about intervening park k; Aik is the attractivity of intervening park k from the perspective of neighbourhood i; and dik is the distance between neighbourhood i and intervening park k (which is less than the distance between that neighbourhood and park j). Several variations on this basic form were examined in order to arrive at the index which performed best.

Essentially, familiarity took one of two forms: (1) the mean rating of familiarity that a neighbourhood had about an intervening park, or (2) a value of "1" if the neighbourhood's mean rating was greater than 1.50, and a value of "0" if the mean rating was less than 1.50. In the first form, familiarity served as a weighting factor in the index reflecting the variable effect that the intervening opportunities may have. Where a neighbourhood was unfamiliar with the intervening park (Fik < 1.5), familiarity was set to zero to remove any effect. In the second form, a value of "1" was assigned to familiarity when a neighbourhood showed any degree of awareness about a park allowing the other factors in the index to take effect. Again, "0" was used to "switch off" this effect. In this case, the simple presence of an intervening opportunity was presumed important rather than the degree of its familiarity to the neighbourhood which follows the suggestion of Butler (1975).

Table 4.8 reports the results of the trials with each version of the intervening opportunities index with the dependent variable of park use (Iij). The particular form of the index is reported at the bottom of the table. Throughout these trials, the measure of distance (dij) that was used within the Pareto distance function was Manhattan distance. As an approximation of the street distance to each park, it was assumed to be the most reliable indicator in this part of the analysis. The measures of attractivity took three forms: (1) the mean rating of attractivity given a park by a neighbourhood; (2) the park's shape index; and

(3) the park's area. These latter two measures served as surrogate indicators of a park's attractivity in an effort to simplify the index for later use.

Table 4.8: Results of Various Indices of Intervening Opportunities Effects

IOij	r	s.e.e.	b	s.e. of b	F	%RMSE
[1]	-.2781	1.0994	-.27810	.0306	80.303*	237.704
[2]	-.3774	1.0599	-.37743	.0390	159.136*	218.704
[3]	-.1379	1.1336	-.13786	.0230	18.560*	267.924
[4]	-.2906	1.0951	-.29057	.0399	88.340*	231.166
[5]	-.3644	1.0658	-.36440	.0466	146.686*	245.698
[6]	-.1094	1.1376	-.10940	.0255	11.604*	277.039

* significant at 0.001 level

$$IO_{ij} = \sum_{k=1}^{m} \left[\frac{F_{ik} A_{ik}}{d_{ik}^{b}} \right] \quad where$$

[1] F = familiarity rating; A = attractivity rating
[2] F = familiarity rating; A = shape measure
[3] F = familiarity rating; A = area measure
[4] F = familiarity (0,1); A = attractivity rating
[5] F = familiarity (0,1); A = shape measure
[6] F = familiarity (0,1); A = area measure

The results indicate that version [2] of the intervening opportunities index provides the best fit in explaining park use. This version, which used the familiarity rating and the shape measure, had the lowest percentage root mean square error (%RMSE) as well as the highest simple correlation (r) and beta coefficient (b). Interestingly, the shape measure performed better than the attractivity rating used in versions [1] and [4] which reduces the complexity of the index in later use.

4.2.4 Recreation Supply Factors

Following the examination of the various measures of distance, estimates of neighbourhood emissivity and park attractivity were recalibrated in the Cesario model using the Pareto distance function. These new estimates then provided the dependent variables for an examination of the contribution of each of the supply and demand factors to their explanation. This allows for a preliminary check on the model's structure as well as the appropriateness of each variable's utility in the model (Ewing, 1976).

In both of the following two sections, the supply factors and the demand factors are treated according to the category within the conceptual model to which they belong. In other words, those variables which define the physical features of a park -- area, shape, presence of a creek or lake shoreline -- are treated separately, but are entered into the model together. This permits the examination of not only each variable's contribution to the explanation of neighbourhood emissivity and park attractivity, but also the contribution of the feature as a whole. In addition, even though a number of configurations of supply features and of demand features were assessed at this stage of the study, only the results of the "best" configurations are presented.

Table 4.9 reports the estimates of park attractivity generated by the Cesario model. These estimates are, in fact, the regression coefficients generated by OLS when fitting the model. Also in the Table are the mean ratings of perceived attractivity as indicated by all the households in the survey (reported earlier on Table 3.20), and the correlation between the two sets of values is quite high (r=0.69254). While the attractivity of a given park will be perceived differently by each neighbourhood, these overall ratings do reflect a general level of attractivity just as the estimates from the Cesario model do.

Before considering the supply factors' ability to approximate these estimates of park attractivity, the supply measures required some adjustments to meet the basic requirements of the linear regression analysis. Not all the park inventory variables were interval level measures, and the distribution of values in others made their inclusion unacceptable. With respect to the physical features (PHj), park area (AREA) and shape (SHAPE) remained unchanged, but the presence of a creek or the lake's shoreline, as nominal measures, had to be transformed. In this case, these two variables were combined to generate a variable indicating no water present ("0"), the presence of a creek ("1"), the presence of the lake shoreline ("2"), or the presence of both ("3"). This created a rank-order variable that provided a weighted indicator of the presumed positive effect of

Table 4.9: Cesario Model Estimates (b) and Perceptions of Park Attractivity

Park	b	Attract.*
B. A. Field	0.59569	3.968
Bronte Beach	0.94231	4.857
Busby	0.05424	4.314
Centennial Square	0.48698	5.502
Coronation	1.46088	5.793
Fisherman's Wharf	0.83937	5.321
Gairloch Gardens	1.11754	6.507
Holton Heights	0.30720	3.784
Hopedale	0.19680	3.582
Lakeside	0.84318	5.242
Lawson	-0.05511	4.855
Lion's Valley	0.76799	4.899
Oakville	0.12423	4.405
Optimist	-0.02136	3.466
Palermo	0.02136	3.494
Pineridge/Hend.	0.43071	3.836
Shell	0.75715	5.851
Sunningdale	0.15455	3.647
Trafalgar	-0.31681	4.608
Wallace	-0.08579	4.216
Mean	0.43106	4.607
s.d.	0.47005	0.887

r = 0.69254
(significant at 0.001 level)

* perceived attractivity rating

having increasing opportunities for water recreation on site (WATER).

With respect to the man-made features in the park (MMj), several of the facilities and the types of playground equipment were so few in number that their distributions were significantly skewed. As a result, three new variables were calculated:

1. sports facilities (SPORTS) which was the sum of the number of sports fields, tennis courts, and baseball fields;

2. park furniture (FURN) which was the sum of the number of washrooms, picnic tables, park benches, and barbeque pits; and

3. playground equipment (PLAY) which was the sum of the number of swings, slides, teeter-totters, climbers, and "big toys".

The number of garden beds (GBEDS) remained the same, but because of extremely low numbers, the number of shelters, all purpose courts, and swimming pools were excluded from subsequent analysis. Even though swimming pools are major attractions, they are really facilities that are found in parks and their patronage does not truly represent park use.

With respect to the locational features of the parks (Lj), the geocoding of their locations allowed for the development of an indicator of their relative position in the community. The coordinates for the recognised central business district (CBD) of the community were used as a reference point, and each park's distance from that point calculated. The CBD, located along the boundary between neighbourhoods 23 and 24 (see Figure 4.2), has traditionally been viewed as the "centre" of the community with other locations frequently described in terms of its position. The measure was interpreted as an indication of the park's peripheral location (PPERIPH); in other words, it reflected the degree of locational centrality possessed by the park. Here, the assumption is that the more centrally located parks may provide more of an opportunity for recreation, and hence, appear to be more attractive.

Once these refinements had been completed, the correlations between the variables were examined to check for possible sources of multicollinearity. The independent variables should not show high correlations or the estimates of their coefficients can be misleading. Clark and Hosking (1986) have suggested that collinearity becomes severe when the correlation exceeds 0.80; here, a more rigorous value of 0.70 was established. The majority of the correlations were below 0.30 with only park area and peripheral location showing a high correlation (r=0.6925) which reflects the general pattern of larger parks being located on the town's edges.

Without including perceived park attractivity, the park attributes were entered into a linear regression analysis in an effort to explain the variation in the Cesario model estimates of park attractivity. The results are shown in Table 4.10.

Overall, these park attributes were able to explain 71.0% of the variation in the estimates of park attractivity with the number of garden beds (GBEDS) appearing to be the most important of these variables with its beta value of 0.37236. Interestingly, some of the factors traditionally viewed as

Table 4.10: Cesario Model Estimates Explained by Park Attributes

PARK attribute	b	s.e. of b	BETA
PHj			
AREA	.07893	.13677	.18967
SHAPE	-.23443	.24212	-.24581
WATER	.52282	.48576	.28244
MMj			
SPORTS	-.19468	.12035	-.30791
FURN	.01945	.09272	.05493
PLAY	-.02817	.06401	-.07352
GBEDS	.17932	.08678	.37236
Lj			
PPERIPH	.00456	.09835	.01351

$R^2 = 0.7100$
F = 3.3657; sig. F = 0.033

being synonymous with urban parks, such as playground equipment (PLAY), appear to have little relative importance in the overall explanation of the estimates even though they may be vitally important in a local context.

Despite the low significance levels of many of the variables in the equation, because they comprise a necessary feature of the supply component of the conceptual model, all of them are retained throughout the analysis. In addition, even though the overall R^2 may not appear here to be as large as might have been hoped, this equation does not take into account the perceptions of the individual neighbourhoods. The variable perceptions of park attractivity held by the neighbourhoods modify the effect of these resource measures and serve to redefine the role of each park as an opportunity for recreation.

4.2.5 Recreation Demand Factors

The estimates of neighbourhood emissivity were generated at the same time as the park attractivity estimates in the Cesario model, and they are shown in Table 4.11. The predominately negative values should not be regarded as an indication of community-wide low levels of recreation demand for urban parks. Rather, as essentially regression coefficients, these values simply reflect the weights associated with each neighbourhood, and therefore, they are relative indicators of emissivity or neighbourhood demand for use of urban parks. Hence, NBRs 1, 2, 14, 30, 38, and 42 all show higher degrees of emissivity whereas NBRs 16, 20, 25, and 33 show much lower levels.

In Figure 4.7, the variations in emissivity across the community can be seen. Distinct patterns are evident in each of the three regions with the areas in the West region generally appearing to have a somewhat greater demand for park use. In contrast, apart from one neighbourhood (NBR 30), the East region of the town has an average or below average level of recreation demand. The greatest variations between neighbourhoods with respect to the demand for parks occur in the North region.

Table 4.11: Cesario Model Estimates (b) of Neighbourhood Emissivity

NBR	b	NBR	b
1	0.08537	25	-0.91235
2	-0.09743	26	-0.59395
3	-0.27523	27	-0.44101
4	-0.48826	28	-0.33774
5	-0.24112	29	-0.38718
6	-0.32066	30	0.07558
7	-0.12007	31	-0.54944
8	-0.29239	32	-0.55436
9	-0.45769	33	-0.86518
10	-0.46910	34	-0.56248
11	-0.54440	35	-0.61905
12	-0.34606	36	-0.60895
13	-0.69627	37	-0.65970
14	-0.05707	38	-0.05057
15	-0.59029	39	-0.50599
16	-0.81949	40	-0.69812
17	-0.53280	41	-0.54735
18	-0.65037	42	-0.09613
19	-0.16314	43	-0.45483
20	-1.24010	44	-0.31484
21	-0.60132	45	-0.35580
22	-0.75960	46	-0.28951
23	-0.45371	47	-0.36704
24	-0.60442	48	-0.40039

Mean = -0.45483 s.d. = 0.25994

As with the supply factors, some of the variables representing the demand system needed to be transformed prior to the analysis of the emissivity estimates. This was not the case, however, for the demographic features (SEi) which were represented by the attributes used in the derivation of the

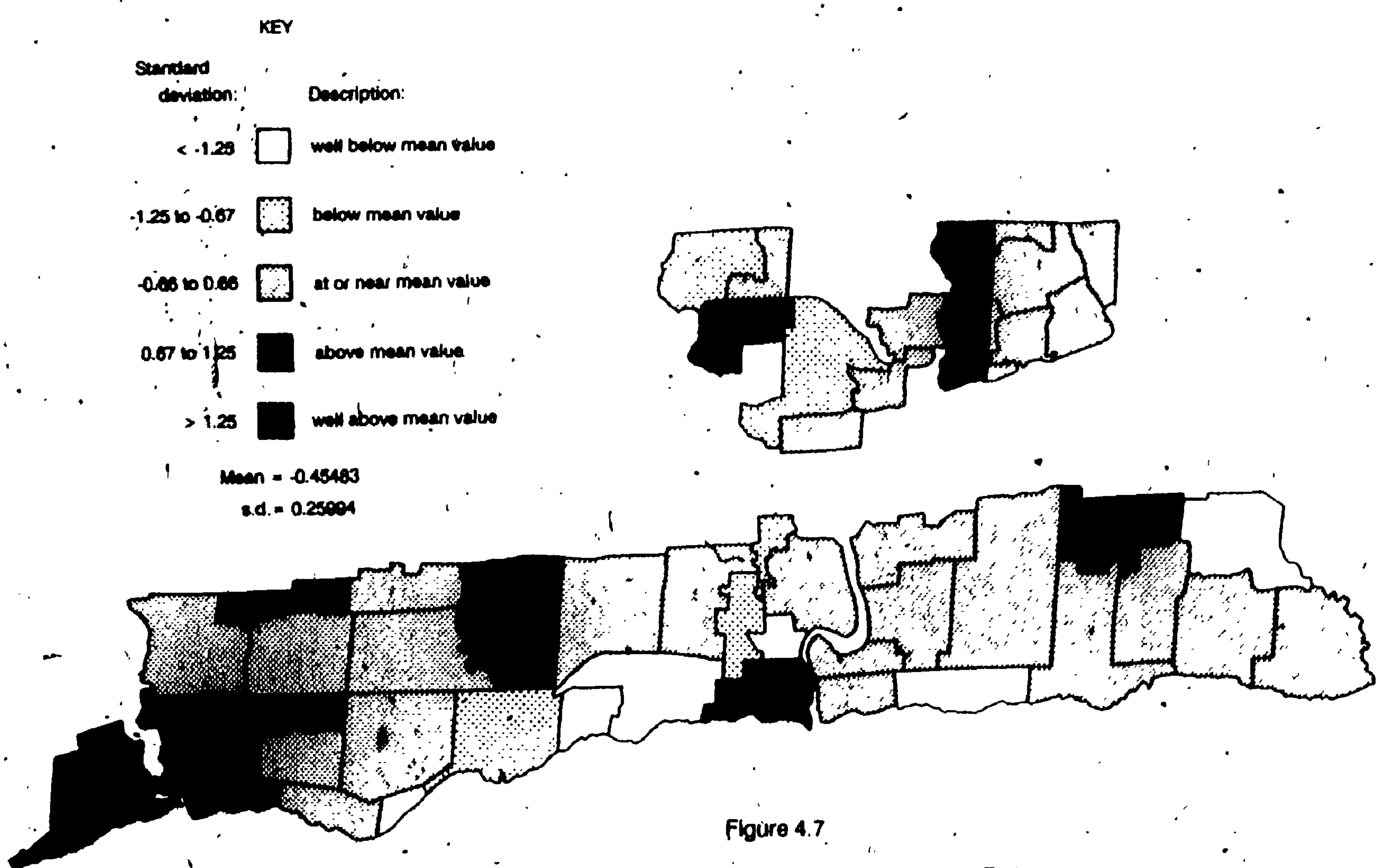


Figure 4.7

Neighbourhood Emissivity Based on Cesario Model Estimates neighbourhoods -- mean age of persons in a household (MEANAGE), mean number of persons per household (NUMBER), and mean combined total income (INCOME) -- as well as the length of tenancy at the present address measured in years (YEARS). Each of these variables did not require modification.

With respect to the residential/structural features of the neighbourhood (RSi), the measures used were the proportion of households in the neighbourhood that owned their residences (OWNER), that owned or had access to a private yard (YARD), that owned or had access to a private swimming pool (POOL), and that owned a boat of any kind (BOAT). These measures reflect the extent to which a neighbourhood is somewhat more self-reliant in terms of providing alternative, private recreation opportunities of the same nature as those found in the public parks.

With respect to the locational features of the neighbourhoods (Li), two measures were generated to reflect the relative location of each area in terms of one another and in terms of the parks. The first measure is equivalent to the peripheral location measure calculated for the parks. Here, the distance from the mean centre of households in a neighbourhood to the CBD (NPERIPH) was calculated to provide an indication of the extent to which a neighbourhood may be on the edges of the community, and therefore less proximal to available opportunities.

The second indicator of the neighbourhoods' locational features was the mean distance separating a neighbourhood from the 20 main parks (MDIST). This measure provided an indication of which neighbourhoods were physically closest to all the parks, and consequently, perhaps in an advantageous position. All else being equal, the neighbourhood with the lowest mean distance to all the parks has the greatest available opportunity for recreation.

The recreation participation features (RPi), which are represented by the mean total participation in 11 selected recreation activities and by the mean proportion of that participation that occurs in the parks, required the most innovative adaptation. The desire was to generate a measure for each activity which reflected the neighbourhood's relative demand for park opportunities as suggested by higher than expected rates of participation at those sites. Such a measure would reveal not just the potential demand resulting from higher participation rates, but also the expressed demand resulting from higher proportions of that participation occurring in the parks.

Hence, the mean total participation in an activity was used as the independent variable in a simple regression procedure to predict the mean proportion of that participation which was carried out in the parks. Evaluating goodness-of-fit was unimportant since it is the resultant "error" which is most revealing about the neighbourhoods. The residuals derived from the analysis represent that participation above or below the amount expected to be occurring in the parks. In this way, the residuals for each of the 11 activities capture in one measure the relative degree of demand for the parks to satisfy the participation in these activities. The names of the variables used for the residual values of these recreation activities are listed below.

a. WALK-HIKE: walking/hiking for plaeasure
b. BICYCLE: recreational bicycling
c. JOGGING: jogging
d. SWIMMING: recreational swimming
e. TENNIS: tennis
f. X-SKIING: cross-country/nordic skiing
g. TOBOGGAN: tobogganning/sledding
h. ICESKATE: ice skating
i. GAMES: casual games and sports
j. PICNIC: picnicking
k. SPORTS: competitive league sports

The neighbourhood residual values for each activity that resulted from this process were employed as the indicators of recreation participation features in the demand component. As a descriptive example, consider the map of residuals from the participation in swimming (Figure 4.8). NBRs 7, 42, 44, and 46 are areas where swimming occurs in the parks at much higher than expected levels, while NBRs 17, 23, 25, 28, and 32, for example, have much lower occurrences of swimming in the parks than expected. Now, by comparing these observations with Table 4.12 which shows the percentage of households in each neighbourhood that own or have access to a private swimming pool, a clear pattern emerges. The neighbourhoods with lower than expected levels of swimming in the parks frequently have above average percentages of households with private pools. In areas where the percentage of households with pools is generally below average, as in the North region, there is a correspondingly higher than expected level of participation in swimming in the parks. Clearly, the presence of alternative, private opportunities for recreation reduces the need for public recreation sites in order to satisfy specific types of demand (Butler and Wright, 1983).

As a summary perspective on the proportion of recreation participation occurring in the parks, the residual values for the 11 activities were summed to generate a composite measure of neighbourhood demand for parks with respect to these recreational pursuits. Figure 4.9 maps this aggregate indicator and reveals some interesting albeit general patterns. The neighbourhoods on the edges of the community appear to show higher than expected levels of demand for park opportunities, especially in the North region. In contrast, the centrally located neighbourhoods in the East region show lower that expected levels of demand as do NBRs 17, 18, and 21 in the West region. Presumably, these areas are satisfying their demand in alternative locations, or have demand which remains unsatisfied.

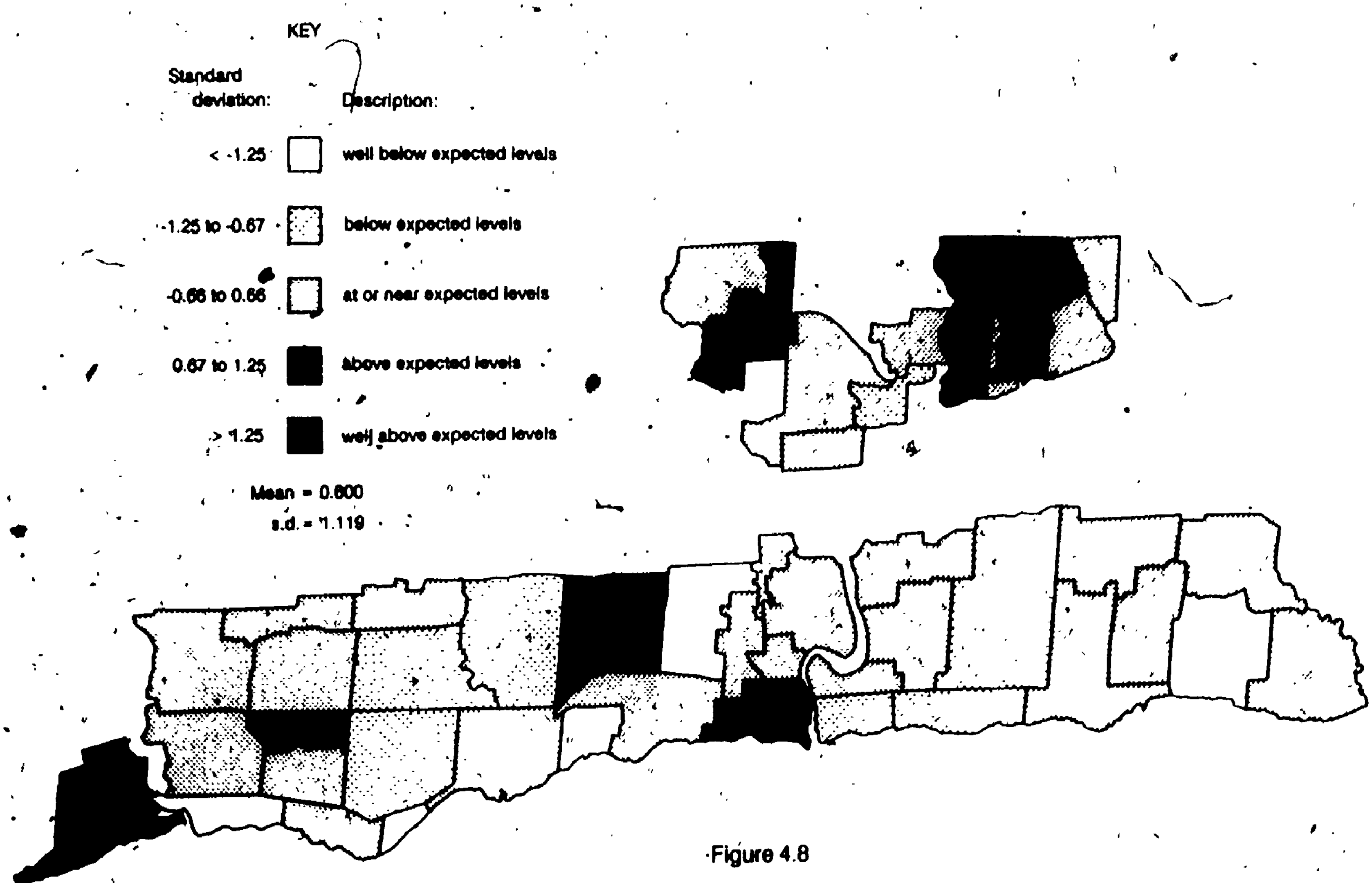


Figure 4.8

Residual Map of Participation in Swimming in Parks

Table 4.12: Proportion of Households in Neighbourhood with Swimming Pools

NBR	Pool	NBR	Pool	NBR	Pool
1	0.09	17	0.06	33	0.13
2	0.00	18	0.06	34	0.35
3	0.21	19	0.20	35	0.15
4	0.23	20	0.00	36	0.00
5	0.14	21	0.15	37	0.32
6	0.29	22	0.00	38	0.15
7	0.28	23	0.13	39	0.07
8	0.32	24	0.09	40	0.26
9	0.14	25	0.02	41	0.03
10	0.28	26	0.06	42	0.27
11	0.17	27	0.08	43	0.00
12	0.44	28	0.47	44	0.13
13	0.42	29	0.45	45	0.00
14	0.14	30	0.23	46	0.00
15	0.18	31	0.26	47	0.29
16	0.17	32	0.59	48	0.18

Mean = 0.187 s.d. = 0.147

With these modifications to the variables representing the demand component completed, they were checked for multicollinearity, and as with the supply factors, none proved to be severe enough to warrant concern. Some of the higher correlations of note (although they were not entirely unexpected) included higher mean combined total income and higher percentage of Households in the neighbourhood with a swimming pool (r=0.6263); higher mean number of persons in a household and lower mean age of household members

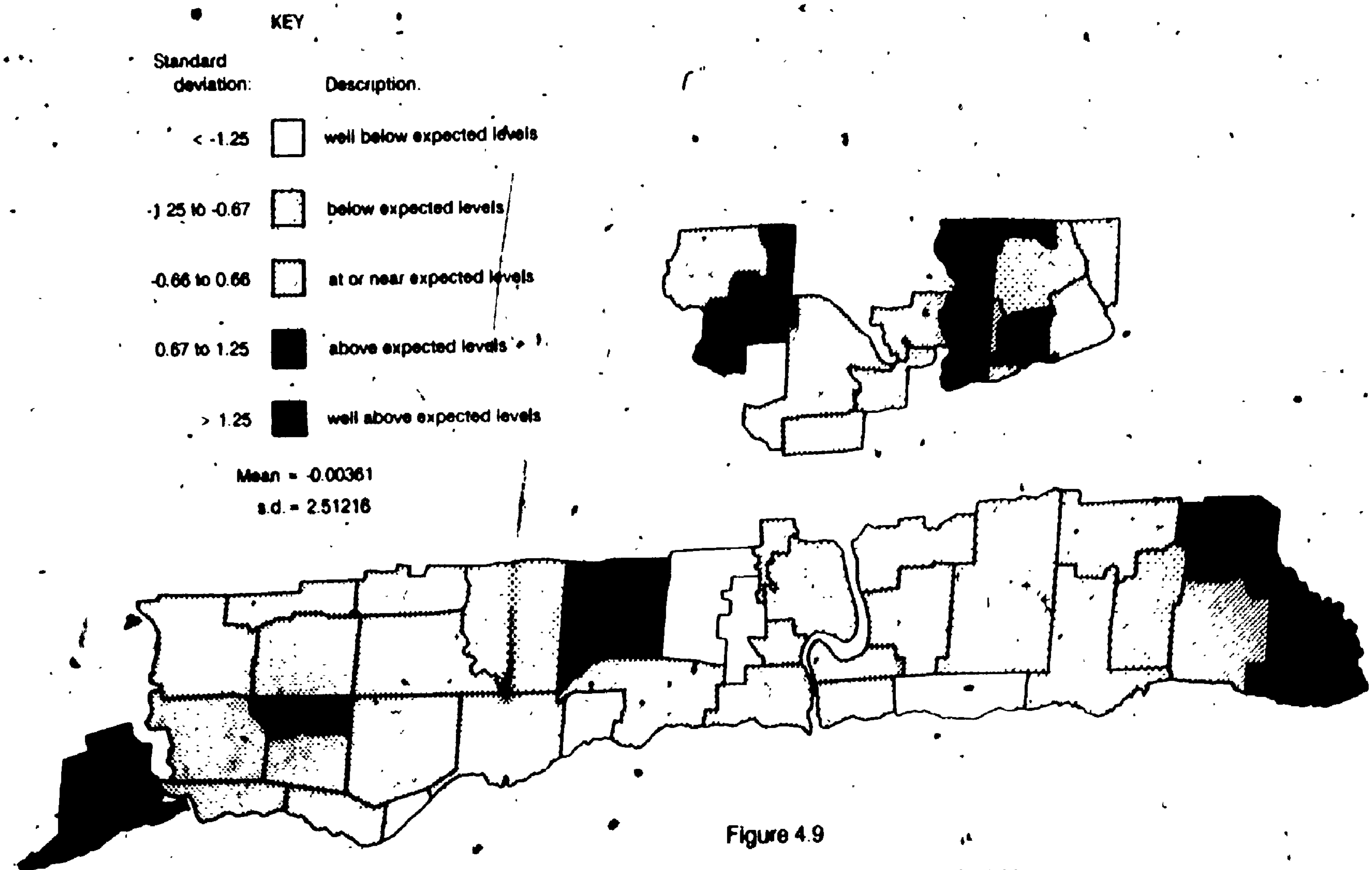


Figure 4.9

Residual Map of Participation in all Recreation Activities (r=-0.5943); and, lower mean age of household members and more peripheral location of neighbourhood (r=0.4278).

The variables were entered into a linear regression analysis with the estimates of neigbourhood emissivity derived from the Cesario model serving as the dependent variable. The results, shown in Table 4.13, indicate that these neighbourhood features explain 62.72% of the variation in neighbourhood emissivity.

Some of the more important variables, based on the magnitude of the beta values, in explaining the variation in neighbourhood emissivity include the length of tenancy (YEARS), the mean number of household members (NUMBER), the mean age of household members (MEANAGE), and the participation in bicycling in the parks (BIKE). Interestingly, despite the frequent criticisms made of the explanatory power of demographic variables, they appear to be among the most important in defining the emissivity of the neighbourhoods.

The inclusion of the measure of a neighbourhood's familiarity with the parks will serve to modify these objective features of the demand component, thereby bringing about the variable demand that a neighbourhood has with respect to each park. Here, familiarity serves the same role as perceived attractivity does in the supply component by introducing the dynamism of these systems not evident in these simple assessments of the Cesario estimates.

Table 4.13: Cesario Model Estimates Explained by Neighbourhood Features

NBR feature	b	s.e. of b	BETA
SEi			
MEANAGE	-.64718	.50064	-.47809
NUMBER	-.37649	.81982	-.28203
INCOME	.19588	.27800	.21194
YEARS	.14184	.16726	.25275
RSi			
OWNER	.07262	.15329	.21818
YARD	-.17645	.33224	-.17495
POOL	-.02022	.07634	-.08063
BOAT	.09715	.11832	.16955
RPi			
WALK-HIKE	.04514	.03715	.18825
BICYCLE	-.23636	.08291	-.44507
JOGGING	-.07037	.09079	-.13916
SWIMMING	.04240	.04004	.18255
TENNIS	-.09003	.09002	-.16097
X-SKIING	-.29088	.19675	-.24653
TOBOGGAN	.26677	.23916	.21763
ICESKATE	-.05020	.09553	-.09200
GAMES	.10756	.11209	.15778
PICNIC	.25373	.28113	.19066
SPORTS	-.01567	.09316	-.02568
Li			
NPERIPH	.09010	.06826	.25078
MDIST	-.11372	.30371	-.07903

$R^2 = 0.6272$
F = 2.0834; sig. F = 0.039

With the completion of the determination of the "best fitting" distance function and of the structure of the supply and demand factors in the Cesario model, the calibration of the final model explaining park use can be carried out. This model, then, represents the combination of factors which leads directly to the derivation of the recreation potential surfaces. Not only does this process provide a methodological advantage over previous applications of potential as a simple index, but it also represents one of the attempts to bring together a number of indicators of both recreation supply and demand in one model based on a conceptual understanding of their role in explaining recreation behaviour (Harrison and Stabler, 1981).

Chapter V

URBAN RECREATION POTENTIAL SURFACES

5.1 THE URBAN RECREATION SUPPLY-DEMAND MODEL

With the structure of the relationship between the various supply and demand factors established, these factors and the distance function may now be incorporated into a gravity model. The calibration of the gravity model can be regarded simply as a regression analysis placing the equation into linear form by means of logarithmic transformations. This does not represent a structural change, but rather, a change in the perspective taken to the application of the model (Archer, 1976). All the variables representing the various features of the conceptual model -- with the exception of the residual values used to indicate in-park participation of 11 recreation activities -- had their natural logarithms taken prior to inclusion in the model. The negative values associated with the residuals indicating in-park participation precluded this step.

In addition, one other variable was modified before the calibration of the model began. The perceived attractivity of the 20 main parks by each of the neighbourhoods is a relative measure in that the the respondents rated the parks along a 7-point scale. As such, the evaluations that are made tend to be comparative (Peterson, Dwyer, and Darragh, 1983); that is, one park's attractivity rating is typically based on how it compares to all the other parks within the reference group. To capture that comparative evaluation, the perceived attractivity measures were redefined in terms of whether a park was above or below the mean perceived attractivity of the other 19 parks from the perspective of each neighbourhood. This new measure was determined by the following equation:

$$CATT_{ij} = \left[\frac{A_{ij}}{\left(\frac{\sum_{k=1}^{m} A_{ik}}{m-1} \right)} \right]. \qquad [5.1]$$

where CATTij is the comparative attractivity of park j from the perspective of neighbourhood i; Aij is neighbourhood i's perceived attractivity rating of park j; Aik is neighbourhood i's perceived attractivity rating of park k (not including park j); and m is the number of parks rated by the neighbourhood (here, m=20).

As a result, parks perceived to be more attractive than others in the group receive values greater than 1.0 whereas comparatively less attractive parks receive values less than 1.0. Such an indicator allows one to regard a park as "more attractive" than another on the basis of a comparative evaluation rather than on an arbitrary scale with no absolute values defining attractiveness.

With these conditions established, all the demand-related and supply-related features were entered into the regression equation first, followed by the distance function and perceptual indicators. The variables were entered into the equation as "blocks", each representing a feature from the conceptual model (denoted by SEi, RSi, and so on). This maintained the spirit of the conceptual model by keeping the integrity of each of the features intact rather than allowing an arbitrary solution to the equation. The results of the urban recreation supply-demand model are shown in Table 5.1. Overall, the model explained 66.11% of the variation in neighbourhood park use, or more precisely, in the natural logarithm of the mean park use per household in each neighbourhood. Of this, the bulk of the variation is accounted for by the intervening opportunities index (R^2 change=0.1558), the shape of the park (R^2 change=0.1008), and the neighbourhood's familiarity with the park (R^2 change=0.1531).

With respect to just the demand-related features and the supply-related features, those variables describing the 20 main parks accounted for 24.1% of the total variation whereas the variables describing the emissivity of the neighbourhoods accounted for only 2.6% of the total. Clearly, the attractivity of the parks appears to play a much greater role in the determination of park use than does the nature of the neighbourhoods' residents. This could very well be

Table 5.1: Results of Supply-Demand Gravity Model

FEATURE Variable	b	s.e. of b	BETA	r	R^2 change
SEi					
MEANAGE	-1.0099	.3626	-.1678*	-.0122	.0002
NUMBER	-1.1084	.5786	-.1868	.0306	.0001
INCOME	.3086	.1964	.0751	-.0022	.0001
YEARS	.1493	.1181	.0598*	.0493	.0046
RSi					
OWNER	.2334	.1090	.1577*	.0458	.0001
YARD	-.3559	.2379	-.0793	.0374	.0001
POOL	-.0198	.0570	-.0178	.0094	.0001
BOAT	-.0441	.0824	-.0174	.0332	.0001
RPi					
WALK-HIKE	.1123	.0273	.1124*	.0783	.0060
BICYCLE	-.2231	.0593	-.0945*	-.0455	.0033
JOGGING	-.0676	.0640	-.0306	.0450	.0004
SWIMMING	.0740	.0266	.0754*	.0375	.0005
TENNIS	-.0057	.0664	-.0025	-.0032	.0001
X-SKIING	-.2402	.1452	-.0469	-.0225	.0005
TOBOGGAN	.5658	.1707	.1125*	.0042	.0041
ICESKATE	-.0889	.0669	-.0369	-.0577	.0029
GAMES	.1379	.0803	.0455	.0164	.0001
PICNIC	.2812	.2102	.0479	.0264	.0022
SPORTS	.0865	.0651	.0329	-.0277	.0002
Li					
NPERIPH	.0098	.0508	.0062	.0324	.0001
MDIST	-.1262	.2384	-.0197	-.0538	.0029
PHj					
AREA	-.1547	.0378	-.1490*	.0581	.0031
SHAPE	-.2369	.0748	-.0996*	-.3175	.1008
WATER	-.0022	.1534	-.0005	.3443	.0386
MMj					
SPORTS	-.1758	.0484	-.0855*	-.1965	.0098
FURN	.0799	.0292	.0753*	.2699	.0009
PLAY	-.0605	.0319	-.0407	-.0540	.0049
GBEDS	.0306	.0308	.0247	.2847	.0761
Lj					
PPERIPH	.0957	.0296	.1145*	-.0544	.0069
Dij					
[illegible]Oij	-.0331	.0439	-.0253	-.2823	.1558
PARKTO	-.2686	.0508	-.1884*	-.4086	.0707
PERCEPTIONS					
CATTPARK	.0074	.1063	.0019	.4288	.0125
FAMPARK	1.5631	.0764	.6486*	.7556	.1531

* significant contribution at 0.05 level

$R^2 = 0.6611$ %RMSE = 94.815
F = 54.746; sig.<.001

the result of assuming far greater homogeneity within and/or far greater heterogeneity between the neighbourhoods than is actually present. Interestingly, the shape of the park appears to play a greater role amongst the physical features than area which traditionally has been viewed as the predominant indicator of attractivity of a park. Also, the relationship of shape with park use tends to verify the earlier speculation that the more linear parks may be more attractive to users (r=-0.3175; sig.<.001).

As is characteristic of most gravity models, the distance function does present a deterring effect to park use by the residents in each neighbourhood. Here, the combined effect of the Pareto distance measure and the intervening opportunities index explained 22.65% of the variation in park use (see Table 5.1). The interesting corollary of this observation is that distance continues to play a significant role in determining behaviour even in urban areas where the distances to be overcome are not especially daunting. In this respect, the intervening opportunities index appears to symbolise the relative distance that residents may be willing to travel to use a park.

By virtue of the standardised coefficients (BETA), however, park familiarity is by far the most important variable in the equation explaining park use. In fact, when examined alone, park familiarity explained 57.1% of the variation in park use (F=425.663; sig.<.001) and had a %RMSE of 113.143

both indicating a performance almost as good as that of the complete model. The results in Table 5.1 do not reflect the actual importance of park familiarity because it did not enter the equation until after the demand and supply features and the distance function had already been accounted for in the results. The model was calibrated in this way because those features are, in a sense, "fixed" in that they are in place before the role of the residents' familiarity "takes effect". Nonetheless, familiarity was able to establish itself as one of the primary determinants of park use by picking up much of the variation still unexplained at the time of its entry.

Further, the importance of the intervening opportunities index in the model points to the presence of park familiarity in that the index was "weighted" by a familiarity factor. As a result, it appears that intervening opportunities do provide alternative sites for potential park users, but only when those users are sufficiently familiar with these alternatives. In addition, the relative attractivity of a park -- as another perceptual variable -- would likely play as important a role in the model, but not for the presence of these two other variables. The simple correlation of relative park attractivity and park use (r=0.4288; sig.<.001) was second only to park familiarity in strength, but again, much of its explanatory power was accounted for by previously entered variables as well as by park familiarity.

The importance of these perceptual variables -- and in particular familiarity -- cannot be overstated. The resultant strength of park familiarity in the model coincides with the findings of Stynes, Spotts, and Strunk (1985) and of Perdue (1987) in their studies which included measures of awareness in models explaining recreation behaviour. In both of these cases, awareness of recreation opportunities improved the models significantly. Here, the strong correlation between park use and park familiarity is not confined to the aggregate level of analysis. The relationship is just as strong when a single park is considered.

In Figure 5.1, a scatterplot illustrating the relationship between the familiarity of each neighbourhood's residents with a park -- in this case, Bronte Beach -- and the use of it is shown. While this example represents the strongest correlation amongst the 20 main parks, all but one of the other parks (Palermo which had by far the lowest use) showed similar patterns with the average correlation being 0.6109 (s.d.=0.1320). The implications of such patterns are profound.

Observations such as this made at the neighbourhood level provide a better understanding of the spatial nature of patterns of park use and factors like familiarity. The overall performance of the supply-demand gravity model reflects its ability to predict park use for each neighbourhood-park pair, but not for the total park use made by each neighbour-

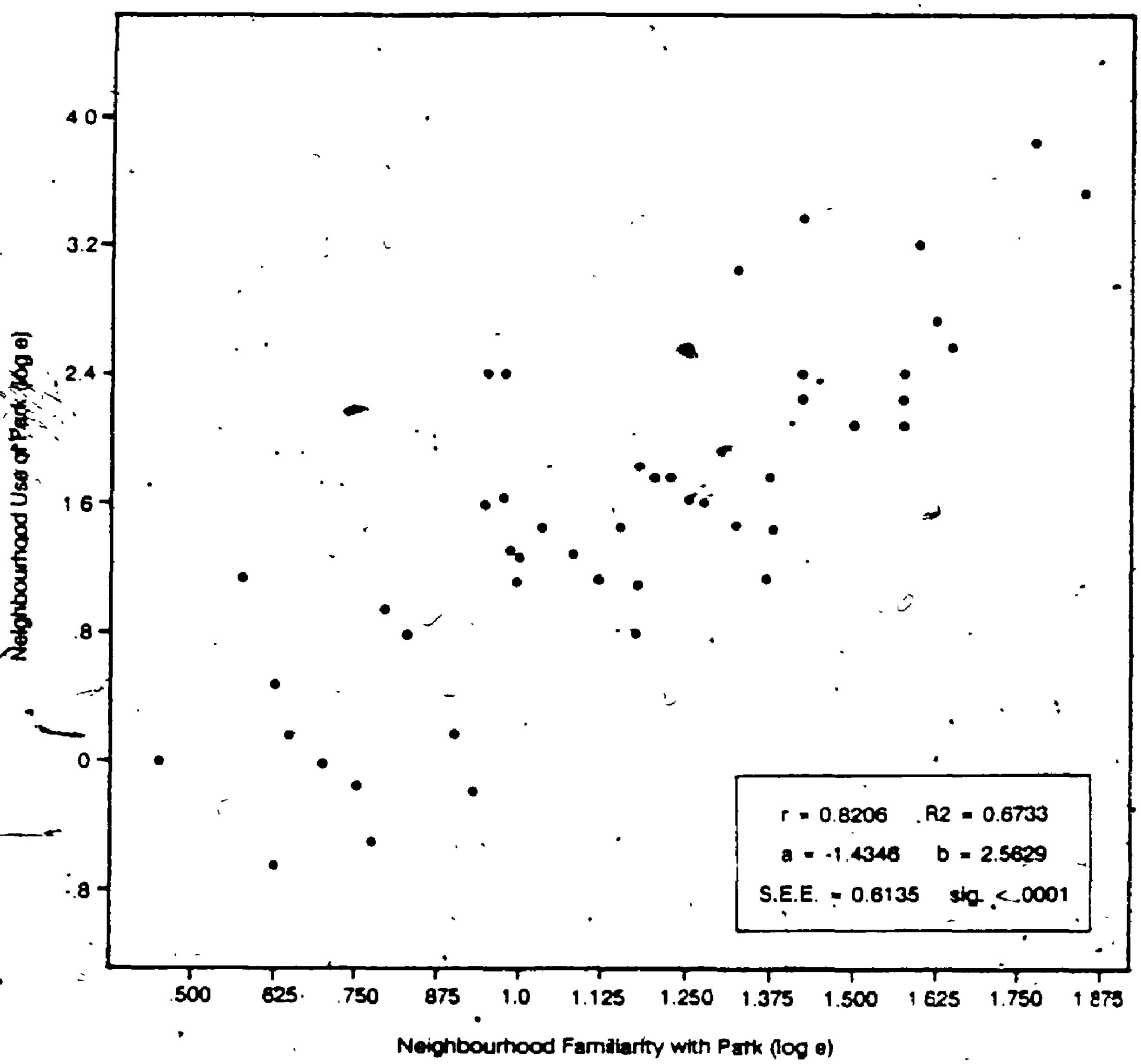


Figure 5.1

Scatterplot of Park Familiarity and Use: BRONTE BEACH hood. Beaman and Do (1976) have argued that planners and managers are concerned ultimately with the total use that various zones -- in this case, neighbourhoods -- make of the parks because it is total park use which typically influences management and policy. To that end, the aggregate park use actually made by each neighbourhood as well as that predicted by the model was calculated and compared. The total observed and total expected use (antilogarithms of model estimates) of the parks by each neighbourhood are shown in Table 5.2. These totals are simply the sum of a neighbourhood's average annual use of each of the 20 main parks as reported by the respondents and determined by the supply-demand gravity model. The mean values for the observed and the expected levels of park use shown at the bottom of the table, as well as their sums, are not equal because of the greater variance in the observed levels of use. The expected values are based on estimates derived from a log-linear model where the variance is lower, and therefore, once the antilogarithms are taken, the sum and mean differ from the observed measures. Consequently, the expected levels of park use typically underpredict the observed levels (Baxter, 1983).

Nevertheless, a visual comparison of the observed with the expected park use suggests that the model results, once aggregated, predict quite well the use actually made of the 20 main parks. In fact, the simple correlation between them

3

Table 5.2: Observed and Expected Park Use by Neighbourhoods

NBR	Observed park use	Expected park use	NBR	Observed park use	Expected park use
1	5082	5052.0	25	1356	1275.9
2	2118	1782.2	26	2916	2869.9
3	3966	3452.1	27	696	706.7
4	3678	2355.8	28	1470	1402.6
5	3150	2703.3	29	1824	1582.0
6	3390	3591.3	30	3786	2694.7
7	3894	3690.9	31	1488	1237.9
8	3144	3005.9	32	1704	1531.2
9	3120	1718.8	33	564	654.1
10	3750	2905.5	34	1116	1371.6
11	1878	2141.1	35	1428	1149.4
12	4938	4240.2	36	1350	894.3
13	2412	1587.0	37	1572	1694.0
14	4260	3287.9	38	2370	1825.6
15	3102	2329.3	39	2364	1775.4
16	498	623.8	40	2556	2450.2
17	1356	1183.0	41	2340	1952.4
18	1788	1154.5	42	1500	1411.8
19	1794	1562.1	43	1116	911.9
20	816	822.5	44	2280	2256.4
21	1650	1730.9	45	780	1019.7
22	1326	711.0	46	576	793.5
23	2628	1330.0	47	2286	1673.5
24	1842	1254.2	48	612	566.3

Mean observed park use = 2200.63
(s.d.=1175.41)

Mean expected park use = 1873.25
(s.d.=1017.58)

is 0.9329 (sig.<0.0001). Overall, the mean expected park use by the neighbourhoods is approximately 17% lower than the observed as would be anticipated in the log-linear model, but the variation in the expected totals does approximate the actual fluctuations in park use by the neighbourhoods.

The correlation between observed and expected park use is portrayed in the scatterplot in Figure 5.2. It reveals a clearly linear relationship with a coefficient slightly greater than 1.0 (b=1.078; s.e.=.061) which is not surprising given, on average, the slightly lower predicted levels of neighbourhood park use.

Based on the correlation for the aggregate park use of the neighbourhoods, residual values were calculated and mapped to reflect which neighbourhoods appeared to be using the parks either much more or much less than expected given the results of the model. Figure 5.3 shows the results of the mapping of the residuals, and highlights those neighbourhoods which do not conform to expected levels of park use. Generally, the West region has several neighbourhoods which show higher levels of park use than expected (NBRs 4, 9, 10, 13 to 15, 18, and 22), and those which are at or below expected levels are the majority of the neighbourhoods in the North region. Accordingly, most of the neighbourhoods in the West region use the parks more frequently than the community average ($\bar{X}$=2200.63) whereas the neighbourhoods in the North region generally use the parks less often than the community wide average. The exception to this general observation are neighbourhoods 18 and 20 in the West region

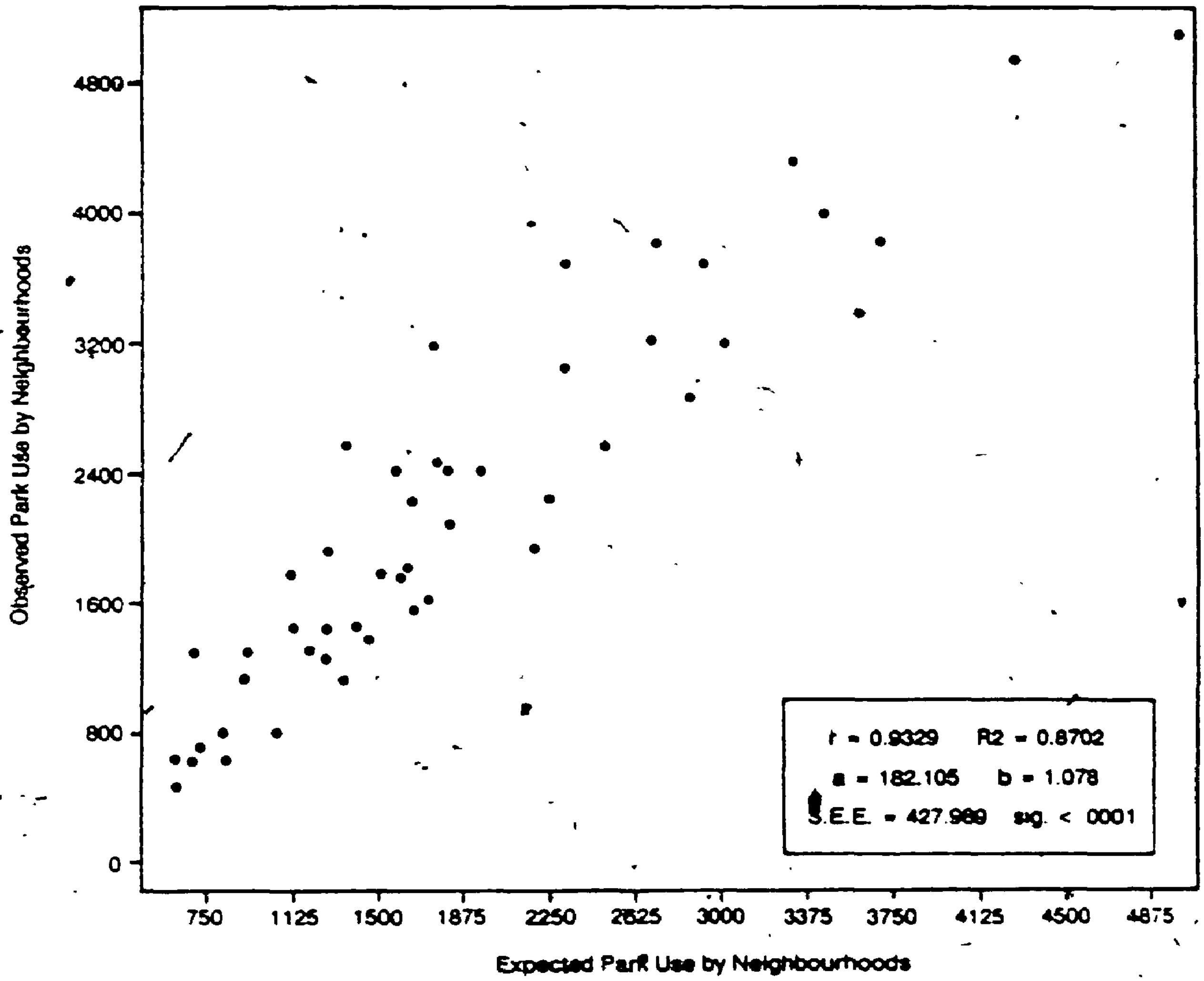


Figure 5.2

Scatterplot of Observed and Expected Park Use by Neighbourhoods which, even though they show higher than expected levels of park use, they have use levels still below the average for all neighbourhoods in the community.

The results reflected in these Figures (5.2 and 5.3) illustrate how the supply-demand gravity model predicts park use more precisely for lower levels of use than for higher levels. Given that the use of urban parks tends to be relatively lower than is typically assumed by recreation planners (Gold, 1973), the ability of the model to predict lower levels of use is, in fact, a favourable characteristic. When one considers the many other, probably little used, parks which are available in the town, predicting use in these smaller parks is an important feature. Overall, then, these results are encouraging in that they suggest that the model has been reasonably successful in describing not only neighbourhood use of individual parks, but also each neighbourhood's aggregate use of all the 20 main parks.

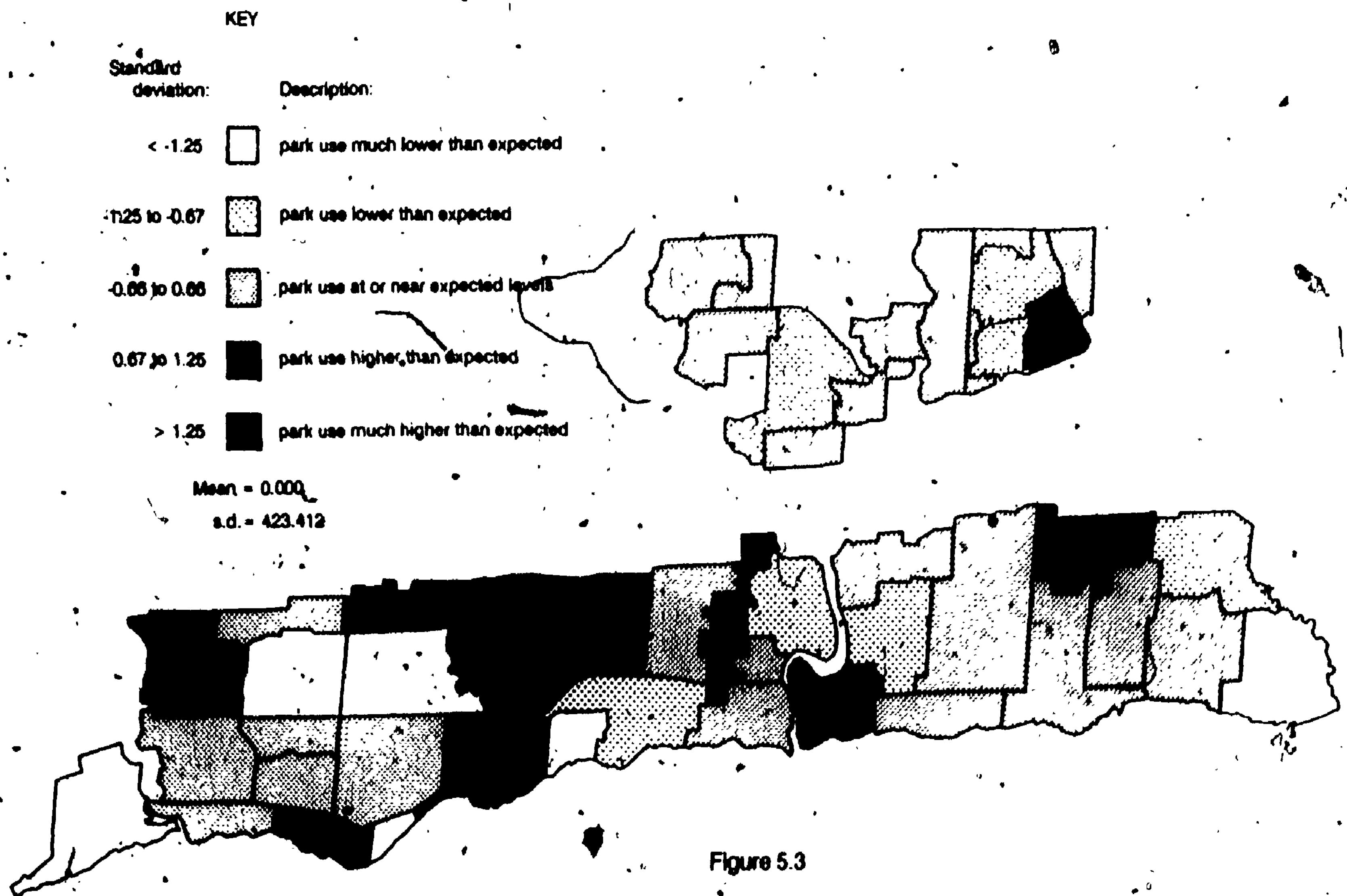


Figure 5.3

Residual Map of Aggregate Park Use by Neighbourhoods

5.1.1 Estimation of Perceptions of "Other Parks"

With the calibration of the urban recreation supply-demand model, the next step is to derive directly from the model the measures of potential for the two systems. However, while the model represents the entire demand system by virtue of the 48 neighbourhoods, the supply system is represented only by the 20 main parks used on the survey questionnaire. As a result, the derivation of the recreation supply system's potential values would not truly capture the entire parks system in the community. Consequently, before the derivation of the potential measures can begin, the other 94 parks must be incorporated into the model.

The park inventory provided the basic data necessary to describe the other parks in terms of their physical features (PHj), man-made features (MMj), and relative location (Lj), but data on the neighbourhoods' perceptions of these other 94 parks are not provided by the inventory. On the questionnaire, the respondents had the opportunity to "write in" other parks with which they were familiar and their responses should have provided the necessary information to complete the data set. Unfortunately, the pattern of response to this section of the questionnaire made depending directly on the respondents' reported familiarity and use of the other parks unreliable.

Perhaps the most alarming result concerning the response to that part of the survey focusing on the other parks in the community are the tremendously low levels of familiarity that appear to exist about these other opportunities. On the one hand, this simply reaffirms the observations of Gold (1977), Johnson (1979), and others that the public is generally unaware of and does not make use of urban parks. On the other hand, from a methodological standpoint, the likelihood of receiving comprehensive responses to this "write in other parks" question was not great (Babbie, 1986). However, if a certain park was, in fact, important enough to the respondents as a recreation opportunity, one should expect that it would be listed. Therefore, the low levels of response concerning these other 94 parks may reasonably represent the relatively low importance of them as opportunities in the overall supply system.

The specific parks which were most frequently written in by the respondents are shown in Table 5.3 along with their overall mean familiarity ratings. The parks listed represent just those with which at least 1% of all the respondents reported being familiar. This means, then, that only 29.8% of all the parks in the community are known to even 1% of the residents (20 main parks + 14 other parks). Further, 21.1% of the parks (n=24) received no mention whatsoever by the respondents, and another 14% of the parks (n=16) received only a single mention each. Therefore, the community's residents are almost entirely unaware of 35.1% of the parks (n=40) available to them. With respect to the familiarity rating, the respondents writing in the parks reported high levels of familiarity ($\bar{X}$=6.587 for the parks in Table 5.3) showing that these parks are indeed important to the residents. However, across the community, these parks are relatively little known. On the 7-point scale used, none of the other parks had ratings higher than 1.2. At the neighbourhood level, these parks are more familiar to some and not at all to others which again points to the importance of perceptions in potential park users' responses to the available opportunity set.

Table 5.3: Other Parks Familiar to Responding Households

Park	Households familiar with park (n)	Percentage of all households	Overall familiarity rating
Lawson Play.	43	3.70	1.197
Sheridan Hills	33	2.84	1.154
Ardleigh	26	2.24	1.130
Falgarwood	23	1.98	1.110
George's Sq.	22	1.89	1.108
Woodhaven	19	1.63	1.096
Dingle	18*	1.55	1.092
Wedgewood	18	1.55	1.081
Glen Allan	17	1.46	1.080
Seabrook	15	1.29	1.076
Joshua Valley	14	1.20	1.068
Brookdale	12*	1.03	1.062
Queen Eliz.	12	1.03	1.058
Rebecca Gdns.	12	1.03	1.048

* ranking based on overall familiarity

The locations of the parks listed in Table 5.3, which are fairly evenly distributed, are illustrated in Figure 5.4 along with the 20 main parks. Even a superficial comparison of this distribution of "known" parks with all those actually available in the community (n=114; see Figure 3.2) reveals how small the perceived opportunity set is for the community's residents. In fact, the typical household reported being familiar with, on average, 8.93 parks (s.d.=5.04) in the community with the distribution being skewed towards less than that. In other words, a potential park user typically chooses among, in total, fewer than 9 parks -- not 114 parks.

Given these results, without comprehensive information about the other 94 parks coming directly from the survey, those perceptual factors comprising an important part of the supply-demand model had to be estimated. The estimation procedures, which are described below, produced values associated with the neighbourhoods' perceptions of these other parks which, in the cases of the more frequently reported other parks, were compared to the reported levels from the survey as a means of lending some confidence to the reliability of the estimates.

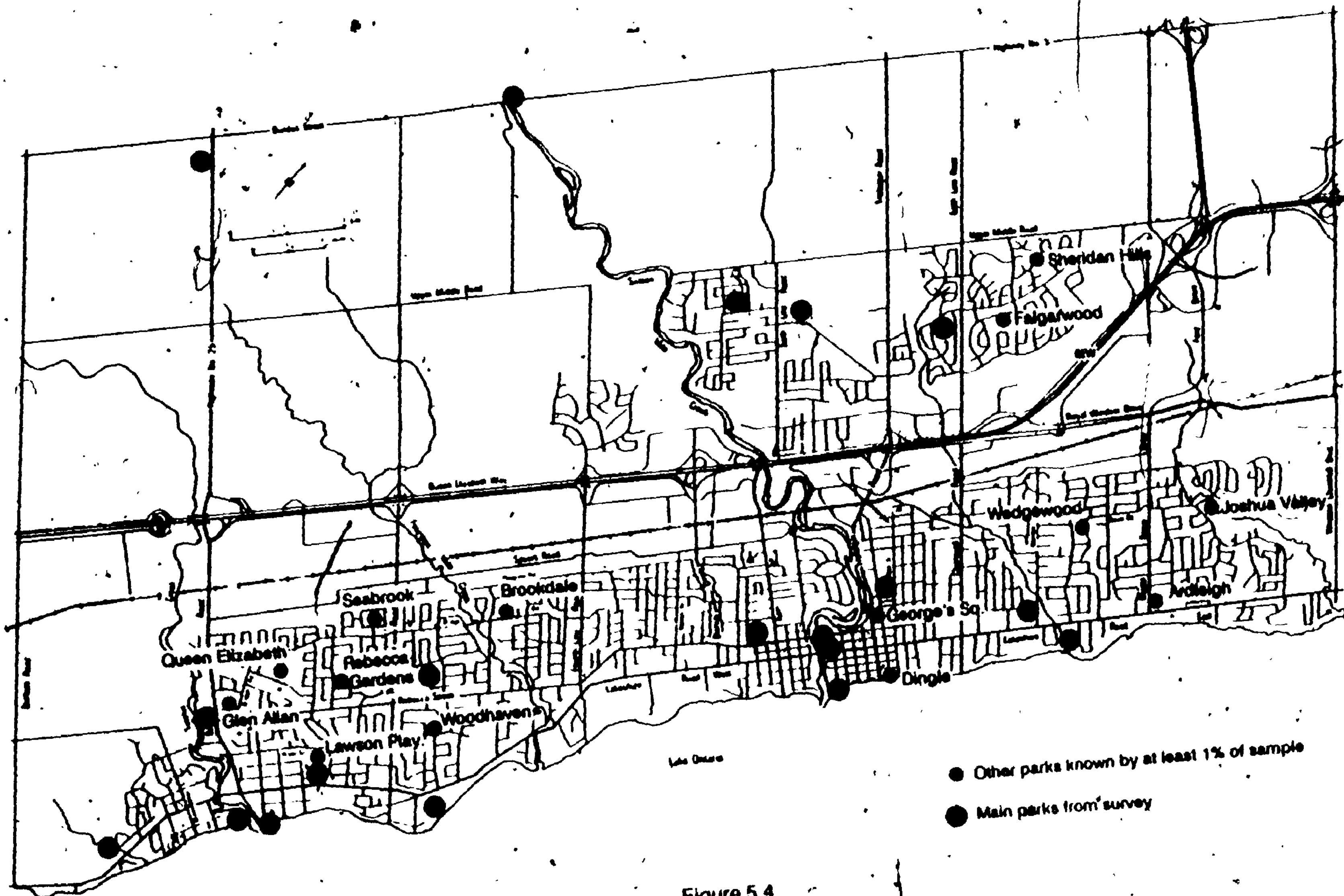


Figure 5.4

Parks Familiar to 1% of Respondents

5.1.1.1 Relative perceived attractivity

In order to estimate the attractivity of the other parks, those factors contributing to the perceived attractivity of urban parks must first be understood. To do this, the neighbourhoods' ratings of perceived attractivity of the 20 main parks were used as the dependent variable in a regression analysis and the parks' attributes used as independent variables. The nature of the relationship assumed here is a commonly held view in the spatial interaction literature which regards attractivity as a function of the characteristics of the destination (Archer, 1976; Beaman and Do, 1976). Therefore, the physical features (PHj), the man-made features (MMj), the locational indicator (Lj), and the distance function were presumed to constitute the principal factors in the determination of the ratings. As before, a multiplicative model was specified so natural logarithm transformations were used on all the variables.

The results of the analysis are shown in Table 5.4. Overall, 46.5% of the variation in perceived attractivity was explained by the parks' attributes with the number of garden beds (R^2 change=0.2433), the shape of the park (R^2 change=0.0865), and the presence of water (R^2 change=0.0524) making the largest contributions. The presence of garden beds in a park is typically an indication of a park intended in part for display: more garden beds, the greater the intent.

Table 5.4: Estimating Perceived Attractivity of Parks

FEATURE Variable	b	s.e. of b	BETA	r	R^2 change
PHj					
AREA	.0633	.0116	.2335*	.0703	.0049
SHAPE	-.2015	.0231	-.3246*	-.3733	.0865
WATER	.1530	.0487	.1269*	.2318	.0524
MMj					
SPORTS	-.0173	.0152	-.0323	-.0558	.0003
FURN	-.0139	.0094	-.0502	.3081	.0004
PLAY	-.0488	.0099	-.1267*	-.1201	.0154
GBEDS	.1456	.0084	.4500*	.4800	.2433
Lj					
PPERIPH	-.0759	.0091	-.3480*	-.1963	.0501
Dij					
IOij	-.0003	.0098	-.0010	-.0532	.0063
PARETO	-.0361	.0115	-.0971*	-.1269	.0055

* significant contribution at 0.05 level

R^2 = 0.4651   %RMSE = 19.534
F = 82.520; sig.<.001

The importance of the shape of the park to perceived attractivity is consistent with the model explaining park use. Interestingly, those factors normally associated with park attractivity, such as park area or number of facilities (Ewing, 1980), do not contribute a great deal to the explanation even though the presence of park furniture (e.g. picnic tables, park benches) is relatively highly correlated with perceived attractivity (r=0.3081; sig.<.001).

To estimate the perceived attractivity of the other 94 parks, the data on those parks from the inventory were inserted into the regression equation and calculated through for each park. The resultant values were then compared to the reported ratings for those 14 parks with which at least 1% of the sample was familiar, and the majority were found to be within one standard deviation of the actual ratings, indicating an acceptable approximation. While the "fit" of the equation as measured by the explained variance was not as good as was hoped, the low %RMSE of 19.5 suggests that these derived estimates for the other parks should be reasonably accurate. These estimates, then, became part of the final model leading to the potential surfaces.

5.1.1.2 Estimated familiarity

The estimation of the neighbourhoods' familiarity with the other 94 parks followed a similar procedure to that described above. However, in this case, both the supply-related features and the demand-related features have been included in the regression analysis. Those factors associated with the parks necessarily contribute to the level of familiarity possessed by a neighbourhood in that they describe, albeit in an objective, physical manner, the types of recreation opportunities available there. Therefore, recreation demand which seeks to be expressed in the parks must first recognise the types of opportunities available, then select among them. Ultimately, those parks with the features which are better able to satisfy demand become the ones which are more familiar to the residents.

The contribution of the residents' demographic characteristics to their familiarity with the parks in the community has been demonstrated in other studies (Smale, 1983a; Spotts, 1983; Stynes, Spotts, and Strunk, 1985). Such factors as years of residency in the community, age of respondent, and number of persons in a household all had some degree of influence on levels of familiarity. In addition, the work of Hayward and Weitzer (1983) suggests that with approximately 40% of outdoor recreation participation occurring in parks, the nature of the participation must, too, play a role in the determination of familiarity.

Therefore, all the demand system features of the supply-demand model were included in the regression analysis attempting to predict the neighbourhoods' familiarity with the other 94 parks. The results of the analysis are shown in Table 5.5. The combination of these factors explains, overall, 60.7% of the variation in familiarity which is comparatively better than the approximately 42% explained variation achieved by Stynes, Spotts, and Strunk (1985) in a model predicting park awareness based only on park attributes and distance.

Among the more important variables in explaining park familiarity are distance (R^2 change=0.1857), the shape of the park (R^2 change=0.1284), and the number of garden beds

Table 5.5: Estimating Neighbourhood Familiarity

FEATURE Variable	b	s.e. of b	BETA	r	R^2 change
SEi					
MEANAGE	.2715	.1616	.1087	.0716	.0051
NUMBER	.4877	.2577	.1980	.0299	.0012
INCOME	-.0767	.0876	-.0450	.0217	.0008
YEARS	.0501	.0527	.0484	.1242	.0096
RSi					
OWNER	-.1113	.0485	-.1811*	.0349	.0040
YARD	.2004	.1059	.1076	.0867	.0004
POOL	.0051	.0252	.0110	.0669	.0015
BOAT	-.0061	.0368	-.0058	.0014	.0003
RPi					
WALK-HIKE	-.0114	.0122	-.0275	-.0649	.0048
BICYCLE	.0422	.0264	.0431	.0128	.0002
JOGGING	.0898	.0283	.0981*	.0539	.0058
SWIMMING	-.0281	.0118	-.0690*	-.0370	.0048
TENNIS	.0185	.0296	.0191	.0009	.0008
X-SKIING	.0416	.0647	.0196	-.0010	.0001
TOBOGGAN	-.0506	.0762	-.0243	-.1033	.0001
ICESKATE	-.0305	.0297	-.0305	-.0606	.0018
GAMES	-.0384	.0358	-.0305	-.0060	.0014
PICNIC	.0768	.0937	.0315	.0626	.0010
SPORTS	.0170	.0290	.0156	-.0076	.0001
Li					
NPERIPH	.0239	.0226	.0359	-.0430	.0002
MDIST	.0266	.1061	.0100	-.1246	.0011
PHj					
AREA	.1577	.0160	.3659*	.1896	.0048
SHAPE	-.2073	.0318	-.2101*	-.3584	.1284
WATER	.3745	.0672	.1954*	.3227	.0277
MMj					
SPORTS	-.1531	.0298	-.1795*	-.1829	.0075
FURN	-.0004	.0130	-.0009	.2838	.0038
PLAY	-.1206	.0136	-.1955*	-.0824	.0119
GBEDS	.1498	.0116	.2912*	.3659	.1275
Lj					
PPERIPH	-.0679	.0127	-.1957*	-.0398	.0609
Dij					
IOij	-.0612	.0195	-.1126*	-.2808	.0042
PARETO	-.2491	.0211	-.4212*	-.4004	.1857

* significant contribution at 0.05 level

R^2 = 0.6073 %RMSE = 30.567

F = 46.289; sig.<.001

(R^2 change=0.1275). The prevalence of distance in the equation is not surprising because the likelihood of even casual contact with nearby parks is much greater. The relatively important role played by a park's peripheral location (PPERIPH) in the equation (R^2 change=0.0609) appears to support this observation. As with perceived attractivity, the number of garden beds is likely a surrogate indicator of the "profile" that the park has in the community, and in a similar way, the elongated shape of a linear park may present a more dominant image than an areally larger but more compact park. With respect to this latter point, it is of interest to note that the simple correlation of park area (r=-0.3584) was much stronger than that of park shape (r=0.1896) suggesting that the importance of park shape is tied to other factors within the model whereas this may not be the case with respect to park area (see Table 5.5).

As with the estimates of perceived attractivity, the estimates of neighbourhood familiarity with the other 94 parks were compared to a selection of the reported levels from the survey. The results coincided quite satisfactorily which was important given the predominant role played by familiarity in the supply-demand model explaining park use.

5.1.1.3 Intervening opportunities index

The intervening opportunities index used in this study introduced a measure of a neighbourhood's familiarity with an intervening park to the index to control for the effects of alternative sites which are not known to the neighbourhood. The extension of the index to all 114 parks requires that all parks nearer to the neighbourhood than the park in question be included in the calculation of the index. However, given the extremely low numbers of parks with which the neighbourhoods are, on average, familiar, the inclusion of all parks in the determination of the index seemed unproductive.

Consequently, the only parks which were considered to be potentially competing sites were the 20 main parks from the survey. This not only simplified the calculation of the index, but it has intuitive merit as well. The 20 main parks, as the generally most heavily used and maintained ones in the community, represent the only real competition faced by the other parks in the system. As such, their influence on the decision to use another park in the system (presuming they are familiar to the neighbourhood's residents) would be much more pervasive than, say, an intervening playground.

Given, too, the very low levels of familiarity with the majority of the other parks, the index would become negligible in the model as the familiarity factor in the equation would remove most of the effect of the intervening parks. Interestingly, had the index been included in the model in its original form, it would very likely have biased the results tremendously when one considers the role that familiarity has been shown to play. With these considerations in mind, the intervening opportunities index was calculated for each of the other 94 parks in the same fashion as it had been for the 20 main parks -- with the familiarity factor.

5.2 DERIVATION OF POTENTIAL SURFACES

The derivation of potential directly from the supply-demand gravity model of urban recreation follows the relatively simple procedure of calculating the values for each system by inserting the variables and regression coefficients from the model into the potential equation. The equation for potential, introduced earlier, is as follows for the recreation demand system:

$$V_j = \sum_{i=1}^{n} \frac{D_i}{d_{ij}^b} \qquad [2.6]$$

And for the recreation supply system, the equation takes the following form:

$$V_i = \sum_{j=1}^{m} \frac{S_j}{d_{ij}^b} \qquad [2.7]$$

Earlier studies have used the results of a spatial interaction model to estimate the value of the b parameter in the distance function prior to the calculation of potential (Pooler, 1982), and in this study, a similar process is followed, but for all the variables in the equation. Therefore, each of the measures on the factors included in the supply and demand components of the model also are "weighted" by the regression coefficients estimated in the supply-demand gravity model.

In this study, not only the two individual system surfaces are to be determined, but also a surface which integrates these two surfaces to create the recreation opportunity spatial system potential surface. However, unlike the studies by Coffey (1977, 1978) and Coffey and Matwijiw (1979) which took the ratio of two systems (population and income) at the same set of reference points (census tract centres), the supply points (i.e. coordinates of parks, m=114) and the demand points (i.e. mean centres of neighbourhoods, n=48) in this study do not occupy the same locations in this spatial system. Therefore, an arbitrary set of reference points was created by overlaying a grid on the coordinate space embracing the locations of the parks and neighbourhoods. The intersecting points of the grid thereby became the reference points to which the potential values of both the recreation supply and demand systems were calculated, and subsequently, the ratio of these values taken for the opportunity system. The density of the grid points was arbitrarily selected with the simple criterion of establishing a set of points which were sufficiently dense so as to facilitate the interpolation of the potential surfaces. Essentially, the density of points is such that the distance between them, for the most part, locates several points between each pair of parks or neighbourhoods. The 635 grid reference points are illustrated in Figure 5.5 with those points considered falling "within" the neighbourhoods highlighted with "+"s.

As a result of establishing this set of reference points, a problem described by Pooler (1982) concerning the surface estimation was avoided. By relying on the locations of the parks and neighbourhoods to estimate the potential values, the results are subject to the unique spatial configuration of these points. In fact, Dalvi and Martin (1976) empirically demonstrated how various configurations of points to which potentials were estimated created quite different surfaces. However, the regular pattern provided by the grid reference points (see Figure 5.5) meant a corresponding consistency in the estimation of the potential values and in the determination of the surfaces.

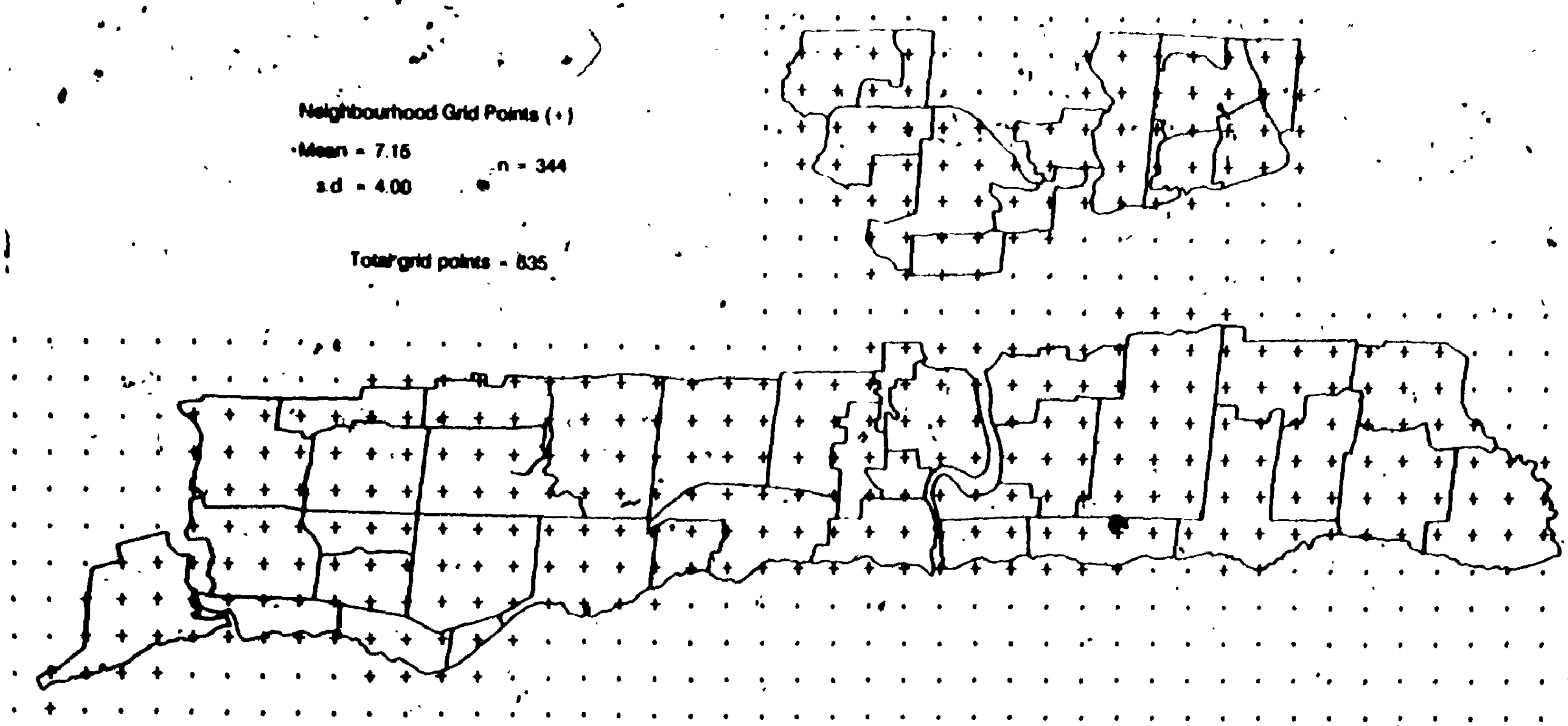


Figure 5.5

Grid Reference Points Used for Potential Surfaces

5.2.1 Estimation of Potential Values

With the establishment of the grid reference points, the potential values for both the recreation supply and the recreation demand systems could be calculated to these points. This meant that a slight modification to equations [2.6] and [2.7] had to be made to reflect this fact. Consequently, to calculate the potential values for the recreation demand system to the grid reference points, equation [2.6] was modified in the following way:

$$U_k = \sum_{i=1}^{n} \frac{D_i}{f(d_{ik})} \quad [5.2]$$

where Uk is the recreation demand system potential value at point k, Di is the combination of demand factors and their associated regression coefficients which characterise neighbourhood i, f(dik) is the distance function associated with neighbourhood i and grid reference point k which incorporates both the Pareto distance function and the intervening opportunities index, and n is the number of neighbourhoods in the demand system.

Similarly, the potential values for the recreation supply system were calculated to the grid reference points by modifying equation [2.7] to the following form:

$$V_k = \sum_{j=1}^{m} \frac{S_j}{f(d_{jk})} \quad [5.3]$$

where Vk is the recreation supply system potential value at point k, Sj is the combination of supply factors and their associated regression coefficients which characterise park j, f(dik) is the distance function associated with park j and grid reference point k which, as before, incorporates both the Pareto distance function and the intervening opportunities index, and m is the number of parks in the supply system.

The factors making up the demand system component in equation [5.2] corresponded, of course, with those used in the gravity model: the demographic characteristics (SEi), the residential/structural features (RSi), the recreation participation residuals (RPi), and the locational features (Li) of the neighbourhood. Each factor was weighted by its regression coefficient and summed with the others prior to entering the distance function in the equation. Similarly, the supply system component in equation [5.3] was made up the parks' physical characteristics (PHj), man-made features (MMj), and locational feature (Lj) which were weighted by their regression coefficients as well.

With respect to the perceptual factors in the gravity model, a neighbourhood's familiarity with a park (FAMPARK) was added to the demand component of equation [5.2]. Park familiarity is, in essence, a function of the neighbourhood's demand for these types of recreation opportunities. Increased experiential information about the parks (Level 3 of the conceptual model) reflects the behavioural response to the demand for them -- something which was verified in the supply-demand gravity model. Hence, a greater degree of familiarity exists amongst those neighbourhoods where the demand is being expressed as opposed to those neighbourhoods where the demand is less and therefore the need to be familiar is correspondingly less. In this respect, the inclusion of the familiarity factor in the demand system component served to modify the effects of the objective factors which characterise the neighbourhoods.

The comparative perceived attractivity of the parks (CATTPK) was incorporated into the supply system component of equation [5.3] because it is inherently a measure of the parks themselves. For the most part, attractivity is a function of a park's objective features as interpreted from the perspective of the individual neighbourhoods. Therefore, when the potential values are calculated to each of the grid reference points, they will be a function of the relative attractivity of all the parks in the supply system. In this respect, the comparative perceived attractivity measure transforms the parks from simple "resources" into <u>opportunities</u> for recreation which more accurately reflect the nature of the supply system.

5.2.2 Urban Recreation Demand System

Using equation [5.2], the potential values for the recreation demand system were calculated at the 635 grid reference points. The resultant values were then standardised to better reflect the spatial variations in demand for recreation across the community. Thus, values below the mean of 0.0 represented points on the surface where demand was less than the community average whereas values above the mean represented points on the surface where demand was greater than the community average.

Following the calculation of the demand system's potential values to the grid reference points, a contouring programme (UCON2) was employed to produce the potential surface on a CalComp plotter. This surface was then plotted over the neighbourhood outline map of the town to produce a contour map reflecting the variations in recreation demand potential across the community. The contour interval was selected so that five contour lines would be plotted within each standard deviation of potential values. Thus, the contour interval for the demand system potential surface was 0.20. The same procedure is, in essence, followed in the derivation of all the subsequent potential surfaces.

The recreation demand system potential surface is illustrated in Figure 5.6. Demand potential is highest in the neighbourhoods in the vicinity of Sixteen Mile Creek near the centre of the community (NBRs 17 to 27), and the entire

North region of the town shows above average levels of demand potential. Another pocket where there is a small rise in demand potential is in the central neighbourhoods of the West region where values rise above average in NBRs 6, 7, 8, 11, and 14. Areas where the demand potential is relatively low are confined to the peripheral neighbourhoods of the West and East regions (NBRs 1 to 4 and NBRs 32 to 34 respectively).

With the overall performance of the demand system component being relatively poor in the supply-demand gravity model, this outcome is not surprising. Even though the familiarity factor has been included within the component, its influence is not sufficient to overcome the effect of the distance function. Consequently, distance, which was an important factor in the model, becomes the principal determinant of the potential values making up this surface, and the map shown in Figure 5.6 reflects this. The central locations are "closer to all other points" than the peripheral locations, and as a result, the aggregate effect of distance on the demand component is reduced. Similarly, the points near the edges of the grid system generate the highest aggregate distances so the values of the demand component here play a much smaller role.

Taking this into consideration, the relatively higher levels of demand potential found in the entire North region and in the central West region suggest that, without the

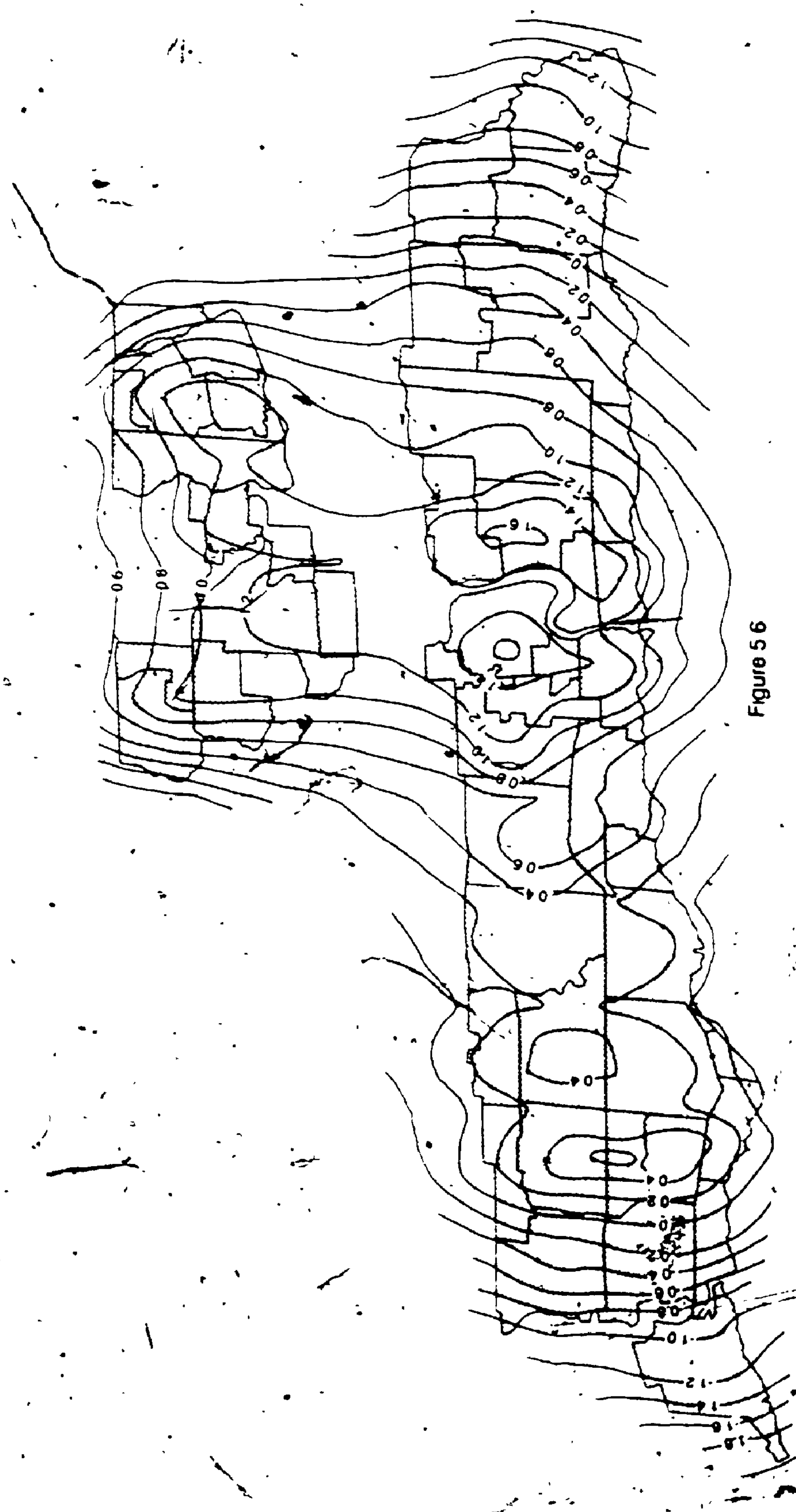


Figure 5 6

Recreation Demand System Potential Surface effects of the distance function, the demand for urban recreation here may be quite significant. Also, the peripheral neighbourhoods may not be quite as "demand-poor" as the potential surface of Figure 5.6 suggests.

5.2.3 Urban Recreation Supply System

As with the demand system, the recreation supply system potential values were calulated at the 635 grid reference points using equation [5.3]. The resultant values were standardised so that the mean supply potential value equalled 0.0 and variations from the mean represented above (+) and below (-) average levels of recreation opportunity provision in the community. The contour map of these values reflecting the variations in recreation supply potential is shown in Figure 5.7.

Relative surpluses in the provision of recreation opportunities again appear to be based in the centre of the community (NBRs 17 to 27). Not only is there a small cluster of parks in this area, but these parks include four of the 20 main parks from the survey as well as several other parks measuring highly on important factors from the supply-demand gravity model -- the presence of water and the comparative attractivity of the parks.

Two other areas with above average levels of supply potential include the neighbourhoods near Fourteen Mile Creek in the West region (NBRs 2, 3, 7 to 9), and many of the neighbourhoods in the North region (NBRs 35 to 44). In

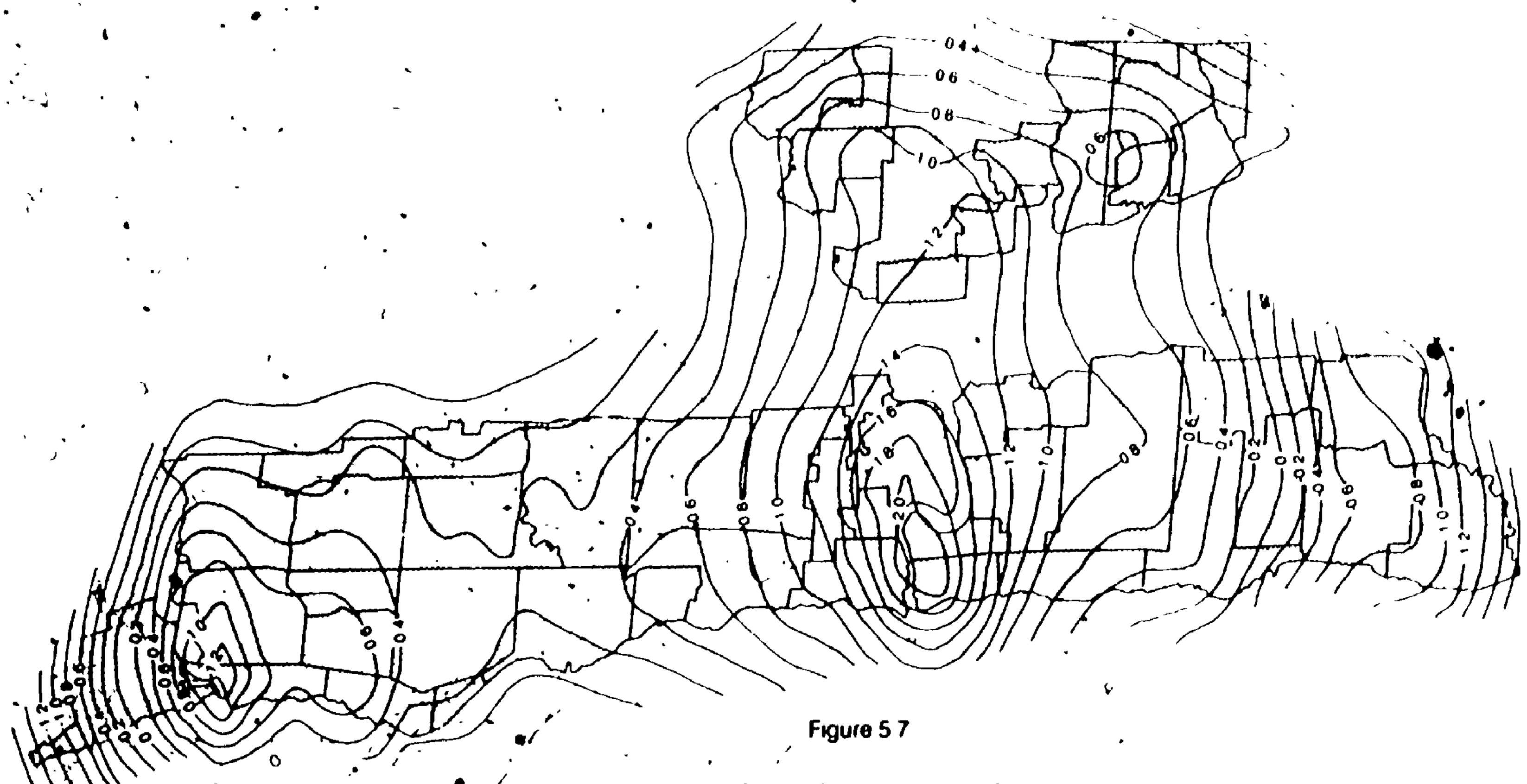


Figure 5 7

Recreation Supply System Potential Surface the West region, the higher levels of supply potential likely occur for the same reasons as those in the centre of the community. In the North region, the pattern is less easy to explain, but may be the result of the greater access both to the main parks found in this region and to those parks in the centre of the town. Ironically, residents of the North region often feel "cut off" from the rest of the community because of the Queen Elizabeth Highway which bisects the town. However, despite this perceived barrier, based on the model's results, the parks near the lake are relatively accessible and are perceived to be comparatively attractive.

In the calculation of the supply system potential values, the supply component played a more prominent role in the supply-demand gravity model. As a result, the aggregate measures of the supply factors -- notably, park shape, presence of water, number of garden beds, and park furniture -- offset the effects of the distance function to a greater extent than the demand system component was able to do. Therefore, the supply system potential surface illustrated in Figure 5.7 may be a "truer" reflection of the relative levels of accessible recreation opportunity in the community than the demand system potential surface shown in Figure 5.6.

5.2.4 Recreation Opportunity Spatial System

To generate the recreation opportunity spatial system potential values, the supply and demand systems were integrated by taking the ratio of their standardised values at each of the 635 grid reference points. This involved the simple calculation of equation [5.4]:

$$E_k = \frac{\sum_{j=1}^{m} \frac{S_j}{d_{jk}}}{\sum_{i=1}^{n} \frac{D_i}{d_{ik}}} \qquad [5.4]$$

where Ek is the recreation opportunity spatial system potential value at point k. Equation [5.4] can be expressed more simply as follows:

$$E_k = \frac{V_k}{U_k} \qquad [5.5]$$

Before equation [5.5] was applied, a value of "10" was added to the potential values for the supply and demand systems in order to remove all the negative values. In this way, the problem of misinterpreting the source of negative ratios was avoided. For example, if the demand potential value at point k was 0.6 indicating above average levels of demand, and the supply potential value at the same point was -0.5 indicating below average levels of supply, the resultant recreation opportunity potential would be -0.83. However, the same value would be achieved if the negative sign was switched to the demand potential value, yet without additional information clarifying the nature of the relationship between the values, the interpretation may not change.

Therefore, by adding in a factor of 10 to all the supply and demand potential values, such problems of interpretation are avoided. In the example above, the ratio would equal 0.896 (Ek=9.5/10.6) in the first case, and 1.117 (Ek=10.5/9.4) in the latter thereby distinguishing between the above and below average values.

The interpretation of the ratio values corresponds to the theoretical propositions concerning equal opportunity of provision in the community. At the points where the ratio equals 1.0, there is a "balance" in the provision of recreation opportunities and in the demand for them. Where the ratio is greater than 1.0, the supply potential for urban recreation is greater than the demand potential indicating a surplus of opportunities for recreation given the demand for them. Where the ratio is less than 1.0, the urban recreation demand potential is greater than the supply potential indicating a deficiency in available opportunities to meet the demand. Therefore, in a theoretically equitable provision of urban recreation opportunities -- one where the level of supply meets the existing demand -- all the ratio values should equal 1.0 and the resultant surface, when mapped, should be "smooth".

Following the calculation of the ratios to the grid reference points, the mean of the resultant values (Ek) was 1.007 with a standard deviation of 0.049. The recreation opportunity spatial system potential surface is illustrated in Figure 5.8 which uses contour lines at 0.01 intervals.

The potential surface reflecting the recreation opportunity spatial system illustrates two areas which are extremely "supply-rich" and several pockets of the community where the levels of demand appear to be exceeding the available opportunities for recreation. Despite showing relatively high levels of demand, the neighbourhoods in the centre of the community (NBRs 19 to 21, 23, and 24) have a surplus of opportunities for recreation as defined by the supply system potential for this area. Apparently, the parks in this area have greater potential to satisfy demand for recreation beyond what currently is being expressed here.

This pattern is even more evident in the neighbourhoods surrounding the mouth of the Fourteen Mile Creek in the West region of the community (see Figure 5.8). Neighbourhoods 1 to 4 all possess opportunity potential values more than two standard deviations above 1.0 which reflect a provision of recreation supply far in excess of what the levels of demand in the area require. Other areas where the supply potential is slightly greater than the demand potential are found

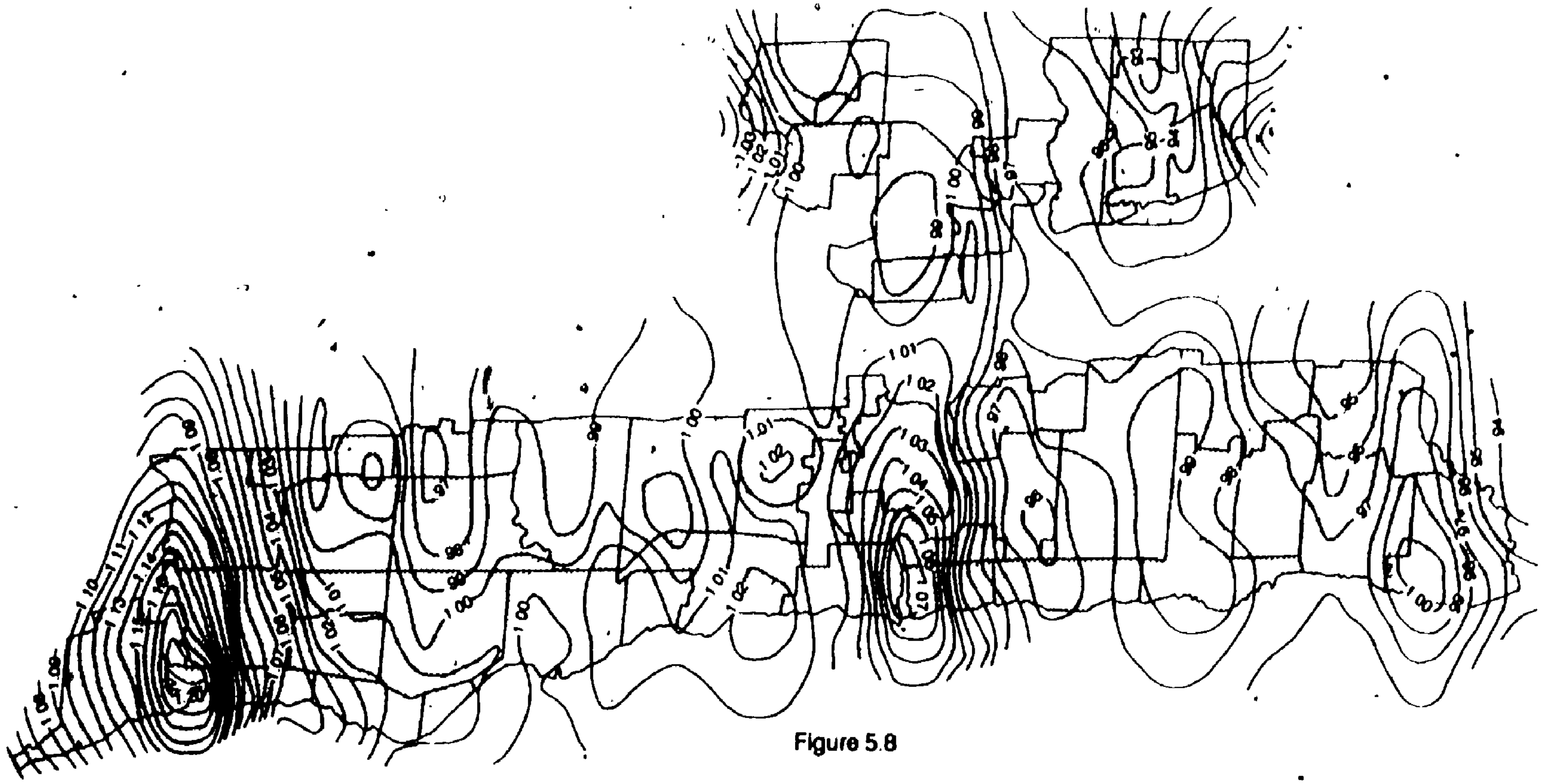


Figure 5.8

Recreation Opportunity Spatial System Potential Surface along the lake shoreline in the West region, but for the most part, these areas appear to show a degree of equal opportunity.

The areas in the community where the levels of supply potential do not meet the higher levels of demand potential are found predominantly in the North region, especially in neighbourhoods 43 to 47. Here, the demand potential values are among the highest across the community yet the supply potential values, although showing above average levels, are not correspondingly high. The other pockets in the community which appear to be "supply-poor" are located in areas where the density of parks is not as great as in the "supply-rich" areas (see Figure 3.2). Neighbourhoods 10, 26, 28, 30 to 33, and 37 all share this general characteristic. In the case of the more affluent, larger house-lot neighbourhoods of the East region, the inadequacy of recreation supply opportunities may not be as severe a problem as it may be in the neighbourhoods of the North region where the lack of opportunity may present a constraint to, for example, young families living in townhouses and apartments.

Overall, the East region neighbourhoods, generally, are not as well provided for as the West region neighbourhoods given their levels of demand for recreation, yet both regions are better provided for than the North region neighbourhoods which are almost entirely embraced by "supply-poor" provision of opportunities. An examination of the demand system potential surface (Figure 5.6) and the supply system potential surface (Figure 5.7) shows that this deficiency is the result of slightly above average supply levels coupled with even greater levels of demand. However, as was suggested earlier, the higher levels of supply potential in the North region may be somewhat inflated by its relative accessibility to the parks near the lake at the centre of the town. Taking this into consideration, the deficiency here may represent a "real" lack of provision relative to the rest of community.

Nevertheless, a number of areas exist in the community which, according to theoretical propositions, suggest that equal opportunity in the provision of urban recreation opportunities is being achieved. Much of the central area of the West region shows potential values at or very near to 1.0 which reflects equipotentiality in these neighbourhoods. Similarly, parts of the North region (NBRs 36 and 40) and neighbourhood 34 in the East region show a relative balance between the levels of recreation that is provided and that which is demanded. Interestingly, in neighbourhood 34, the levels of demand potential are below the community average as are the levels of supply potential, but the resultant level of recreation opportunity shows the correspondence between the two systems. Therefore, relatively supply-poor areas can exist in the community without necessarily creating a lack of opportunities for recreation so long as the levels of demand therein correspond to that supply.

In order to compare these results with some of the indicators pertaining to the neighbourhoods in the community, the mean of the potential values at the grid reference points considered to be "within" each neighbourhood (denoted by "+" in Figure 5.5) were calculated. These mean values of neighbourhood opportunity potential were then compared to the total park use by the neighbourhood (from Table 5.2), the number of parks within the neighbourhood, and the total area in hectares of parkland within the neighbourhood. Table 5.6 shows the mean values of opportunity potential for each neighbourhood as well as the numbers and area of parks in each.

Even though the use of these measures assumes that the availability of parks and park area ends at the neighbourhood boundary, and that the mean potential values are independent of those outside the neighbourhood, they do provide an indication of the relative accessibility of the neighbourhood's residents to the opportunities immediately available to them. The mean opportunity potential of the neighbourhoods was strongly positively correlated with the neighbourhood's observed total park use (r=0.4840; sig.<.0001) and the number of parks in the neighbourhood (r=0.5636; sig.<.0001). The correlation with area of parkland was significant, but much less so (r=0.2603; sig.=.037) suggesting that the simple availability of parks may be more important than their size -- a notion already postulated by Butler (1972).

Table 5.6: Recreation Opportunity System Potential and Park Indicators

NBR	ROS poten.	PARK INDICATORS n	PARK INDICATORS Area	NBR	ROS poten.	PARK INDICATORS n	PARK INDICATORS Area
1	1.123	10	19.141	25	.975	0	0
2	1.093	4	2.267	26	.972	2	2.894
3	1.133	6	4.478	27	.986	1	1.069
4	1.099	3	12.890	28	.983	5	8.298
5	1.009	1	2.076	29	.987	1	4.695
6	1.003	1	1.259	30	.974	2	3.305
7	1.016	0	0	31	.971	2	1.536
8	1.030	3	5.868	32	.975	2	2.960
9	1.024	3	2.085	33	.970	4	8.702
10	.978	0	0	34	.971	5	7.521
11	.985	2	11.854	35	.999	1	.287
12	1.005	3	14.839	36	.983	3	4.428
13	1.008	2	1.336	37	.993	3	13.232
14	.992	1	1.612	38	.998	3	3.651
15	1.000	4	3.424	39	.992	0	0
16	1.011	2	.664	40	.993	3	4.783
17	.998	2	.700	41	.981	1	3.542
18	1.008	2	3.501	42	.963	3	8.331
19	1.022	2	4.168	43	.956	0	0
20	1.041	1	.046	44	.951	1	3.845
21	1.030	3	2.116	45	.944	3	7.517
22	1.007	1	1.314	46	.925	0	0
23	1.038	4	1.331	47	.963	0	0
24	1.032	3	2.586	48	.969	3	7.548

Mean recreation opportunity potential = 1.007 (s.d.=0.049)

Mean number of parks per neighbourhood = 2.313 (s.d.=1.828)

Mean park area (ha) per neighbourhood = 4.119 (s.d.=4.345)

5.2.4.1 Potential surfaces based on traditional factors

To this point, the derivation of the potential surfaces has been based on an adherence to the theoretical rationale associated with the conceptual model. In this respect, the surfaces portrayed in Figures 5.6, 5.7, and especially 5.8 should be regarded as the logical outcomes of this process, and they are a measure of the provision of and demand for urban recreation. This perspective assumes, of course, that the modelling procedures have been correctly specified and that no serious statistical error has entered the process. Consequently, the recreation opportunity spatial system potential surface should be regarded as a "true" reflection of where equal opportunity in provision is occurring and where it is not.

However, even if the assumptions associated with this view are valid, an unresolved question concerns the extent to which this process of operationalising the conceptual model has, in fact, improved upon existing means of treating the same problem of assessing equal opportunity in the provision of recreation opportunities. In other words, has the opportunity potential surface shown in Figure 5.8 provided additional information not forthcoming from more traditional approaches to assessing equal opportunity?

In order to evaluate the performance of the conceptual model as presented in this study, a similar process was followed in the derivation of the potential surfaces, but for a traditionally specified gravity model. Presumably, if the conceptual model, which incorporates several important features of both the demand system and the supply system of urban recreation, has produced a more meaningful description of the provision of opportunities in this community, then its results should show logical, recognisable differences from those produced by a more traditional model. This is not to suggest that the results of the two models must <u>necessarily</u> be different, but that the observable differences are due to a theoretically more plausible and accurately specified conceptual model.

The gravity model used here to explain neighbourhood use of the parks was comprised of variables traditionally employed to serve as surrogate indicators of origin emissivity, destination attractivity, and of the deterring effect of distance. Following the assumptions underlying the application of recreation standards, the following indicators were used to represent the components of the model:

1. the number of households in the neighbourhood (HHOLDS) represented the origin or demand component;

2. the area in hectares of the park (AREA) represented the destination or supply component; and

3. the straight-line or Euclidean distance (EUCLID) between the park and the neighbourhood represented the distance component

The "traditional" gravity model therefore took the following form:

$$I_{ij} = a \frac{D_i S_j}{d_{ij}^b} \qquad [5.6]$$

where Iij is the total use made of park j by neighbourhood i, Di is the number of households in neighbourhood i, Sj is the area of park j, dij is the straight-line distance between neighbourhood i and park j, and a and b are parameters to be estimated. Following natural logarithm transformations to put equation [5.6] in linear form, the model was calibrated to produce the results shown in Table 5.7.

Table 5.7: Results of "Traditional" Gravity Model*

FEATURE Variable	b**	s.e. of b	BETA	r	R^2 change
Di HHOLDS	1.6013	.1447	.3102	.3152	.0994
Sj AREA	.3043	.0498	.1768	.0814	.0066
Dij EUCLID	-.9324	.0692	-.3895	-.3501	.1426

$R^2 = 0.2485$
F = 105.397; sig.<.001

* dependent variable is total park use by neighbourhood

** unstandardised regression coefficients

Overall, the traditional gravity model explained 24.85% of the variation in total park use which is not especially remarkable nor descriptive. The Euclidean distance between the neighbourhood and the park contributed the greatest amount to the solution (R^2 change=0.1426), and appeared to be the most important variable in the equation (BETA=-0.3895). Unlike the supply-demand gravity model, the demand component here -- number of households -- played an important part in the determination of total park use contributing approximately 40% of the total explained variance. Interestingly, the "attractivity" of the parks (as defined by area) contributed little to the solution unlike the more important role it played in the supply-demand gravity model.

With these results, the calculation of the potential values at the 635 grid reference points followed essentially the same procedure as was employed for the full model. Equation [5.3] was used to calculate the demand potential values, and equation [5.4] was used to calculate the supply potential values with the regression coefficients again serving as "weights" on the neighbourhood and park measures.

The contour map of "traditional" demand system potential is shown in Figure 5.9. Clearly the most notable aspect of this surface is the complete contrast it provides to the demand potential surface generated by the full model (Figure 5.6). In fact, in almost precisely the same areas that demand potential was higher than average on that map, traditional demand potential surface shows significantly below average values. The same pattern holds true for areas where demand potential values are above average here -- they generally are below average on the full model's demand potential surface.

The greater importance that the demand component plays in the traditional model is being reflected in Figure 5.9 as neighbourhoods with more households are raising the potential values in those areas. But should the assumption that a greater number of households necessarily increases the demand for recreation be accepted? Certainly, the traditional demand potential surface simply reflects a variation on population potential with little real connection to urban recreation demand as described in the conceptual model.

The "traditional" supply system potential surface is shown in Figure 5.10, and it follows, but to a lesser extent, a similar pattern with respect to its contrast to the full model's supply potential surface (Figure 5.7) as did the demand potential maps. Here, the potential values in the vicinity of the centre of the community (NBRs 19 to 24) and at the periphery of the West region (NBRs 1 to 4) are well below average whereas in the full model's supply potential surface, these areas show above average values. However, correspondingly higher potential values are found on both surfaces in the North region of the community although the traditional supply potential surface is less "smooth".

For the most part, the traditional supply potential surface shown in Figure 5.10 is a reflection of the very larg-

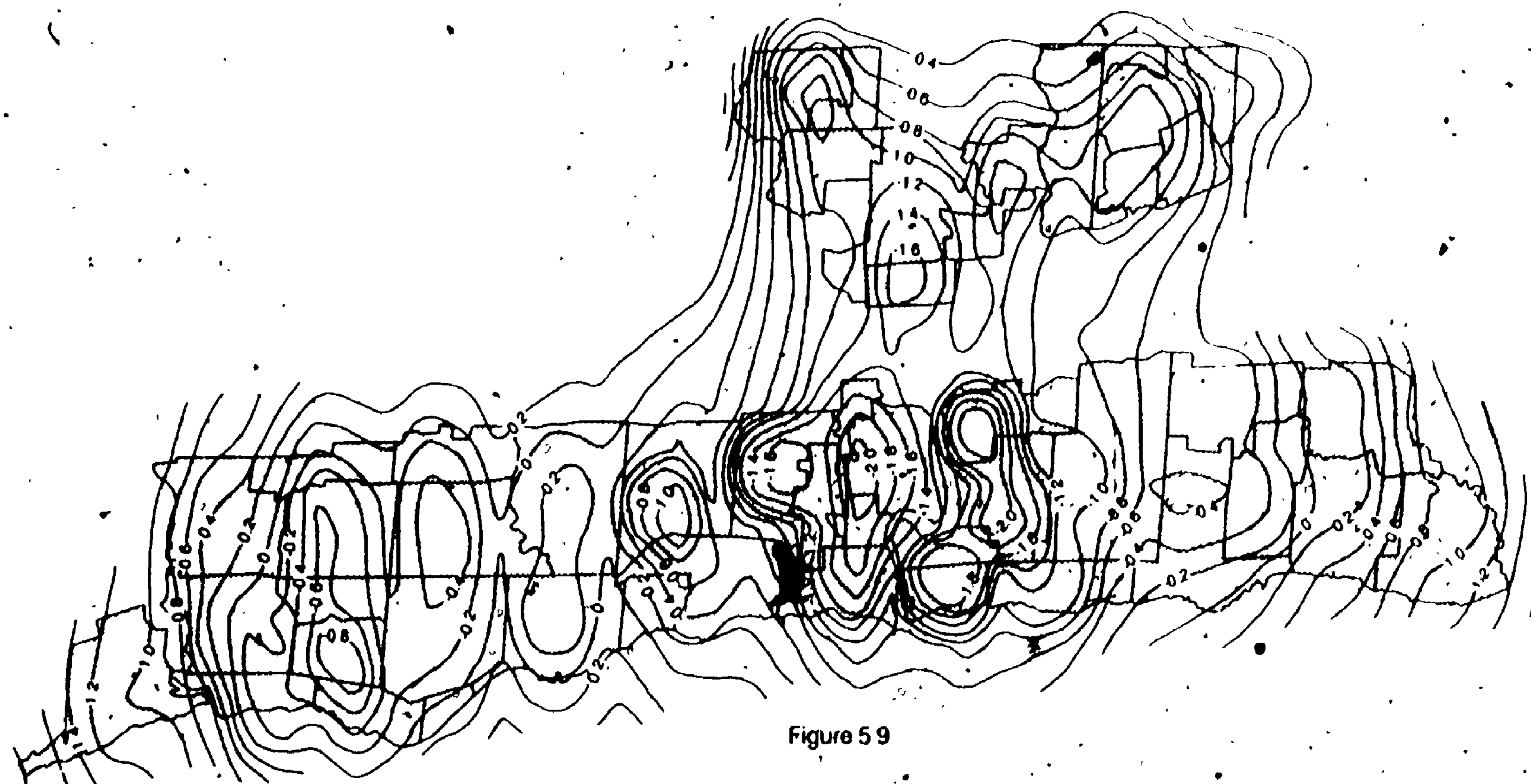


Figure 5 9

Traditional Demand System Potential Surface

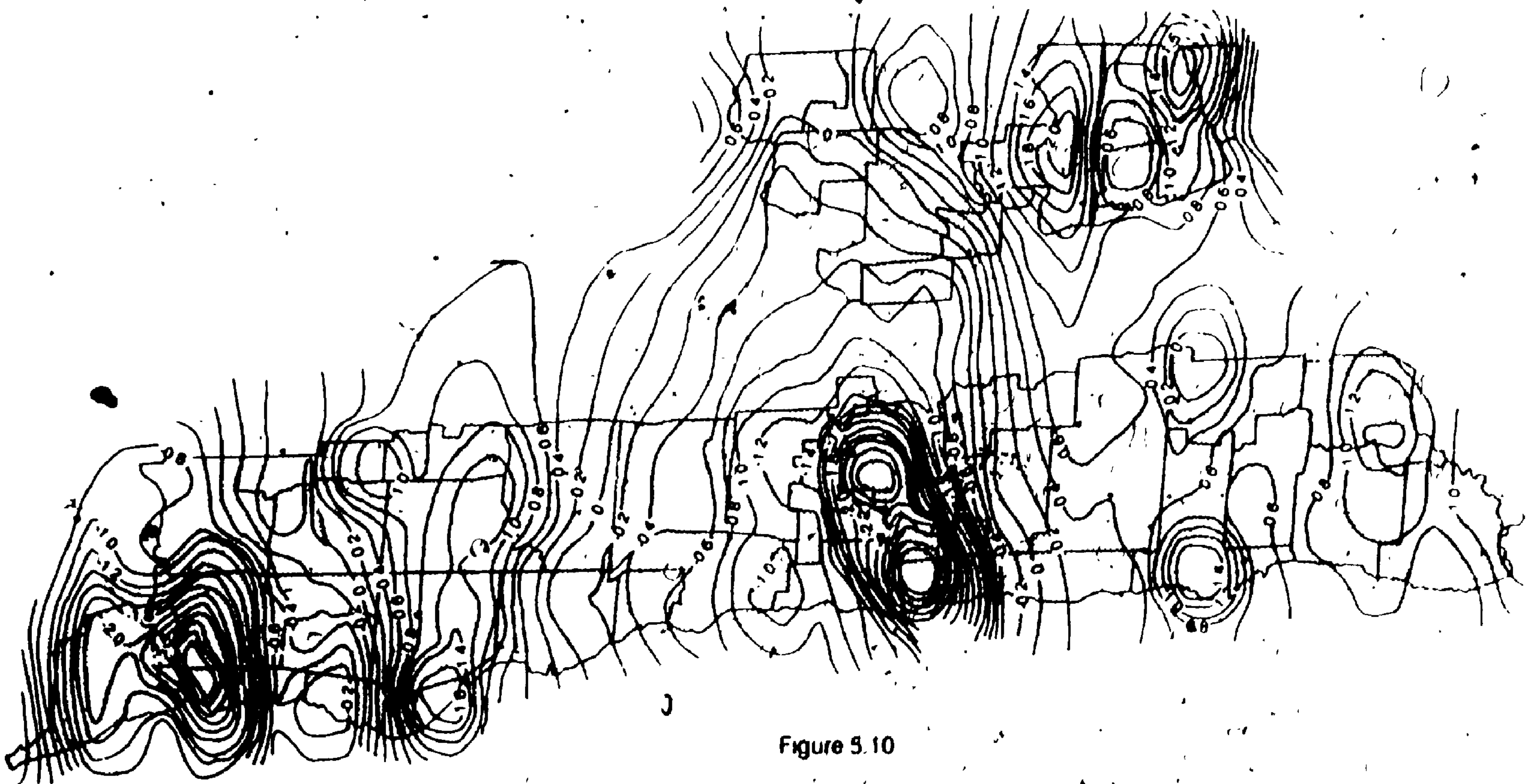


Figure 5.10

Traditional Supply System Potential Surface est parks in the community. The generally higher values in the North region coincide with the a greater degree of accessibility to parks such as Lion's Valley (41.49 ha), Oakville (8.62 ha), Pinerdige/Henderson (7.38 ha), and Sheridan Hills (6.97 ha). Similarly, the isolated "peaks" in the surface all correspond with other large parks in the community, most notably, Coronation, Gairloch Gardens, Seabrook, and Joshua Valley (refer to Figure 5.4).

As with the traditional demand potential surface, this surface of supply potential is based on the assumption that a simple indicator such as park area provides a measure of the availability of opportunities for recreation in the community. However, the parks must first be familiar to the community's residents before they can take advantage of them irrespective of the size of the park. And as was suggested by the correlation between the full model's mean potential values and number of parks in the neighbourhoods, park area may be less important than the simple presence of a park in providing an opportunity for recreation -- a notion already suggested by Butler (1972).

To generate the "traditional" opportunity system potential surface, the ratio of the supply potential values to the demand potential values was taken at each of the 635 grid reference points. The contour map of the resultant ratio values is shown in Figure 5.11. Again, for the most part, the results of this surface are in complete contrast to the full model's recreation opportunity spatial system potential surface (Figure 5.8). Areas of the community which the full model suggested were "supply-rich" (i.e. the community's centre and the Fourteen Mile Creek area) are the areas most severely under-provided for according to the traditional model's opportunity potential surface. Similarly, the North region, especially neighbourhoods 41 to 48, is presumably well served by the parks in that area as the potential values from the traditional model all are well above average levels. Yet, the full model's opportunity potential values in the North region are all below average levels suggesting quite the opposite level of provision.

The mean potential values for each neighbourhood as derived from the traditional opportunity potential surface are reported in Table 5.8. These values were then compared to the observed park use, numbers of parks and park area in the neighbourhood (from Tables 5.2 and 5.6), as well as the mean potential values from the full model. The mean potential values in the neighbourhood were strongly positively correlated with park area (r=0.4652; sig.<.001) as would be expected given specification of the supply potential component. However, the correlation between the mean potential values and the number of parks was not significant (r=0.0832; sig.=.287) suggesting that, at least for this traditional model, the availability of parks does not necessarily create opportunities for recreation unless they are relatively large.

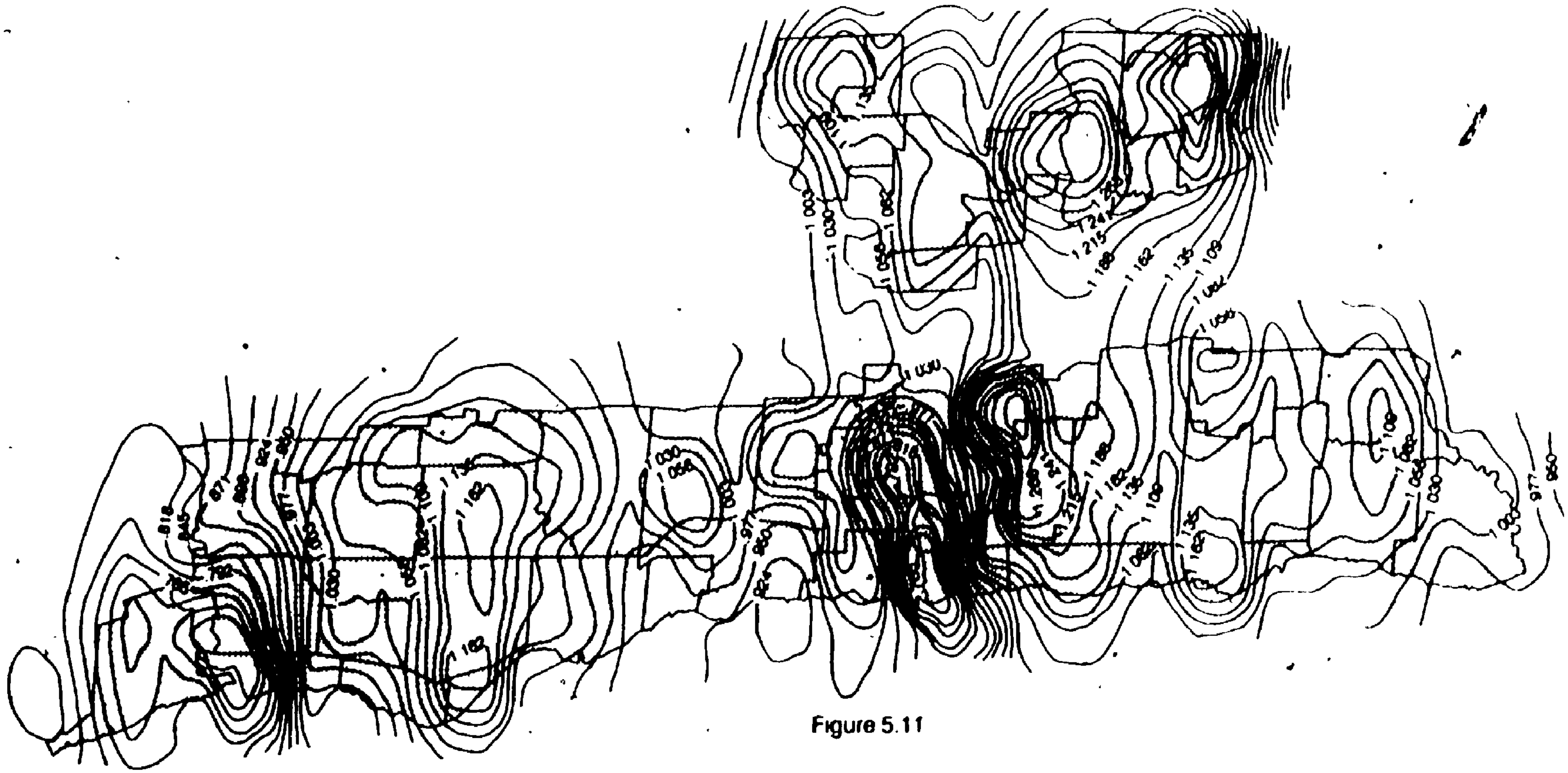


Figure 5.11

Traditional Opportunity System Potential Surface

Table 5.8: Traditional Model Potential Values Within Neighbourhoods

NBR	Trad. poten.	NBR	Trad. poten.	NBR	Trad. poten.
1	1.009	17	.869	33	1.032
2	.984	18	.913	34	1.023
3	1.068	19	.915	35	.938
4	1.131	20	.838	36	.984
5	1.107	21	.931	37	.990
6	.996	22	.889	38	.996
7	.994	23	.863	39	1.037
8	1.014	24	.893	40	1.005
9	1.034	25	.902	41	1.029
10	1.038	26	.864	42	1.080
11	1.075	27	.904	43	1.006
12	1.186	28	.991	44	1.033
13	1.027	29	1.075	45	1.066
14	1.058	30	.978	46	1.081
15	.946	31	.948	47	1.010
16	.936	32	1.004	48	1.218

Mean traditional model value = 1.009
(s.d.= 0.121)

Observed park use by the neighbourhoods was not as strongly correlated with these mean potential values (r=0.2662; sig.=.034) as it was with the mean potential values from the full model. Additionally, the correlation between the traditional model's mean potential values and the full model's mean potential values was not significant (r=-0.0845; sig.=.284) as might have been expected given the contrast between their potential surfaces (Figures 5.8 and

5.11). Consequently, given the correlations of both models' potential values with neighbourhood park use, but not with each other, these two sets of mean potential values appear to be explaining quite different aspects of park use.

If it is assumed that the conceptual model has been specified correctly, and that the "traditional" model lacks information, then if the potential values of one are regressed against the other, the resultant residuals should indicate the relative degree of "error" in the traditional model that exists at any given reference point. Using the 344 grid reference points considered to be within the neighbourhoods' boundaries, the correlation between the potential values of the full model and of the traditional model was 0.2628 indicating that the full model could explain just 6.91% of the variation in the traditional model. The limited amount of observable correspondence between the potential values of the two surfaces highlights the loss of information resulting from the use of the traditional model. Although beyond the scope of this study, an exploration of the nature of this loss of information would be quite useful. What specific aspects of the traditional model does the conceptual model actually improve upon?

The contrast in the two surfaces of opportunity potential reveals the fundamental difference between the traditional, limited approach to assessing provision of recreation opportunities, and the approach proposed by the conceptual model of urban recreation. By operationalising the conceptual model in such a way as to incorporate many of the factors which theoretically are related to the demand for and supply of urban recreation, the potential surfaces ultimately better reflect the balances and imbalances in provision that exist as a result of the dynamic relationship between the two systems. This has not only a sounder theoretical rationale, but it makes intuitive sense, and that, despite any statistical or structural inadequacies in specifying the model, is a much more satisfying outcome to this process.

Chapter VI

EQUIPOTENTIALITY IN URBAN RECREATION OPPORTUNITIES

Whenever a new conceptual framework is offered as an alternative to an existing perspective, in this case, on how equity in the provision of urban recreation opportunities may be achieved, questions arise as to the viability of the new model in terms of both its theoretical and practical relevancy. However, the model presented here and its ultimate realisation in the form of the recreation opportunity spatial system surface has provided the most comprehensive effort yet to incorporate those factors which comprise urban recreation supply and demand, and to delineate a relative measure of equity in the provision of recreation opportunities. Nevertheless, those questions which do arise concerning the effects of, for example, adopting particular methodological strategies or measuring a concept in an arbitrary way, must be assessed for their potential influence on the outcome of the process. In this way, the conceptual model in its operationalised form ultimately is strengthened through the elimination of sources of statistical and structural error.

6.1 METHODOLOGICAL ISSUES AND CONCERNS

The operationalisation of the conceptual model of urban recreation and its subsequent empirical testing inevitably lead to questions concerning the validity of both the measures adopted to represent the concepts and the specific techniques employed to determine the relationships between these concepts. For the most part, the strategies selected are reflective of accepted practice in the literature and by what are felt to be sound theoretical arguments. Nevertheless, the very nature of the methodological procedures -- their underlying assumptions, structure, and idiosyncrasies -- ultimately introduces effects typically unaccounted for in the derivation of the conceptual model.

6.1.1 Fitting the Supply-Demand Gravity Model

The general model of spatial interaction -- as expressed by the gravity model -- provides a reasonable approximation of the numbers of trips between a set of origins and destinations (Baxter, 1983). What it does lack, however, is an accepted theoretical rationale, although there have been attempts to provide one (Wilson, 1971; Sheppard, 1978). Most of the attention previously has been focused on the calibration of the model and on understanding the relationship between the three basic components which comprise it.

While many improvements have been made over the years to the basic structure of the gravity model (e.g. origin- and destination-specific constraints), the desire here to derive measures of potential directly from the model as well as to maintain a degree of simplicity in application prescribed the use of the simple model. Had this study been concerned more with the structural intricacies of the model and its absolute specification than with the application of the conceptual model and the notion of equipotentiality, a more rigorous pursuit of the "correct" model would have been appropriate. Too often, emphasis is placed on the mathematical elegance evident in a study, and not on the theoretical contribution found therein. The simpler version of the gravity model did provide, in fact, a reasonably good fit to the observed interaction between the parks and the neighbourhoods lending some empirical support for the conceptual model proposed here.

That part of park use which is not explained by the model may be the result of a number of factors. In many cases, the unexplained variance is attributed to the absence of other important variables which a researcher may not have been able to include for a variety of reasons. Here, with the conceptual model providing a framework both for the explanation of recreation behaviour in urban areas and for the collection of relevant data, it must be assumed that the most important variables have been included. Any other features associated with either the recreation supply or demand system, if introduced to the model, therefore, should not significantly improve the model's performance. For example, both the age of the park and the length of residency may have played important roles in the explanation of park use. However, as Spotts (1983) has shown, both of these variables are closely related to park familiarity and it is this factor, with its broader implications for the conceptual model, which serves as a surrogate measure for the others.

Other sources of error common to most, if not all, attempts to calibrate gravity models include statistical error resulting from the inaccurate measurement of variables, structural error resulting from the misspecification of the model, and aggregation effects which occur as a result of the creation of origin and/or destination zones. These sources of error are normally recognised if not discussed and typically are regarded as negligible in their influence on the results. There are, however, some special concerns which are unique to this study that are based in these sources of error.

The focal point of the model is the dependent variable: reported use of the 20 main parks by the community's residents. The accuracy with which the use of the parks is reported by the respondents is subject to some concern as self-reported participation has come under criticism by many researchers (Chase and Godbey, 1983; Boothby, 1987). Typically, estimates made by participants are exaggerated unintentionally providing a misleading depiction of actual use (Chase and Harada, 1984). If this were the case in this study, the actual levels of park use would be even lower than the reported low levels. In contrast, because the reported participation was intended to represent the entire household's use of each park, it is just as likely that a respondent could underestimate total use by being somewhat unfamiliar with the actual involvements of all household members. Ultimately, whatever errors are present must be assumed to be randomly distributed throughout the data.

Accepting that these self-reported participation rates are reasonably valid and -- perhaps more importantly -- reliable, the next area of concern pertains to the determination of the estimate of total annual park use, and subsequently, the mean annual park use by households in the neighbourhoods. The way in which the estimate was calculated was an attempt to reflect seasonal variations in park use rather than assuming a constant rate of use throughout the year. The lower use and non-use of parks during the winter months has been described elsewhere (Wilkinson and Lockhart, 1977; More, 1985), and it is this pattern that was to be reflected in the final calculation. What this also may have done, of course, was magnify self-reporting errors in the estimates should the respondents have overestimated their winter use of the parks. Had the seasonal balance not been introduced, however, the bias resulting in some of the estimates would likely have been even greater. Additional reductions in the effects of "outliers" likely occurred once the estimates were aggregated to the neighbourhood level.

Ultimately, it must be assumed that the final form of the estimate of park use by the neighbourhoods was a reliable measure and did capture the variations in park use across the community for which it was intended. In this view, the precision of the measure is of less importance than its reliability which is critical if assumptions about the residents' recreation behaviour are to be made. Ironically, in this study the reliability of this measure is not as easily verified as its validity (Bailey, 1987).

In a related vein, the validity of selected variables introduced to the model may not be in question from a purely measurement perspective, but their acceptance as valid indicators of the concept they are intended to represent may be questioned. For example, the measure of shape employed in this study can be regarded as a valid indicator of the linearity or "compactness" of a park, but whether or not it serves as one of the indicators of a park's attractivity is open to question. Does the potential park user perceive differences in park shape and behave in response to them? Certainly, this is the subtle extension to the interpretation of this measure. The intent here is not to refute the use of such indicators, but to recognise how the operationalisation of such concepts can lead to interpretations which, albeit based in logical reasoning, may be extended beyond reasonable limits.

Another possible source of error in the gravity model is that which may have been introduced as a result of the aggregation of respondents into neighbourhoods. Whenever data are aggregated, there is a certain loss of information or detail which is associated with the original units of analysis. Yet, this was a necessary step in order to facilitate the calibration of the gravity model and to generate zones which were meaningful with respect to the community itself. In fact, an associated benefit of the aggregation was that it served to remove a certain amount of the "noise" resulting from households which departed extraordinarily from neighbourhood norms.

The problem receiving the most attention as a result of the aggregation of individuals into homogeneous zones is the error which is introduced when estimating the parameters of gravity models. The nature of the error still is not well understood (Openshaw, 1984), but the real issue may well be in the <u>process</u> as opposed to the outcomes. Most studies evaluate the appropriateness of the areal units employed in terms of the goodness-of-fit of the model assuming that properly created zones will result in the best fit. However, the establishment of theoretically meaningful zones, or of zones which have practical utility, has more relevance conceptually to the theoretical underpinnings of the model. In other words, the model's performance should not define the zones -- the relevance of the zones to the conceptual framework should. Hence, in this case, a certain amount of confidence must be placed in the process which logically defined the neighbourhoods because it was based not in the desire to improve the model's results, but rather, in the desire to generate relevant and meaningful neighbourhoods of people with distinct demands for urban recreation. These types of zones are those which are most useful in the context of recreation planning.

Lastly, the model itself may be flawed structurally; that is, there may be error resulting from the misspecification of the model. Faith in the conceptual model does not necessarily guarantee that the structure adopted when operationalising the model will capture the essence of the relationships described. A considerable amount of literature exists concerning the theoretical rationale for the gravity model as well as numerous attempts to improve its structure. A particular concern for many researchers is the assumption of the statistical independence of the model's components. The calibration of the model assumes this independence, yet as the conceptual model illustrates, there clearly is an inherent interdependence amongst the components. Nevertheless, the model has consistently, if inexplicably, predicted interactions reasonably well.

6.1.2 Calculation of Potential

The derivation of potential directly from the gravity model in the study is an innovation in that the calibration of the model, usually regarded as an independent process, was linked directly to the theoretical rationale for using potential. Previous studies which have calibrated the gravity model first have done so in order to obtain an empirically derived parameter for the distance function, not because of any intuitive interest in what the model was in fact providing in terms of an explanation for the system involved. Here, not just the parameter tied to the distance function, but all the coefficients associated with each of the variables in the model contributed to the final measures of potential. The gravity model itself had intrinsic value in that it provided a view of the importance of the different features in the recreation supply-demand relationship which were later reflected in the potential surfaces for each system, as well as for the recreation opportunity spatial system.

The latent danger in this methodological approach is that it may simply produce a somewhat glorified variation of a recreation space standard. A frequent criticism of standards is that they employ a single measure as an indicator of the "need" for recreation facilities and parks. A similar concern could be expressed with respect to the potential values because once the various features have been summed into each of the two system's components, a single measure, like a standard, results. However, the potential measure is a reflection of the combined influence of each of the features of the conceptual model, and once aggregated, provides a "weighted" indicator of the level of opportunity offered by the parks and the level of demand for the recreational use of them. These measures, therefore, are responsive to the variations that exist across the community, and do not assume that a single indicator can effectively capture these variations.

This difference, then, points to a more fundamental distinction between the potential measure and the traditional space standard. Standards are assumed to be, firstly, universally applicable in that the demand for recreation is typically equated simply with population density and that the supply of recreation resources all provide the same level of opportunity. Secondly, they are assumed to be eternal in that the assumptions described above do not change over time. In contrast to these broad assumptions, the potential measure recognises the dynamic nature of both the supply and the demand systems, spatially and temporally. This measure is based on existing conditions which reflect the spatial differences in an evolving community and in the opportunities perceived to be provided by the parks at a particular point in time.

6.1.2.1 The interpolation of potential surfaces

The determination of the surfaces based on the potential values has been presumed to be a function of those factors which have contributed to the definition of the supply and the demand systems. In this respect, the resultant contour surfaces are interpreted as being a reflection of the actual distributions of recreation resources, the demand for them, and finally, the level of opportunity being provided. However, these surfaces are not only a reflection of the steps taken to define the potential measures, but are the result of the influence of factors tied to the interpolation of the surfaces as well.

As pointed out earlier in the discussion concerning the grid reference points, the spatial structure of the distribution of points at which potential is measured can have an effect on the surfaces' configuration. However, by using a regular distribution of grid points, the interpolation of the surfaces is based on a more complete data set that is without gaps in spatial information. Further, the relatively small distances between the grid reference points means that each system will not be interpolated to as smooth a surface as would have resulted from a more dispersed set of points (Craig, 1974). This approach also ensures internal consistency in the derivation of the surfaces because each of them is based on the same set of reference points.

A corollary of this methodological issue concerns the finite set of points which define the community's parks and neighbourhoods. Only under conditions where an unbounded, uniform plane is present could a truly "smooth" surface result from the interpolation of the potential values (Goodchild, 1987). Where there is a closed system of points -- one defined by an arbitrary boundary -- as is the case here, the surface necessarily will produce a centrally located "hill" reflecting the centre's generally greater accessibility to all other points in the system. As a result, any expectation of deriving a smooth surface for the recreation supply and demand systems is negated due to this basic methodological idiosyncrasy of potential. Such would not be the case, however, for the recreation opportunity spatial system which is based on the ratio of the supply and demand systems, and is therefore not a directly derived potential surface. Further, the appearance of this phenomenon is not entirely inappropriate given the importance demonstrated by the distance function (PARETO, IOij), a surrogate measure of accessibility, in the supply-demand gravity model. The question therefore becomes one of determining how much of a departure from "smoothness" is attributable to this idiosyncrasy and how much is caused by real variations in recreation supply and recreation demand, and ultimately, in the ratio between them. Clearly, the greater role of the latter is preferred.

Lastly, irrespective of the care taken to bring about the most valid measures of potential and the best configuration of reference points, the algorithm selected to carry out the contouring of the potential values to generate the surfaces will determine the final look of the maps, and consequently, influence the interpretations drawn from them. The particular software used in this study, UCON2, goes through three basic steps in the determination of the contour surface. In the first step, a plane is positioned at each data point (the potential values) so that it passes through that point and minimises the weighted distance to each of its neighbouring points. The number of neighbouring points considered in positioning the plane can be prescribed -- the default number, used here, is 10. The weighting factor used to determine a neighbouring point's contribution to the positioning of the plane can also be prescribed, but again, the default value (-2) was used.

UCON2 overlays a grid of prescribed dimensions over the data points in the second step then calulates the value at the point where the grid intersects the planes of the nearest data points. The value at the grid point is determined, like the planes, by considering the weighted distance between the point of intersection and the location of the data points. The number of neighbours considered is determined by the size of the radius of the search area around the grid point.

Once values have been calculated at each of the grid points, the third step in the process initiates the contouring of the surface. The contouring begins with the lowest contour level and searches for two adjacent grid points with values above and below this level. Then, using the grid squares defined by the points, the contour line progresses from square to square, passing through their sides at the proportionally linear points, until the contour line closes or reaches the edge of the defined surface. A "smoothing function" is incorporated in order to remove abrupt directional changes in a contour line brought about by large differences between adjacent point values.

The default parameters assigned by UCON2 at each step of the contouring process have been selected because they provide a good approximation of most surfaces. Further, with no particular rationale presenting itself for changing these parameters, they were deemed the most appropriate values to adopt. Perhaps the most influential condition in the process concerns the distance factor used to position the planes at each data point and to calculate the values at each grid point. However, because the potential values are positioned on a well defined grid of the same dimensions as the grid used in UCON2, the effect of the distance factor would be precisely the same in the calculation of all new values. Therefore, the concern over the effects of the distance factor under circumstances where the nearest neighbours are dispersed in radically different ways does not arise.

The one parameter which may have had the greatest effect on the outcome of each surface was the radius of the search area around a grid point. The default value of 5 inches encompassed anywhere from 24 to 69 neighbouring points representing, on average, approximately 6 to 7% of all the reference points on a surface which were then used in the calculation of the grid point values. Consequently, the default search area contributed to surfaces which are "smoother" and therefore are more conservative depictions of the variations in recreation supply, demand, and opportunity provision than those which actually may exist.

Ultimately, the utilisation of a contouring package like UCON2 has introduced a series of arbitrary refinements to the rigorously defined potential values calculated at the grid reference points, and these refinements may have produced surfaces which do not capture the intended outcome of the potential values. Whether or not changes to the parameters in the package would have produced a "better" surface cannot be determined here.

6.1.3 Is the Model Right and Reality Wrong?

Throughout the study, an underlying perspective has been that the conceptual model does in fact describe the relationship between urban recreation supply and urban recreation demand, and how these combine to determine recreation behaviour in the community. Further, by attempting to describe observed park use through the use of a gravity model based on the conceptual model's structure, it was assumed that the model had been correctly specified and could produce estimates of park use which were theoretically accurate. These estimates became the basis for the derivation of the potential surfaces which were examined as reflections of a presumed reality arising from the community.[3] Yet, these estimates and the subsequently derived potential surfaces are the outcomes of the faith placed in the conceptual model, in the supply-demand gravity model, and in the determination of potential.

This faith placed in the conceptual model carries over into the interpretation of the results. This is most evident in the interpretation of the fit of the gravity model to the observed levels of park use (see Figure 5.2). Where the model overpredicted the use of a park by a neighbourhood, it was assumed that this indicated a neighbourhood where latent demand existed which could be satisfied by removing certain barriers, real or perceived, to the residents' use of the parks. In a sense, they are being "denied" the opportunity for recreational use of the parks. By enhancing the degree of familiarity held about the available opportunities or by increasing the level of attractivity of certain features of known parks, it was assumed that this latent demand could be turned into expressed demand.

Where the model underpredicted the actual use of a park by a neighbourhood, it was assumed that this indicated a neighbourhood's response to created demand which occurred because of a stronger match than anticipated between demand and supply, or perhaps because of a limited degree of familiarity with other opportunities, current levels of use were focused into the one or two known parks. Similarly, to relieve the pressure of these higher than expected levels of use, other parks could be made more attractive as opportunities or simply be made more familiar to the residents of such neighbourhoods.

Nevertheless, all of these assumptions and interpretations concerning the application of and the results derived from the models are based in a belief that the models are "right" and reality is in some way "wrong". This is not an inappropriate line of reasoning if the goal is to arrive at some general understanding associated with the processes under study as it was here, but one must guard against carrying this perspective into the realm of prescribing definite solutions to problems tied to the population being considered. Hopefully, the outcomes of the theoretical approach are tied to the establishment of general principles and propositions which can be explored empirically themselves.

6.2 EQUAL OPPORTUNITY AND URBAN RECREATION POTENTIAL SURFACES

The determination of whether or not equal opportunity in the provision of recreation is being achieved in the community rests with the interpretation which is made of the potential surfaces. The degree to which the opportunity potential surface must depart from a theoretically smooth one -- and hence, equal opportunity -- to reflect real disparities in provision is not specified here. As a result, the interpretation of the surfaces is, to some extent, subjective in that evaluations of "supply-rich" and "supply-poor" areas (at least in the context of the levels of demand expressed there) are relative to levels of opportunity provision elsewhere in the community.

An interpretation of the "peaks" and "pits" in the potential surfaces that must be guarded against, however, is that they represent the specific locations where a new park may be located in the case of "pits", or where financial resources or levels of demand may be diverted from in the case of "peaks". While this may be a desirable managerial response, it is not in keeping with the theoretical underpinnings of the potential surfaces as reflections of the interplay of the recreation supply and demand systems. When a surface is considered as an indicator of the relative accessibility to recreation opportunity that exists in the community, then the variations in its surface can be seen to reveal where the demand and supply sytems depart from one another. The question remains, however, as to whether these variations truly reveal departures from equitable provision of opportunity. Yet, this is the first step towards the development of a systems approach to the planning of urban recreation in which the variable nature and interdependence of the components of the related supply and demand systems making up the recreation opportunity system are recognised.

6.2.1 A New View of the Provision of Recreation Opportunities

The conceptual model of urban recreation and its empirical realisation in the form of the potential surfaces has provided a new "systems" perspective on the provision of urban recreation opportunities that is not dependent on the assumptions tied to the use of recreation space standards. Rather than regarding each recreation resource in the community as one of several independent elements which collectively define the parks system, recreation planners must recognise two basic principles in this new view. Firstly, each recreation resource is a component of an interdependent system of opportunities within the community. Consequently, when the role of one resource changes as a result of the enhancement of its physical amenities or the altering of its use, the effect is felt throughout the system as demand becomes redistributed either through increased numbers of recreationists, altered preferences for new sites by existing recreationists, or both. Changes to a component of the system are necessarily felt elsewhere throughout the system. The potential surfaces for recreation supply, demand, and the opportunity spatial systems, as continuous surfaces rather than sets of discrete points, reflect this.

Secondly, each recreation resource comprising the system provides quite different levels of opportunity for recreation from the perspective of its potential users. Understanding the contribution a park makes to the opportunity set of different recreationists reveals more of its value and quality as a resource than does an inventory of that resource's amenities. A comparison of the corresponding potential surfaces derived from the supply-demand gravity model and the traditional model dramatically demonstrates this notion. The "disparities" in provision reflected in the surface generated by the traditional model illustrate the assumptions inherent to standards that higher population densities indicate higher levels of demand and that increased area of parkland necessarily promotes increased opportunity. The surfaces generated by the full model, on the other hand, show that, within the system, the parks generate quite different levels of opportunity just as the neighbourhoods demonstrate varying levels of demand for the parks. In this respect, the residents of the community are responding to the opportunities for recreation which they know exist, not simply the individual resources of which they are aware.

Unfortunately, the acceptance of this new perspective with these underlying principles to urban recreation planning will not come about easily. The difficulty in attempting to introduce an innovative approach to the planning of an effective urban recreation system is based in the characteristics of current planning practices (Gold, 1973). Urban recreation open space and facility planning is characterised by the following general features (which have been adapted from those identified by Marriott, 1980):

1. Urban recreation planning typically lacks an overall development programme which has specific priorities layed out. Such a programme could provide impetus to a systems planning approach where parks and facilities would be regarded as an integrated system of opportunities for recreation. The lack of clear statements concerning the goals and objectives of the leisure service agencies has been noted by Getz, Graham, Payne, and June (1985) in their review of recreation master plans of municipalities across Canada.

2. Urban recreation planning tends to be conservative in nature. Generally, recreation space standards have become imbedded in the planning process, and there is a real reluctance to adopt innovative approaches. Admittedly, part of this problem stems from the political constraints impeding the implementation of any new process and in the unwillingness to assess whether traditional approaches have in fact "failed". Evaluating urban recreation provision, which has been based on standards, with standards likely would not reveal departures from equal opportunity of provision.

3. Urban recreation planning continues to be preoccupied with the provision of <u>resources</u> rather than with the provision of <u>opportunities</u> for recreation. This more than anything else points to the dominance of the use of standards in recreation planning, and hence, a concentration on the supply side alone. Getz et al. (1985) also noted an inattentiveness to demand related factors in Canadian master plans.

The development of a philosophy oriented towards the provision of a system of recreation opportunities would be the first step in moving away from traditional planning approaches (Ellis and Homenuck, 1979). While the conceptual model and the methods described and employed here may not provide directly applicable solutions to the problems associated with the provision of urban recreation opportunities, they have offered a new perspective -- a new way of looking at existing conditions, and of devising alternative strategies. The systems approach adopted here can provide a quite different view of not only the provision of recreation resources, but also of the variable levels of demand for them and how they interrelate to produce an urban recreation opportunity system which can be defined spatially.

6.2.2 The Role of Perceptions in Recreation Behaviour

The results of the supply-demand gravity model clearly demonstrated the importance of perceptions, and in particular familiarity, in explaining urban park use. This observation is not without precedent as several researchers recently have found that awareness of recreation parks and facilities is a necessary prequisite to their use (Spotts, 1983; Hayward and Weitzer, 1984; Spotts and Stynes, 1984; Godbey, 1985; Perdue, 1987). While this may seem intuitively obvious, the results of this recent research, and especially those described in this study, point to the serious shortcomings of the majority of approaches taken to explaining the recreational use of facilities and parks. Only Smale (1983a) and Stynes, Spotts, and Strunk (1985) have attempted to identify those factors which are closely associated with awareness in the hope of developing surrogate measures for perceptions when such data are not readily available.

Even though the numbers of parks with which a typical resident is familiar appears to be surprisingly low, this may be an indication of the completed search for alternative sites in order to participate in recreational activities. An individual selecting a park for his or her recreation can be expected to cease the search once a suitable site has been found (Elson, 1976). Presumably, once one or two parks have been identified which satisfy the needs of the participant, the desire to become familiar with additional parks ends. Hence, no more than a very few parks are required to complete the opportunity set from the recreationist's perspective. Further, there is no need for each resident to be aware of the smaller neighbourhood parks across the community when there are typically several in the vicinity of his or her residence. The parks which are larger and offer generally better facilities are more familiar to the residents because these parks offer unique opportunities which the smaller, albeit more numerous, parks do not.

However, a significant proportion of the community's residents remain unaware of virtually any of the recreation opportunities available for their use, and it is this group with which the leisure service agency should be most concerned. In fact, Godbey (1985) has noted that the number of residents who are simply unaware of the available opportunities is far greater than the number who are aware, but choose not to participate -- the true non-users. He goes on to suggest that by better informing the "unaware" residents, participation levels could be increased because many of these individuals would choose to participate if they knew of the opportunities which currently existed. In this respect, by broadening the awareness base possessed by the residents, the leisure service agency may be able, as a result, to increase and redistribute park use -- if, of course, this is a specific goal of the agency and if the residents desire an increase in their participation.

Both Hayward and Weitzer (1984) and Spotts and Stynes (1984) suggest a number of ways of informing the public about the available opportunities within the community. The ultimate goal of such an effort would be to adjust the demand system without having to introduce real changes to the supply system which is often a typical response when there is a perceived deficiency in provision. As Godbey (1985) points out, "residents of every household should make decisions concerning participation based upon a functional awareness of those services which are available to them" (Godbey, 1985:11). As a consequence, changes to the recreation opportunity system may be less important for the achievement of equal opportunity than is the enhancement of the public's familiarity with the available opportunities so that they may choose between a broader array of alternatives.

However, attempting to the familiarise the residents about opportunities with which they are currently unaware may not serve to redistribute use nor move closer to an equitable provision of recreation. If the residents are satisfied with their present choices of parks for their recreational pursuits, it is unlikely that they will redistribute themselves. Therefore, it is the people who are currently dissatisfied with their opportunity set who are the best audience for information about the possibilities that exist. Ironically, should these potential park users become actual users, the supply and demand systems will change, and not simply due to their enhanced role, but also due to the response of existing users to the changed experiential environment of their recreation opportunity sets. Hence, a new recreation opportunity spatial system will be created.

The one aspect which remains to be resolved in this question is whether or not changes in the awareness levels of the residents will elicit real behavioural responses. Perdue (1987) has expressed a similar concern about whether increased levels of knowledge contribute to changes in spatial behaviour, or whether in fact, levels of knowledge are developed as a result of ongoing spatial behaviour. In one of the few studies focusing on this issue, Krumpe and Brown (1982) were able to demonstrate that advanced knowledge about the attributes of lesser-used trails in Yellowstone National Park did in fact affect hikers' choices. Nevertheless, further research is needed to determine if simply informing the public of available opportunities will result in their use of them, and if so, to what extent.

6.3 FINAL OBSERVATIONS

At various points throughout the study, a number of intriguing research questions arose, like those posed above, that were not able to be examined in great detail. While pursuing each of them may have provided significant insights into the nature of urban recreation resources and behaviour, the many departures may have diverted attention/away from the principal concerns of this study. They do provide, however, impetus for a programme of research in urban recreation which is an area sorely in need of continued investigation.

For example, an underlying assumption upon which much of this work has been based concerns the presumed equal importance of the supply and the demand components in urban recreation. The conceptual model graphically depicts them as having an equal share in the determination of recreation behaviour; the supply-demand gravity model was structured in a way that implied an equal role for each component as well as its constituent elements; and the recreation opportunity spatial system potential surface was based on a ratio of standardised values of the supply and demand components implying an equal contribution to the determination of equipotentiality in the community. Yet, there is no definitive empirical evidence to support this assumption. In fact, if one considers the results of the supply-demand gravity model as an indication of the actual importance of the components, then the factors associated with the demand component appear to play a minor role in determining urban recreation behaviour. Ironically, these continue to be the factors used most often in recreation demand modelling. Clearly, more research is needed to better understand the relationship between these two components and their ultimate contribution to the explanation of recreation behaviour.

Another engaging area of examination concerns the degree to which departures from a theorised "smooth" surface representing equal opportunity truly reveal regions in the community which are being either over or under provided with opportunities for recreation. Given that the calculated ratio represents a relative measure of the balance between the supply of and the demand for recreation in the community, departures are assessed against community wide averages. Consequently, it is not known if, in fact, the entire community is either over provided or under provided with recreation opportunities, but only that certain neighbourhoods have a surplus or a deficit of opportunities when compared to their counterparts. This is not to suggest that there is a need to establish absolute measures of provision (like standards), but only to emphasise that the patterns described here are not generalisable to other communities. In any case, recreation planners and managers are ultimately concerned with the relative provision of opportunities <u>within</u> their community.

At a more specific level, the relationships between total participation in each of the selected recreation activities, the proportion of the activities' participation which was carried out in the parks, and total park use were not examined exhaustively even though they provided a new perspective on recreation behaviour and park use. An understanding of the relationships between these variables, either at the household or the neighbourhood level, for all parks or for specific parks, may reveal the degree to which the parks provide the opportunity for these activities to be participated in, or perhaps the extent to which they are able to satisfy the contextual needs associated with participation in selected activities but not others. Certainly, the results seemed to indicate that the parks were a focal point for ice skating, but not so for swimming (see section 4.2.5 on recreation participation). This in large part points to a park's capability to serve as an <u>opportunity</u> rather than simply a site for recreation. An even more perplexing question concerns whether the parks may in fact give rise to the involvement as opposed to simply providing the outlet for it.

The many questions which have arisen as a consequence of this research process have more than anything else strengthened the arguments concerning the importance of regarding urban recreation as a function of dynamic systems of the supply of recreation opportunities and the demand for them as expressed by the community's residents. The variability revealed in the spatial distribution of such aspects as the residents' demographics and participation in a variety of recreation activities, their degree of familiarity with the opportunities available to them, the perceived attractivity of the parks, and the physical resources available within the parks themselves all point to the dynamism within the community vis-a-vis recreation supply and demand. Further, the dynamism found in these two independent systems progresses at much different rates with demand being the less stable of the two and recreation supply typically showing much slower, normally incremental adjustments. In the face of such evidence, efforts to achieve equal opportunity in the provision of recreation opportunities which are based on assumptions asserting homogeneity of demand for recreation and the equivalence of opportunity found in parks (i.e. recreation standards), become completely unacceptable.

The calibration of the supply-demand gravity model and the subsequent derivation of the potential surfaces did verify the underlying notions of the conceptual model of urban recreation proposed here. The significant improvement over the traditional model in both phases of the study has demonstrated both the theoretical and the empirical advancements inherent to the conceptual model and in its realisation in the recreation opportunity spatial system surface. From a theoretical perspective, the extent to which equal opportunity is being achieved in the provision of recreation opportunities across the community can be assessed much better in the context of this process as it extends beyond considerations solely of equality or efficiency. Even though the disparities and surpluses revealed may be relative within the community, they are nevertheless "real" to the residents.

With respect to the direct application of these results to urban recreation planning, the value of this process does not lie so much with the identification of specific areas or sites for the development of new resources, but rather, with the contribution of a new perspective on the relationship between the supply of and the demand for recreation in an urban context. This is especially important when the views of provisional equity held by planners and managers (traditionally based on standards of equality) are so important to the resultant patterns of resource and service distributions

(Wicks and Crompton, 1987). Consequently, if this research has been able to demonstrate the importance of recognising the dynamism of both recreation supply and demand, and their interplay in defining where equal opportunity is and is not occurring, then it has made a significant contribution to the ultimate resolution of problems of urban recreation provision.

APPENDIX

The copy of the questionnaire which has been included in this Appendix has been photo-reduced to fit the page size of this dissertation. The original questionnaire was printed in pamphlet form on pages of approximately legal size so the printing was not as small as it appears here.

Much of the information gathered within the questionnaire was not included in this dissertation. Due to the size of the sample, the survey was regarded as an opportunity to compile a data set on urban recreation behaviour and perceptions that was significantly comprehensive in breadth and detail. It is hoped that these data will provide a source for subsequent inquiry.

SURVEY OF RECREATION PARTICIPATION AND PERCEPTIONS

Please read each question carefully and be sure to answer all of them

SECTION A

HOUSEHOLD CHARACTERISTICS

The information in this section will be used to see if different types of households in Oakville have different recreation perceptions and patterns of participation

1. How many persons including yourself are in this household? ____

2. List below everyone in your household indicating each person's age, sex, main occupation as well as his or her relationship to you (for example, husband, daughter, unrelated, etc.) START WITH YOURSELF

LIST OF HOUSEHOLD MEMBERS

	Relationship or connection to you	Age	Sex	Main Occupation (Use these categories - employed, not employed, student, or preschool)
1	Respondent (you)			
2				
3				
4				
5				
6				
7				
8				
9				
10				

3. What is the total combined income for your household? $ ______ per year

4. How many years have you lived in your present household? ______ years

5. Do you own or rent your household? (CHECK ONE)

☐ own ☐ rent

6. Which of the following dwelling types best describes your household? (CHECK ONE)

☐ single detached house ☐ row house or townhouse
☐ semi-detached or duplex ☐ apartment

7. Did you live somewhere else in Oakville before moving to your present household? (YES or NO) ____

- If YES, for how many years did you live at your former household? ____ years
- Please name the two streets at the intersection closest to your former household in Oakville:

______________ and ______________

SECTION B

[illegible]

[illegible]

[illegible]

PARKS	FAMILIARITY	ACCESSIBILITY	ATTRACTIVENESS	RECREATIONAL USE OF PARKS
Bronte Athletic Field				
Bronte Beach				
Bushy				
Centennial Square				
Coronation				
Fisherman's Wharf				
Gairloch Gardens				
Holton Heights				
Hopedale				
Lakeside				
Lawson				
Lion's Valley				
Oakville				
Optimist				
Palermo				
Pineridge Henderson				
Shell				
Sunningdale				
Trafalgar				
Wallace				

[illegible]

[illegible]

OTHER PARKS	FAMILIARITY	ACCESSIBILITY	ATTRACTIVENESS	RECREATIONAL USE OF PARKS

[illegible]

OPEN SPACES	FAMILIARITY	ACCESSIBILITY	ATTRACTIVENESS	RECREATIONAL USE OF SPACES

SECTION B

[illegible]

RECREATIONAL USE OF POOLS

SWIMMING POOLS	FAMILIARITY	ACCESSIBILITY	ATTRACTIVENESS				
Bronte							
Brookdale							
Centennial							
Falgarwood							
Lions							
Queen Elizabeth							
Wedgewood							
White Oaks							

RECREATIONAL USE OF ARENAS

ARENAS	FAMILIARITY	ACCESSIBILITY	ATTRACTIVENESS		
Kinsmen					
Maplegrove					
Oakville					

RECREATIONAL USE OF LIBRARIES

LIBRARIES	FAMILIARITY	ACCESSIBILITY	ATTRACTIVENESS		
Centennial					
Woodside					
White Oaks					

[illegible]

SECTION C

[illegible]

RECREATIONAL ACTIVITY	Number of household members who participate	[illegible] number of times in average month household members participate	[illegible]	[illegible]	Most frequent household participant
Walking/hiking for pleasure					
Recreational bicycling					
Jogging					
Swimming					
Tennis					
Cross-country skiing					
Tobogganing/sledding					
Ice skating					
Casual game sports					
Picnicking					
Competitive league sports					

SECTION D

This section deals with your participation in private and commercial recreation, that is, leisure and recreation not usually provided for by a public agency like the Parks and Recreation Department

1. Does anyone in your household own, share, or have access to a private yard or lot? (IF YES, CHECK ONE)

   ☐ own ☐ share ☐ have access to

2. Does anyone in your household own or have access to a private swimming pool? (IF YES, CHECK ONE)

   ☐ own ☐ have access to

3. Does anyone in your household own or have regular access to a vacation property such as a cottage, condominium, or time-shared residence? (YES or NO) _

   *IF YES, name the town or city that the vacation property is in or closest to ______________

4. Does anyone in your household own any of the following types of boats? (IF YES, CHECK ALL THAT APPLY)

   ☐ sail ☐ power ☐ canoe or kayak

5. Does anyone in your household own any of the following items? (IF YES, CHECK ALL THAT APPLY)

   ☐ Home video games

   ☐ Home computer

   ☐ Video cassette player/recorder

6. Listed below are a number of private recreation activities. Indicate the number of household members, if any, who have participated in each activity at least once during the last 12 months, and then indicate the combined total number of times in an average month that these household members participated in each activity.

Recreation activity	Number of household members who participate	Combined total number of times in average month household members particapate
Attend movies	___	___
Dining out	___	___
Go to bar, tavern	___	___
Go to arcades	___	___
Church related activities	___	___
Downhill skiing	___	___
Curling	___	___
Baseball	___	___
Soccer	___	___
Golfing	___	___
Boating	___	___
Ice Hockey	___	___

7. Have you or anyone else in your household participated in a recreation programme in the last 12 months that was sponsored by the Oakville Parks and Recreation Department? (YES or NO) _____

   *If YES, indicate the number of household members who did participate ___

8. For the following types of clubs, indicate the number of household members, if any, that belong to each, and then indicate the combined total number of times in an average month that they make use of the club. Also, indicate who in the household is the most active user of the club (refer to the LIST OF HOUSEHOLD MEMBERS).

	Number in household who are club members	Combined total number of times in average month household members use the club.	Most active user of club in household:	Name of club
Racquet club	______	______	______	______
Health fitness club	______	______	______	______
Curling club	______	______	______	______
Golf club	______	______	______	______
Boating/yacht club	______	______	______	______
Social Club	______	______	______	______
Other ______ (specify type)	______	______	______	______

These final questions concern only you and not the rest of your household.

9. How many times did you dine out in the last 30 days at each of the following types of restaurant?

	Total times in last 30 days.
Regular full service, full menu restaurant	___
Ethnic full service, full menu restaurant	___
Fast food outlet	___
Snack bar (eg. doughnut shop, ice cream parlour, etc.)	___

10. What type of restaurant did you go to the last time you dined out? (CHECK ONE)

☐ regular full service ☐ ethnic full service ☐ fast food outlet

11. What was the name of the restaurant that you last dined out at? (If outside of Oakville, name the city or town it is in) ______________ ______________

12. What was the total cost of your individual meal, including drinks? $______

13. On which day of the week did you last dine out? ______________

14. What was the time of day when you last dined out? (eg. 6:00 p.m.) ______________

15. What activity were you involved in just before you went to dine out?

____

16. Where were you participating in this activity before dining out?

☐ at home OR if not, name the two streets at the intersection closest to where you were before dining out:

______________ and ______________

17. How much time (in minutes) did it take you to get from this location to the restaurant where you last dined out? ______ minutes.

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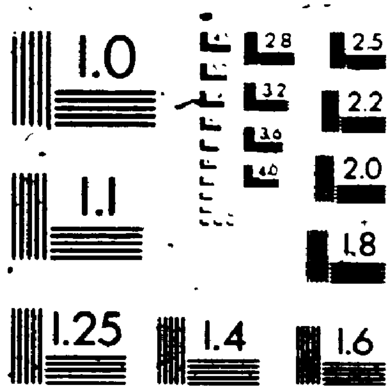

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