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A Spatial Analysis Of Children's Preferences For City Streets As Travel Routes

Thomas Joseph Underwood

A SPATIAL ANALYSIS OF CHILDREN'S PREFERENCES FOR CITY STREETS AS TRAVEL ROUTES

by

Thomas Joseph Underwood

Department of Geography

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ABSTRACT

This study seeks to deduce preference patterns of urban children, aged approximately seven to fourteen years, in London, Ontario, for various types of city streets as travel routes, and to isolate the characteristics of streets that explain variance in those patterns. The principal analytical techniques used are Paired Comparison and Multiple Regression Analysis. Data requirements for Paired Comparison Analysis are of the form: subject i, whose socio-economic and locational backgrounds are known, chooses S street displays, one from each of S pairs X_1Y_1, X_2Y_2 ..... X_sY_s, as preferred routes. The number of pairs (S) is determined by the number of street types judged. Quantification of display characteristics, combined with original choice patterns, yield the data for Multiple Regression. The model deduces a consensus ranking of street types for the total subject group and for significant subgroups. Subsequently, street type rankings are related to display characteristics.

The children generally prefer busy through highways and arterial streets as travel routes; local (residential) streets are not widely favoured. Variety of visual stimuli, pedestrian safety and traffic control features, cleanliness and commercial outlets, are the most common attributes of desirable routes and an almost unanimous aversion to streets carrying heavy advertising is revealed.

The study demonstrates the utility of nonverbal data collection methods in dealing with young subjects whose facility with language may vary with age, home location and socio-cultural background. Levels of intra-subject agreement in environmental judgments appear to be higher in this study than in similar works involving the young, where data collection was linguistically based.

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CHAPTER I

PHILOSOPHICAL FRAMEWORK AND CONCEPTUAL BASE

"What we know of our town depends on what
can be seen from the public rights of way."
(Lindley, 1971, p. 19)

Urban Studies: A New Trend

Cities and their inhabitants have been the subject of study by scholars of many disciplines since the beginning of recorded history. Urban geographers and demographers have contributed much to the understanding of the man/city symbiosis, largely in terms of spatial distributions of urban phenomena and of their changing patterns over time. "Most geographic facts lie within the realm of man's influence upon the earth. This fact leads most geographers to study man's influence on the earth rather than environmentalism" (Peattie, 1970, p. 211). However, in recent times, a noticeable awakening of interest in the latter area of study has been apparent. Increasingly, the question of the influence of the environment on man is being raised by geographers. This has led to studies of man's perception of and attitudes toward his surroundings, both natural and manmade, aimed at understanding some of the causes of human behaviour in space. Inevitably, in attempting to explain man's actions, preference plays a principal role. Generally, man chooses one course of action or set of circumstances over another because he perceives some advantage to

himself in so doing. Thus, in attempting to explain human behaviour in space, an understanding of man's preferences for different sets of spatial circumstances becomes essential. Consciousness of this fact has been central to the decision to undertake this study which assesses one aspect of the man/city relationship, namely, the preferences of children for various types of city streets as travel routes.

Children and Streets

The decision to embark on a study of the child/city association was precipitated by the writer's consciousness of the importance of that association in the context of a rapidly urbanizing society. Today's children are the adults of tomorrow and the degree of affinity that urban children develop with their environment in their formative years can be assumed to have an important effect not only on their current enjoyment of their milieu; but also on their future satisfaction as inhabitants of cities. "Memories of childhood are important emotional underpinnings of modern man's life, and are to be laughed away or disregarded at our peril and great loss" (Clay, 1969, p. 134). It is difficult to imagine how a child, raised in an urban setting with which he could establish little empathy, would reach adulthood having a satisfactory rapport with his city. Conversely, an enjoyable childhood experience with the city may help to lay the foundations of a fulfilling adult association with urban areas. It is suggested that a child's contact with the streets of his city contributes substantially to the formation of his attitudes to the city as a whole.

Children are experientially closer to the streets than adults.

In their movements about the city, at least until age 16 years, they are limited to essentially two modes of travel, walking or riding as passengers in vehicles. The role of bicycles for travel in the city is considered minimal on the grounds that, for reasons of safety, many streets, particularly those of North American cities, are unfit for use by juvenile cyclists. As pedestrians, children experience streets more exquisitely than the adult motorist who is insulated from many aspects of his route by the artificial environment of his personal vehicle and by the necessity to devote all, or the greater part of, his attention to his pilotage task. Even as passengers in vehicles, children, relieved of the exigencies of driving and spurred by the innate appetite for environmental exploration, perceive the street more acutely than adults to whom the experience is likely to be, at best repetitious, or, at worst, a bore.

The Street: Image Builder and Problem Area

The influence of streets on the urbanite's perception of his surroundings forms a recurrent theme in the literature of urban environment, of which more will be said later in this chapter. It is generally held that an observer's knowledge of a city, even his home city, is based, almost totally, on what can be seen from public roadways. These roadways, ranging in character from heavily used through highways to quiet suburban access roads, form the matrix on which the fabric of the city is hung. There is no part of the city more public than its streets, or to which such free access is so readily available. Children have a special affinity for streets. Streets provide congregating, living and play space, often the only such space available. However,

they provide even more. The anonimity of the crowd allows the individual child comparative freedom from adult imposed rules of conduct. Streets are amongst the few places in today's city where this kind of freedom, coupled with danger, experienced at first hand, adds spice to the lives of children.

The urban road, as opposed to its rural counterpart, was chosen for study since it is, and presumably will be, the home location of most children in western industrial society. Doxiadis' prophecy of Ecumenopolis (Gordon, 1963, p. 6), the world city, seems more likely to be fulfilled with each passing day. If the world population is to be predominantly urban, then the street will continue to play an increasing role in the lives of more and more of the world's young people, while the rural route becomes less and less important.

Streets seem to generate many of the problems of cities. Urban designers of the past did not model their roads to accommodate modern traffic patterns. The network of congested streets found in the central areas of most cities testifies to this fact. Urban authorities have recognized the need to redesign the older parts of many cities for some time and renewal schemes are part of the future plans of most progressive communities. Consciousness of the pressing nature of this problem led former President Lyndon B. Johnson of the United States to assert that "In the next forty years we [the American people] must rebuild the entire urban United States" (Rudofsky, 1969, p. 41). Renewal schemes are, of necessity, accompanied by major street modifications. Careful planning of such changes, based on the best possible knowledge of the needs and desires of citizens in regard to their streets may help to

relieve future generations of functional and aesthetic problems similar to those experienced by today's urbanite with street systems designed for a horse and buggy era. This knowledge can be acquired only through careful and wide ranging research into all aspects of the man/street relationship. The need for this kind of research is continually emphasized in the literature of urban environment having been alluded to by such writers as Krutch (1958), Parr (1966), Lowenthal (1967a), Caminos, Turner and Steffian (1969), Porteus (1966) and Milgram (1971). This study is a step towards a reduction in the gap between what we know of man in the urban milieu, and what we need to know, if cities of the future are to offer their inhabitants an environment which is not just functional, but which provides a congenial atmosphere for human activity. "The values of things designed and built lie in their relationships to the users and makers not in any quantifiable characteristics of the isolated object (Caminos, Turner & Steffian, 1969, p. vi).

The discussion so far has aimed at clarifying the philosophical framework within which the conceptual base of this study was formulated. Its main purpose has been to justify the choice of

(a) children as the segment of the population from which the subjects are drawn, and

(b) streets as significant determinants of urban imagery and form. There were also cogent practical reasons for these choices and these are outlined in Chapter II of this work. The conceptual background to the research is set out in the following section.

The Problem and its Conceptual Base

The attitudes of children, aged approximately seven to fourteen years, to various kinds of city streets are examined to determine whether or not discernible patterns of preference for the different types of travel routes are revealed. The possible relationships of certain socio-cultural, demographic and locational characteristics of subjects to preference patterns are assessed and certain features of streets are scrutinized to determine their apparent influences on inter street choices by subjects.

This study hinges on the assumption "that the eye is the organ which transmits to us our basic perceptions of the world outside" (Portman, 1969, p. 115) and that "space, experientially, is primarily visual space" (Bartley, 1969, p. 176). Figure 1.1 illustrates the conceptual framework of the project and broadly outlines the research plan in a sequential manner. Phase 1 of the investigation examines two principal concepts:

(a) The traffic patterns of streets, and therefore their officially defined primary functions, significantly influence their attractiveness to juvenile travelers within the city, and

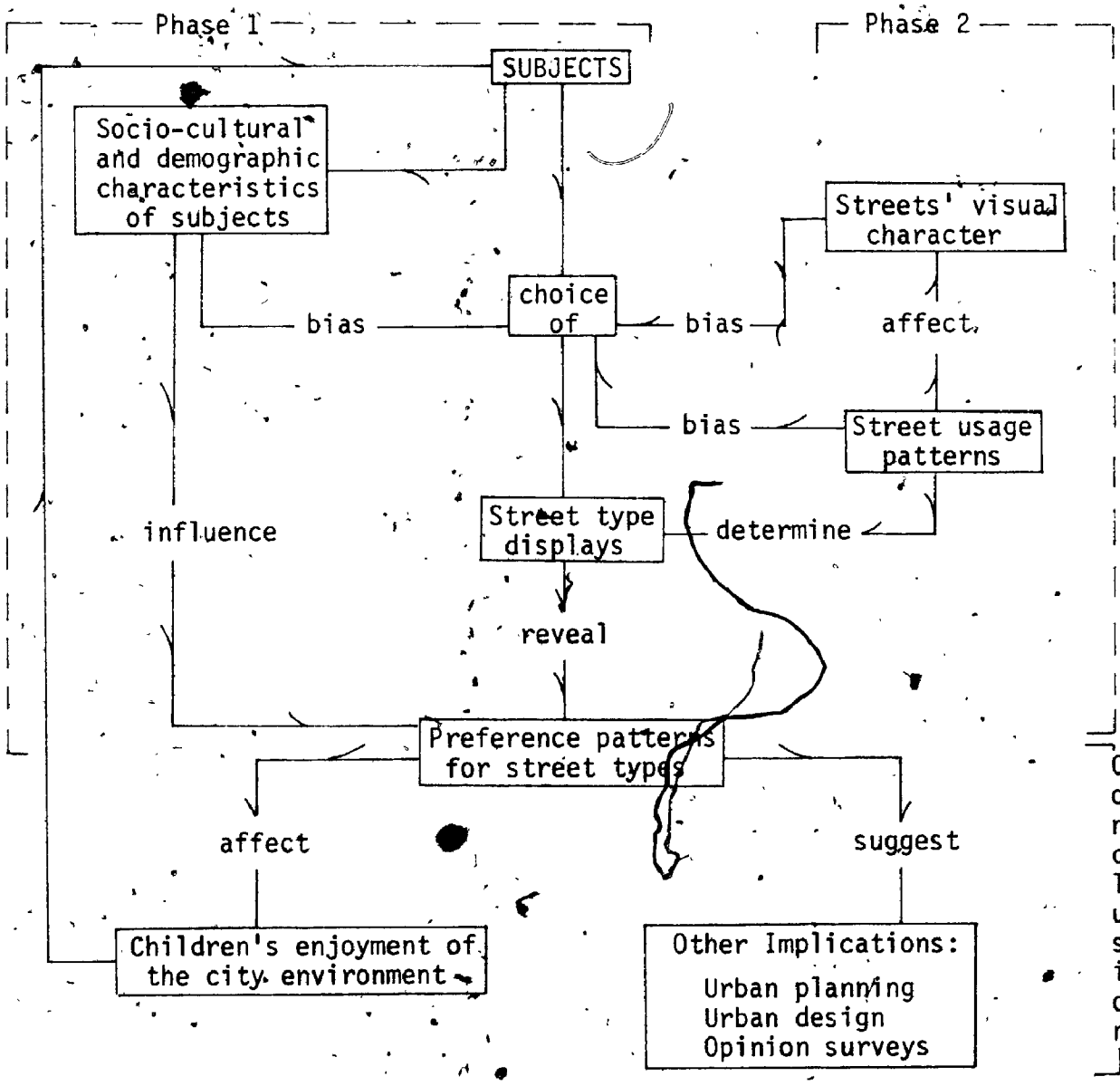
(b) The socio-cultural, demographic and locational backgrounds of subjects bias their expressed preferences for the different street types to which they are exposed.

In Phase 2 of the project a single concept dominates. It may be stated as follows:

> The visual character of streets, as revealed by their mix of visible features, is a principal determinant of their appeal, as travel routes, to the young.

FIGURE 1.1

Conceptual Model: Children's Preferences for City Street Types



Source: T. J. Underwood

In the concluding section of the study the research methodology is evaluated and conclusions are drawn on the basis of the findings from both phases of the analysis.

The conceptual model is operationalized in Chapter III of this work, following hypothesis formulation, and a research procedure model is presented (see Figure 3.1). The remainder of Chapter I is devoted to a review of the literature in the field of perception of the urban environment and the place of this study in that field is discussed in Chapter II.

Review of the Literature

Any attempt to review the literature in the field of children's perception of the environment poses an immediate problem; it is remarkably scarce. "Although the importance of the subjective views of environment and how they vary from place to place has long been noted it has only been in the last decade that perception of the environment has become a major focus for systematic research" (Saarinen, 1974, p. 255). It is noteworthy that the bulk of such research to date is focused on the perceived environments of adults to the almost total exclusion of the views of juvenile observers. Therefore, some of the works cited here will be pertinent to the current research primarily as background, or from a methodological standpoint.

The pioneering work in the field of urban environment perception must be attributed to Lukashok and Lynch (1956). They examined the question of adult memories of urban childhood. The subject group of 40 people, aged 18 to 32 years, ranged from student through cab driver

to sociologist. Each was asked to reminisce on his childhood in the city. Data collected in this way were supplemented by specific information on home location, neighbourhood and home city of each interviewee. Remembered features of subjects' home cities were categorized by frequency of mention by the total group. In all, 18 aspects of cities proved impressive enough to be recalled (Lukashok & Lynch, 1956, p. 143). The most frequently recalled items related to what the writers call the "floor" of the city, closely followed by features of the "walls". Trees occupied a position of considerable importance in the reminiscences of most of the subjects. The researchers concluded that "they [the interviewees] hardly expect to have an enjoyable city environment, as if a mild civic nausea were a normal burden of man's existence" (Lukashok & Lynch, 1956, p. 152). Lynch (1960) has proven to be a milestone work in urban perception research. By the author's own definition, the book deals with "the look of the city". A total of 60 residents of Boston, Jersey City and Los Angeles were interviewed in the course of data collection. Each subject identified a feature of his native city which, in his opinion, symbolized its character, listed a number of other distinctive features, drew a sketch map with compass orientation and gave verbal directions from one point in his city to another. Aggregations of these responses compared to an assessment, by trained observers, of each area's image-building capacity gave a measure of the "imageability"[1] of each city for each subject. Lynch found that

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[1]Imageability is defined as the capacity of an object to form a significant part of the mental image of its environs.

the most useful segment of the data bank was that composed of the listings of distinctive features by interviewees. These conveyed "the highlights of a city--its visual essence" (Lynch, 1960, p. 145). De Jonge (1962) and Gulick (1963), both using techniques modelled on that of Lynch, assessed the imageability of Dutch and Arab cities respectively. Both suggest the addition of a further dimension to Lynch's model to allow for the image building power of certain city features that have cultural significance to the inhabitants of cites under study. They point out that the cultural, and particularly religious, symbolism of certain urban components is a significant determinant of their ability to impress themselves on the consciousness of local inhabitants.

These early works, which dealt with the visual impact of the city as remembered, led naturally to the next phase of investigation of perception of the urban environment, namely, the study of response to urban stimuli in situ. Appleyard, Lynch and Meyer (1964) examined subject response to the view of the city as seen from the highway. They were primarily concerned with the impact of the serial view[2] of the cityscape as seen from a moving vehicle. The methodology was developed by a research team travelling the approaches to New York, Hartford, Conn., Boston and Philadelphia. Impressions were recorded in a number of modes. The results of analysis of the team impressions were used as control data in evaluating the responses of 20 adult

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[2]The serial view is the view as seen from a moving platform as opposed to the view from a static position.

subjects whose impressions of route C1 in Boston were recorded during trips on the highway. The main outcome of the study was a design for a freeway, a main criterion for which was the presentation to the road user of a continuous series of stimulating vistas, creating what is described as "a new world of vision inherent in our speed of movement" (Appleyard, Lynch & Meyer, 1964, p. 63). A unifying feature of all the studies mentioned so far is their macro scale; they concern themselves with the image of entire cities or major portions thereof. Two studies, of which the writer is aware, have reduced the scale of investigation, either by restricting areas studied, as in Lowenthal and Riel (1972a, b, c, d, e, f, g & h) or by drawing subjects from a narrower segment of the population, as in Cisek (1966). Coincidentally, these works also made the first real effort to involve children in such research, the first as part of the subject group and the second as the entire data source. Lowenthal and Riel (1972) drew their subjects from four cities in the United States, New York, Boston, Cambridge, Massachusetts and Columbus, Ohio. "In each city between forty and ninety-four individuals of varying backgrounds were recruited to walk a set of routes selected by the researchers as representative of the urban environment as a whole" (Lowenthal & Riel, 1972e, p. 1). Subjects recorded their impressions of, and their preferences for, each of the selected milieu, and of the city as a whole, in a variety of modes, ranging from interviews with the research team, through freely expressed written comments, to responses to 50 concept pairs definitive of different environmental qualities. The investigators concluded, amongst other things, that

(a) "Where people are makes more difference to the structure

of the way they see the world than who they are" (Lowenthal & Riel, 1972g, p. 37).

(b) "Since people feel that 'good' and 'bad' things go together it may be fruitless to hope for environments pleasing in all respects" (Lowenthal & Riel, 1972h, p. 45).

Cisek (1966) is the only major work in the field of children's perception of the urban environment of which the writer is aware. Even this, by the author's own admission, is confined to what he calls "the children of poverty", the subject group being drawn from four of the poorest areas in Boston, Massachusetts. Fifty-seven subjects were originally selected but, due to poor attendance at data collection sessions, the final and major part of the data set, was obtained from interviews with ten children from the Washington Park area of Boston. Twelve separate interviews were conducted, each aimed at obtaining a response to a particular type of urban stimulus. The study produced a large array of findings and recommendations which, on the basis of the exceedingly limited sample, must be interpreted with caution. The following is a small sampling of the results and suggestions set forth in the report of the investigation:

(a) Children living in poor areas enjoy multi-level architecture interspersed with large trees and grassy play areas.

(b) Proximity to stores, both visually and physically, is likely to add to children's enjoyment of the city.

(c) Location of multi-storey buildings in such a way that they are easily differentiable from their surroundings allows them to become landmarks for children in their daily travels. This may add to

children's sense of security and hence, their enjoyment of their surroundings.

Previous Research--A Common Problem

Data collection for all of the studies mentioned above, with few exceptions, was heavily dependent upon verbal description and semantic differential. This, it is suggested, constitutes an element of some weakness. Where data are language dependent, the researcher must contend with the problem of subjects' varying facility with verbal communication. The problem is particularly acute in the use of semantic differential. An example will serve to illustrate this dilemma. When a subject group is asked to rate an urban scene on an n-point scale between, for example, clean and dirty, it is apparent that each subject's judgement is influenced by his background, experience, aesthetic sensibility and numerous other factors. When this semantic difficulty is combined with the possible bias inherent in the choice, order and juxtaposition of concept pairs, it may be that responses are partially conditioned by the mechanics of stimulus presentation, obscured by language misinterpretations or both. It is likely that these difficulties, significant as they may be in research using adult subjects, would be even more acute with young children whose language is still in the formative stage, and whose responses to environmental stimuli sometimes tend to the extreme. Lowenthal and Riel found that, "in response to the same set of milieu, emotionally loaded terms, largely negative in tone, occurred more frequently in free descriptions by younger than older observers" (Lowenthal & Riel, 1972e, p. 59). The experiences of researchers using language as the main medium for data collection in

studies involving children suggest that such methods are something less than optimal.

Certain other methods of gathering data on children's perceptions of the environment have been tried with varying degrees of success. One such method is interpretation of subject produced drawings of various aspects of their surroundings. Cisek, in his work with poor children in Boston, used this technique as part of his data collection methodology. He points out that drawings done by children, aged seven to eleven years, are largely symbolic and that the symbolism is ideosyncratic to each child (Cisek, 1966, p. 20). Because of this, the presence of the artist became necessary during some picture interpretation sessions. The presence of the children at such sessions reintroduces the whole spectre of verbal response, the value of which has already been questioned in research involving children. Cisek notes, in his conclusions, that "children respond best to interviews involving sketches, choices to mark...and a limited number of major issues for consideration (two or three)" (Cisek, 1966, p. 197). This finding, coupled with the experiences of other researchers and the writer's own experience with elementary school children, helped in two decisions which are basic to the research plan used in this study.

(a) Presentation of environmental stimuli to the children is kept as uncomplicated as possible, and

(b) The nature of the decisions demanded of the subjects and the recording of responses are devised so as to be neither onerous nor confusing, for even the youngest child involved.

The actual methodology of data collection used in this study is detailed in Chapter II of this report.

CHAPTER II

THE STUDY CONTEXT AND DATA COLLECTION

> ...a breath thou art,
> Servile to all the skyey influences
> That do this habitation where thou keepest
> Hourly afflict.
>
> William Shakespeare

The Study in Perspective

> Recent studies of environmental perception and cognition point toward a useful new area of interdisciplinary research on the borders of Geography and Psychology. Most of the work thus far has dealt with highly complex processes of environmental behaviour; little has been done to sort out and examine the individual components of that behaviour. (Blaut, McCleary & Blaut, 1970, p. 335)

The "individual components" mentioned above are so numerous as to defy comprehension since they encompass all of the actions of man on the environment, all of the reactions of the environment to man and his works and every element of the environment including man, a formidable array indeed. The writer has chosen to examine part of the relationship of children to the streets of a city. The philosophical reasons for this choice of research area have been outlined in Chapter I, at which time it was suggested that there were also somewhat more practical reasons why this particular phenomenon was chosen for examination. These are outlined below:

(1) "It has long been recognized that the psychological influence of environment on the behaviour and development of the child is

extremely important" (Lewin, 1935, p. 66). If this is so, it behooves us to find out all we can of the child/environment relationship. Since "geography is the reciprocal relationship between physical environment and life" (Peattie, 1970, p. 22), it seems fitting that studies in this field should be the province of geographers. If we do not choose to take up the challenge, we may lose the initiative as this "most interesting study (environmentalism) is falling into the hands of psychologists, sociologists and others" (Peattie, 1970, p. 187).

(2) Although research in environmentalism has been coming to the fore in recent times, most of the work has been adult oriented; children have been largely ignored. The writer's lifelong association with child education has crystallized his resolve to attempt to amend that situation.

(3) The young seem to be the segment of the population which is most alienated from the city and all it stands for. Although this tension between juveniles and their urban environment does not tend to show itself until the teen years, the seeds of the unrest may be sown during the child's early life in the city. This study proposes to cast some light on those features of the public street that please or irk young children. If these facts can be isolated, one more step will have been taken toward the knowledge of what constitutes a compatible urban environment for man and what does not.

(4) "More than any other urban pattern, the street system scores[1]

---

[1]The word 'scores' is used in the theatrical sense to denote an instrument that shapes an outcome.

the quality and character of the life pattern of its [the city's] inhabitants for centuries" (Halprin, 1969, p. 85). The street's ubiquity and its fascination for children make it an important area for study which has often been ignored, particularly in North America. "They [North Americans] don't give a hoot for streets and see no reason why they should" (Rudofsky, 1969, p. 15). However, this attitude is largely an adult one.

> For the middle aged, the home, the security of four walls, the dinfng room table and the over-stuffed livingroom chair in front of the T.V. is the city environment. But for all those others the city street is where the action is and where the quality of life in the city is determined.
> (Halprin, 1969, p. 89)

Consciousness of these facts has shaped the writer's approach to his study to a major degree.

Streets and the Geographer

"Nothing is more geographic than a route" (Peattie, 1970, p. 296). The history of the development of Geography as a discipline in its own right is closely linked with the progressive movement of man across the face of the earth. It parallels the history of the diffusion, first of human population from its primary areas of concentration, and subsequently of major ideas and ideologies, which have shaped the present state of man, from the cradles of civilization in the Middle East. The routes over which these movements took place form a prime concern of geographers.

A city street is a route, a segment of linear space, over which people continually communicate. Many were important trails or caravan routes before they became streets, and their subsequent influence in shaping the plans of cities, and land use patterns within them have been

extensively documented. Human preference has played a prominent role in the formation of the character of streets from earliest times. During the course of man's early movements across the unexplored globe, trails were popular travel routes on the basis of the principle of least effort; it is easier to follow an existing path than to break trail. But when trails became streets, a new range of influences shaped their character and use pattern. Different types of streets emerged depending upon their preferred use and may be categorized simply as:

(1) Through streets,

(2) Business streets, and

(3) Residential streets.

In the early pioneer town, these usages could often not be separated, the original street performing all three functions in some cases. The developmental sequence of these early towns tended to follow a fairly set pattern. An entrepreneur set up shop beside a well travelled route to service both the residential trade of the surrounding countryside, and the passing trade of travellers. Inevitably, he lived on the premises. With the growth and increasing prosperity of the settlement, many of the business people built "suburban" residences, entirely separate from the store or workshop, thus bringing about the first major separation of urban land use in the town. In the larger towns and cities, four main street types evolved and once again more than one major function could be served by some streets, so that categories could not be termed mutually exclusive. To the aforementioned street types of the early towns was added the arterial street designated primarily for movement of vehicular traffic. The post World War II period

saw the rise of one further category, i.e., the residential street of the planned subdivision (Appendix C). The category into which any given street fits is almost invariably decided by the main function the street fulfils. Over time, the categorization of some streets may change both actually and officially because of changes in their use pattern brought about by the evolution of the city. Thus, streets in the core of the city which were once prime residential areas may gradually become commercialized, heavily travelled arteries.

Usage determines the character of a street to a major extent and can change its visual impact over time. Usage can also determine its desirability for any given purpose. Thus, an individual, given the task of expressing preference for one street over another, cannot make a judgment until the dimensions within which his choice must be made are preset for him. This can be accomplished by asking him to choose which street, in his estimation, fulfils a given function best. Thus, when presented with a choice between two street scenes, an interviewee may express different preferences depending upon whether he is asked to choose on the basis of desirability as a residential area, as a place to shop, or simply, as a travel route. Most individuals possess such a preference structure for various kinds of streets for differing functions. The collective preference structure of a given community will, to a very great extent, determine the land use pattern of their city, and it is becoming increasingly common to find this community preference institutionalized in Official Plans and zoning regulations.

Geographers have always shown a keen interest in the structure of cities, the distribution of various types of urban land use, the changes

which occur over time in these functional distributions, and urban traffic patterns. For further information, the reader is referred to de Planhol (1959), Hurd (1903), Burgess (1925), Hoyt (1939), Harris and Ullman (1945) and Firey (1947). Recently, this interest has expanded to include the urbanite's perception of various aspects of the city, of which more will be said later.

The Functions of Streets

"Streets are the entrails of the city, with more than a touch of scatalogical flavour, constipation being one of their chronic ailments" (Rudoksky, 1969, p. 16). Not everybody would accept Rudofsky's definition of the place of the street in the fabric of the city without reservation. Streets are many things to many people. The city engineer may see the street as entrail, artery, vein or capillary depending upon the prime function it performs. This function determines the designation of street type by city authorities to no small degree. In North America, the service function of streets has, traditionally, been weighted heavily in favour of vehicular traffic. However, "in countries where their [street's] function has not yet deteriorated into highways and parking lots, a number of arrangements make streets fit for humans" (Rudofsky, 1969, p. 13). These "arrangements", of necessity, include places for people to walk in comfort and safety.

The architect's view of the street is an integral part of his building. It forms both an introduction to and the underpinnings of his total exterior design. An attractive approach has always been considered an important attribute of any major architectural enterprise.

To the vehicle operator the street is a route joining points in the city, and little else, if his livelihood is dependent to a large degree upon his vehicle.

The average urbanite, however, may have an entirely different approach to the street. "Working class people will use the street as living and congregating space while the middle-class will use it as a corridor to go elsewhere" (Michelson, 1970, p. 29). Alfred Lord Tennyson may have told us much about the attitude of the privileged upper-classes to the street when he wrote: "I loathe the squares and streets and the faces that one meets" (Rudofsky, 1969, p. 19). As a matter of fact, the language is replete with colloquialisms which suggest a derogatory connotation for the word "street" and anything pertaining to it. A "woman of the street," a "corner boy" and an "alley cat" being held up as examples of the less desirable elements of city life.

But, in this, as in many other facets of life, children are the great levelers. By and large, perhaps because they have not yet learned the biases of their forebears, or, in some cases, have denied them, they often find the street infinitely more exciting than the areas urban designers plan for them.

> The planners' concept of total separation of automobile and pedestrian may well fall afoul of behaviour preferences. Children, voting with their feet, have tended to avoid the sterile play environments of planned housing developments, preferring to play in streets, parking lots and other stimulating areas. (Porteus, 1971, p. 171)

This sentiment is not peculiar to Porteus, having been voiced by many other writers including Proshansky, Ittleson and Rivlin (1970,

p. 382) and Allen (1968, p. 15). Because of their predilection for the street, and their tendency to use it for purposes other than simple access, children form an association with the urban roadway which is at once unique and fascinating, and which offers an important area for research in the social sciences.

Comprehension of the Environment--Research Initiatives

Research in the field of perception of the everyday environment is of comparatively recent origin. Kenneth Craik (1968) has accused psychologists of being "unduly tardy" in their entry to the field (Craik, 1968, p. 29). Their related investigations have tended to be carefully controlled laboratory research in the "perception and symbolization of discrete stimuli" (Kates, 1966, pp. 26-27). With the exception of Piaget and his associates, this is probably a fair criticism. "Surprisingly, the initiative in the development of research in environmental psychology has been with the disciplines of environmental design and planning" (Craik, 1968, p. 29). Saarinen contends that "the experts [in environment] are beginning to realize their near-total ignorance of the complexities of the man-environment interaction" (Saarinen, 1967, p. 3). He further asserts that the past decade has seen a remarkable increase in research related to man and his physical environment. In any list of researchers involved with this new found field of interest, geographers tend to figure rather prominently. However, as Saarinen hastens to point out, the state of the art is still more or less in its infancy.

(c) The writer chose eight arterial and eight collector streets at random. Pictures of each were taken between 7:45 a.m. and 8:45 a.m. and between 3:30 p.m. and 4:30 p.m. These constitute "rush hour" periods. They are also the times during which children travel to and from school. Counts of the number of vehicles visible in each picture were made. These counts were subjected to Chi-square analysis and no significant difference was found between the visible traffic load of the arterial and collector streets during the times in which the photographs were taken. It was reasoned that since no significant difference in visible traffic was apparent on the two street types during the times that the subject group would be most likely to be using the streets, they could be safely treated as a single street type for purposes of this study.

Choice of Display Content

Eight streets in each of the eight street type categories described above were chosen randomly to be photographed. Choices were made as follows:

(a) A large scale map of the city was overlaid with a grid of one inch squares, 100 on the east-west axis and 80 on the north-south axis.

(b) Two series of 64 random numbers were generated, the first ranging from 1 to 100 inclusive was used to determine the easting and the second ranging from 1 to 80 gave the northing for the series of 64 street scenes photographed. The precise location and orientation of each picture was determined as follows:

(1) The first pair of random coordinates was assigned to Picture 1 in Category 1 (finished Provincial highways).

Measurement of Perception

The only way perception of any stimulus can be measured is by monitoring response; in other words, a subject's behaviour reflects his perception of stimuli both endogenous and exogenous. A principal difficulty in the study of stimulus-response is the intervention of "noise".[2] The researcher may be as clinical as is humanly possible in the control of his data collection but he can never say with conviction that this response is generated totally by this or that stimulus "because of the inherent difficulty of finding out the things a person really thinks" (Wood, 1968, p. 54). Relating stimulus to response is always complicated by what Saarinen (1969, p. 3) calls "intervening variables".

Investigations in perception of the environment have taken two approaches to date:

(1) "Roughly outlining the significant factors in real human decisions related to environment with the hope of developing theory later" (Saarinen, 1969, p. 3).

(2) "Precisely measuring limited and isolated aspects of perception in artificial environments in order to gradually build up more rigorous methodology and theory which can be applied in the real world" (Saarinen, 1969, p. 3).

This study belongs largely in the first category with some pretentions toward the second. It will seek to isolate the significant

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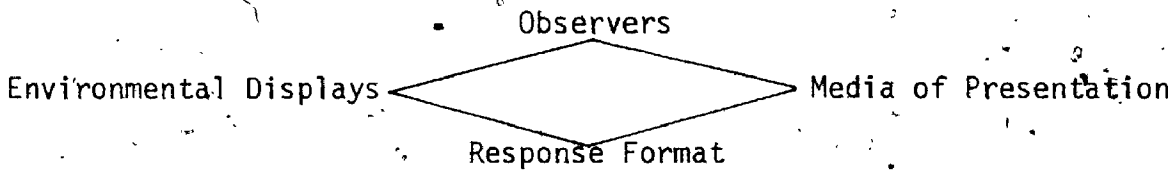
[2]The problem of noise in perception research is dealt with later in this chapter.

factors in the real environment which influence children's choices, although the method of presentation of stimuli has a large component of artificiality. This was introduced with the hope of infusing a greater degree of rigor in both data collection and analysis.

The Study Format

Craik (1968) underscores the four main elements of any study in perception of the environment:



(Craik, 1968, p. 30)

His process model for studies in this field is shown in Table 2.1. The current work relates to Craik's model as illustrated in Table 2.2.

The Observers

For purposes of this study, the observer group was chosen from the students of the elementary schools of the London Board of Education, London, Ontario. A ten percent sample of the total school population, aged seven to fourteen years, was considered statistically adequate for the project. Since it would be difficult, and extremely inconvenient for the school system, it was not deemed possible to take a ten percent sample of the students of each school in the city. Therefore, a random sample of ten of the 67 public schools of the city was chosen and the pupils of each school were contacted, a total of 2,833 children. Of these, 2,654 formed the final subject group. Data obtained from 179 subjects had to be omitted from the data set because of incomplete,

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LEAF 26,

NOT MICROFILMED.

Kenneth Craik, "The Comprehension of the Everyday Physical Environment", JOURNAL OF THE AMERICAN INSTITUTE OF PLANNERS, Vol. 34, No. 1, 1968, p. 31.

illegible or otherwise spoiled response sheets. The location and service area of each school sampled is shown in Map 2.1.

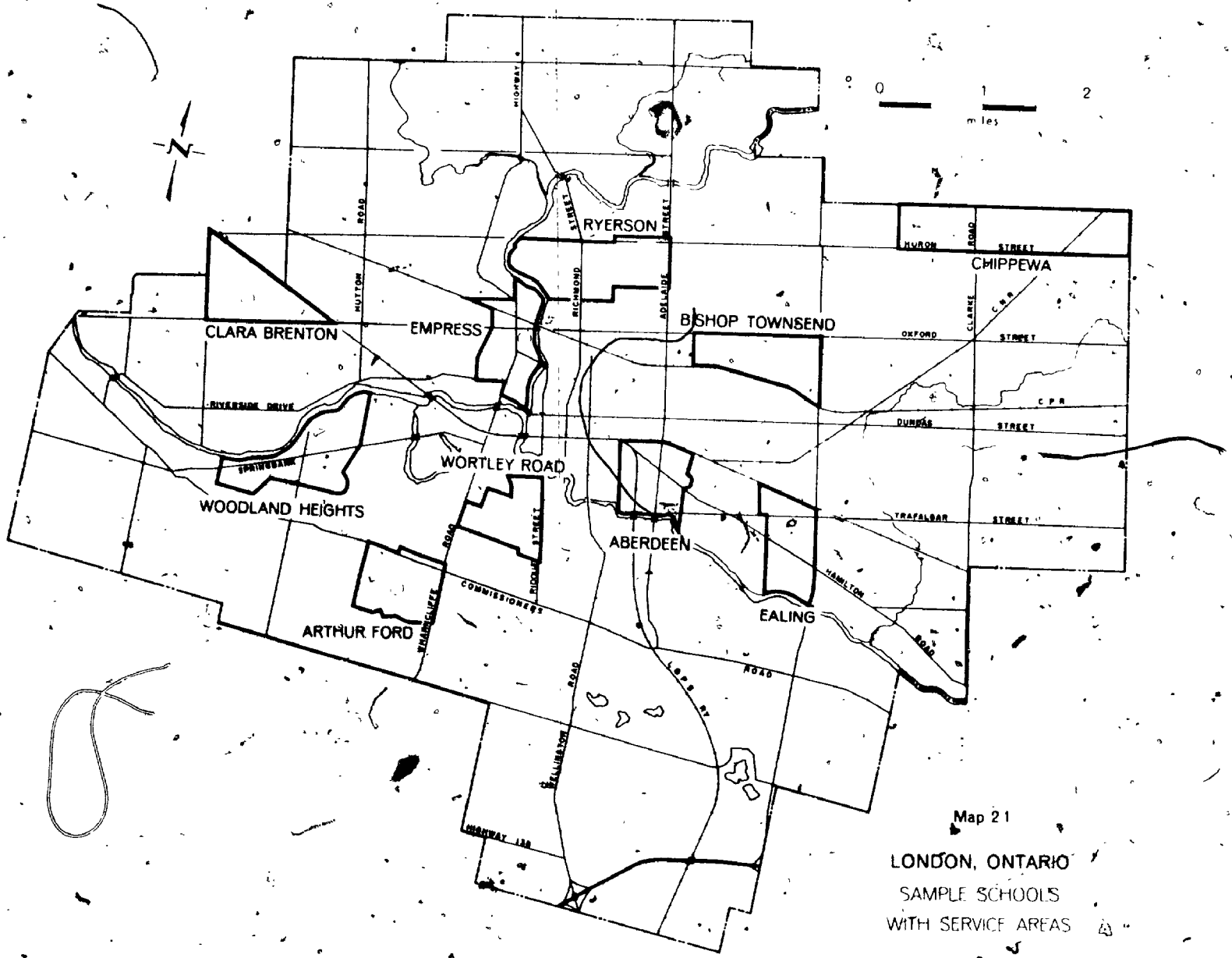
TABLE 2.2

The Current Study and Craik's Model

The Elements of the Model	Current Study	Craik's Subcategory
Observers	Children aged 7-14 years	Special user-client groups
Environmental Displays	Colour slides of city streets	Photographic studies
Response Format	Preference for one of two displays	Ratings
Validational Criteria	Characteristics of streets pictured	Measures of objective characteristics of environmental displays

The Environmental Displays

A person's perception of the environment is influenced by many factors, the existence and functions of which are often not clearly understood. It is not the province of this study to elaborate on when, where, why and how we perceive the milieu within which we live. For an enlightening and brief insight into these aspects, the reader is referred to Ittelson and Cantril (1954). There is, however, one point which must be at least mentioned here and that is the problem of "noise" in all perception. Noise is defined as any interferenee with the reception of a pure signal by the observer and can be endogenous or exogenous to him. Whatever its origin, noise plays an important part



Map 21

LONDON, ONTARIO
SAMPLE SCHOOLS
WITH SERVICE AREAS

in all studies of perception, and is largely unquantifiable in a real world situation, since the endogenous element is unique to each subject and changes with mood, energy reserve, time and many other factors. In studies of perception of the everyday environment controlling for noise is virtually impossible. The greater part of one's perception of the real world is visual. "The eyes take the lead in making a pathway into cosmic space" (Gesell & Ilg, 1946, p. 424). This conviction forms a recurrent theme in the literature, having been expressed by writers such as Cullen (1961, p. 10), Appleyard, Lynch and Meyer (1964, p. 3) and Lindley (1971, p. 19).

The writer, therefore, decided that this study would concern itself with visual perception only. The problem of presentation of the environmental displays also had to be resolved. Many of the modes suggested by Craik (1968) were considered and were abandoned as either unsuitable for this project or prohibitively expensive, as would be the case in all "direct experience"[3] approaches. Finally, the idea of photographic displays was settled on. Since the basic purpose of the study is to determine whether children prefer one type of street over another, some initial categorization of streets was necessary as a first step. The categorization used by London city authorities was accepted as a useful beginning. This typology is based on the service function of the streets and is divided into four broad categories:

(1) Streets which are also designated as provincial highways, whose function, in addition to carrying in-city traffic, is the

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[3] A direct experience approach involves the subject directly in the environment and hence would require much travelling and would be expensive of both time and money.

conveyance of through traffic. These might be expected to show some usage by heavy trucks.

(2) Arterial and collector streets, whose principal purpose is traffic movement. Some of these might also belong in (1) above.

(3) Local streets in unplanned neighbourhoods with a grid street pattern, which serve principally as access routes to homes, particularly in the older residential areas of town (see Appendix C).

(4) Local streets in planned neighbourhoods having a curvilinear street pattern (see Appendix C).

Each of the above street types can be divided into two subsections, finished and unfinished.[4] This approach gave eight street types, to be presented to the subject group for consideration. Although it might have been desirable to separate arterial and collector streets, thus having ten rather than eight street types, this was not done for three reasons:

(a) Increasing the number of street types to ten, because of the mode of display presentation decided on, would have created problems in data collection. These will be discussed later in this chapter.

(b) The two street types perform very similar main functions, i.e., movement of in-city traffic.

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[4] A street is considered finished if it has a paved roadway with curbs and gutters; it might or might not have sidewalks. It is unusual in London, Ontario, to find an unfinished street with sidewalks. Normally, unfinished streets have earth shoulders for pedestrian use. A roadway is considered paved if the surface material is made up of an aggregate and binder mixed prior to application. The other most common surfacing method used by the city, oiling, consists of spraying the road surface with a binder; spreading dry aggregate over the binder and rolling it in. This method is normally used on unfinished streets.

(c) The writer chose eight arterial and eight collector streets at random. Pictures of each were taken between 7:45 a.m. and 8:45 a.m. and between 3:30 p.m. and 4:30 p.m. These constitute "rush hour" periods. They are also the times during which children travel to and from school. Counts of the number of vehicles visible in each picture were made. These counts were subjected to Chi-square analysis and no significant difference was found between the visible traffic load of the arterial and collector streets during the times in which the photographs were taken. It was reasoned that since no significant difference in visible traffic was apparent on the two street types during the times that the subject group would be most likely to be using the streets, they could be safely treated as a single street type for purposes of this study.

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(b) Two series of 64 random numbers were generated, the first ranging from 1 to 100 inclusive was used to determine the easting and the second ranging from 1 to 80 gave the northing for the series of 64 street scenes photographed. The precise location and orientation of each picture was determined as follows:

(1) The first pair of random coordinates was assigned to Picture 1. in Category 1 (finished Provincial highways).

(2) The appropriate grid square on the map was located. The closest point on a street of the appropriate type to the centre of the grid square was taken as the location from which the picture would be taken. The direction in which the camera would be aimed was determined by the flip of a coin, heads being north or east, tails south or west. Picture 2, Category 1, was then assigned the second pair of coordinates and the process above was repeated and so on to Picture 8, Category 8.

Photographic Procedures

In order to ensure the maximum uniformity of quality, colour and density in the pictures, certain measures were taken:

(a) The same camera (Canon TL with a 50 mm. 1:1.8 lens) was used for all the pictures.

(b) Kodachrome II film was used throughout.

(c) Pictures were all taken under the same conditions of light intensity + or - 5% as measured by light meter.

The entire photographic procedure was undertaken within a period of one week in the late Spring of 1972. Garbage pickup days were avoided so that the appearance of the streets would not be adversely affected by curbside piles of trash. Actual data collection was done in the last week of June 1972.

Data Collection

Fifty-six of the sixty-four slides, chosen for their uniformity of light transmission, were used in the environmental display presentations. Twin Kodak Carousel projectors and twin portable screens ensured uniformity of reproduction. In schools where a sufficiently

large screen was available, use of the portable screens was dispensed with. Children from Grades two through eight were assembled in the auditoria and were given response sheets (Appendix A), the use of which was explained in advance of the presentation. The subjects were told that they were about to be shown a number of pairs of pictures of streets. Each child was asked to choose from each pair the street he would prefer to walk along and to record his choice by placing an "X" in the appropriate square on his response sheet. Personal information was entered by each child on the top of the sheet, with the aid of the teacher where necessary, and the final effort was signed by each respondent. Presentation of environment displays was kept as simple as possible. The operator announced that he was about to show a certain pair of pictures and pointed out the appropriate response position on a sample response sheet. The pair of street scenes was then shown and children were asked to record their choices while the displays were still before them. The technique used in data collection was simple and appropriate to the analytical model used. This is discussed in detail in Chapter III of this dissertation. It required that all possible pairs of the eight street types under investigation be shown to the subject group. It will be remembered that, in discussing the number of street types to be used that one reason given for including arterial/collector streets as a single category was to keep the number of street types as small as possible. The reason for this was to avoid prolonging each data collection session beyond the attention span of the children. Using eight street types involved presentation of $\frac{n(n-1)}{2}$ or 28 pairs of displays. If ten street types had been used, the number of

pairs would have risen to 45. Each pair of pictures was shown for 20 seconds with a time lag of 20 seconds between pairs. Thus, in showing 28 pairs, the time involved was approximately 15 minutes, well within the attention span of even a seven year old. Had ten street types been used, display time would have been extended to approximately 23 to 25 minutes, leading to the possibility of loss of interest for at least some of the subjects. It was also considered desirable to keep each session as short as possible so that the children could have a question period following the data collection. This was done in the hope that, given the opportunity to question the writer about the research and its purpose, the experience would not simply prove to be a pointless exercise, but would have some educational value for the children involved.

Controls on Data Collection

A child's interest in any activity wanes with time. This suggests the possibility that children would be more attentive and discerning in their judgments at the beginning of a data collection session than they might be later. In an attempt to mitigate this effect, the order in which the slide pairs were presented was random and was changed four times during the course of the experiment. There was also the possibility of problems of "handedness"--some subjects might tend to choose left more often than right or vice versa, not because of attributes of the displays but because of dominance of one side over the other. This contingency was controlled for by presenting the pictures in random left/right orientation and was changed each time the slide order was changed. Also, in schools where the same slide order was used, the left/right placing of the projectors and their carriers was altered from

one school to the next. An effort was also made to eliminate the possibility of bias due to respondents probable familiarity with at least some of the street scenes shown. Where the picture of any street was devoid of worded signs or traffic, the slide was reversed in the projector thus exchanging left for right. Also, pictures of streets in the immediate vicinity of any of the sample schools were not used in data collection. However, despite these efforts, in at least one session, one boy recognized a street at the opposite side of the city from his home; his father's restaurant appeared in the picture.

In practice, the problem of boredom/attention span did not arise. Quite the contrary, each school session became very absorbing for the children, a fact attested to by the chorus of disappointed "Ah's" which greeted the end of some presentations and the enthusiastic question periods that followed.

Grouping of Schools for Data Collection

Had identical pairwise slide displays been used in every data gathering session, it would have been difficult to tell whether preferences expressed were in any way related to the functional nature of the streets involved. However, by maintaining the same pairings from the standpoint of functional designation of streets, while changing the actual street pictures from one data session to the next, it was hoped that some judgment could be made regarding:

(a) The children's ability to recognize a street's primary function from visual cues only, and

(b) The subject group's preferences for one street type, as functionally defined, over another.

For example, if in one school, the finished arterial/unfinished arterial display pair was Oxford Street and Huron Street respectively, in another school the same functional pair might be represented by Queen's Avenue and Adelaide Street North. It seemed desirable to make this kind of pairwise change as often as possible. In practice, the actual number of times the change was made was dictated by circumstance. Since data collection was undertaken in the last week of the school year 1972-73, so as to disturb the normal working of the schools as little as possible, the number of days available was five. This meant that more than one school would have to be visited each day and it proved impossible to make slide changes between schools on any one day. Thus, a maximum of five slide changes was possible. In fact, because of the necessity to accommodate the schools as much as possible, it proved necessary to visit two groups of three schools on consecutive days and two groups of two schools on the following two days. Thus, four slide changes were made.

Given the grouping constraints mentioned above, an effort was made to combine the schools in such a way as to add one more dimension to the research. It was reasoned that by combining schools that had certain similarities and differences in any one group and by showing identical slide displays to the subjects, any differences in expressed preferences might make it possible to infer or, at least, hypothesize some relationships between differences in preference and characteristics of the school population, whether they be locational or socio-economic. The actual groupings decided on and the reasons behind the choice of schools are outlined below.

Group 1 - The school population in Group 1 was drawn from Woodland Heights and Wortley Road Public Schools. As can be seen from Map 2.1, both are located in the southwest quadrant of the city and their service areas run down to the river on the north. They serve primarily residential areas that are quite similar in socio-economic terms; this aspect of the schools will be dealt with in more detail in Chapter VI. However, there are important differences between the schools and their districts. Wortley Road has been in existence since 1892 and serves an old residential neighbourhood which is currently suffering some deterioration due to its proximity to the city core. It is densely built up and possesses little public open space. Woodland Heights, in existence since 1961, services an area of low density development with large amounts of open space which includes some of Springbank Park, the city's largest public park, the horticultural plant of the London Public Utilities Commission, Woodland Cemetery and Greenway Park. All of this adds an almost rural quality to the Woodland Heights district.

These two schools were combined so that any differences in preference for urban spaces that might relate to the age and degree of congestion of the home area of subjects might be revealed.

Group 2 - Arthur Ford and Aberdeen Public Schools comprised Group 2. The schools and their districts differ quite radically in this case. Ford is a comparatively new school, opened in 1963, and it services a planned residential development of the same age and younger. It is an area of low density housing on curvilinear streets, and single family homes predominate. All utilities are underground, except for two streets, Gordon and Highland, which predate the development proper.

In general, the area is devoid of mature trees and is almost typical middle class housing. Aberdeen School, constructed over the period 1883 to 1896, serves an old, rundown district on the fringe of the city core. Housing is congested, often decrepit, and strip commercial development, largely unplanned, has invaded the two busy arteries that intersect within 100 yards of the school property. The district, which runs down to the river on the south side, contains a rundown 19th century appliance factory and a small oil products plant, neither of which add to the aesthetics of the area. Socio-economically speaking, the Aberdeen School district is very low in the hierarchy of London residential neighbourhoods.

These schools were paired so that the influence on preference for street types brought about by living in such diametrically opposed milieu, if any, might be inferred from analysis of data from both schools.

Group 3 - The third group of schools consisted of Clara Brenton, Ryerson and Ealing Public Schools. These three schools span the city from west to east and apart from their spatial separation they are also well separated in socio-economic terms. Clara Brenton, opened in 1963, serves a middle to upper middle-class planned residential neighbourhood of recent origin. The curvilinear streets are finished, well kept and devoid of large trees. In socio-economic terms, the Clara Brenton district is close to the top of the scale of residential areas in London. Ryerson School has served old north London since 1915. Its service area has been the traditional upper-middle-class neighbourhood of London, a position that now seems threatened by a number of factors principal among which are:

(a) Deterioration of the area due to encroachment of central city functions,

(b) Subletting of what were once large, single family dwellings,

(c) Diminishing school populations with the accompanying possibility, currently under discussion, of school closures in that general area, and

(d) Inability to attract new families into the area because of the difficulty of buying and maintaining many of the houses as single family dwellings.

Despite its problems, the Ryerson district can still be construed as being equal to, or above, the Clara Brenton area in socio-economic status. The broad streets, mature maples and impressive houses lend the area a dignity and visual diversity which the new planned housing developments cannot seem to duplicate. Ealing School has served its area since 1909. However, other than in age, the school and its service area bear little resemblance to Ryerson and its district. Ealing's area is a rundown lower-class neighbourhood which has suffered badly from strip commercial development, notably along Hamilton Road and Trafalgar Street, from encroachment by industry such as a cement plant and poultry packing concern and from heavy traffic on routes that intersect and border the district. It must be considered extremely low in desirability as a residential neighbourhood.

The grouping was considered advantageous because of the spatial separation of the schools and the mix of socio-economic circumstances. The Clara Brenton/Ryerson combination might be expected to reveal differences in preference for urban milieu between children from upper-

class families who live in new versus established neighbourhoods. The Ryerson/Ealing comparison might throw some light on differences in preference revealed by children from poor versus well-off older areas of the city.

Group 4 - Group 4 comprised Empress, Bishop Townsend and Chippewa Schools. Empress has served its area since 1922. The district is an old residential area, on the fringe of the city core, which is deteriorating from a housing desirability point of view. The school is situated within a block of one of London's busiest intersections. Housing is generally congested, although the district does encompass two small public parks, West Lions and Kensington. The Empress area is low in socio-economic status and is very similar to the Aberdeen district discussed earlier. Bishop Townsend School has served its area since 1958. The school district contains relatively new housing on a grid street pattern. Some strip-commercial development which is rather haphazard has occurred along Oxford Street which borders the school district on the north. A major military installation, Wolseley Barracks, occupies the western half of the school district. The district has an openness to it which is largely visual since much of the green space in the area is not accessible to the public. Socio-economically, one would have to describe the Townsend service area as lower middle-class to lower-class.

Chippewa Public School, opened in 1966, serves a new housing development in northeast London, an area of the city that is still undergoing extensive housing construction with the prospect of more to come. At present, the school district is relatively isolated from the rest of the city and is not easily accessible by public transportation.

It comprises mostly single family dwellings on finished streets with underground services and is probably best described as lower middle-class housing.

These schools were included in one group because of their similarity in socio-economic terms, while differing quite radically in age of development and location. It was reasoned that a comparison of findings from analysis of Empress and Townsend data might reveal dissimilarities in preferences expressed which might be due to the different character of housing development in the areas. Similarly, an Empress/Chippewa or Townsend/Chippewa comparison might reveal differences in preference which might be attributable to locational and/or age differences of the two areas or to the influence of living in unplanned versus planned residential neighbourhoods.

Results of comparisons suggested above will be discussed in some detail in Chapter VII of the dissertation.

Data Preparation

Because of the volume of data involved, use of a computer was considered necessary. The information was, therefore, punched on computer cards, one for each child contacted. Sorting, ordering and analysis of the data were undertaken and will be discussed in detail in Chapter III.

CHAPTER III

ANALYSIS - PHASE 1

> A scientist may be a student of any other subject. He is always a participant in perception.
> (Ittelson & Cantril, 1954, p. 7)

The quest for areas of agreement among people is as old as the first choice of a leader by the earliest anthropoids, as new as the latest opinion poll; seldom is this agreement total and the probability of approaching unanimity decreases with the number of participants. This research is such a quest and the methodology evolved seeks out statistically significant areas of agreement in what children perceive as preferred travel routes in the city, and the characteristics of the routes which may influence these preferences. The entire research rests on the assumption that the "common aspects" of perception described by Ittelson and Cantril (1954) can be isolated at an acceptable level of statistical rigor from the type of data described in Chapter II and from a grid square analysis[1] of each of the environmental displays used during the course of this project.

Data Organization

Because presentations of the displays to the subjects were in

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[1] Grid square analysis is a technique which can be used to examine the quantitative content of pictures, maps, etc. See Shafer and Meitz, 1970.

random sequence and random right/left orientation, the data had to be ordered before analysis could proceed. A computer program was written which reordered each subject's responses and recorded them as they would have been received had each presentation been made in the following order of street types:

1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8
2-3, 2-4, 2-5, 2-6, 2-7, 2-8
3-4, 3-5, 3-6, 3-7, 3-8
4-5, 4-6, 4-7, 4-8,
5-6, 5-7, 5-8
6-7, 6-8
7-8

Subjects' responses and personal data were then repunched on a new set of computer cards.

The Thesis Hypotheses

The methodology which has been used during the course of this study aims at testing the following hypotheses:

(1) School children aged seven to fourteen years display a preference structure in their choice of urban travel routes that is statistically acceptable.

(2) Chronological age, developmental age, and home area of the city influence the children's preference structure.

(3) Children's preferences for different kinds of streets as routes are determined, at least in part, by the visual characteristics of the streets.

Phase 1 of the study tests those hypotheses listed under (1) and (2) above. The second phase, which is methodologically different from the first, will be treated separately in Chapters V and VI of this work. The two phases will be brought together in the concluding chapter.

The Research Procedure Model

The research design follows the process model shown in Figure 3.1. Phase 1 of the model has three principal aims:

(a) To obtain the preferred ranking of the eight street types as revealed in the responses of each individual subject.

(b) To elicit from the information obtained in (a) above a consensus ranking of the street types for:

(i) the entire subject group, and

(ii) any significant subgroups thereof.

Each of the above aims is discussed in detail below, the techniques used to accomplish them are examined and the rationale behind each is outlined.

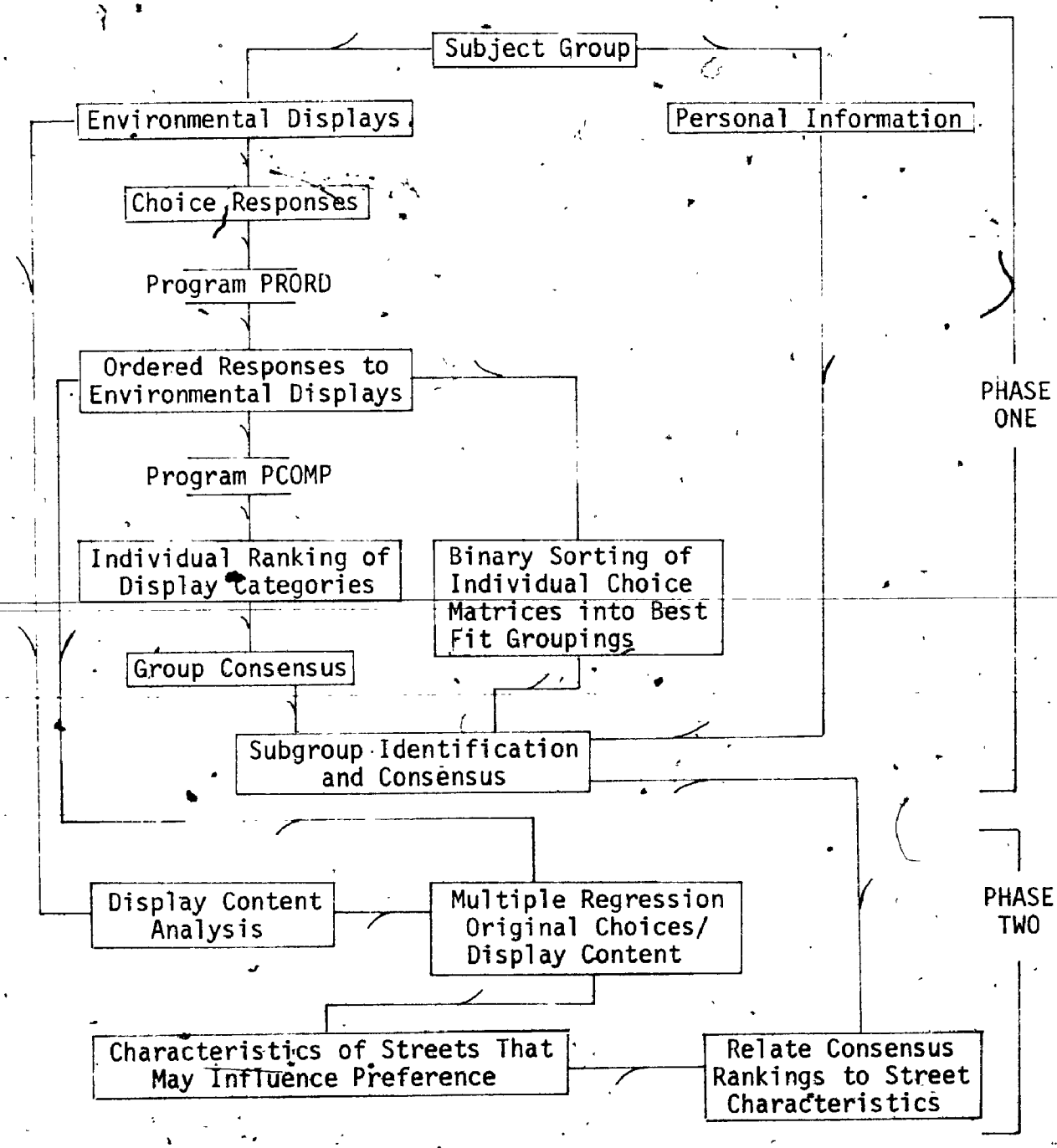
Individual Preferred Ranking of Street Types

The simplest way to obtain an individual's preferred ranking of a number of items would, of course, be to present him with the n items and ask him to rank them 1 to n in order of preference. In the present instance, this would involve presenting each subject with eight photographs, one of each street type considered, chosen as representative of the various categories of city streets. However, a number of objections can be raised to this approach which convinced the writer that it would be inappropriate in this project. These objections are outlined below.

(1) The most obvious argument against the use of simple ranking in this research is the difficulty of choosing a street of a given type, e.g., a finished arterial, which could be deemed reasonably representative of all finished arterials in a given city. It is suggested that the probability of capturing the essence of finished arterials, if such

FIGURE 3.1

Research Procedure Model--Perception of the Visible Environment



Source: T. J. Underwood

exists, is greatly enhanced by exposing each subject to several examples of each street type chosen at random from across the city, the more examples the better, subject always to the necessity to avoid boring the viewer with too much visual stimulation. This approach has another obvious advantage in that it reduces the possibility of researcher-induced bias in the choice of the environmental displays presented to the subject group. In this study, seven examples of each type of street under consideration were shown to each child sampled.

(2) Ranking always suffers from a serious handicap which has been documented by many researchers including Kendall (1955), Kendall and Babington-Smith (1939-40), David (1963) and Moroney (1970). In any multi-dimensional judgment where the quality or qualities of several items to be ranked are not representable as definable linear variables, ranking is an extremely difficult process.

> The truth is that in multi-dimensional judgments of this sort we are always more or less out of our depth. To ask a man to arrange a set of items in a ranked list under such circumstances is artificial and inappropriate. We are asking the impossible. (Moroney, 1970, p. 341)

David has stated that:

> ranking is quick only when differences [between items being ranked] are fairly apparent; otherwise the process of ranking requires in practice many repeated pairwise comparisons of tentative neighbours before a reasonable ordering becomes established. (David, 1963, p. 10)

In some instances, the displays used during data collection by the writer did not show marked pairwise differences. It was, therefore, felt that in the light of the comments by other researchers in the field, simple ranking would be of questionable value in this study.

(3) Ranking conceals statistical inconsistency in an individual's

choice pattern, simply because there is no opportunity for contradictions to show themselves. A simple example will illustrate this problem. If a person is asked to make pairwise choices between three items A, B and C and if his choices are A→B,[2] B→C, then logically A→C. However, as often happens, the choice sequence might well be A→B, B→C and C→A. The choice C→A here reveals inconsistency in the preference pattern. This, however, cannot always be construed as illogical; it is illogical only if the quality or qualities of A, B and C which are being judged are definable in terms of a linear variable. If, on the other hand, the criterion for choice is subjective judgment, then it can be argued that any apparent inconsistency is attributable to changes in the dimensions within which the choices are made. However, knowledge of levels of inconsistency in a subject's choice pattern can sound several warnings to the researcher:

(a) Differences between items may be so slight as to make consistent choices impossible, or nearly so.

(b) Individual subjects may prove inconsistent because of lack of interest or boredom.

(c) The criterion or criteria on which the individual is asked to base his judgments may be overshadowed by some other aspect of the items judged.

(d) A subject may be choosing at random, for whatever reason.

(e) The original categorizations of displays may not be reflected by their visual character.

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[2]During the course of this study, the convention A→B is used to denote that A is preferred over B.

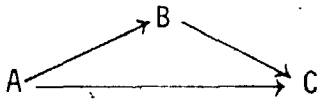
Because of the objections to the process of simple ranking and the author's conviction that what applies to adult subjects in this area applies with even greater force to juveniles, another technique was sought which could be relied on to give a ranking of the eight street types involved, while avoiding the drawbacks described above, and which would allow inconsistencies to show themselves. The method chosen was that of Paired Comparisons.

Paired Comparisons

The Method of Paired Comparisons had its beginnings with the German psychometrist Fechner in 1860, and has been used extensively in psychology and in consumer preference testing. Refinement and popularization of the method must be attributed to Thurstone (1927) and it has proved to be effective in the study of multi-dimensional choice problems. Each judge is presented with all possible pairs of the items to be evaluated provided the number of items (n) is small enough so that the task does not become unnecessarily lengthy. Where n is large and where a number of judges is available, it is not necessary to present all pairs to each judge. In this case, the judging is rendered less onerous by allocating only a portion of the choices to be made to each subject. Design of this kind of experiment is discussed by David (1963, pp. 60-74). In the case under study here, where n = 8, it was not found necessary to divide the number of choices in this manner. Given n items to be judged, the number of pairs is $\frac{n\ (n-1)}{2}$, thus each child sampled had to make 28 choices and was not allowed to declare himself undecided. The basic building block of the technique is the preference triad. Where only three items A, B and C are to be judged, the

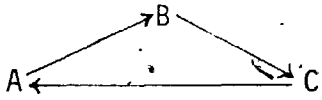
following triads might occur:

(a) The Resultant Triad



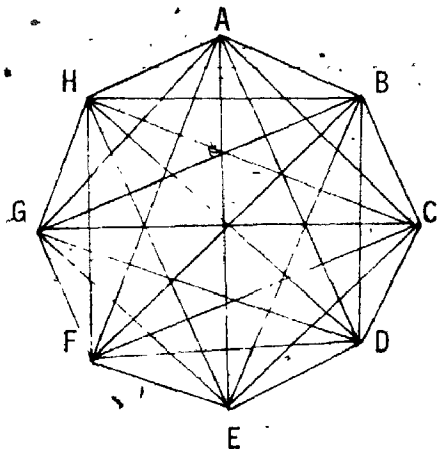
This is a statistically logical set of choices A→B, B→C therefore as a result of these two choices A must be preferred to C.

(b) The Circular Triad



In this set of choices a certain inconsistency is revealed. Although A→B and B→C yet C→A.

Of course, the number of items (n) is seldom limited to three. Where n>3 the more complex Polyad, broken down into its component triads, illustrates the comparison process (in this case for n = 8):



The comparison of the actual (observed) number of circular triads for each subject to the maximum possible number gives a measure of his consistency of choice. The maximum number of circular triads that can occur in an experiment of the nature of the one undertaken here is:

$\frac{n^3 - n}{24}$ where n is the number of items compared and is odd,

or

$\frac{n^3 - 4n}{24}$ where n is even.

(Kendall & Babington-Smith, 1939-40, pp. 327-329).

Observed Number of Circular Triads

Ascertaining the number of circular triads in a subject's responses can be done by diagramming his choices and counting the inconsistencies. This, however, would be a laborious task, particularly if the number of subjects is large. Fortunately, a rapid method for computing the number of circular triads has been evolved. Each subject's responses are set up in matrix form as:

Item	1	2	3	4	5	6	7	8	Score a_i
1		1	1	0	1	0	1	1	5
2	0		0	1	0	1	1	0	3
3	0	1		0	1	1	1	0	4
4	1	0	1		0	0	0	0	2
5	0	1	0	1		0	0	0	2
6	1	0	0	1	1		0	0	3
7	0	0	0	1	1	1		0	3
8	0	1	1	1	1	1	1		6

Where the symbol 1 denotes preference for the row item over the column item.

In general, the number of preferences scored by item one (a_i) is:

$$\sum_{i=1}^{n} a_i = \tfrac{1}{2}n\,(n-1)$$

where n = number of items to be differentiated

a_i = the row score for item i

and there will be $2^{\frac{1}{2}n(n-1)}$ different preference matrices. The number of circular triads occurring in a preference matrix can then be

determined by means of the relationship

$$C_i = \frac{n}{24}(n^2-1) - \tfrac{1}{2} T_i$$

where C_i = number of circular triads in matrix i

n = number of items to be differentiated

$T = \sum (a_i - \bar{a})^2$

and $\bar{a} = \sum a_i/n = \tfrac{1}{2}(n-1)$ [3]

Programming this technique for the computer was both simple and efficient. The maximum possible number of circular triads for each subject's choice matrix was found, as was the number of circular triads he had recorded. Calculation of a Coefficient of Consistency was then undertaken.

Coefficient of Consistency

The Coefficient of Consistency is defined by Kendall and Babington-Smith as

$$K = 1 - \frac{24C}{n(n^2-1)} \quad \text{when n is odd}$$

and

$$K = 1 - \frac{24C}{n(n^2-4)} \quad \text{when n is even,}$$

where K = Coefficient of Consistency

C = observed number of circular triads

n = number of items to be differentiated

(Kendall & Babington-Smith, 1939-40, pp. 327-329).

Testing for significance presents a minor problem because, to the best knowledge of the writer, no tables have been published beyond the case

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[3] For a more in-depth treatment of the method for arriving at the observed number of circular triads, see David, 1963, pp. 21-23.

of seven items or twenty-one paired comparisons. A table of significance had to be calculated for the present case where eight items are involved. This was done by simulation and the method used is described in detail in Chapter IV. There was also a necessity to determine whether a significant level of agreement existed between subjects on the relative preferability of the items presented to them. This involved calculation of a Coefficient of Concordance.

Coefficient of Concordance

Individual consistency in choice is not of primary concern in this study. The derived ranking from each subject's response matrix and, subsequently, the degree of agreement amongst individual rankings by the entire subject group or by significant subgroups is pertinent to the main thrust of the study. Calculation of the Coefficient of Concordance is detailed below.

Having tabulated a choice matrix for each subject, his preference ranking was derived in the following way. His favourable choices for each street type were counted and entered as a score (a_i) for each type. These were then ranked 1 to 8 according to score, the highest being allocated first place and so on. Where a tie occurred, e.g., street types 3 and 8 scored equally for fourth position, they were ranked fourth and fifth at random. This was done so that the computer program would not always rank them sequentially as 3 = 4th and 8 = 5th thus introducing a mathematical bias. It is conceded that this is a point of weakness the avoidance of which would be desirable in future research of this nature.

Given this ranking for each subject, calculation of the Coefficient

of Concordance between subjects is undertaken. In a case where m judges rank n items their degree of agreement is calculated as follows:

(a) The total of ranks for each judge will be the sum of the first n natural numbers or simply $\frac{n(n+1)}{2}$. If then there are m judges, the total of all ranks for all judges is $\frac{mn(n+1)}{2}$.

(b) Should the judges be unable to exercise any discrimination in their choices, it can be assumed that each item ranked would get 1/n of the total sum of ranks or $\frac{mn(n+1)}{2n} = \frac{m(n+1)}{2}$.

(c) If, on the other hand, they showed perfect judgment, then the rank totals for individual items would form the series:

$$m, 2m, 3m \ldots\ldots\ldots\ldots\ldots nm$$

but not necessarily in that order.

(d) The difference between the observed and expected totals will form a measure of the agreement amongst the judges. The maximum value that can be reached by the sum of squares of these differences is

$$Smax = \frac{m^2 (n^3-n)}{12}$$

which would occur only in the case of perfect agreement. The ratio between observed and expected sum of squares is termed the Coefficient of Concordance and is calculated as

$$W = \frac{S}{Smax} = \frac{S}{\left[\frac{m^2(n^3-n)}{12}\right]} = \frac{12S}{m^2(n^3-n)}$$

where

W = Coefficient of Concordance

S = Sum of squares of the difference between observed and expected rank totals

m = number of judges

n = number of items ranked

W is tested for significance using Snedecor's distribution of F:

$$F = \frac{(m-1)\ W}{1-W}$$

with degrees of freedom for the greater estimate = $(n-1) - \frac{2}{m}$ and for the lesser estimate = $(m-1)\left[(n-1) - \frac{2}{m}\right]$ [4]

Once it is established that a significant level of agreement exists between the subjects, the consensus ranking which best reflects the opinion of the entire subject group can be obtained. This is done by ordering the items judged on the basis of rank totals for all subjects. The item with the lowest rank total is most preferred, and that with the highest total least preferred.

Subgroup Identification and Analysis

In any situation where a consensus is sought from a population, it is seldom found to be unanimous. There are inevitably various shades of opinion ranging from total agreement with the general consensus to total disagreement. It seemed that a similar phenomenon would present itself in the present situation and it was assumed that the various shades of opinion would identify significant subgroups of the population being examined. In order to identify such groupings, the following technique was devised:

(a) Each subject's ranking of the eight street types was correlated to the consensus ranking using Spearman Rank Correlation.

(b) Subjects were then grouped according to the level of correlation achieved. Groups were defined within the following limits:

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[4] For a more detailed treatment of Coefficient of Concordance, see Moroney, 1970, pp. 337-339.

Group 1	0.000
Group 2	0.001 to 0.333
Group 3	0.334 to 0.666
Group 4	0.667 to 1.000
Group 5	-0.001 to -0.333
Group 6	-0.334 to -0.666
Group 7	-0.667 to -1.000

Each subgroup so identified was analyzed separately in exactly the same way as the entire group and a consensus ranking and F statistic was calculated for each group.

This method has an inherent weakness in that the criterion for grouping was the consensus ranking of the total sample, which, because it was highly generalized, might tend to hide the finer nuances of preference contained in the raw data. For this reason, a second method of identifying significant subgroups of the population directly from the raw data was sought. A binary sort routine was finally settled on. Its use will be detailed in Chapter IV of this study.

Preference Structure of Subgroups Defined by Socio-Cultural Attributes of Subjects

It has been hypothesized that age, sex, developmental age (as represented by grade level achieved at school), school attended and type of street on which the home is located would all significantly influence a child's preference structure for streets as travel routes. In order to test these hypotheses, the membership of each opinion subgroup derived from the binary sort routine was analyzed. The composition of each opinion group by age, sex, developmental age, school and home street type was derived and subjected to Chi-square Analysis. The objective of this exercise was to ascertain whether personal characteristics

of subjects bore a significant relationship to membership in any particular opinion subgroup.

Summary

Completion of the Chi-square Analysis described above marked the end of Phase 1 of this project. It will be remembered that the objectives of Phase 1 were:

(1) To obtain a consensus ranking of eight street types based on their desirability as travel routes to elementary school-age children.

(2) To identify significant subgroups of the total sample based on internal levels of agreement among individual subjects.

(3) To determine whether personal characteristics of subjects bore significant relationships to revealed preference patterns.

The actual analysis performed is described in detail in Chapter IV and the findings under each of the objectives listed above are tabulated.

CHAPTER IV

PREFERENCE PATTERNS FOR TRAVEL ROUTES

> Every act of judgment is a division of the field of our experience into what matters and what does not.
> (Jacob Bronowski, 1968, p. 36)

It is axiomatic that we cannot exercise a significant degree of discrimination in any field which is outside the range of our experience. It is also true that every individual's field of experience is unique, at least to the extent that even shared encounters are not perceived in equal measure by all the participants. If it was not for this variation in the ability of people to receive and interpret stimulation, one of two probably intolerable situations would beset mankind: either there would be no great virtuosos in any field, or everybody would be a Beethoven or a Da Vinci. Fortunately, the capacity to perceive the quintessential nuances of even the stuff of everyday life is not shared equally by all of humanity. This difference in perceptual and cognitive capacity, however, complicates the job of the researcher in search of consensus in a given population. Agreement can only be sought on the ground which is common to all of his subjects, and so, much of the experience of individual subjects is either lost in the case of those with a broad experiential background, or is stretched to the limit of usefulness in the case of those whose field of experience is somewhat narrower. Variation in experience, and therefore in the personal value

systems that derive from experience, is common to all populations and is a principal reason why a high degree of agreement between a large number of judges is unusual in instances where criteria on which judgments are based are multi-dimensional in nature. This phenomenon was quite apparent in the present project and a high degree agreement was not found in the entire subject group. This statement, however, needs some qualification. One objective of the research was to ascertain whether children displayed discernible preferences for different street types as pedestrian travel routes. The street classifications used are those defined by the city authorities on the basis of the principal function of each thoroughfare. When the subjects were asked to make a choice between two streets on the basis of their preferences for one or the other as a travel route, they were not told the official classification of each as it was felt that:

(a) Such information might be beyond the understanding of some of the children, or

(b) Knowledge of the official designation of a street might prejudice the choices of those subjects who were familiar with the implications of street designations for traffic flows.

It may be, therefore, that children used criteria other than function as the basis for their expressed preferences, and that the visual cues which might reveal the designated functional character of urban streets are lost amongst the multitude of other visual stimuli, making it impossible to recognize the different functional types from pictures alone. An attempt will be made in Chapter VI of this thesis to identify the characteristics of urban streets which may be significant influences

in children's preferences for various types of city streets as pedestrian travel routes.

Findings from Phase 1 of Analysis

The subject group for this experiment was composed of 2,165 elementary school children ranging in age from seven to fourteen years approximately. Before the analysis could proceed, a decision had to be made regarding the level of consistency in choice which would be considered desirable for each individual subject. Since, to the best knowledge of the writer, no tables for K (Coefficient of Consistency) have been published beyond the case of seven items, and since this research involves eight street types, it was necessary to calculate the probability of occurrence of various values of K from 0 to 1 for the case of eight items on a random basis. A program was written which simulates 100, eight by eight choice matrices similar to that shown in Chapter III, Page 50, in which the choices were entered on a random basis. The Coefficient of Consistency (K) was then calculated for each random matrix and the results tabulated. Table 4.1 shows the outcome of this simulation. Column 1 shows values of K from 0 to $\geq .65$ by increments of .05, Column 2 gives the number of times each value of K occurred in the 100 simulations, and Column 3 lays out the probable number of occurrences of a given value of K or less in 100 randomly simulated choice matrices. It will be noted that $K \geq 0.25$ is required to ensure a better than 50 percent chance that the choice pattern is not random. In the present case, it was reasoned that respondents whose choice matrices yielded a $K \geq 0.25$ were more sensitive to the functional character of the streets viewed than those with $K < 0.25$ and

TABLE 4.1

Occurrences of Values of K (Coefficient of Consistency) in 100 Randomly Simulated 8 x 8 Choice Matrices

Value of K	Number of Occurrences of Each K Value	Running Total
0	0	0
.05	4	4
.1	14	18
.15	12	30
.2	15	45
.25	9	54
.3	13	67
.35	4	71
.4	10	81
.45	9	90
.5	3	93
.55	3	96
.6	2	98
$\geq$ .65	2	100

Source: T. J. Underwood

that their choices were influenced accordingly, while the latter group may have been swayed more by criteria other than function. Since Phase 1 of this project is concerned primarily with preferences for street types designated by primary function, only those subjects whose Coefficient of Consistency (K)$\geq$0.25 were included. Of the 2,655 subjects, 1,656 (63%) achieved K$\geq$0.25 and 999 produced K$<$0.25. For ease of identification, these two divisions of the total sample will be known as Subsample A and Subsample B respectively. Data obtained from Subsample A were subjected to Paired Comparison Analysis as described in Chapter III. Results from the analysis for Subsample A and its constituent subgroups are shown in Table 4.2.

Interpretation of Results

Total Subsample A - Overall agreement amongst the entire subsample with regard to ranking of street types by function is low with a Coefficient of Concordance (W) = 0.064 significant at the .001 level. This suggests that amongst the subjects whose responses were analyzed in this phase of the research, the consensus, although slim, leans toward the following preference order for urban street types:

Rank	Type	Description
1	1	Finished Through streets
2	3	Finished Arterial streets
3	4	Unfinished Arterial streets
4	2	Unfinished Through streets
5	7	Finished Planned Residential streets
6	5	Finished Unplanned Residential streets
7	8	Unfinished Planned Residential streets
8	6	Unfinished Unplanned Residential streets

TABLE 4.2

Paired Comparison Analysis - Subsample A with Subgroups

GROUP		CONSENSUS RANKING	COEFFICIENT OF CONCORDANCE W	SNEDECOR'S F	DEGREES OF FREEDOM		LEVEL OF SIGNIFI-CANCE	NUMBER OF SUBJECTS	
					Greater Estimate	Lesser Estimate			
Total Subsample A		13427586	0.064	112.4	6.9	11513	.001	1,656 (t)	
Sub-Group	Correlation limits/subgroup to sample							Number of subjects	% of total (t) above
1	0.000	13527684	0.066	1.688	6.9	166	not signifi-cant	35	2.10
2	.001 to .333	41327685	0.055	29.626	6.9	3596	.001	515	31.10
3	.334 to .666	14238567	0.288	169.934	6.9	2938	.001	421	25.42
4	.667 to 1.000	14236857	0.677	389.268	6.9	1300	.001	187	11.29
5	-.001 to - .333	35718264	0.077	29.820	6.9	2518	.001	361	21.79
6	-.334 to - .666	57382614	0.3428	62.600	6.9	838	.001	121	7.30
7	-.666 to -1.000	57863214	0.625	24.938	6.9	103	.001	16	0.96
							TOTAL	1656	100.00

INDEX OF STREET TYPES

1. Through Finished
2. Through Unfinished
3. Arterial Finished
4. Arterial Unfinished
5. Unplanned Local Finished
6. Unplanned Local Unfinished
7. Planned Local Finished
8. Planned Local Unfinished

SOURCE: T. J. Underwood

Some tentative conclusions can be drawn from the above findings:

(1) The most preferred pedestrian travel routes are also the streets with the heaviest volume of vehicular traffic, i.e., Through and Arterial streets.

(2) Residential streets whether they be planned or unplanned have a low priority as pedestrian routes.

(3) Within the above groupings, finished streets are preferred to unfinished streets.

Subgroups Within the Total Sample

Subgroups were identified on the basis of each subject's ranking of street types relative to the consensus ranking of the total group. Using Spearman's Rank Correlation, each subject's preference ranking was correlated to the group consensus ranking. Subgroups were then defined within certain correlation limits and each subject was allocated to the group within whose limits his correlation to the group consensus fell. The subgroup correlation limits were:

Subgroup Number	Correlation to Group Consensus
1	0
2	.001 to .333
3	.334 to .666
4	.667 to 1.000
5	-.001 to -.333
6	-.334 to -.666
7	-.667 to -1.000

It will be noted from Table 4.2 that:

(a) The rankings derived from the responses of 1,123 subjects (67.81% of total) correlate positively with the group consensus. These

comprise subgroups 2, 3 and 4. In all three groups, through and arterial streets are preferred to residential streets as pedestrian routes.

(b) Group 5 comprising 361 subjects or 21.79% of the total contains those whose rankings correlate negatively with the group consensus. The fact that this group's consensus ranking falls into two clear sections, i.e., finished streets ranked 1 through 4 and unfinished streets ranked 5 through 8 suggests that the diagnostic criterion for preference amongst this group may very well be whether or not the street is paved, has curbs and gutters and, in most cases, sidewalks.

(c) Group 6 into which 121 (7.30% of total) observations fall shows a clear leaning towards the residential street over the arterial or through street as a pedestrian route. However, it will be noted that, once again as with Group 5, the diagnostic criterion for choice may well be the condition of the travelled portion of the street.

(d) Only 16 of the subjects (0.96% of total), Group 7, clearly opt for residential streets as pedestrian routes ranking them in the first four places. Again, whether or not the street is finished seems to be an important criterion for choice, finished streets being ranked in positions 1 and 2 over unfinished streets.

(e) Thirty-five subjects in Group 1 or 2.10% of the total yielded rankings that did not correlate with the sample consensus.

Although the Coefficient of Concordance (W) for all subjects in Subsample A and the coefficients for all subgroups save one are statistically significant, one has to wonder whether levels of concordance as low as those calculated for all children in Subsample A and for subgroups

2 and 5 are practically significant. They probably are not. This suggests two important questions:

(1) What level of concordance is acceptable for practical purposes when dealing with such a large number of judges as in Subsample A when:

(a) The diagnostic criterion on which preference is supposedly based is multi-dimensional in nature.

(b) The criterion is difficult to identify from visual cues only?

(2) Is the Rank Correlation of rankings derived from subject responses with sample consensus the best method of grouping subjects into the optimum opinion subgroupings?

Both of these questions are discussed in further detail below:

(1) Because it is not possible to establish a value for the Coefficient of Concordance such that any value below it is deemed practically insignificant in a particular situation, the researcher is put in the position of:

(a) Arbitrarily selecting the threshold value which is acceptable to him, or

(b) Accepting statistically significant values and leaving it up to his readers to decide whether or not they deem values to be practically significant. The writer leans towards the latter approach with one stipulation, his criterion for acceptability was that concordance levels be statistically significant beyond the .001 level.

(2) The Rank Correlation Method of establishing subgroups suffers from one serious weakness. The partitioning criterion, total sample consensus, is highly generalized. As described earlier, the consensus

is arrived at by aggregating the rankings derived from each subject's response matrix. Since each subject's derived ranking assumes that the subject made his choices on the basis of street function, it is not a valid criterion for categorizing subjects whose diagnostic criteria may have been other than function. It was, therefore, felt that it was a useful method for subdividing Subsample A but that another method would have to be used for any analysis involving Subsample B.

Opinion Subgroups from Raw Data

An algorithm was sought which would cluster the original raw choice data of the total sample on the basis of similarities between individual subject's range of choice responses. It was stipulated that the algorithm would be capable of:

(a) producing groupings of maximum internal homogeneity,

(b) grouping on the basis of similarities between subject's total range of 28 choices without introducing any process of aggregation or generalization of individual response matrices, and

(c) arranging the groups without reference to the origins of the stimuli which generated the responses. Thus, children would be grouped into opinion categories defined by similarities in response patterns without using attributes of the displays that generated the responses as grouping criteria.

The program finally used was based on a location-allocation algorithm.

The Location-Allocation Method of Subgrouping

The grouping dilemma is as ubiquitous as science itself, since without grouping the researcher is always dealing with extremes, either

the gross sample or individual items within the sample; subsets of the sample remain hidden. Essentially, the problem is always the same; a number of observations in terms of several variables need to be grouped according to similarities in the arrangement or weighting of intra-observation variable lists. If amongst the total sample there are observations in which the constituent variables all have the same values, then grouping is a simple matter and may be done by visual scanning. This, however, seldom happens. The more usual case involves clustering observations on a "best fit" basis and that is the approach taken here. The technique seems to work well and is particularly useful with large data sets.

The number of subgroups desired is specified in advance; in the present case, ten were asked for, lest each school from which a sample was drawn should turn out to be an opinion group in itself. The rationale behind the technique is as follows:

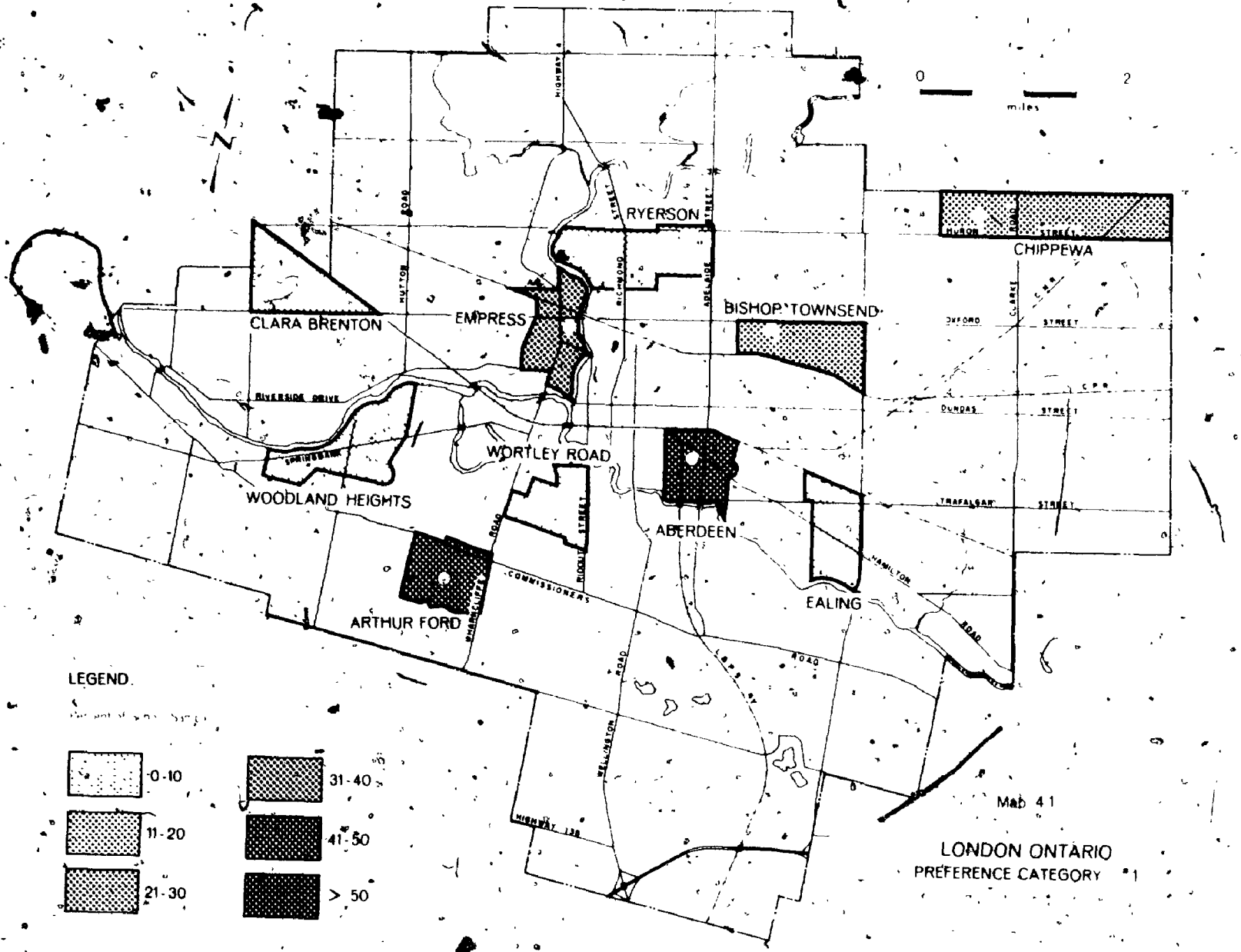
> Let the number of groups required be m, the number of variables n and the number of observations N. We begin by generating m random points in n- dimensional attribute space, within the observed range of the data....An allocation [of the data observations] is made next by assigning each of the N sample points to the nearest random point or 'centre'. For binary data, the distance between two points is simply the number of dissimilar attributes. As a result of the allocation each centre receives a certain number of points. Centres are then relocated so that they are central to the allocated groups and therefore are as similar to them as possible. The point chosen must be that which minimizes the aggregate distance from the centre to the observations in the group. Having relocated each centre in this way, the observations are now reallocated, and the cycle of location and allocation repeated until no further change occurs, usually within ten cycles.
>
> (Goodchild, 1973, pp. 2-3)

The entire data set was partitioned using the above method and the membership of each preference category was mapped by school. The

results are shown in Maps 4.1 through 4.10. It will be remembered that the pairwise combinations of slides used during data collection were changed four times for reasons stated earlier. Thus, any particular combination was used in more than one school. The schools in which exactly similar pairwise arrangements were used were:

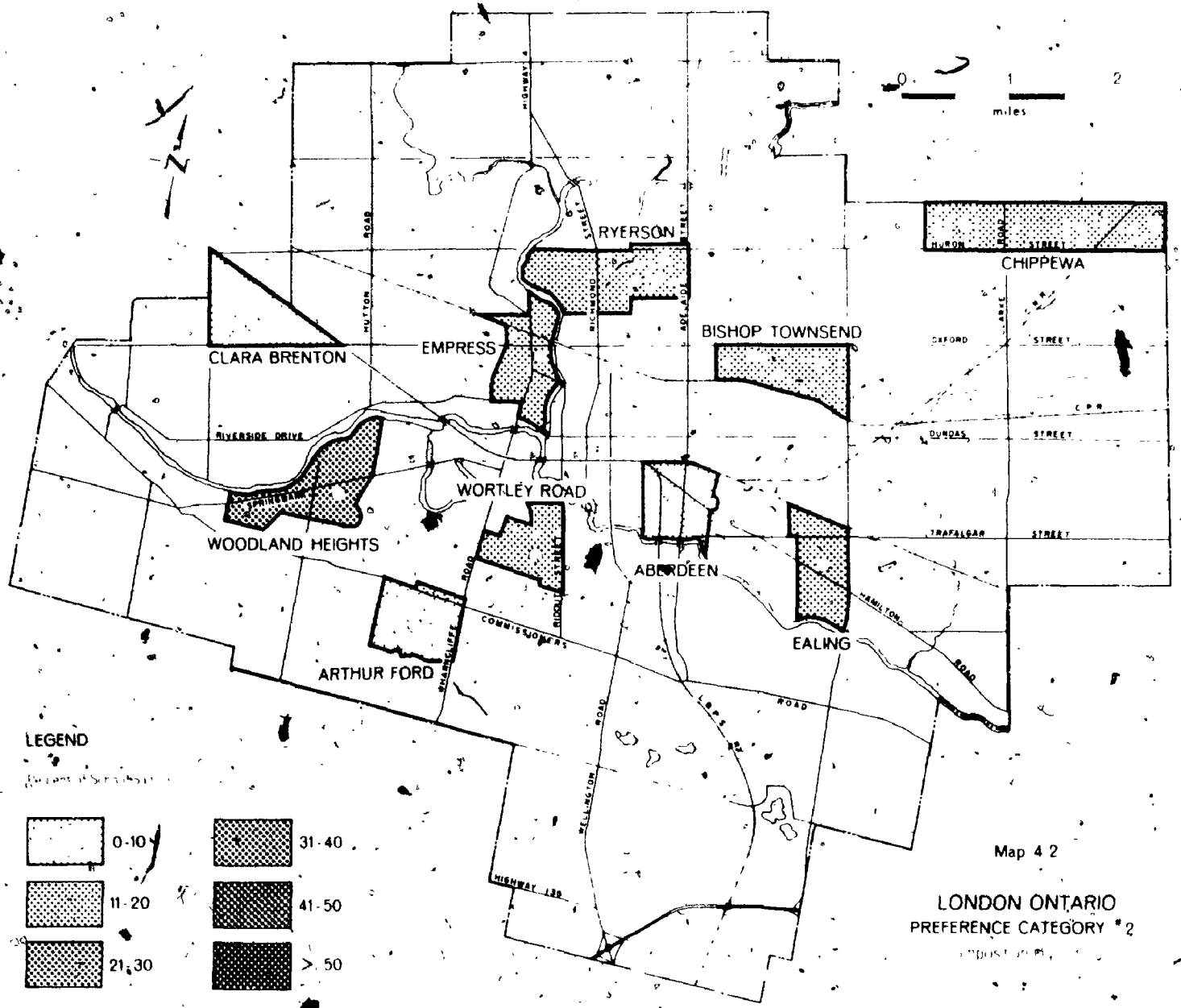
Slide Arrangement	School Group
1	1. Woodland Heights, Wortley Road
2	2. Arthur Ford and Aberdeen
3	3. Clara Brenton, Ryerson and Ealing
4	4. Empress, Bishop Townsend, Chippewa

An examination of Maps 4.1 through 4.10 shows that some pattern exists in the percentage of the school samples falling into any one preference category and that this pattern follows the above groupings of schools quite closely. Thus, School Group 1 is strongly represented in Preference Category 4, moderately represented in Categories 2 and 6 and weakly represented in all others. School Group 2 predominates in Preference Category 1, is moderately present in Category 5 and is weak in all others. Preference Category 7 is dominated by Group 3 schools which show a moderate presence in Categories 3 and 6 and are marginally represented in all other categories. Children from Group 4 schools are most heavily represented in Preference Category 1 with moderate representation in Categories 2, 3 and 8 and are weak in all other categories. This suggests that the actual pairing of slides was an important determinant of revealed preference patterns. Since slides were always paired on the basis of the functional designation of the streets involved, the conclusion that must be drawn is that characteristics of street scenes other than their functional character as traffic routes were important



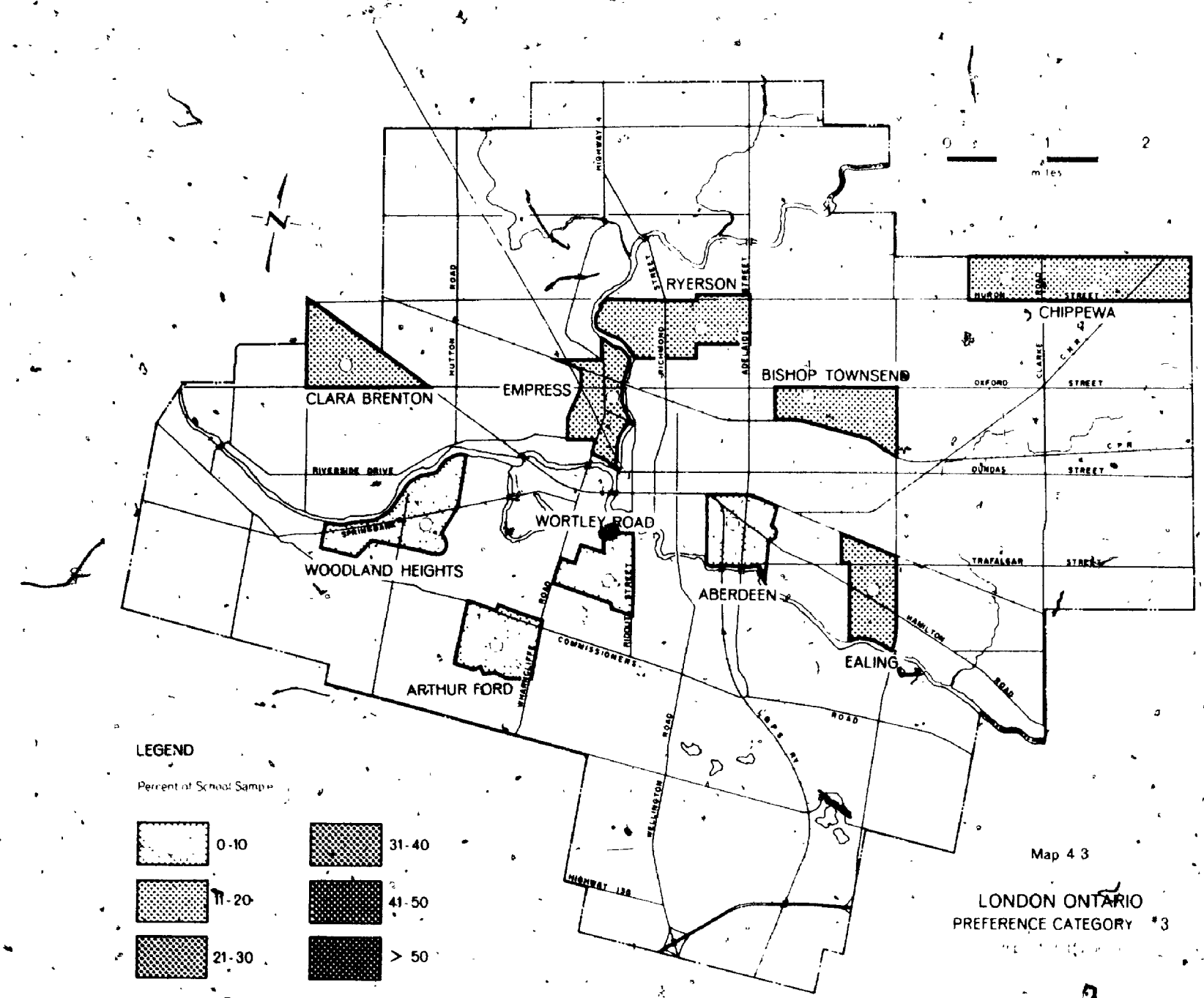
Map 4.1

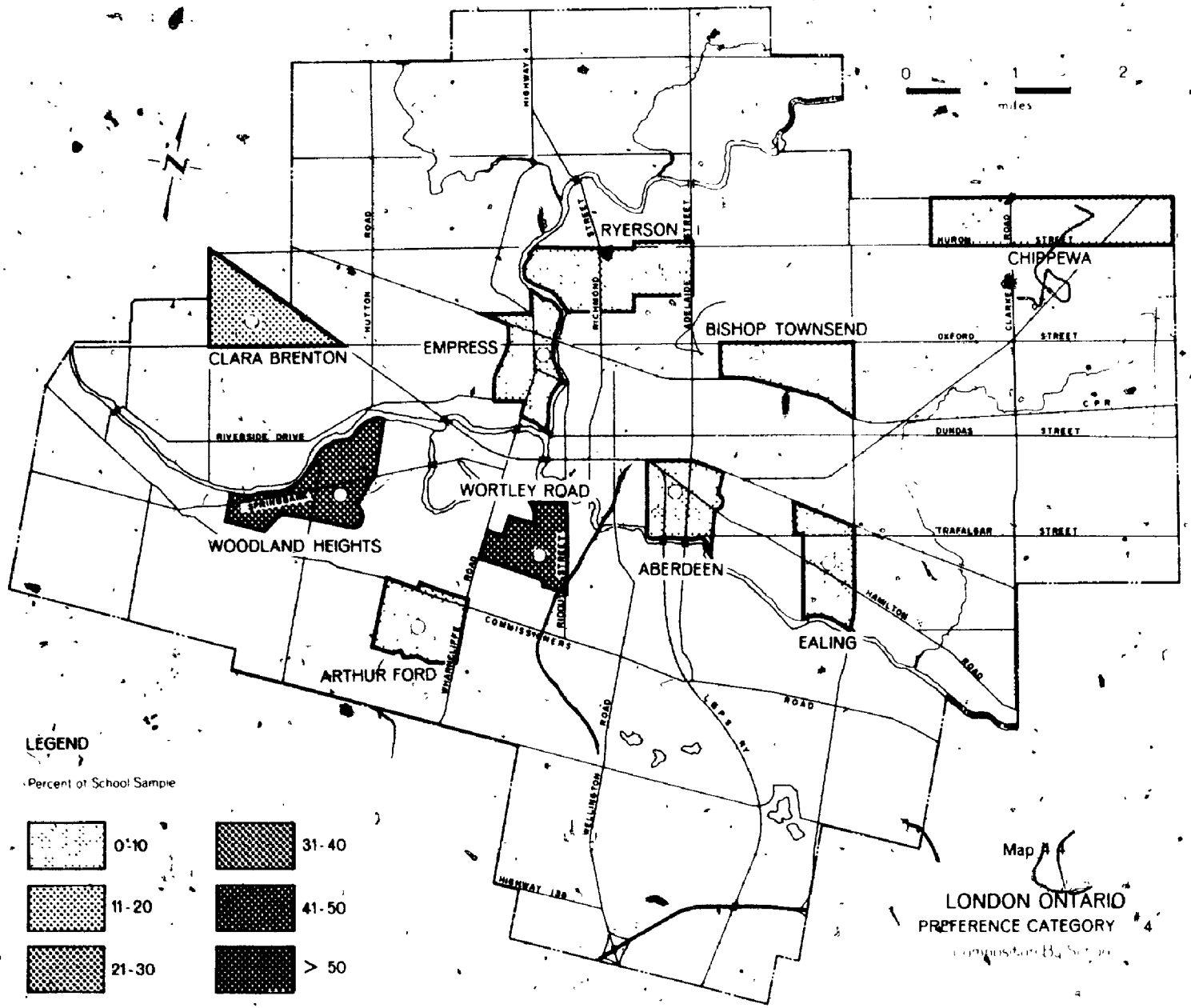
LONDON ONTARIO
PREFERENCE CATEGORY #1

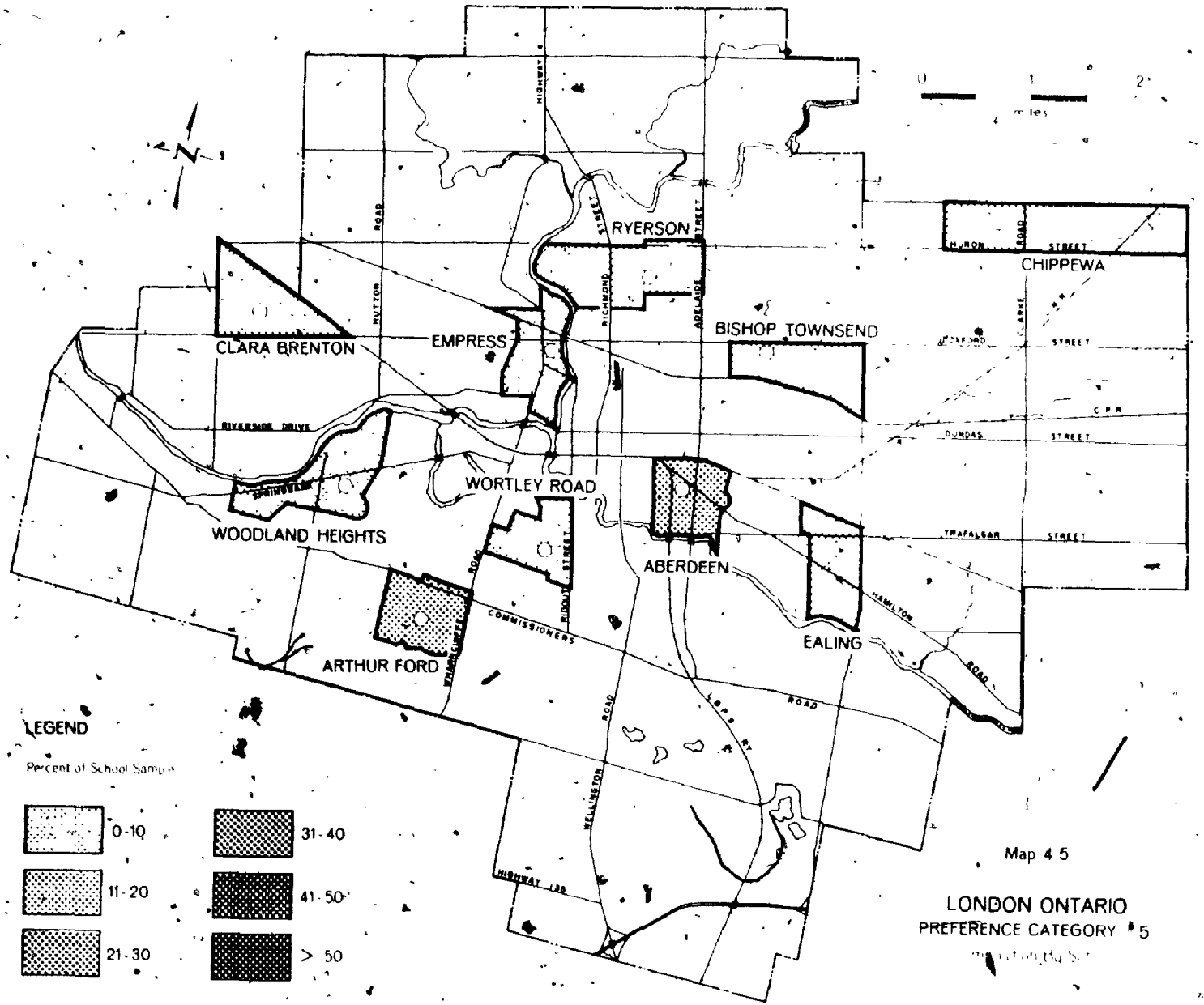


Map 4.2

LONDON ONTARIO
PREFERENCE CATEGORY #2

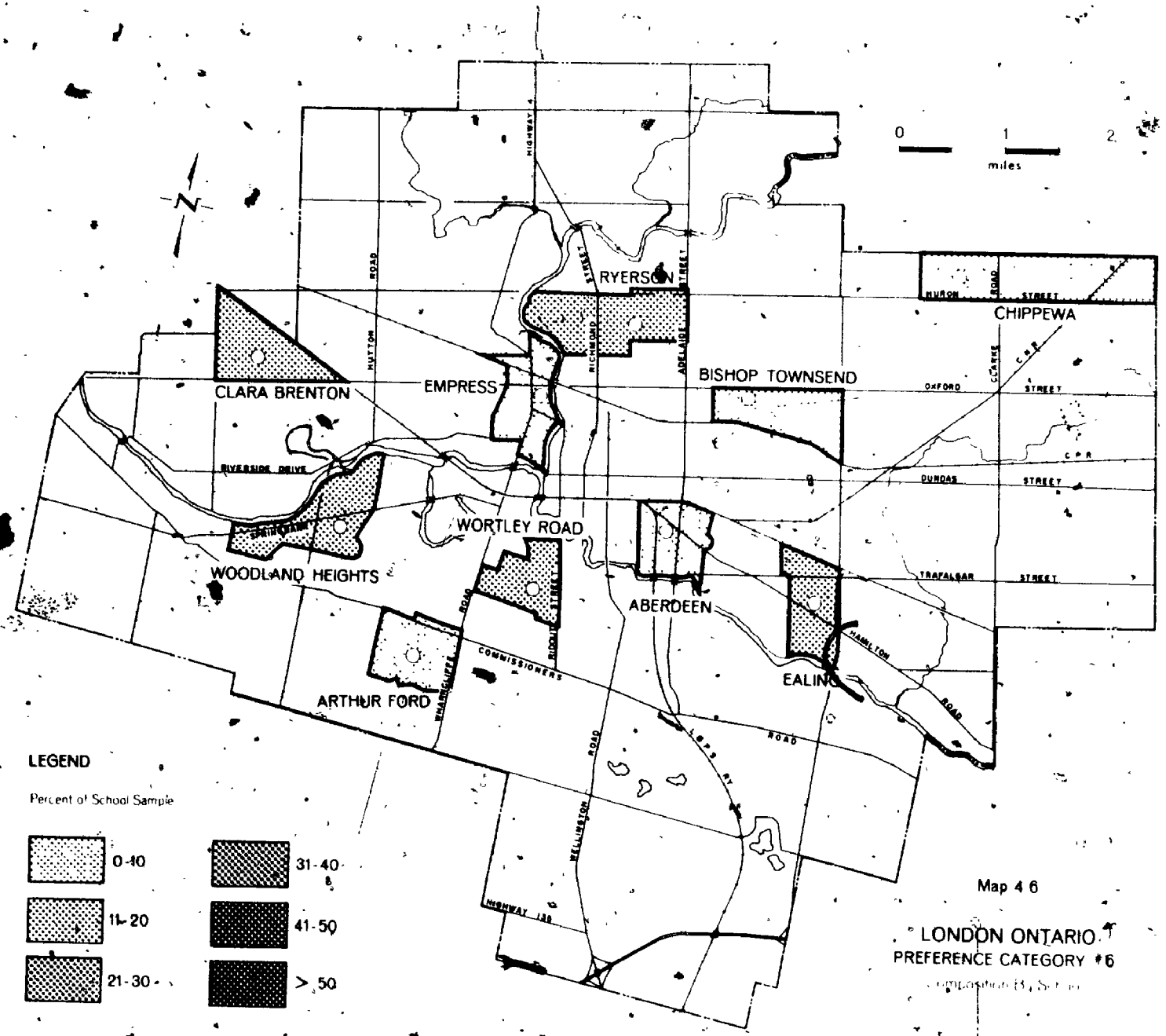

0 1 2
miles
N
RYERSON
CHIPPEWA
BISHOP TOWNSEND
EMPRESS
CLARA BRENTON
WORTLEY ROAD
WOODLAND HEIGHTS
ABERDEEN
EALING
ARTHUR FORD
HIGHWAY
RICHMOND STREET
ADELAIDE STREET
HURON STREET
OXFORD STREET
DUNDAS STREET
TRAFALGAR STREET
CPR
RIVERSIDE DRIVE
SPRINGBANK
HUTTON ROAD
WHARNCLIFFE ROAD
BURBRIDGE STREET
COMMISSIONERS ROAD
HAMILTON ROAD
WELLINGTON ROAD
HIGHWAY 126
LEGEND
Percent of School Sample
0-10
11-20
21-30
31-40
41-50
> 50
Map 4 3
LONDON ONTARIO
PREFERENCE CATEGORY #3


0 1 2
miles
N
RYERSON
CHIPPEWA
BISHOP TOWNSEND
CLARA BRENTON
EMPRESS
WORTLEY ROAD
WOODLAND HEIGHTS
ABERDEEN
EALING
ARTHUR FORD
HURON STREET
OXFORD STREET
DUNDAS STREET
TRAFALGAR STREET
RIVERSIDE DRIVE
HUTTON ROAD
RICHMOND STREET
ADELAIDE STREET
CLARENCE STREET
WELLINGTON ROAD
HIGHBURY AVENUE
COMMISSIONERS ROAD
HAMILTON ROAD
LEGEND
Percent of School Sample
0-10
11-20
21-30
31-40
41-50
> 50
Map A 4
LONDON ONTARIO
PREFERENCE CATEGORY 4



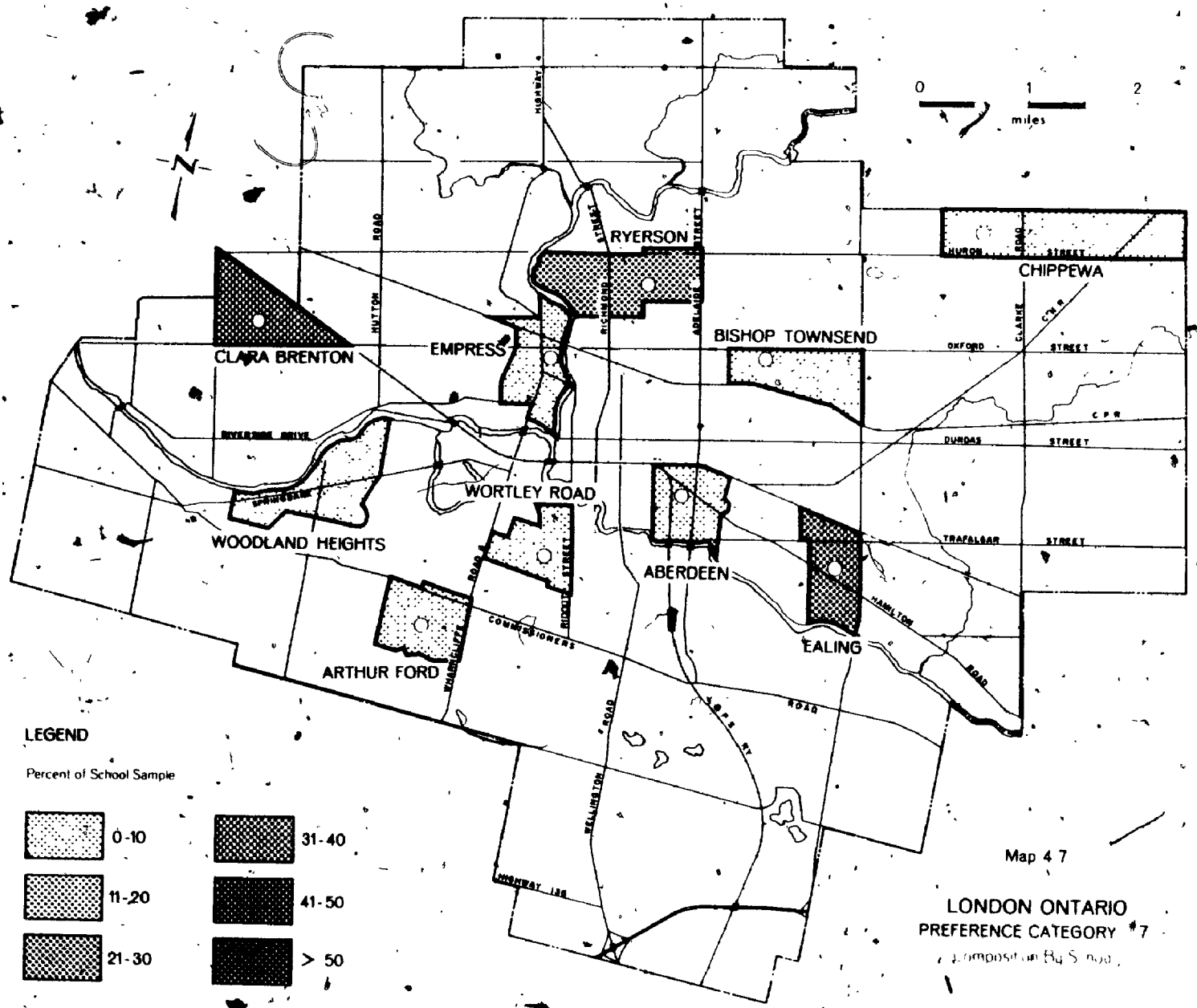
Map 4 5

LONDON ONTARIO
PREFERENCE CATEGORY # 5



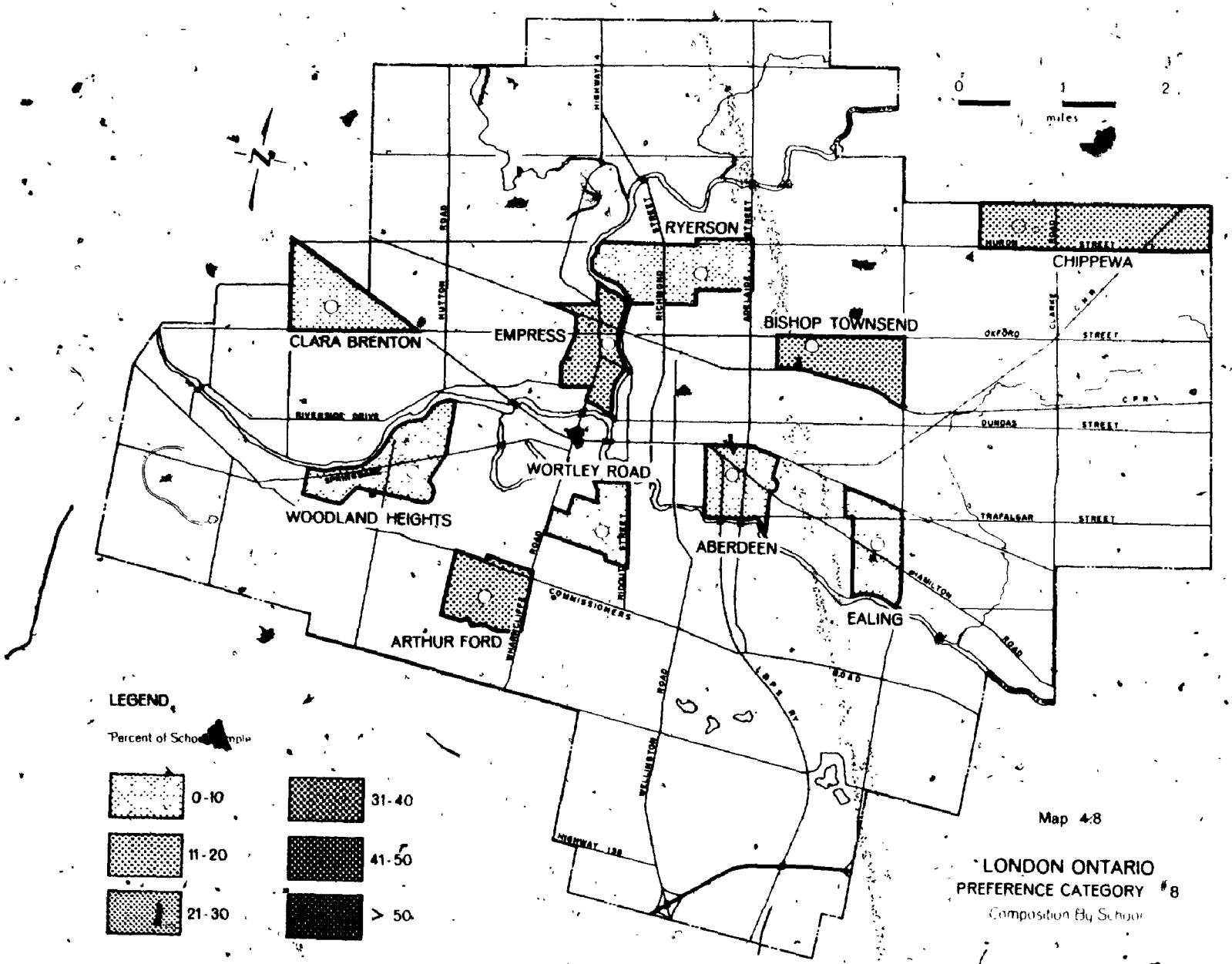
Map 4 6

LONDON ONTARIO
PREFERENCE CATEGORY #6



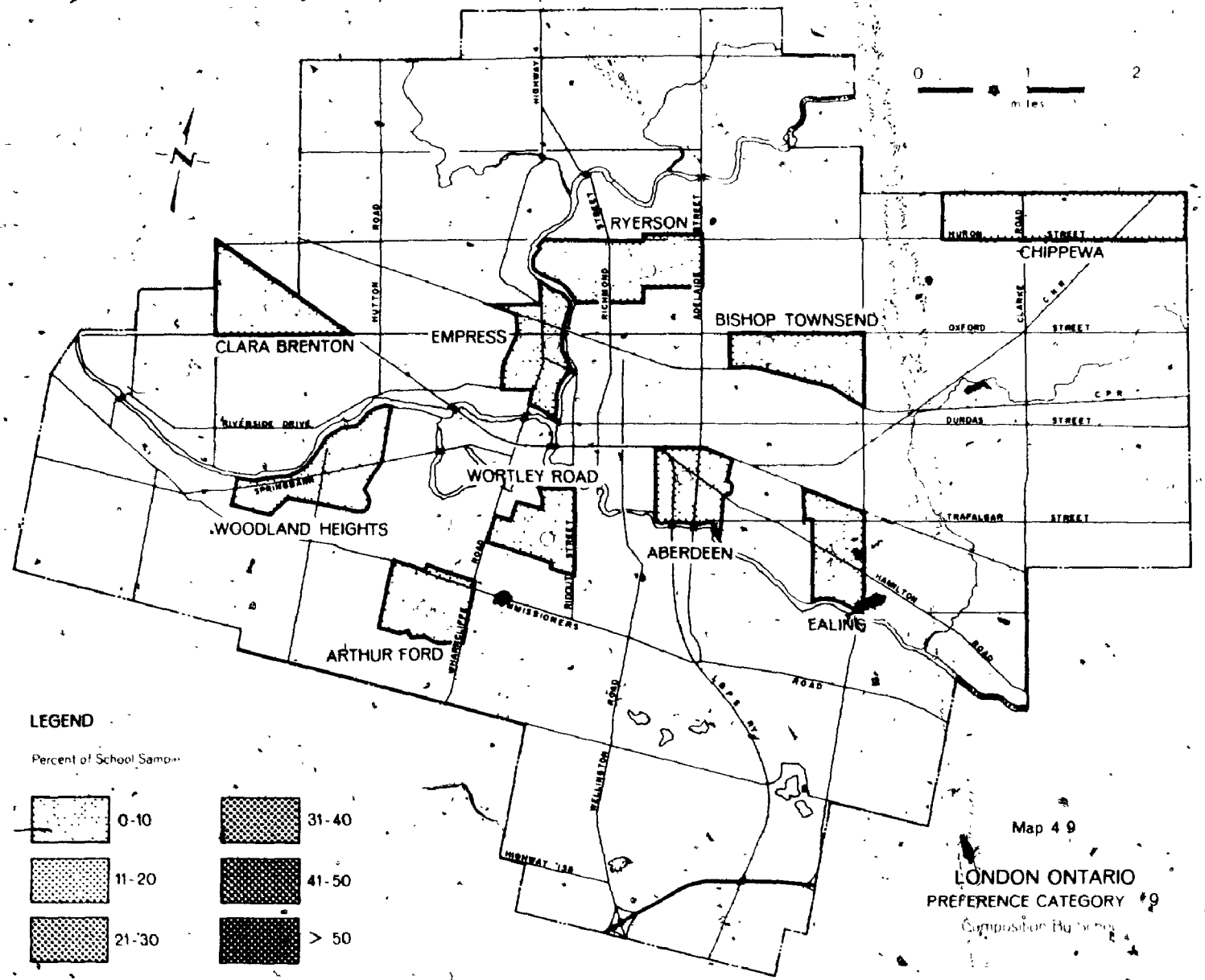
Map 4 7

LONDON ONTARIO
PREFERENCE CATEGORY #7
Composition By Sex



Map 4-8

LONDON ONTARIO
PREFERENCE CATEGORY #8
Composition By School

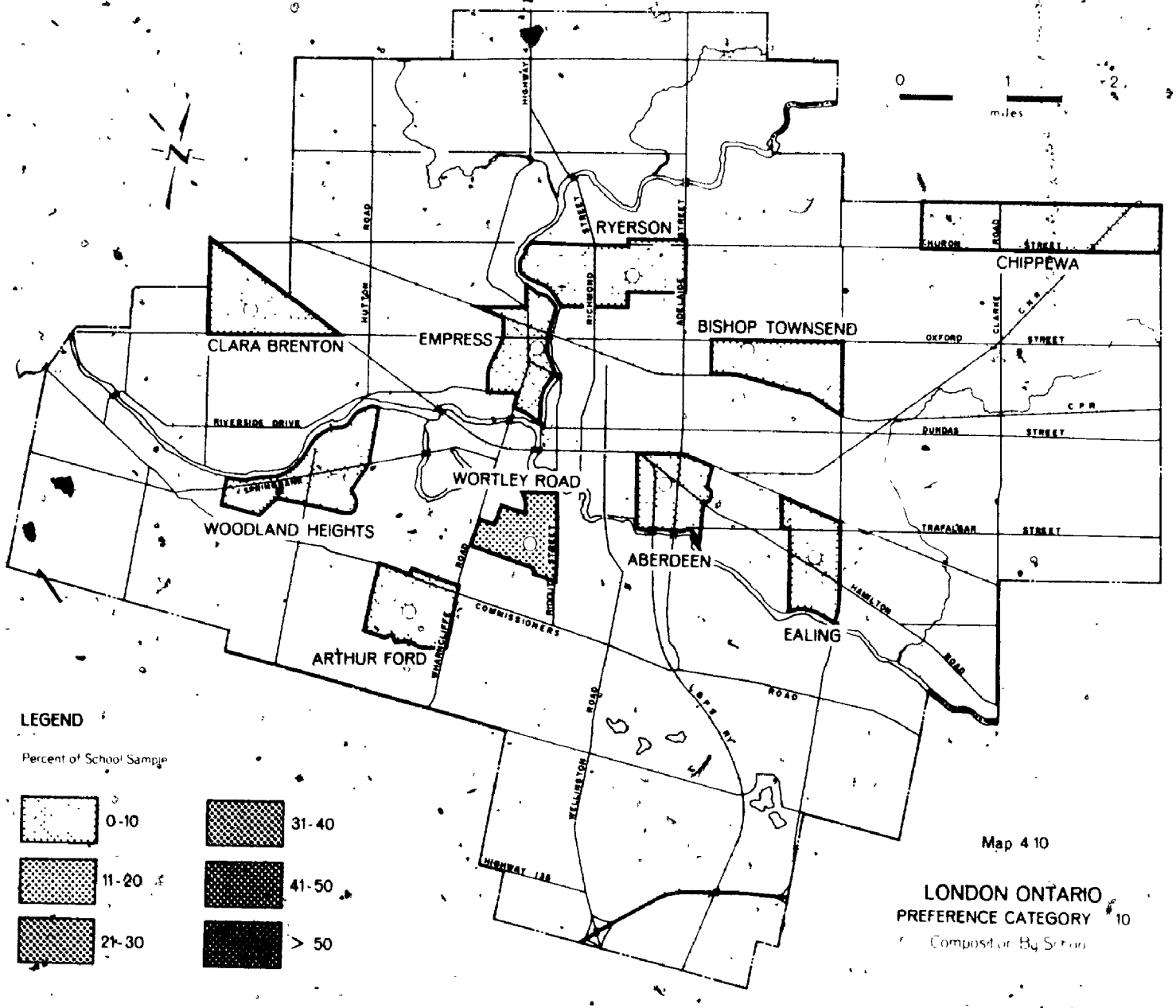


Map 4.9

LONDON ONTARIO

PREFERENCE CATEGORY #9

Composition By Sex



Map 4.10

LONDON ONTARIO
PREFERENCE CATEGORY 10
Composite By Score

TABLE 4.3

Paired Comparison Analysis - Opinion Categories of Total Sample

OPINION CATEGORY	CONSENSUS RANKING	COEFFICIENT OF CONCORDANCE W	SNEDECOR'S F	DEGREES OF FREEDOM		LEVEL OF SIGNIFI-CANCE	NUMBER OF SUBJECTS	PERCENT OF TOTAL SAMPLE (t)
				Greater Estimate	Lesser Estimate			
1	35162748	.2193	124.138	6.995	3092.005	.001	455	17.13
2	14268753	.2682	134.118	6.995	2560.005	.001	397	14.94
3	32416758	.3120	97.025	6.991	1496.009	.001	220	8.28
4	41253876	.3020	214.551	6.996	3470.004	.001	523	19.69
5	18357624	.2266	51.272	6.989	1223.011	.001	180	6.78
6	82317456	.1020	22.263	6.990	1370.010	.001	207	7.79
7	43721685	.2217	85.182	6.993	2091.007	.001	313	11.78
8	45283716	.2043	42.103	6.988	1146.012	.001	172	6.48
9	41735268	.1531	13.556	6.974	523.026	.001	84	3.16
10	14237865	.2846	38.984	6.980	684.020	.001	105	3.95
						TOTAL	2656 (t)	100

SOURCE: T. J. Underwood

influences in the subjects' choices.

Each preference category was analyzed using Program PCOMP. The minimum acceptable Coefficient of Consistency was set at 0.1. The rationale for this was that a higher α level would have automatically excluded all of those children in Subgroup B from the analysis and this was considered undesirable if a consensus for the maximum possible number of children in each preference category was to be obtained. The results of this particular analysis are shown in Table 4.3. A comparison of Tables 4.2 and 4.3 reveals that, while Table 4.2 shows two groupings with very low values for the Coefficient of Concordance (W), no such low values appear in Table 4.3. It will also be noted that although one group in Table 4.2 yields a W value which is not significant, there are no such values in Table 4.3. It was, therefore, concluded that the opinion categories derived from the Location-Allocation algorithm were satisfactorily homogeneous opinion subgroups of the total sample. Although intra-group agreement as reflected in the values of W are relatively high for such large numbers of subjects judging multi-dimensional phenomena, the intergroup consensus rankings do not display any easily discernible communality of preference across the total sample. However, if each street type is tabulated against its rank for all ten opinion categories as in Table 4.4, some communality does emerge. In Table 4.5, the numbers of times each street type has been ranked in the first four positions and the second four positions have been aggregated. It will be noted that streets which normally carry heavy traffic loads (types 1 to 4) predominate in the first four preferred ranks and local residential streets are more often relegated to

TABLE 4.4

Ranks of Street Types from Opinion Categories

Street Type	Number of Occurrences of Each Rank							
	1	2	3	4	5	6	7	8
1	3	2	1	2	1		1	
2		2	4	1	1	1	1	
3	2	1	2	2	2			1
4	4	2	1			1	1	1
5		2		2	1		3	2
6				2	1	2	2	3
7			2		3	4	1	
8	1	1		1	1	2	1	3

Source: T. J. Underwood

TABLE 4.5

Aggregation of Ranks from Opinion Groups

Street Type	Ranks 1 to 4	Ranks 5 to 8
1	8	2
2	7	3
3	7	3
4	7	3
5	4	6
6	2	8
7	2	8
8	3	7

Source: T. J. Underwood

the last four ranks. However, as has been hypothesized earlier, it may be that rankings resulted from judgments based on criteria other than the functional designation of streets. For this reason, the possible connections between physical attributes of environmental displays and preference will be pursued in greater detail in Chapters V and VI.

Socio-Cultural Influences on Preference Patterns.

In order to test whether certain socio-cultural phenomena influenced the preference patterns of the subjects, the following procedure was undertaken. The opinion categories derived from the Location-Allocation algorithm were assumed to represent the best possible groupings of the subjects according to preference for various kinds of city streets with differing combinations of physical attributes. It was postulated that a child's membership in one of the ten preference categories obtained from the Location-Allocation routine might be partially determined by certain socio-cultural aspects of his background. Chronological age, educational level, sex, type of street on which the child's home is located and school attended were thought to be factors which might be significant determinants of preference patterns. Five hypotheses were formulated to test these assumptions using Chi-square analysis. These are treated individually below. In preparing the data for analysis, it was discovered that a small number of subjects fell below seven years of age, above fifteen years of age or lived on Type 2 streets. Because their inclusion in the cross-tabulation would have created problems due to large numbers of zero entry cells, they were eliminated from the analysis. Sixty-two subjects were involved thus

TABLE 4.6

CROSSTABULATION----CATEGORY AGAINST SCHOOL TO SEX

FILE NONAME (CREATION DATE = 23/11/75)

* * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * * *
CATEG BY AGE
* PAGE 1 OF 2

CATEG	AGE: COUNT / ROW PCT / COL PCT / TOT PCT	7	8	9	10	11	12	13	14	15	ROW TOTAL
1	COUNT	23	41	62	84	78	61	51	33	10	443
	ROW PCT	5.2	9.3	14.0	19.0	17.6	13.8	11.5	7.4	2.3	17.1
	COL PCT	22.1	17.8	19.0	19.5	19.7	14.6	12.6	13.8	20.8	
	TOT PCT	.9	1.6	2.4	3.2	3.0	2.4	2.0	1.3	.4	
2	COUNT	12	35	47	66	58	60	56	42	6	382
	ROW PCT	3.1	9.2	12.3	17.3	15.2	15.7	14.7	11.0	1.6	14.7
	COL PCT	11.5	15.2	14.4	15.3	14.7	14.4	13.8	17.6	12.5	
	TOT PCT	.5	1.3	1.8	2.5	2.2	2.3	2.2	1.6	.2	
3	COUNT	13	24	28	38	41	29	26	9	3	211
	ROW PCT	6.2	11.4	13.3	18.0	19.4	13.7	12.3	4.3	1.4	8.1
	COL PCT	12.5	10.4	8.6	8.8	10.4	7.0	6.4	3.8	6.3	
	TOT PCT	.5	.9	1.1	1.5	1.6	1.1	1.0	.3	.1	
4	COUNT	11	35	50	49	57	95	124	80	15	516
	ROW PCT	2.1	6.8	9.7	9.5	11.0	18.4	24.0	15.5	2.9	19.9
	COL PCT	10.6	15.2	15.3	11.4	14.4	22.8	30.6	33.5	31.3	
	TOT PCT	.4	1.3	1.9	1.9	2.2	3.7	4.8	3.1	.6	
5	COUNT	13	18	26	39	17	30	14	19	8	184
	ROW PCT	7.1	9.8	14.1	21.2	9.2	16.3	7.6	10.3	4.3	7.1
	COL PCT	12.5	7.8	8.0	9.1	4.3	7.2	3.5	7.9	16.7	
	TOT PCT	.5	.7	1.0	1.5	.7	1.2	.5	.7	.3	
6	COUNT	3	14	23	33	32	38	38	20	2	203
	ROW PCT	1.5	6.9	11.3	16.3	15.8	18.7	18.7	9.9	1.0	7.8
	COL PCT	2.9	6.1	7.1	7.7	8.1	9.1	9.4	8.4	4.2	
	TOT PCT	.1	.5	.9	1.3	1.2	1.5	1.5	.8	.1	
7	COUNT	11	16	39	55	59	55	49	15	2	301
	ROW PCT	3.7	5.3	13.0	18.3	19.6	18.3	16.3	5.0	.7	11.6
	COL PCT	10.6	7.0	12.0	12.8	14.9	13.2	12.1	6.3	4.2	
	TOT PCT	.4	.6	1.5	2.1	2.3	2.1	1.9	.6	.1	
COLUMN TOTAL		104	230	326	430	395	417	405	239	48	2594
		4.0	8.9	12.6	16.6	15.2	16.1	15.6	9.2	1.9	100.0

(CONTINUED)

TABLE 4.7

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SFx

* CROSSTABULATION OF CATEG BY GRADE * PAGE 2 OF 2

GRADE

CATEG	COUNT / ROW PCT / COL PCT / TOT PCT	2	3	4	5	6	7	8	ROW TOTAL
8		18	37	26	33	24	21	14	173
		10.4	21.4	15.0	19.1	13.9	12.1	8.1	6.7
		8.5	12.1	6.4	8.0	5.7	4.6	3.8	
		.7	1.4	1.0	1.3	.9	.8	.5	
9		7	16	8	15	18	9	6	79
		8.9	20.3	10.1	19.0	22.8	11.4	7.6	3.0
		3.3	5.2	2.0	3.6	4.2	2.0	1.4	
		.3	.6	.3	.6	.7	.3	.2	
10		10	18	10	16	17	20	15	102
		9.8	13.7	9.8	15.7	16.7	19.6	14.7	3.9
		4.7	4.6	2.5	3.9	4.0	4.3	4.0	
		.4	.5	.4	.6	.7	.8	.6	
COLUMN TOTAL		211	384	406	414	424	460	373	2594
		8.1	11.8	15.7	16.0	16.3	17.7	14.4	100.0

RAW CHI SQUARE = 232.86394 WITH 50 DEGREES OF FREEDOM. SIGNIFICANCE = .0000

reducing the effective sample from 2,656 to 2,594. Since they made up only slightly over two percent of the total sample, it was felt that the advantages gained from their exclusion far outweighed any possible advantage accruing from their presence in the analysis.

Chi-Square Analysis--Socio-Cultural Characteristics

Null Hypothesis #1 - There is no relationship between chronological age of the subject and his membership in a preference category.

Children's ages were cross-tabulated against preference category and subjected to Chi-square analysis. Table 4.6 shows the resultant contingency table and Chi-square statistics. As can be seen, the null hypothesis is rejected at an extremely high level of significance (beyond .0001). It can, therefore, be assumed with a high degree of statistical certainty that the age of a child does influence the preference category to which he belongs.

Null Hypothesis #2 - No relationship exists between educational level and preference category.

Table 4.7 displays the contingency matrix and Chi-square statistics obtained by cross-tabulating the subjects' grade level against preference category. The null hypothesis is rejected at the .0001 level of significance. This suggests that educational level attained does influence the preference pattern of the subject as indicated by the preference category to which he belongs.

Null Hypothesis #3 - No significant relationship exists between the sex of a subject and the preference category to which he belongs.

The contingency matrix and Chi-square statistics shown in Table 4.8 were obtained by cross-tabulating sex of subject against preference

TABLE 4.6

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SEX

FILE NONAME (CREATION DATE = 23/11/75)

* C R O S S T A B U L A T I O N O F *

CATEG BY AGE

* PAGE 1 OF 2

CATEG	AGE: COUNT / ROW PCT / COL PCT / TOT PCT	7	8	9	10	11	12	13	14	15	ROW TOTAL
1	COUNT	23	41	62	84	78	61	51	33	10	443
	ROW PCT	5.2	9.3	14.0	19.0	17.6	13.8	11.5	7.4	2.3	17.1
	COL PCT	22.1	17.8	19.0	19.5	19.7	14.6	12.6	13.8	20.8	
	TOT PCT	.9	1.6	2.4	3.2	3.0	2.4	2.0	1.3	.4	
2	COUNT	12	35	47	66	58	60	56	42	6	382
	ROW PCT	3.1	9.2	12.3	17.3	15.2	15.7	14.7	11.0	1.6	14.7
	COL PCT	11.5	15.2	14.4	15.3	14.7	14.4	13.8	17.6	12.5	
	TOT PCT	.5	1.3	1.8	2.5	2.2	2.3	2.2	1.6	.2	
3	COUNT	13	24	28	38	41	29	26	9	3	211
	ROW PCT	6.2	11.4	13.3	18.0	19.4	13.7	12.3	4.3	1.4	8.1
	COL PCT	12.5	10.4	8.6	8.8	10.4	7.0	6.4	3.8	6.3	
	TOT PCT	.5	.9	1.1	1.5	1.6	1.1	1.0	.3	.1	
4	COUNT	11	35	50	49	57	95	124	80	15	516
	ROW PCT	2.1	6.8	9.7	9.5	11.0	18.4	24.0	15.5	2.9	19.9
	COL PCT	10.6	15.2	15.3	11.4	14.4	22.8	30.6	33.5	31.3	
	TOT PCT	.4	1.3	1.9	1.9	2.2	3.7	4.8	3.1	.6	
5	COUNT	13	18	26	39	17	30	14	19	8	184
	ROW PCT	7.1	9.8	14.1	21.2	9.2	16.3	7.6	10.3	4.3	7.1
	COL PCT	12.5	7.8	8.0	9.1	4.3	7.2	3.5	7.9	16.7	
	TOT PCT	.5	.7	1.0	1.5	.7	1.2	.5	.7	.3	
6	COUNT	3	14	23	33	32	38	38	20	2	203
	ROW PCT	1.5	6.9	11.3	16.3	15.8	18.7	18.7	9.9	1.0	7.8
	COL PCT	2.9	6.1	7.1	7.7	8.1	9.1	9.4	8.4	4.2	
	TOT PCT	.1	.5	.9	1.3	1.2	1.5	1.5	.8	.1	
7	COUNT	11	16	39	55	59	55	49	15	2	301
	ROW PCT	3.7	5.3	13.0	18.3	19.6	18.3	16.3	5.0	.7	11.6
	COL PCT	10.6	7.0	12.0	12.8	14.9	13.2	12.1	6.3	4.2	
	TOT PCT	.4	.6	1.5	2.1	2.3	2.1	1.9	.6	.1	
	COLUMN TOTAL	104	230	326	430	395	417	405	239	48	2594
		4.0	8.9	12.6	16.6	15.2	16.1	15.6	9.2	1.9	100.0

(CONTINUED)

TABLE 4.6

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SEX

* CROSSTABULATION OF CATEG BY AGE * PAGE 2 OF 2

CATEG	COUNT / ROW PCT / COL PCT / TOT PCT	AGE 7	8	9	10	11	12	13	14	15	ROW TOTAL
A		9	20	26	36	22	20	25	5	1	173
		5.2	11.6	15.0	20.8	12.7	11.6	14.5	2.9	.6	6.7
		8.7	12.6	8.0	8.4	5.6	4.8	6.2	2.1	2.1	
		.3	1.1	1.0	1.4	.8	.8	1.0	.2	.0	
9		2	9	13	13	18	10	7	7	0	79
		2.5	11.4	16.5	16.5	22.8	12.7	8.9	8.9	0.0	3.1
		1.9	3.9	4.0	3.0	4.6	2.4	1.7	2.9	0.0	
		.1	.3	.5	.5	.7	.4	.3	.3	0.0	
10		7	9	12	17	15	19	15	9	1	105
		6.9	8.8	11.8	16.7	12.7	18.6	14.7	8.8	1.0	3.9
		6.7	3.9	3.7	4.0	3.3	4.6	3.7	3.4	2.1	
		.3	.3	.5	.7	.5	.7	.6	.3	.0	
COLUMN TOTAL		108	230	324	430	395	417	405	230	48	2587
		4.0	8.9	12.6	16.6	15.2	16.1	15.6	9.2	1.9	100.0

RAW CHI SQUARE = 204.52513 WITH 72 DEGREES OF FREEDOM. SIGNIFICANCE = .0000

TABLE 4.7

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SEX

* CROSSTABULATION OF *
CATEG BY GRADE
* PAGE 1 OF 2

CATEG	COUNT / ROW PCT / COL PCT / TOT PCT	GRADE 1	2	3	4	5	6	7	8	ROW TOTAL
1		46	55	84	86	80	45	47		443
		10.4	12.4	19.0	19.4	18.1	10.2	10.6		17.1
		21.8	18.0	20.7	20.8	18.9	9.8	12.6		
		1.8	2.1	3.2	3.3	3.1	1.7	1.8		
2		28	41	70	53	65	67	58		382
		7.3	10.7	18.3	13.9	17.0	17.5	15.2		14.7
		13.3	13.4	17.2	12.8	15.3	14.6	15.5		
		1.1	1.6	2.7	2.0	2.5	2.6	2.2		
3		25	28	37	39	40	27	15		211
		11.8	13.3	17.5	18.5	19.0	12.8	7.1		8.1
		11.8	9.2	9.1	9.4	9.4	5.9	4.0		
		1.0	1.1	1.4	1.5	1.5	1.0	.6		
4		87	38	61	48	49	150	127		516
		5.2	7.4	11.8	10.5	11.4	29.1	24.6		19.9
		12.8	12.4	15.0	13.0	13.9	32.6	34.0		
		1.0	1.5	2.4	2.1	2.3	5.8	4.9		
5		21	28	32	28	25	29	25		184
		11.4	15.2	17.4	15.0	13.6	15.8	13.6		7.1
		10.0	9.2	7.9	5.8	5.9	6.3	6.7		
		.8	1.1	1.2	.9	1.0	1.1	1.0		
6		9	23	29	29	33	45	35		203
		4.4	11.3	14.3	14.3	16.3	22.2	17.2		7.8
		4.3	7.6	7.1	7.0	7.8	9.8	9.4		
		.3	.8	1.1	1.1	1.3	1.7	1.3		
7		20	26	49	45	43	47	31		301
		6.6	8.6	16.3	21.6	20.9	15.6	10.3		11.6
		9.5	8.5	12.1	15.7	14.9	10.2	8.3		
		.8	1.0	1.9	2.3	2.4	1.8	1.2		
COLUMN TOTAL		211	306	406	418	424	460	373		2594
		8.1	11.8	15.7	16.0	16.3	17.7	14.4		100.0

(CONTINUED)

TABLE 4.7

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SEX

* CROSSTABULATION OF *
CATEG BY GRADE
* PAGE 2 OF 2

CATEG	GRADE	2	3	4	5	6	7	8	ROW TOTAL
	8 COUNT	18	37	26	33	24	21	14	173
	ROW PCT	10.4	21.4	15.0	19.1	13.9	12.1	8.1	6.7
	COL PCT	8.5	12.1	6.4	8.0	5.7	4.6	3.8	
	TOT PCT	.7	1.4	1.0	1.3	.9	.8	.5	
	9 COUNT	7	16	8	15	18	9	6	79
	ROW PCT	8.9	20.3	10.1	19.0	22.8	11.4	7.6	3.0
	COL PCT	3.3	5.2	2.0	3.6	4.2	2.0	1.6	
	TOT PCT	.3	.6	.3	.6	.7	.3	.2	
	10 COUNT	10	14	10	16	17	20	15	102
	ROW PCT	9.8	13.7	9.8	15.7	16.7	19.6	14.7	3.9
	COL PCT	4.7	4.6	2.5	3.9	4.0	4.3	4.0	
	TOT PCT	.4	.5	.4	.6	.7	.8	.6	
	COLUMN TOTAL	211	306	406	418	424	460	373	2598
		8.1	11.8	15.7	16.0	16.3	17.7	14.4	100.0

RAW CHI SQUARE = 232.86394 WITH 54 DEGREES OF FREEDOM. SIGNIFICANCE = .0000

TABLE 4.8

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SEX

* CROSSTABULATION OF CATEG BY SEX *

CATEG	SEX 1	SEX 2	ROW TOTAL
1	221	222	443
	49.9	50.1	17.1
	17.2	17.0	
	8.5	8.6	
2	187	195	382
	49.0	51.0	14.7
	14.5	14.9	
	7.2	7.5	
3	93	118	211
	44.1	55.9	8.1
	7.2	9.0	
	3.6	4.5	
4	246	270	516
	47.7	52.3	19.9
	19.1	20.7	
	9.5	10.4	
5	90	94	184
	48.9	51.1	7.1
	7.0	7.2	
	3.5	3.6	
6	106	97	203
	52.2	47.8	7.8
	8.2	7.4	
	4.1	3.7	
7	147	154	301
	48.8	51.2	11.6
	11.4	11.8	
	5.7	5.9	
8	97	76	173
	56.1	43.9	6.7
	7.5	5.8	
	3.7	2.9	
9	46	33	79
	58.2	41.8	3.0
	3.6	2.5	
	1.8	1.3	
10	54	48	102
	52.9	47.1	3.9
	4.2	3.7	
	2.1	1.9	
COLUMN TOTAL	1287	1307	2594
	49.6	50.4	100.0

RAW CHI SQUARE = 9.78462 WITH 9 DEGREES OF FREEDOM, SIGNIFICANCE = .3682

(CONTINUED)

category. The null hypothesis is not rejected suggesting that sex of the subject has no significant bearing on the preference category to which the child will relate.

Null Hypothesis #4 - The type of street on which the child lives as determined by the official designation bears no relationship to the preference category into which the subject falls.

The results of cross-tabulating home street type against preference category for each subject are displayed in Table 4.9. The Chi-square score of 299.708, significant at .0001, warrants rejection of the null hypothesis. It can, therefore, be assumed that the official designation of home street type according to primary function does have a bearing on the preference children express for various street types as pedestrian travel routes.

Null Hypothesis #5 - No relationship exists between school attended by a subject and his expressed preferences for various types of city streets as pedestrian travel routes as indicated by the preference category into which he falls.

Cross-tabulating school attended against preference category for each subject gave the results depicted in Table 4.10. A Chi-square value of 2274.94, with 81 degrees of freedom, is sufficient to reject the null hypothesis at the .0001 level of significance. It might be contended, therefore, that school attended does affect the placement of a subject in a particular preference category. However, a caveat must be entered here. It is possible that the apparent influence of school on preference was induced by the methodology used in data collection. While displays used in each school were always the same, the pairwise

TABLE 4.9

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SEX

* * * * * * * * * C R O S S T A B U L A T I O N   O F * * * * * * * * *
CATEG BY STREET
* PAGE 1 OF 2

STREET 1

CATEG	COUNT / ROW PCT / COL PCT / TOT PCT	1	3	4	5	6	7	8	ROW TOTAL
1	COUNT	3	66	8	148	10	191	17	443
	ROW PCT	.7	14.9	1.8	33.4	2.3	43.1	3.8	17.1
	COL PCT	8.6	25.5	6.8	16.7	15.4	17.4	12.3	
	TOT PCT	.1	2.5	.3	5.7	.4	7.4	.7	
2	COUNT	4	30	26	139	10	140	33	382
	ROW PCT	1.0	7.9	6.8	36.4	2.6	36.6	8.6	14.7
	COL PCT	11.4	11.6	22.2	15.7	15.4	12.8	23.9	
	TOT PCT	.2	1.2	1.0	5.4	.4	5.4	1.3	
3	COUNT	3	23	3	93	4	78	7	211
	ROW PCT	1.4	10.9	1.4	44.1	1.9	37.0	3.3	8.1
	COL PCT	8.6	8.9	2.6	10.5	6.2	7.1	5.1	
	TOT PCT	.1	.9	.1	3.6	.2	3.0	.3	
4	COUNT	5	37	40	113	18	254	49	516
	ROW PCT	1.0	7.2	7.8	21.9	3.5	49.2	9.5	19.9
	COL PCT	14.3	14.3	34.2	12.8	27.7	23.2	35.5	
	TOT PCT	.2	1.4	1.5	4.4	.7	9.8	1.9	
5	COUNT	1	28	7	37	3	112	4	184
	ROW PCT	.5	10.9	3.8	20.1	1.6	60.9	2.2	7.1
	COL PCT	2.9	7.7	6.0	4.2	4.6	10.2	2.9	
	TOT PCT	.0	.8	.3	1.4	.1	4.3	.2	
6	COUNT	5	18	9	77	4	80	10	203
	ROW PCT	2.5	8.9	4.4	37.9	2.0	39.4	4.9	7.8
	COL PCT	14.3	6.9	7.7	8.7	6.2	7.3	7.2	
	TOT PCT	.2	.7	.3	3.0	.2	3.1	.4	
7	COUNT	11	26	7	137	8	108	4	301
	ROW PCT	3.7	8.6	2.3	45.5	2.7	35.9	1.3	11.6
	COL PCT	31.4	10.0	6.0	15.5	12.3	9.9	2.9	
	TOT PCT	.4	1.0	.3	5.3	.3	4.2	.2	
COLUMN TOTAL		35	259	117	884	65	1096	138	2594
		1.3	10.0	4.5	34.1	2.5	42.3	5.3	100.0

(CONTINUED)

TABLE 4.9

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SEX

* CROSSTABULATION OF *
CATEG BY STREET
* PAGE 2 OF 2

	STREET																					
CATEG	COUNT ROW PCT COL PCT TOT PCT	1		2		3		4		5		6		7		8		ROW TOTAL			
A		0		21		7		54		4		75		12				173			
		0.0		12.1		4.0		31.2		2.3		43.4		6.9				6.7			
		0.0		8.1		6.0		6.1		8.9		6.8		8.7							
		0.0		.8		.3		2.1		.2		2.9		.5							
9		2		6		3		48		2		17		1				79			
		2.5		7.6		3.8		60.8		2.5		21.5		1.3				3.0			
		5.7		2.3		2.6		5.4		3.1		1.6		.7							
		.1		.2		.1		1.9		.1		.7		.0							
10		1		12		7		38		2		41		1				102			
		1.0		11.8		6.9		37.3		2.0		40.2		1.0				3.9			
		2.9		4.6		6.0		4.3		3.1		3.7		.7							
		.0		.5		.3		1.5		.1		1.6		.0							
COLUMN TOTAL		35		259		117		886		65		1096		138				2594			
		1.3		10.0		4.5		34.1		2.5		42.3		5.3				100.0			

RAW CHI SQUARE = 229.70837 WITH 54 DEGREES OF FREEDOM. SIGNIFICANCE = .0000

TABLE 4.10

CROSSTABULATION--CATEGORY AGAINST SCHOOL TO SEX

* CROSSTABULATION OF *
CATEG BY SCHOOL
* PAGE 1 OF 2

CATEG	SCHOOL	1T	2I	3I	4I	5I	6I	7I	8I	9I	10I	ROW TOTAL
1	COUNT	99	105	15	5	15	44	77	33	1	9	443
	ROW PCT	22.3	32.7	3.4	1.1	3.4	9.9	17.4	7.4	.2	2.0	17.1
	COL PCT	57.2	40.2	5.3	3.5	4.2	25.1	33.3	12.1	.6	1.6	
	TOT PCT	3.8	5.6	.6	.2	.6	1.7	3.0	1.3	.0	.3	
2	COUNT	1	5	89	15	18	32	36	25	42	159	382
	ROW PCT	.3	1.3	12.8	3.9	4.7	8.4	9.4	6.5	11.0	41.6	14.7
	COL PCT	.6	1.7	17.4	10.8	7.4	18.3	15.6	9.2	18.4	28.9	
	TOT PCT	.0	.2	1.9	.8	.7	1.2	1.4	1.0	1.6	6.1	
3	COUNT	7	8	34	15	37	32	43	24	1	10	211
	ROW PCT	3.3	3.8	16.1	7.1	17.5	15.2	20.4	11.4	.5	4.7	8.1
	COL PCT	4.0	2.7	12.1	10.8	15.2	18.3	18.6	8.8	.4	1.8	
	TOT PCT	.3	.3	1.3	.6	1.4	1.2	1.7	.9	.0	.4	
4	COUNT	10	22	20	7	33	2	2	75	105	240	516
	ROW PCT	1.9	4.3	3.9	1.4	6.4	.4	.4	14.5	20.3	46.5	19.9
	COL PCT	5.8	7.5	7.1	4.9	13.6	1.1	.9	27.5	46.1	43.6	
	TOT PCT	.4	.8	.8	.3	1.3	.1	.1	2.9	4.0	9.3	
5	COUNT	26	38	5	3	4	4	12	68	9	10	184
	ROW PCT	14.1	21.2	2.7	1.6	2.2	2.2	6.5	37.0	4.9	7.6	7.1
	COL PCT	15.0	13.2	1.8	2.1	1.6	2.3	5.2	28.9	3.9	2.5	
	TOT PCT	1.0	1.5	.2	.1	.2	.2	.5	2.6	.3	.5	
4	COUNT	10	22	20	7	33	2	2	75	105	240	516
	ROW PCT	1.9	4.3	3.9	1.4	6.4	.4	.4	14.5	20.3	46.5	19.9
	COL PCT	5.8	7.5	7.1	4.9	13.6	1.1	.9	27.5	46.1	43.6	
	TOT PCT	.4	.8	.8	.3	1.3	.1	.1	2.9	4.0	9.3	
5	COUNT	26	38	5	3	4	4	12	68	9	10	184
	ROW PCT	14.1	21.2	2.7	1.6	2.2	2.2	6.5	37.0	4.9	7.6	7.1
	COL PCT	15.0	13.2	1.8	2.1	1.6	2.3	5.2	28.9	3.9	2.5	
	TOT PCT	1.0	1.5	.2	.1	.2	.2	.5	2.6	.3	.5	
6	COUNT	4	10	35	25	29	8	3	1	23	67	203
	ROW PCT	2.0	4.9	16.3	12.3	14.3	3.9	1.5	.5	11.3	33.0	7.8
	COL PCT	2.3	3.8	11.7	17.4	11.9	4.6	1.4	.4	10.1	12.2	
	TOT PCT	.2	.4	1.3	1.0	1.1	.3	.1	.0	.9	2.6	
7	COUNT	10	22	96	41	89	9	8	1	2	3	301
	ROW PCT	3.3	7.3	31.9	20.3	29.6	3.0	2.7	.3	.7	1.0	11.6
	COL PCT	5.8	7.5	38.2	42.8	34.6	5.1	3.5	.4	.9	.5	
	TOT PCT	.4	.4	3.7	2.8	3.4	.3	.1	.0	.1	.1	

(CONTINUED)

TABLE 6.10

CROSSTABULATION---CATEGORY AGAINST SCHOOL TO SEX

* C R O S S T A B U L A T I O N O F *

CATEG BY SCHOOL

* PAGE 2 OF 2

CATEG / SCHOOL	1T	2I	3I	4I	5I	6I	7I	8I	9I	10I	TOTAL
8	13	41	5	1	1	28	29	32	11	13	175
	7.5	23.7	2.9	.6	.6	16.2	16.8	18.5	6.4	7.5	6.7
	7.5	13.9	1.8	.7	.8	16.0	12.6	11.7	4.0	2.4	
	.5	1.6	.2	.0	.0	1.1	1.1	1.2	.4	.5	
9	0	1	14	6	2	13	18	5	8	12	79
	0.0	1.3	17.7	7.6	2.5	16.5	22.8	6.3	10.1	15.2	3.0
	0.0	.3	5.0	4.2	.8	7.4	6.6	1.8	3.5	2.2	
	0.0	.0	.5	.2	.1	.5	.7	.2	.3	.5	
10	3	2	10	6	15	3	3	9	27	24	102
	2.9	2.0	9.8	5.9	14.7	2.9	2.9	8.8	26.5	23.5	3.9
	1.7	.7	3.6	4.2	6.2	1.7	1.3	3.3	11.8	7.1	
	.1	.1	.4	.2	.6	.1	.1	.3	1.0	.9	
COLUMN TOTAL	173	295	281	144	243	173	231	273	228	551	2594
	6.7	11.4	10.8	5.6	9.4	6.7	8.9	10.5	8.8	21.2	100.0

RAW CHI SQUARE = 2274.90828 WITH 81 DEGREES OF FREEDOM. SIGNIFICANCE = 0.0000

arrangement of slides was not. If even some of the subjects were making their choices on the basis of criteria, other than function of streets displayed, then it could be argued that the choice pattern in any school was researcher-biased by the choice of slide pairs. Therefore, although the hypothesis of no relationship between school and preference category was rejected at a high level of significance, it must be considered that this hypothesis is not disproven or disprovable using the present data set.

Summary

The aim of this chapter was to determine what preference patterns regarding choice of various city street types as defined by function are displayed by grade school age children. The following trends were evident:

(a) Children of this age group (7 to 14 years approximately) prefer heavily travelled streets to the less busy residential streets as pedestrian travel routes.

(b) Finished streets, usually with sidewalks, are preferred to unfinished streets which do not have paved pedestrian walkways.

(c) Preference categories do exist within the total sample of children which show levels of internal concordance significantly higher than those found in the total sample.

(d) Membership in the preference categories is significantly influenced by the chronological age of the subject, educational level, as reflected in grade attained at school, and type of street on which he/she lives. Sex does not seem to be a determinant of preference in the case under study and the influence of school attended in this regard

must be taken as unproven.

Since the writer's main interest is in the spatial aspects of his topic, the differences in preference patterns attributable to such demographic factors as age and educational level will not be pursued further in this study but may be worthwhile areas for future research.

The analysis of display content and its relationship to expressed preference are examined in the following chapters.

CHAPTER V

ANALYSIS--PHASE 2

> It is extremely difficult to delimit the range either of perception or attention, or to state exactly what will or will not be perceived in any given set of physical conditions.
> (Vernon, 1968, p. 187)

In this chapter a methodology designed to isolate those factors or combinations of factors which may influence preference for one environmental display over another is outlined. That this is a difficult task goes without saying, particularly when the subject group is composed of children. Lowenthal has stated the problem well:

> In short the world as viewed by the young commingles fact and feeling in a generally moderate and indefinite, often private, and internally inconsistent set of structures.
> (Lowenthal, 1972e, p. 60)

However, despite Lowenthal's findings, it was considered that the subjects of this experiment showed a fair degree of agreement in their original pairwise choices between environmental displays. It was decided that the degree of unanimity between subjects from schools where identical combinations of displays were used should be tested statistically. In order to do this, the percentages of children choosing one display over another were tabulated for all 28 pairs of displays used in every possible pair of schools within the groupings described in Chapter III. This gave a series of 28 percentages for each school and the data were used as input to Simple Regression

Tract 8 had the lowest per family income of any in London in 1961 and Tract 9 was fourth lowest of a total of 41 tracts. Average per family income for Tracts 8 and 9 were $3,922 and $4,311 respectively, compared to a Metropolitan average of $5,335. The median values of owner occupied dwellings were the lowest in the city at $9,665 for Tract 8, and $9,813 for Tract 9 against a Metropolitan average of $13,128. Composition of the labour force in the area was:

Occupational Category	Tract 8 % of labour force	Tract 9 % of labour force	Metro Average % of labour force
Managerial	3.44	3.98	8.69
Professional & Technical	17.59	4.51	11.63
Clerical	9.05	14.01	13.54
Sales	3.86	5.95	8.81
Service & Recreational	23.07	17.56	15.61
Transportation & Communication	5.22	7.62	5.55
Primary	.76	.56	2.39
Craftsmen	11.89	14.80	23.83
Labourers	6.07	8.27	3.91

Aberdeen Public School serves an old residential area on the fringe of the city core which is at, or close to, the bottom of the city's socio-economic scale.

Preferences for Street Types

The sample from Aberdeen School was analyzed using program PCOMP. The results of that analysis were:

TABLE 5.1

Comparison of Pairwise Choice Patterns Between Schools Using Simple Regression

	ABER	BREN	CHIP	EAL	EMP	FORD	RYER	TOWN	WOOD	WORT
Aberdeen						.90				
Brenton				.83			.89			
Chippewa					.91			.89		
Ealing		.83					.93			
Empress			.91					.91		
Ford	.90									
Ryerson		.89		.93						
Townsend			.89		.91					
Woodland										.96
Wortley									.96	

All correlations significant at the .001 level..

Source: T. J. Underwood

not the evolution of predictive equations, but rather the isolation of those characteristics of urban streets which might influence children's preferences for one street over another. This would be accomplished on the basis of the Regression Coefficients (b), their signs and statistical significance.

The observation on the dependent variable for each slide in each school was the percentage of the interviewees from that school favouring that particular slide in their particular pairwise choice. This calculation was done for all 56 slides used. It was reasoned that if a significant proportion of the variation of the percentage of subjects in favour of each display could be explained by variation in quantifiable components of the displays used, then it could be said, with a given degree of statistical rigor, that, this or that component of cityscapes was likely to influence preference for one urban vista over another. In order to proceed further, it was necessary to quantify the display components and characteristics. Because these varied considerably, no one technique could be used to quantify all those considered. The variety of methods used in the process of quantification are described below.

Quantification of Display Components

For purposes of this phase of the research, each environmental display used was considered to be a melange of components and characteristics, each of which could vary quantitatively or qualitatively from display to display. For instance, it would be expected that the number of wheeled vehicles visible on an arterial street would normally exceed the number visible on a local residential street. Quantification of

the various components and characteristics varied methodologically from one to another. Certain components of an urban street scene can simply be counted, e.g., automobiles, trucks, houses and utility poles. However, a count of trees would not be valid in this case, since trees vary greatly in size from the newly planted feature trees of a suburban home to the well established maples of the city centre. It would, therefore, be expected that the visual impact would vary, not with the number of trees, but with their gross magnitude as a landscape feature. Because the process of quantification of display features varied so much, it was considered desirable to detail the methodology used on a variable by variable basis. Twenty-six variables pertaining to the visual impact of streets were quantified and can be grouped into categories according to the method of quantification used.

The Independent Variables

Category 1 - All items listed in this category were simply counted:

(a) automobiles (parked or moving)
(b) commercial vehicles (parked or moving)
(c) adults
(d) children
(e) single family dwellings
(f) number of apartments
(g) commercial signs
(h) commercial establishments
(i) utility poles
(j) electrical insulators
(k) traffic control signs

Two of the above items require some clarificatory comment, number of apartments and electrical insulators. The number of apartments in any

apartment building visible was used as a surrogate for the size and, consequently, the visual impact of the building. The number of electrical insulators is used as a measure of the amount of hydro wires visible in any display.

Category 2 - Components of environmental displays included in this category were quantitifed in terms of the percentage of the total area of the picture occupied. Calculation of this percentage was accomplished by projecting each slide onto a screen gridded in one inch squares, 600 in all. The number of squares occupied by each feature was counted, and subsequently expressed as a percentage of the total number of squares on the screen. Partially occupied squares were combined as accurately as possible to form whole squares. Variables quantified in this way were:

(1) Roadway - Defined as that portion of the street devoted to vehicular traffic.

(2) Shoulders - any dirt area between the roadway and the apparent private property lines or any area officially designated as shoulder by means of road markings was included in this variable.

(3) Sidewalks - an area was considered sidewalk if it was paved and obviously intended for pedestrian use.

(4) Trees - under this heading was included trees, shrubs, and hedges.

(5) Sky.

(6) Green Open Space - this variable included all areas under grass such as lawns, boulevards and fields.

(7) Buildings - included all structures.

Category 3 - This category encompassed those aspects of city streets which are best quantified in linear terms since they do not occupy a significant area of the total scene:

(a) Curbs

(b) Road markings.

The quantity of both variables was measured in inches on the gridded screen and this measure was used as a surrogate for the actual visible quantity of either variable in a given display.

Category 4 - Variables included in this category are not components of urban street scenes *per se* but might best be described as characteristics of components. They include:

(1) Street type as defined by city authorities.

(2) Type of road surface.

(3) Average age of buildings.

(4) Economic status of the street.

(5) Cleanliness.

All of these variables were categorized according to different criteria. It is, therefore, considered desirable to describe briefly the criteria for categorization in each case.

(1) Street Type

The streets which were photographed originally were divided into eight categories defined by officially designated prime function. The same eight categories were used as input to the multiple regression routine and are identical to those listed in Chapter II, Pages 28-29.

(2) Type of Road Surface

Road surfaces were divided into three categories as follows:

Category	Road Surface
3	paved
2	oiled
1	dirt

(3) Average Age of Buildings

The street scenes were shown to a student of the housing field in London (Jackson, 1973) who estimated the average age of the buildings in each, giving greatest weight to easily discriminable foreground edifices. Categories were then defined as:

Category	Average Age Range in Years
1	0 - 10
2	11 - 20
3	21 - 40
4	41 - 60
5	60

(4) Economic Status

The economic status of a given street was taken as equal to the average wage and salary income per family of the census tract in which that particular portion of the street was situated. In two cases, the street in question formed the boundary between two tracts which differed one quintile in average income. In both cases, the streets in question were arterials. Because the traffic volume carried by an arterial tends to lower its status as a residential street and consequently the average wage and salary income of residents, the streets in question were allocated the economic status of the tract with the lower average income. Census data from 1961 Census of Canada were then used to define quintiles as follows:

Quintile	Annual Earnings
1	$3,922 - 4,713
2	4,803 - 5,192
3	5,243 - 5,639
4	5,648 - 6,581
5	6,582 - 8,950

Source: 1961 Census of Canada

(5) Cleanliness

Five categories were established for cleanliness and were defined as follows:

Category	Number of Pieces of Trash* Visible
5	0
4	1 - 5
3	6 - 10
2	10 - 15
1	15

*trash is construed here as litter of any kind, paper, cartons, fallen tree branches, etc. The count was of visibly differentiable pieces.

Category 5 - It was felt that the degree of diversity of content in a cityscape might have a bearing on its appeal to the subject group. Since diversity is such a nebulous characteristic, it was not considered possible to quantify it directly. A surrogate for a measure of the diversity of a cityscape was therefore sought. Finally, it was considered that a count of the number of variables listed in Variable Categories 1, 2 and 3 would be a reasonable substitute for a measure of the diversity of any given display. This count was then entered as the final variable in the list of independent variables.

The Dependent Variable

For each display the observation on the independent variable was taken as the number of judgments in favour of that display expressed as a percentage of the total number of judgments made in a given pairwise choice:

$$Pij = \frac{Cij \times 100}{Tj}$$

where Pij = percent of judgments in favour of display i in the subject group from school j.

Cij = number of judgments in favour of display i in the subject group from school j.

Tj = total number of students in sample from school j.

This calculation was made for each slide used in each school and provided a unique observation on the dependent variable for each display for each school.

Analysis

The dependent variable described above was regressed against the 26 display content variables described earlier as independent variables. The objective of the exercise was to attempt to isolate those physical characteristics of street scenes which may have influenced the children's choices. If this were possible with an acceptable level of statistical significance, then it would be possible to describe fairly rigorously the physical makeup of the preferred pedestrian travel route(s) as seen by the children of each school sampled. Differences of opinion from school to school would also be revealed thus making it feasible to suggest some possible influences of home neighbourhood on preference patterns of children. The initial run of the program showed that two variables, percentage of displays occupied by trees and percentage of

displays occupied by sky showed a high degree of inverse collinearity suggesting that one was redundant. The percentage of sky was dropped from the analysis on the assumption that sky is the common backdrop to every outdoor vista and, as such, is less likely to be a principal determinant of preference for one scene over another than the presence of trees.

The results of the ten Multiple Regressions, one for each school sampled, are summarized and findings from each are examined in the light of a socio-economic profile of the school service areas based on Census of Canada, 1961[1] statistics. The data are outdated in respect to financial matters when compared to available 1974 figures. However, they are used here only as an indication of the relative socio-economic standing of the school service areas and, as such, are deemed to be still quite valid.

This completes Phase 2 of the research from the point of view of methodology. Findings are discussed in the succeeding chapter, inter-school comparisons are drawn and an effort is made to link the findings from Phase 1 of the study with those from Phase 2.

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[1]As of February, 1974, the necessary data for 1971 had not yet been published by Statistics Canada.

CHAPTER VI

VARIANCE IN STREET CHOICES EXPLAINED BY STREET CHARACTERISTICS

> Even on highways whose primary function is the carriage of goods and people visual form is of fundamental importance. (Appleyard, Lynch & Meyer, 1964, p. 3)

As has been stated in Chapter V, ten Multiple Regressions were run using data from each of the sample schools. The stated aim of these was to determine what components of the street scenes used best explain variance in the revealed preferences of subjects. It was postulated that the results would show:

(1) Which features of streets, if any, tend to capture the attention of children, and

(2) Whether a given feature would normally be expected to have a positive or negative influence on preference.

Findings from the regressions are discussed below for each school subject group.

Street Components and Street Type Preferences

(1) Aberdeen Public School

Aberdeen School serves part of Census Tracts 8 and 9. Census[1]

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[1] All Census of Canada statistics quoted in Chapter VI are taken from Melling and Boyce, 1968, pp. 80-102.

Tract 8 had the lowest per family income of any in London in 1961 and Tract 9 was fourth lowest of a total of 41 tracts. Average per family income for tracts 8 and 9 were $3,922 and $4,311 respectively, compared to a Metropolitan average of $5,335. The median values of owner occupied dwellings were the lowest in the city at $9,665 for Tract 8, and $9,813 for Tract 9 against a Metropolitan average of $13,128. Composition of the labour force in the area was:

Occupational Category	Tract 8 % of labour force	Tract 9 % of labour force	Metro Average % of labour force
Managerial	3.44	3.98	8.69
Professional & Technical	17.59	4.51	11.63
Clerical	9.05	14.01	13.54
Sales	3.86	5.95	8.81
Service & Recreational	23.07	17.56	15.61
Transportation & Communication	5.22	7.62	5.55
Primary	.76	.56	2.39
Craftsmen	11.89	14.80	23.83
Labourers	6.07	8.27	3.91

Aberdeen Public School serves an old residential area on the fringe of the city core which is at, or close to, the bottom of the city's socio-economic scale.

Preferences for Street Types

The sample from Aberdeen School was analyzed using program PCOMP. The results of that analysis were:

Sample size	178
Number of respondents with K<0.25	35
Number of respondents included in analysis	143
Consensus ranking of street types	3 5 1 7 2 6 8 4
Coefficient of Concordance (Kendall's W)	0.192
Significance level	.001

It is interesting to note that the children of Aberdeen School ranked finished streets in the first four places in their preference order. Since all of these street types except possibly type 7 (finished planned residential streets) would be equipped with sidewalks, this may suggest a preoccupation with safety on the part of the student population. In this particular school, this would be quite understandable. The school service area is traversed by two heavily travelled arterial streets, Adelaide and Hamilton Road, and the school's rear entrance opens directly on to the latter. Consciousness of the desirability of sidewalks for pedestrians may well have been nurtured in the student population by the school safety program. However, in an area such as the Aberdeen district, where traffic is normally heavy, the necessity for pedestrian walkways is evident even to young children. It will also be noted that, although finished arterials are considered the most desirable travel routes, unfinished arterials are considered least desirable again emphasizing the weight the children lend to safe pedestrian walkways. A similar trend shows in the rankings of all other street types, finished streets being consistently preferred to unfinished streets of similar type.

Characteristics of Streets that Explain Variance in Preference

A Stepwise Multiple Regression, as described earlier, was run on data from Aberdeen School. The results of the Regression are shown in Table 6.1. A Multiple R = .69718, significant at the .05 level, was achieved using 18 independent variables ($X_1 \ldots\ldots X_{18}$). 48.606 percent of the variance in Y is explained. However, it will be noted that four variables (4, 2, 16 and 21) account for 40.172 percent of variance in Y. It must, therefore, be concluded that these are important influences in the preference patterns of the subject group. A closer examination of these is, therefore, desirable. The four variables are:

4 - Percentage of display occupied by road shoulders,[2]
2 - Percentage of display occupied by vehicular roadway,
16 - Age category of houses in the display, and
21 - Diversity of the display.

The signs of the regression coefficients (b) are negative for variables 4 and 2 and significant at the .001 level. The sign of the coefficient for variable 16 is positive and significant at the .01 level. Variable 21 shows a negative sign for b but must be interpreted with care as it is not significant and "there is a significant chance, at least 15%, that the true regression coefficient is of the opposite sign as the calculated value due to random errors in the data" (Nie et al, 1970, pp. 185-186). That the sign for b is opposite in this case is reinforced by reference to Table 7.5. It will be noted that in eight of the ten samples, the sign of b is positive thus casting some doubt on the

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[2]Shoulders are defined as unpaved areas between the vehicular roadway and the apparent adjacent property lines which are reserved for pedestrian use.

TABLE 6.1

ABERDEEN SCHOOL CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. VAR026 CHILDREN'S CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	F	BETA
VAR004	PERCENT SHOULDERS	.48089	.23125	.23125	-.48089	-1.84970	-.49147
VAR002	PERCENT ROADWAY	.58816	.34593	.11468	-.09003	-.02739	-.38345
VAR016	AGE OF HOUSES	.61557	.37892	.03299	.28764	2.91809	.32561
VAR021	DIVERSITY OF VIEW	.63382	.40172	.02280	-.05652	-1.15365	-.16011
VAR022	AMOUNT OF UTILITY WIRES	.64109	.41100	.00928	-.33114	-.20934	-.23277
VAR006	PERCENT TREES	.64859	.42067	.00966	.08186	-.35504	-.25993
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.65858	.43373	.01307	-.03560	1.10045	.18543
VAR005	PERCENT SIDEWALKS	.66280	.43931	.00558	.13758	-1.46845	-.08385
VAR011	NUMBER OF TRUCKS	.66757	.44564	.00634	-.13080	-1.00872	-.22352
VAR020	ECONOMIC STATUS	.67061	.44971	.00407	-.08856	-1.50960	-.12034
VAR003	PERCENT GRASS	.67488	.45546	.00574	.34654	.86883	.17035
VAR001	STREET TYPE	.67917	.46127	.00581	.18357	-2.32655	-.29065
VAR023	AMOUNT OF ROAD LINES	.68687	.47178	.01051	-.10729	-.33097	-.28115
VAR017	NUMBER OF COMMERCIAL OUTLETS	.68868	.47428	.00250	.06892	.86166	.34578
VAR014	CLEANLINESS	.69135	.47797	.00368	.03463	2.51677	.14661
VAR007	PERCENT BUILDINGS	.69376	.48130	.00333	-.08685	-.20256	-.11098
VAR010	NUMBER OF AUTOS	.69526	.48339	.00209	-.16165	.48807	.32808
VAR012	NUMBER OF ADULTS	.69718	.48606	.00267	-.05690	-1.31494	-.21102
VAR018	NUMBER OF COMMERCIAL SIGNS	.69848	.48787	.00180	-.01380	-.78196	-.12938
VAR008	TYPE OF ROAD SURFACE	.69995	.48992	.00206	.10483	2.10623	.09599
VAR015	NUMBER OF HOUSES	.70083	.49116	.00123	.23563	-.21551	-.06797
VAR019	NUMBER OF APARTMENTS	.70138	.49193	.00077	-.18835	-.04580	-.06330
VAR013	NUMBER OF CHILDREN	.70187	.49262	.00069	.10292	-1.01038	-.08026
VAR025	NUMBER OF UTILITY POLES	.70208	.49292	.00029	-.20752	-.09351	-.04011
(CONSTANT)						103.02919	

* SIGNIFICANT AT THE .05 LEVEL

validity of the negative sign in this case. Because of this, variable 21 will be ignored in the present instance. Aberdeen students, therefore, prefer streets that do not have shoulders, i.e., are finished, where the vehicular roadway is not occupying a large part of the vista, i.e., narrow, probably two-lane streets and which give access to older homes.

Comparison of Findings from Paired Comparison and Multiple Regression Analysis

The primary objective of the Multiple Regression Analysis was identification of the components of urban street scenes which may influence preference for one street over another when choosing a pedestrian travel route. A secondary objective was verification of results from Paired Comparison Analysis of children's responses to various street pairs presented to them. This latter objective is discussed below.

Paired Comparison Analysis revealed that the subject group from Aberdeen School ranked street types in the following order of preference as pedestrian travel routes:

(1) Finished arterial streets
(2) Finished unplanned local streets
(3) Finished through highways
(4) Finished planned local streets
(5) Unfinished through highways
(6) Unfinished unplanned local streets
(7) Unfinished planned local streets
(8) Unfinished arterial streets

Reference to Table 6.1 shows that variable 4, percentage of display occupied by road shoulders, is by far the most important contributor

to explaining variance in Y. Although the presence of shoulders on a city street may not in itself be a determinant of preference for or against that street as a pedestrian route, road shoulders are invariably accompanied by other street characteristics which, as a package, prove undesirable to a pedestrian. Roads in cities that have shoulders are, by and large, not paved either. If they carry heavy traffic, the road surface is oiled and presents a patchy, uneven appearance. Edges of the roadway are normally jagged and the shoulders are dusty when dry and muddy when wet. Road markings, for traffic control, are not general on this street type. The children of Aberdeen School are consistent in their dislike for this kind of street for walking, they ranked finished streets, i.e., those without shoulders, 1, 2, 3 and 4, while those with shoulders are ranked 5, 6, 7 and 8. The negative Regression Coefficient (b) for variable 4 in Table 6.1 confirms this. The subject group also seems to prefer streets that are narrow (variable 2) and with houses that are old (variable 16). All of these show a predilection for well established, older areas of the city which is once again borne out by the results of the Paired Comparison Analysis in which, amongst the group of finished streets ranked 1, 2, 3 and 4, planned suburban streets are ranked fourth. In the unfinished group ranked 5, 6, 7 and 8, once again the newly developed streets rank below the established ones. This is even true of unfinished arterials, which, as pointed out earlier, are on the outskirts of town and usually newly developed.

(2) Clara Brenton Public School

The service area of Clara Brenton School is totally contained in Census Tract 22. Average incomes in Tract 22 were amongst London's

highest in 1961 at $7,123 against a Metropolitan average of $5,335. The median value of owner occupied dwellings was $16,641 while the Metropolitan average was $13,128. The labour force in the tract broke down as follows:

Occupational Category	Tract 22 % of labour force	Metro Average % of labour force
Managerial	21.37	8.86
Professional & Technical	21.11	11.63
Clerical	12.77	13.54
Sales	14.52	8.81
Service & Recreational	8.40	15.61
Transportation & Communication	1.59	5.55
Primary	1.52	2.39
Craftsmen	12.81	23.83
Labourers	2.03	3.91

Clara Brenton serves a relatively new development of well above average quality housing and could be classed as a typical upper-middle-class suburb. It will be noted that the first four occupational categories above account for 69.77 percent of the labour force in the district. The school population, from a socio-economic standpoint, is close to the top of the scale in London.

Preferences for Street Types

Paired Comparison Analysis of data from Clara Brenton School yielded the following results:

Sample size	285
Number of respondents with $K<0.25$	80
Number of subjects included in analysis	205
Consensus ranking of street types	2 4 3 1 7.5 8 6
Coefficient of Concordance (W)	.2988
Significance level of W	.001

Interpretation

Streets that would normally carry heavy vehicular traffic are favoured as pedestrian travel routes and are ranked 1, 2, 3 and 4. Further, of these four street types, unfinished streets (types 2 and 4) are given precedence over finished streets (types 1 and 3). This suggests a preference for main thoroughfares on the outskirts of town where types 2 and 4 occur most frequently. Street types 2 and 4 tend to be sparsely developed and almost rural in character with much open space evident, e.g., Wharncliffe Road south of Commissioner's Road and Huron Street east of Adelaide Street. Street types 3 and 1, ranked 3rd and 4th respectively, are for the most parts heavily travelled core area arterials and through routes. Type 3 streets (finished arterials) in London, Ontario, are invariably lined with mature trees while type 1 streets (finished through highways), with the exception of Richmond Street North, are devoid of trees. This may account in part for the preference of type 3 over type 1. Residential streets are relegated to the last four places in the preference order as pedestrian routes, finished streets (7 and 5) are preferred over unfinished (8 and 6) and planned subdivision streets (7 and 8) are preferred over unplanned residential streets (5 and 6).

This subject group displays a clear preference pattern, opting for the heavily travelled over the less busy streets, and newly developed streets over older established ones. They seem in fact to be choosing the types of streets which occur in and around their own immediate residential area as the most desirable pedestrian travel routes.

Characteristics of Streets that Explain Variance in Y

Stepwise Multiple Regression using data from Clara Brenton School yielded the following results (see Table 6.2). A Multiple R = .70678, significant at the .05 level, was obtained from 19 independent variables ($X_1 \ldots X_{19}$); 49.953 percent of the variance in Y was explained, the first four variables explaining 23.263 percent. These four variables describe quite well the type of street favoured by this subject group, the remaining 15 simply adding detail:

V 23 - Linear quantity of road traffic markings.
V 6 - Percentage of display occupied by trees.
V 5 - Percentage of display occupied by sidewalks.
V 4 - Percentage of display occupied by shoulders.

The signs of the regression coefficients (b) are positive for variables 23, 6 and 4 and negative for variable 5; they were all statistically significant. This subject group prefers a well travelled street (others do not have traffic markings on pavement), with trees in abundance. Large areas of sidewalk and large numbers of commercial signs are not features of preferred streets but commercial outlets are. A diverse view containing relatively new buildings but few apartment buildings is favoured. Streets most often chosen as preferred routes showed presence of adults but not children.

This subject group seems to have a more sophisticated approach to choosing their favourite travel route than did the children of Aberdeen School. Many facets of streets seem to be considered, and the degree of concordance they display is relatively high.

TABLE 6.2

C BRENTON SCHOOL CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. VAR026 CHILDREN'S CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	B	BETA
VAR023	AMOUNT OF ROAD LINES	.31681	.10037	.10037	.31681	.54408	.39361
VAR006	PERCENT TREES	.41641	.17507	.07470	.21316	.31864	.19867
VAR005	PERCENT SIDEWALKS	.46602	.21717	.04211	-.17971	-8.60317	-.41838
VAR004	PERCENT SHOULDERS	.48232	.23263	.01546	-.10192	.14346	.03246
VAR021	DIVERSITY OF VIEW	.49323	.24328	.01065	.10163	5.73707	.67809
VAR018	NUMBER OF COMMERCIAL SIGNS	.51202	.26217	.01889	.03415	-4.50917	-.63538
VAR016	AGE OF HOUSES	.52519	.27582	.01366	.00081	-2.23976	-.21297
VAR008	TYPE OF ROAD SURFACE	.54104	.29273	.01690	.05059	-5.40270	-.20969
VAR017	NUMBER OF COMMERCIAL OUTLETS	.55440	.30735	.01463	.12223	2.44454	.83548
VAR013	NUMBER OF CHILDREN	.59111	.34942	.04206	-.01821	-14.00549	-.94742
VAR019	NUMBER OF APARTMENTS	.61523	.37850	.02909	-.16522	-.34251	-.16849
VAR012	NUMBER OF ADULTS	.63421	.40223	.02372	.14226	5.70998	.78035
VAR010	NUMBER OF AUTOS	.65502	.42906	.02683	.14291	-1.52476	-.87287
VAR025	NUMBER OF UTILITY POLES	.67454	.45501	.02595	.15355	-.73126	-.26715
VAR024	AMOUNT OF CURBS	.68440	.46840	.01339	.03949	.36961	.23171
VAR020	ECONOMIC STATUS	.69233	.47933	.01093	.12816	-2.57601	-.17408
VAR015	NUMBER OF HOUSES	.69862	.48807	.00874	-.21414	-.20204	-.05427
VAR014	CLEANLINESS	.70274	.49384	.00577	.07372	3.99753	.19832
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.70678	.49953	.00569	.07942	.49505	.07104
VAR007	PERCENT BUILDINGS	.71023	.50443	.00490	-.22213	-.38525	-.17975
VAR011	NUMBER OF TRUCKS	.71191	.50682	.00239	.15995	1.78492	.33683
VAR002	PERCENT ROADWAY	.71472	.51083	.00401	.13335	.30594	.12075
VAR022	AMOUNT OF UTILITY WIRES	.71591	.51253	.00170	-.12551	-.07757	-.07345
VAR001	STREET TYPE	.71608	.51277	.00025	-.24825	-.40945	-.04356
VAR003	PERCENT GRASS	.71624	.51300	.00022	-.13142	.15401	.02572
(CONSTANT)						-12.11360	

* SIGNIFICANT AT THE .05 LEVEL

Comparison of Findings from Paired Comparison and Multiple Regression Analysis

Analysis of data from Clara Brenton School using the Paired Comparison Routine showed the following ranking of street types as pedestrian travel routes:

(1) Unfinished through highways
(2) Unfinished arterial streets
(3) Finished arterial streets
(4) Finished through highways
(5) Finished planned local streets
(6) Finished unplanned local streets
(7) Unfinished planned local streets
(8) Unfinished unplanned local streets

The independent variables that are most significant in explaining variance in the choice pattern of the subjects have already been listed. It will be noted that the first four variables to enter the regression (see Table 6.2) are all features of the roadway itself and that, following these, characteristics of the environs of the roadway predominate. Preference is clearly indicated for streets on the outskirts of the city which are designed for fast traffic (V 23) but where the bumper-to-bumper traffic of the centre city is unusual (V 10). The results of the Paired Comparison Analysis bears out this contention showing unfinished through highways and unfinished arterials ranked 1 and 2 respectively in the preference order. It is worthy of note that these street types embody most of the significant features of preferred streets revealed in the Multiple Regression. Finished arterial streets and finished through highways, which in London are mostly found in the central city, are ranked below the aforementioned types which also seems acceptable in the light of findings from the Multiple Regression Analysis.

Relegation of local streets to the last four places in the preference order is also understandable since they normally would not show many of the significant features of desirable streets as revealed by the regression.

The pattern of preference of the subject group from Clara Brenton School is well defined and contains few, if any, contradictions. It would seem that these children lean quite strongly in their preferences towards the types of streets with which they are most in contact in their own immediate home area.

(3) Chippewa Public School

Chippewa Public School services part of Census Tracts 30 and 41. The bulk of the school population is drawn from Tract 30 since Tract 41 is largely undeveloped in this area. The socio-economic profile of the school service area will, therefore, be taken as most similar to that of Tract 30. In 1961 the median family income in the area was $5,639 as against a Metropolitan average of $5,335 and the median value of owner occupied dwellings was $14,792 with the Metropolitan average standing at $13,128. The area, therefore, services a population of slightly above average socio-economic standing. The labour force in the tract was as follows in 1961:

Occupational Category	Tract 30 % of labour force	Metro Average % of labour force
Managerial	9.61	8.86
Professional & Technical	15.63	11.63
Clerical	13.41	13.54
Sales	11.34	8.81
Service	14.71	15.61
Transportation & Communication	6.17	5.55
Primary	1.68	2.39
Crafts	24.83	23.83
Labourers	2.24	3.91

Chippewa School serves a relatively new development where representation from the Managerial, Professional and Technical occupations are slightly above the Metropolitan average. The labour force breakdown suggests that this area houses predominantly skilled labour.

Preferences for Street Types

The analysis of data from Chippewa using Paired Comparisons gave the following results:

Sample size	274
Number of respondents with K<0.25	160
Number of subjects included in analysis	114
Consensus ranking of street types	3 2 7 5 1 6 8 4
Coefficient of Concordance (W)	.2305
Significance level of W	.001

Interpretation

A definite preference is shown for finished streets which occupy four out of the first five positions in the preference ranking. The only exception to this is type 2 streets (unfinished through highways) which are found on the outskirts of town and, as has been pointed out already, are semi-rural in character. Unfinished local streets and unfinished arterials do not seem to appeal to this group and are relegated to two of the last three positions in the preference order. The average age of buildings on streets does not seem to weigh heavily with Chippewa children since the new is given precedence over the old in local finished streets (7 and 5), a position which is reversed for local unfinished streets (6 and 8).

Finished streets weigh heavily in the preferences of Chippewa children for pedestrian travel routes which may suggest a preoccupation

with pedestrian safety. The school safety program may very well be at least partially responsible for this.

Characteristics of Street that Influence Preference

Data from Chippewa School were subjected to Multiple Regression; the results are shown in Table 6.3. A Multiple R = .63304, significant at the .05 level, was obtained with 14 variables (X_1.....X_{14}). 40.175 percent of the variance in Y was explained. The subject group favours paved streets (V 8) giving a diverse view (V 21). Cleanliness (V 14), presence of commercial outlets (V 17) and broad areas of sidewalk (V 5) in a setting of high economic status (V 20) suggest themselves as features of desirable pedestrian routes. A negative attitude to broad streets (V 2) with large amounts of trees (V 6), an abundance of advertising signs (V 18), large areas of shoulders (V 4), and dense development (V 7) is apparent.

Comparison of Findings from Paired Comparison and Multiple Regression Analysis

The preoccupation of the Chippewa subjects with clean finished streets as revealed in the Regression Analysis is also reflected in the results from Paired Comparison Analysis; they ranked finished streets in four of the first five places in their preference order. It will also be noted that unfinished streets are ranked in the three lowest positions of that order; the fact that unfinished through highways are high in the hierarchy of preferred routes does not contradict this trend since these streets, although unfinished, are inevitably paved and often are high status areas from a residential point of view.

TABLE 6.3

CHIPPEWA SCHOOL , CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. VAR026 CHILDREN'S CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	B	BETA
VAR008	TYPE OF ROAD SURFACE	.24813	.06157	.06157	.24813	1.13028	.04714
VAR006	PERCENT TREES	.35841	.12846	.06689	.23048	-.04741	-.03177
VAR018	NUMBER OF COMMERCIAL SIGNS	.40706	.16570	.03724	-.16104	-2.83950	-.42999
VAR004	PERCENT SHOULDERS	.44096	.19445	.02875	-.23895	-1.08766	-.26449
VAR021	DIVERSITY OF VIEW	.46116	.21267	.01822	.11452	1.84204	.23398
VAR014	CLEANLINESS	.49823	.24824	.03557	.11074	9.72682	.51860
VAR007	PERCENT BUILDINGS	.52858	.27940	.03116	-.24347	-1.02923	-.51609
VAR022	AMOUNT OF UTILITY WIRES	.55226	.30500	.02560	-.24579	-.39963	-.40668
VAR017	NUMBER OF COMMERCIAL OUTLETS	.56827	.32293	.01793	-.00284	.96326	.35379
VAR023	AMOUNT OF ROAD LINES	.57999	.33639	.01346	-.06303	-.51277	-.39867
VAR001	STREET TYPE	.60875	.37058	.03419	-.01128	-3.62054	-.41396
VAR005	PERCENT SIDEWALKS	.61814	.38210	.01152	.15679	4.49909	.23514
VAR002	PERCENT ROADWAY	.62722	.39340	.01130	.05830	-.25924	-.10996
VAR020	ECONOMIC STATUS	.63384	.40175	.00835	.20512	1.46676	.10701
VAR003	PERCENT GRASS	.64150	.41153	.00978	.03517	-1.16114	-.20837
VAR025	NUMBER OF UTILITY POLES	.64918	.42144	.00991	-.04774	.67567	.26527
VAR015	NUMBER OF HOUSES	.65488	.42886	.00743	.16183	1.32362	.38208
VAR013	NUMBER OF CHILDREN	.65976	.43528	.00642	.15300	-3.96570	-.28830
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.66393	.44080	.00552	.11537	.29726	.04584
VAR024	AMOUNT OF CURBS	.66851	.44690	.00610	.21565	-.25992	-.17512
VAR019	NUMBER OF APARTMENTS	.67295	.45286	.00596	-.15047	.17528	.22272
VAR011	NUMBER OF TRUCKS	.67507	.45572	.00286	.21721	3.72315	.75507
VAR010	NUMBER OF AUTOS	.69092	.47737	.02165	.04984	-.76221	-.46893
VAR012	NUMBER OF ADULTS	.69273	.47987	.00250	.19368	-1.82115	-.26748
VAR016	AGE OF HOUSES	.69304	.48030	.00043	.18986	.36579	.03738
(CONSTANT)						23.63839	

* SIGNIFICANT AT THE .05 LEVEL

In general, the findings from both forms of analysis reinforce each other to a significant degree and suggest that the Chippewa children are impressed by neatness, pedestrian safety and high economic status in their choice of walkways and are not enamoured of commercialized, high density neighbourhoods with broad streets where advertising is a major component of the field of vision.

(4) Ealing Public School

The service area of Ealing Public School is contained almost totally within Census Tract 10 of the City of London. In 1961 average per family income in the tract was $4,616 against a Metropolitan average of $5,335. The median value of owner occupied dwellings was $9,709 when the city average was $13,128. Occupational breakdown of the population was as follows:

Occupational Category	Tract 10 % of labour force	Metro Average % of labour force
Managerial	4.12	8.86
Professional & Technical	4.51	11.63
Clerical	16.20	13.54
Sales	6.31	8.81
Service & Recreational	16.90	15.61
Transportation & Communication	7.69	5.55
Primary	0.60	2.39
Crafts	12.18	23.83
Labourers	6.00	3.91

The school services an area which is below the Metropolitan average in economic terms and the population is largely unskilled. Homes in the area are generally old (over 40 years) and the district appears drab

and rundown. Immediately across Highbury Avenue to the east is an area of newer development which is in marked contrast to the Ealing district.

Preferences for Street Types

Paired Comparison Analysis of Ealing data gave the following results:

Sample size	283
Number of subjects with $K<0.25$	113
Number of subjects included in analysis	170
Consensus ranking of street types	4 1 3 6 7 2 8 5
Coefficient of Concordance (W)	.2305
Significance level of W	.001

Interpretation

At first glance, the consensus ranking of street types obtained from Ealing data seems confused. However, an understanding of the nature of the school area and its environs may help in arriving at an understanding of the children's preferences. The school area is bounded on the south by the Thames River, on the east by Highway 126 (Highbury Avenue), a very busy main route into the city from the Macdonald-Cartier Freeway, and on the north by the Canadian National Railroad Yards. It is traversed by two busy arterial streets, Hamilton Road and Trafalgar Street, and boasts within its boundaries a quarry, a cement plant, a poultry packing plant, a major electrical transformer station and, of late, a large shopping plaza. It is an old congested area plagued by heavy traffic and industrial pollution.

The children rank unfinished arterial streets and finished through highways first and second in their preference order followed by finished arterials and unfinished residential streets in ranks 3 and 4. The street types in or immediately adjacent to the school are:

Street Type	Represented By
4	Hamilton Road east of Highway 126
1	Highway 126
3	Hamilton Road west of Highway 126
6	Many of the residential streets in the school district

It is noteworthy that unfinished arterials are preferred over finished arterials, types 4 and 3 respectively. This may be a function of familiarity. Cisek notes that

> the primary criteria for evaluation [of urban environment] included newness versus oldness, cleanliness versus dirtiness. The children intensely disliked the decay and trash of their environment and tended to reject older elements even if in good physical condition.
>
> (Cisek, 1966, p. 150)

His subjects were in a similar socio-economic category to the Ealing children. Perhaps the same criteria for preference apply in both cases. It would serve to explain preference for unfinished over finished arterials since the former tend to be developed later than the latter. Being physically close to a major through highway may have convinced the subjects of the necessity for sidewalks on such streets thus explaining preference for finished over unfinished streets of this type. Relegation of residential streets to four of the last five places in the preference order is once again in keeping with the findings from other schools, i.e., children prefer busy well travelled streets as pedestrian travel routes.

Characteristics of Streets that Influence Preference

Stepwise Multiple Regression using data from Ealing School yielded results shown in Table 6.4. Twenty-two independent variables gave a Multiple R = .77881, significant at the .05 level. Variance in Y explained was 60.65 percent.

The subject group shows a positive attitude to streets where trees are present in quantity (V 6), where pavement markings control traffic (V 23) and where commercial outlets (V 17) contribute to a diverse visual experience (V 21). Clean (V 14) broad (V 2) streets with finished edges (V 24) that may carry heavy commercial traffic (V 11) are favoured. Negative attitudes to streets with broad sidewalks (V 5), large numbers of commercial signs (V 18) and presence of children in numbers (V 13) are apparent. Streets where old (V 16) homes predominate in a densely developed (V 7) neighbourhood do not impress the Ealing subjects.

The results of the Multiple Regression Analysis of Ealing data do not present a readily interpretable picture of the most preferred type of pedestrian route as seen by the subject group.

Comparison of Findings from Paired Comparison and Multiple Regression Analysis

Paired Comparison Analysis yielded the following ranking of street types from Ealing data:

Rank	Street Type
1	Unfinished arterial streets
2	Finished through highways
3	Finished arterial streets
4	Unfinished unplanned local streets
5	Finished planned local streets

TABLE 6.4

EALING SCHOOL CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. VAR026 CHILDRENIS CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	B	BETA
VAR005	PERCENT SIDEWALKS	.26209	.06869	.06869	-.26209	-10.60325	-.50806
VAR006	PERCENT TREES	.39467	.15576	.08707	.25492	.34594	.21251
VAR018	NUMBER OF COMMERCIAL SIGNS	.42172	.17785	.02209	-.24713	-.26083	-.86921
VAR023	AMOUNT OF ROAD LINES	.49774	.24775	.06990	.10450	.43846	.31253
VAR021	DIVERSITY OF VIEW	.53580	.28708	.03933	-.03691	6.57123	.76525
VAR017	NUMBER OF COMMERCIAL OUTLETS	.56038	.31403	.02695	.09856	2.60488	.87713
VAR013	NUMBER OF CHILDREN	.64634	.41776	.10373	.03252	-14.51935	-.96772
VAR004	PERCENT SHOULDERS	.68245	.46574	.04798	-.00838	.00768	.00171
VAR014	CLEANLINESS	.70122	.49171	.02598	.11010	5.66096	.27671
VAR007	PERCENT BUILDINGS	.72810	.53013	.03841	-.17626	-.52918	-.24327
VAR002	PERCENT ROADWAY	.73315	.53751	.00739	.00990	.18495	.07192
VAR008	TYPE OF ROAD SURFACE	.73672	.54275	.00524	-.15052	-7.14404	-.27319
VAR024	AMOUNT OF CURBS	.74089	.54891	.00616	-.03316	.38661	.23880
VAR012	NUMBER OF ADULTS	.74661	.55742	.00851	.08910	5.64534	.76016
VAR010	NUMBER OF AUTOS	.76686	.59115	.03373	-.00457	-1.62873	-.91866
VAR016	AGE OF HOUSES	.77101	.59445	.00330	.07779	-1.46377	-.13714
VAR020	ECONOMIC STATUS	.77374	.59868	.00423	.24808	-1.67609	-.11211
VAR011	NUMBER OF TRUCKS	.77533	.60114	.00246	.01548	1.63914	.30477
VAR003	PERCENT GRASS	.77660	.60310	.00196	.06747	.48712	.08018
VAR015	NUMBER OF HOUSES	.77763	.60471	.00160	-.07626	.23801	.06299
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.77829	.60573	.00103	-.09569	-.30297	-.04284
VAR025	NUMBER OF UTILITY POLES	.77881 *	.60654	.00081	.10311	-.13752	-.04950
(CONSTANT)						-31.76759	

* SIGNIFICANT AT THE .05 LEVEL

6	Unfinished through highways
7	Unfinished planned local streets
8	Finished unplanned local streets

Multiple Regression reveals a predilection on the part of Ealing students for busy streets with some commercial outlets and a diverse visual impact. This agrees with the findings from Paired Comparison where busy arterial and through streets are ranked in the first three positions of the preference order while less busy local streets occupy four of the last five positions. The placing of unfinished through highways in sixth place is a little puzzling but may be explainable. This subject group shows an aversion to streets carrying heavy advertising which is a main feature of unfinished highways, a street type normally found on the fringe of the city. This fact may account for the apparent lack of popularity of this kind of street. The preference ordering of local streets is difficult, if not impossible, to rationalize. It may be that local streets are of such marginal interest to the children as places to walk that choices were made on the basis of whim rather than for some logical reason.

All things considered, the Ealing subject group have much in common with their peers from other schools dealt with so far. Their obvious preference for busy through and arterial streets as pedestrian walkways, while eschewing the quieter local streets, suggests that they too like to walk where the action is.

(5) Empress Public School

Empress School serves part of Census Tract 6 in London. Census of Canada 1961 shows that per family income in the tract was $4,886,

compared to a Metropolitan average of $5,335. The median value of owner occupied dwellings in the area was $10,526 when the Metropolitan average was $13,128. The occupational breakdown in the area was:

Occupational Category	Tract 6 % of labour force	Metro Average % of labour force
Managerial	5.84	8.86
Professional & Technical	7.91	11.63
Clerical	19.16	13.54
Sales	7.73	8.81
Service & Recreational	17.69	15.61
Transportation & Communication	6.85	5.55
Primary	1.02	2.39
Crafts	8.19	23.83
Labourers	4.15	3.91

Population of the school service area leans heavily toward the non-skilled or semi-skilled occupations. The area is below average in income and house value and is not greatly dissimilar to the Ealing area in its socio-economic profile. Houses in the area are, in general, somewhat younger than those in the Ealing area but not by very much, perhaps five to ten years.

Preferences for Street Types

The results of the Paired Comparison Analysis were as follows:

Sample size	231
Number of subjects with $K<0.25$	129
Number of subjects included in analysis	102
Consensus ranking of street types	3 2 7 5 4 6 1 8
Coefficient of Concordance (W)	.2250
Significance level of W	.001

Interpretation

The subject group from Empress School are prone to prefer finished streets as pedestrian routes. Three of the first four positions in their preference order are given to finished streets:

Rank	Street Type
1	Finished arterial streets
2	Finished planned local streets
3	Finished unplanned local streets

Relegation of finished through highways to second last place in their preference order is puzzling and seems to suggest an aversion to busy routes in the central city where this type of street is most common, however this is merely opinion at this stage. The apparent distaste for unfinished streets which occupy three of the lowest four positions in the ranking suggests a dislike for either the hazards of walking where proper walkways are not provided, or for the generally untidy appearance of unfinished streets, or both. The fact that unfinished through highways rank second does not detract from this assumption as these occur on the outskirts of the city, are, in all cases, paved, and are semi-rural in character being only lightly developed in most cases. Once again, as with all of the subject groups examined so far, residential streets are not highly thought of as pedestrian travel routes but finished streets (types 5 and 7) are preferred to the unfinished variety (types 6 and 8).

Characteristics of Streets that
May Influence Preference

The results of a Stepwise Multiple Regression using data from Empress School are shown in Table 6.5. A Multiple R = .66841, significant at the .05 level was obtained. Sixteen variables ($X_1 \ldots\ldots\ldots X_{16}$)

TABLE 6.5

EMPRESS SCHOOL CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. VAR026 CHILDREN'S CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	B	BETA
VAR008	TYPE OF ROAD SURFACE	.24934	.06217	.06217	.24934	3.21783	.13531
VAR018	NUMBER OF COMMERCIAL SIGNS	.38219	.14607	.08390	-.19330	-8.32171	-.65977
VAR014	CLEANLINESS	.43877	.19252	.04645	.23290	11.50049	.61815
VAR016	AGE OF HOUSES	.50850	.25857	.06605	.16714	.98413	.10138
VAR007	PERCENT BUILDINGS	.53460	.28579	.02722	-.19149	-1.12953	-.57099
VAR021	DIVERSITY OF VIEW	.55681	.31004	.02425	.07376	1.65573	.21202
VAR017	NUMBER OF COMMERCIAL OUTLETS	.58221	.33897	.02893	-.03906	1.66691	.61720
VAR013	NUMBER OF CHILDREN	.59784	.35741	.01844	.08139	-6.15830	-.45134
VAR022	AMOUNT OF UTILITY WIRES	.60743	.36897	.01156	-.17492	-.25230	-.25884
VAR019	NUMBER OF APARTMENTS	.61306	.37585	.00688	-.08622	.10244	.23371
VAR023	AMOUNT OF ROAD LINES	.61765	.38149	.00564	-.01684	-.45592	-.35735
VAR001	STREET TYPE	.63135	.39860	.01711	-.00549	-3.32894	-.38371
VAR015	NUMBER OF HOUSES	.64179	.41189	.01329	.09411	.86378	.25137
VAR011	NUMBER OF TRUCKS	.64900	.42121	.00932	.15362	3.20453	.65518
VAR010	NUMBER OF AUTOS	.66093	.43682	.01562	.11265	-.38167	-.23672
VAR005	PERCENT SIDEWALKS	.66841 *	.44677	.00995	.08148	3.46344	.18248
VAR003	PERCENT GRASS	.67161	.45107	.00429	.02123	-1.23642	-.22368
VAR004	PERCENT SHOULDERS	.67543	.45620	.00514	-.24591	-.99477	-.24387
VAR002	PERCENT ROADWAY	.69148	.46442	.00821	.07863	-.39455	-.16871
VAR025	NUMBER OF UTILITY POLES	.68367	.46741	.00299	-.02489	.46433	.18378
VAR012	NUMBER OF ADULTS	.68582	.47035	.00295	.20144	-2.23796	-.33137
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.68786	.47315	.00280	.00843	-.34419	-.05351
VAR024	AMOUNT OF CURBS	.68886	.47452	.00137	.23753	-.11129	-.07559
VAR006	PERCENT TREES	.68954	.47546	.00094	.16772	-.07797	-.05267
(CONSTANT)						23.31179	

* SIGNIFICANT AT THE .05 LEVEL

explained 44.677 percent of the variance in Y. The subject group preferred streets with paved surfaces (V 8), with a minimum of commercial signs (V 18), that were clean (V 14), possessed of older buildings (V 16) and which were not very heavily developed (V 7). A diverse vista (V 21) with some commercial establishments (V 17), devoid of children (V 13) and dense utility wires (V 22) was preferred. Negative attitudes to road traffic markings (V 23), automobiles (V 10) suggest some leaning towards the outskirts of the city while a negative attitude to variable 1 (street type) suggests a dislike for local streets as walkways.

The results of the Multiple Regression present a reasonably clear picture of the type of route preferred by this subject group and seem to present no major contradictions.

Comparison Results from Multiple Regression and Paired Comparison Analysis

The positive attitude of the Empress children to paved streets is borne out by their ranking of these street types in the first four positions of their ranking of street types from Paired Comparison Analysis. Relegation of finished (paved) through highways to seventh position in the ranking may be attributable to the group's apparent aversion to commercial signs which tend to be rather prolific on this type of street. A trip along a through route in almost any North American city will convince the reader of this. The apparent preference of the group for streets with older homes may account for the placing of finished arterial streets first in their preference order but runs contrary to the placing of street type 7 above type 5. Age of houses may well account for the precedence given street types 5, 4, 6 and 1

over street type 8 in their preferred ranking.

The overriding criterion for judgment of the suitability of a street as a walkway seems to be whether the street offers safe passage to the pedestrian. The location of Empress School on Wharncliffe Road within a block of Oxford Street places it very close to one of London's busiest intersections. The volume of vehicular traffic handled by these two streets has forced a complete rebuilding of the traffic handling facilities in the immediate area of the school, including a controversial street widening program. A visit to the area leaves no doubt as to why these children would show a healthy concern for safety measures in their choice of pedestrian travel routes. Their concern with paving and cleanliness suggests a liking for order, but they are not overly concerned with status of their walkways as evidenced by the failure of the economic status variable to explain even a small amount of the variance in preference expressed.

This group seems impressed by neatness and pedestrian safety on the routes they choose for walking and choose a busy street as their first priority. Their apparent aversion to automobile traffic is understandable in the light of their location.

(6) Arthur Ford Public School

The students of Arthur Ford Public School are drawn from Census Tract 37 of the City of London. In 1961 average per family income in the area was $5,325 compared to a Metropolitan average of $5,335. The median value of owner occupied dwellings was $13,809 against a Metropolitan average of $13,128. Labour force breakdown in the area was as follows:

Occupational Category	Tract 37 % of labour force	Metro Average % of labour force
Managerial	9.38	8.86
Professional & Technical	9.69	11.63
Clerical	15.83	13.54
Sales	11.48	8.81
Service & Recreational	12.28	15.61
Transportation & Communication	5.53	5.55
Primary	1.25	2.39
Crafts	28.04	23.83
Labourers	5.07	3.91

The school services a lower-middle-class area and is about average for the Metropolitan area in socio-economic terms. Craftsmen and the lower end of the white collar work force account for over 40 percent of the workers. School population is drawn from a comparatively new subdivision (less than 20 years old) with few exceptions. The development, known as Norton Estates, is planned, i.e., has curvilinear streets, underground utilities and finished streets.

Preferences for Street Types

The analysis of Arthur Ford data using Paired Comparison yielded the following results:

Sample size	298
Number of subjects with $K<0.25$	82
Number of subjects included in analysis	216
Consensus ranking of street types	5 3 1 7 8 2 6 4
Coefficient of Concordance (W)	.2435
Significant level of W	.001

Interpretation

The placing of finished streets in the first four places of the preference order is a significant indication of the priorities of the subject group, dividing their preferred pedestrian routes into two clear groups. Within group one, finished streets, it is interesting to note that the street type on which the vast majority of the children live is ranked fourth and streets of a more established character are given precedence. All of the street types ranked one through three would be expected to have older buildings, large trees in most cases and to come equipped with sidewalks. The latter fact indicates some preoccupation with pedestrian safety. This preoccupation is also reflected in the ordering of group two (unfinished) streets. Obviously, class 8 streets (planned local) are the streets most likely to carry a light traffic load. Class 2 streets ranked sixth occur on the outskirts of the city and, although they are provincial highways, they do not generally convey the impression of being heavily travelled. The placing of unfinished unplanned local streets and unfinished arterials lowest in the preference order suggests that the subject group are not enamoured of walking on either busy or not so busy streets if proper pedestrian walkways are absent.

The students of Arthur Ford School seem impressed by the pedestrian arrangements provided on their travel routes and then by older streets. The functional designation of streets does not seem to weigh heavily with the group provided pedestrian safety on the route is good.

Characteristics of Streets that May Influence Preference

Stepwise Multiple Regression using Ford data yielded results are summarized in Table 6.6. A Multiple R = .67892, significant at the .05 level, was achieved. Seventeen variables (X_1.....X_{17}) explained 46.093 percent of the variance in expressed preference (Y). Twelve variables (X_1.....X_{12}) explained 44.442 percent of variance in Y and will be taken as the most significant influences on preference in this case.

Variable 4 (see Table 6.7), percentage of environmental display occupied by road shoulders, seems very significant to this subject group, and explains almost 13 percent of the variance in choice. A further 12 percent is added by variable 2, percentage of display occupied by vehicular roadway. These are very significant and give a clear statement of the primary considerations of the group in choosing a pedestrian route. They prefer narrow streets without shoulders. Streets with road traffic markings are down graded (V 23), although they are not averse to traffic signs (V 9). Positive attitudes are shown to streets where older houses (V 16) in quantity (V 15) are interspersed with some commercial outlets (V 17). Broad sidewalks (V 5), a residential character (V 1) and children in large numbers (V 13) are features of streets that evoke negative responses.

This subject group shows very clear likes and dislikes and leaves little doubt as to priorities in the choice of pedestrian walkways.

TABLE 6.6

A FORD CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

********** MULTIPLE REGRESSION **********

DEPENDENT VARIABLE.. VAR026 CHILDREN'S CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	B	BETA
VAR004	PERCENT SHOULDERS	.35976	.12943	.12943	-.35976	-2.31316	-.47189
VAR002	PERCENT ROADWAY	.50086	.25087	.12144	-.15260	-1.05813	-.37651
VAR023	AMOUNT OF ROAD LINES	.53897	.29049	.03962	-.20141	-.27161	-.17715
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.56556	.31986	.02937	.05961	2.86225	.37030
VAR022	AMOUNT OF UTILITY WIRES	.58748	.34513	.02528	-.34617	-.21467	-.18327
VAR017	NUMBER OF COMMERCIAL OUTLETS	.60206	.36248	.01735	.08935	.63948	.19703
VAR021	DIVERSITY OF VIEW	.62203	.38692	.02444	-.15640	-2.20115	-.23455
VAR016	AGE OF HOUSES	.64373	.41438	.02746	.22065	2.76392	.23694
VAR005	PERCENT SIDEWALKS	.65324	.42672	.01234	.07841	-3.27285	-.14349
VAR015	NUMBER OF HOUSES	.65724	.43196	.00523	.30514	.85750	.20765
VAR001	STREET TYPE	.66147	.43755	.00559	.22087	-2.39849	-.23006
VAR013	NUMBER OF CHILDREN	.66614	.44374	.00619	.16493	-2.86132	-.17450
VAR024	AMOUNT OF CURBS	.66810	.44636	.00262	.29438	.08900	.05030
VAR007	PERCENT BUILDINGS	.66934	.44801	.00166	-.12253	-.72405	-.30457
VAR019	NUMBER OF APARTMENTS	.67320	.45320	.00518	-.14622	.20072	.21396
VAR006	PERCENT TREES	.67699	.45831	.00511	.16720	-.17729	-.09965
VAR014	CLEANLINESS	.67892	.46093	.00262	-.01934	1.68245	.07525
VAR003	PERCENT GRASS	.68018	.46264	.00171	.32756	.74898	.11275
VAR020	ECONOMIC STATUS	.68145	.46438	.00174	.04280	-.89145	-.05456
VAR025	NUMBER OF UTILITY POLES	.68241	.46568	.00131	-.27055	-.29496	-.09715
VAR018	NUMBER OF COMMERCIAL SIGNS	.68336	.46698	.00130	-.08702	.67344	.08555
VAR011	NUMBER OF TRUCKS	.68368	.46742	.00044	-.13991	-.65171	-.11088
VAR012	NUMBER OF ADULTS	.68399	.46785	.00042	-.01835	.75833	.09343
(CONSTANT)						126.02836	

* SIGNIFICANT AT THE .05 LEVEL

Comparison of Findings from Multiple Regression and Paired Comparison Analysis

The results of Multiple Regression Analysis show that features of the travelled part of street scenes weigh very heavily in the subjects' judgments as to their desirability as pedestrian routes. The first four variables to enter the regression were all measures of some feature of the street and its edges viz. the roadway, road shoulders, road traffic control markings and traffic signs. Negative attitudes to wide roadways, shoulders and traffic markings all tend to indicate a preference for the not so busy street with adequate pedestrian walkways. Positive judgments on the number of private dwellings, older houses and commercial establishments reveal a liking for older well established streets. These findings are borne out by the results of the Paired Comparison Analysis which places finished streets in the first four positions in the preference order and relegates unfinished streets to the last four places. The choice of street type 5, finished unplanned local streets, as the most preferred travel route is indicative of the preference for older areas revealed in the Regression. However, as was pointed out earlier in assessing the results of the Paired Comparison Analysis, the subject group from Arthur Ford School are most influenced in their choice of a pedestrian route by the presence or absence of adequate walkways.

The Ford group seem to be a little less committed than previous groups to the busy streets as preferred walkways and their apparent lack of interest in a diverse vista only serves to reinforce this. However, like all the groups that have been examined so far, the planned local street, which is probably the safest of pedestrian routes, is not rated highly.

(7) Ryerson Public School

The student body at Ryerson Public School is drawn from portions of Census Tracts 20 and 21. Average per family income in the area was amongst the highest in London in 1961 at $6,315 for Tract 20 and $6,727 for Tract 21 when the Metropolitan average was $5,335. Average values of owner occupied dwellings were $16,182 and $17,599 compared to a Metropolitan average of $13,128. The constitution of the area labour force was:

Occupational Category	Tract 20 % of labour force	Tract 21 % of labour force	Metro Average % of labour force
Managerial	14.75	14.24	8.86
Professional & Technical	19.15	35.40	11.63
Clerical	19.52	16.44	13.54
Sales	10.21	7.18	8.81
Service & Recreational	13.85	13.43	15.61
Transportation & Communication	4.77	1.87	5.55
Primary	.91	.70	2.39
Crafts	12.81	9.35	23.83
Labourers	2.69	1.22	3.91

Ryerson School serves an old, well established upper-middle-class to upper-class area of London. The labour force leans heavily toward the managerial, professional and technical and clerical categories of occupation. The school district is north of Oxford Street and west of Adelaide Street, an area which has been synonymous with the ideal home location in London for many years. It is an area of large older homes on tree-lined streets and real estate agents consistently use the word "exclusive" to describe the neighbourhood. However, pressures from the

expanding core of the city and the student population at the University of Western Ontario, coupled with decreasing school enrolments, are causing some problems in the area and the closing of Broughdale School which is adjacent to Ryerson has been proposed (London Free Press, 1972). Ryerson itself is in no imminent danger of closure.

School Population Preferences for Street Types

Paired Comparison Analysis of Ryerson data yielded the following results:

Sample size	144
Number of subjects with $K<0.25$	59
Number of subjects included in analysis	85
Consensus ranking of street types	4 7 8 1 2 8 6 5
Coefficient of Concordance (W)	.2788
Significance level of W	.001

Interpretation

The most surprising aspect of street ranking from Ryerson is the placing of the most common street in the school area, i.e. finished unplanned local, in 8th place in order of preference and the relegation of the next most similar street type, unfinished unplanned local, to 7th place. These children seem to be saying rather unequivocally that they do not appreciate having to walk along streets similar to those they must travel in their normal daily lives. The placing of through highways and arterial streets in four of the first five ranks of the preference order suggests a preference for the busy, well travelled streets of the city. If this subject group must use a local street as a walkway, it would seem that their preferences lie with planned streets

i.e., the curvilinear suburban types 7 and 8, with precedence given to finished streets. The placing of unfinished arterials first in the preference order followed by finished planned local streets suggests that these children prefer streets on the periphery of the city as walkways followed by busy traffic routes, with central city local streets lowest in the preferred order.

Characteristics of Streets that May Influence Preference

A Stepwise Multiple Regression performed on Ryerson data yielded the following results which are summarized in Table 6.7. Twenty-one independent variables ($X_1 \ldots\ldots X_{21}$) gave a Multiple R = .75477 significant at the .05 level. The first 16 variables gave a Multiple R of .74575, significant at the .01 level and explained 55.614 percent of the variance in Y. These 16 variables will be taken as being the most useful for further study in this case.

The subject group shows a negative attitude to the economic status of streets (V 20), the quantity of sidewalks (V 5), commercial signs (V 18), number of children on the street (V 13) and high density of development (V 7). Positive attitudes are taken to quantity of trees (V 6), traffic control pavement markings (V 23), commercial establishments (V 17), diversity of the vista (V 21), curbs (V 24), cleanliness (V 14), broad roadways (V 2) and number of adults visible (V 12). Two variables, the number of automobiles visible (V 10) and street type (V 1) produce an interesting combination. A negative attitude to number of automobiles and a positive leaning toward less busy streets suggest that the bustle of the central city may not appeal greatly to the Ryerson child.

TABLE 6.7

RYERSON SCHOOL CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. VAR026 CHILDREN'S CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R		F	BETA
VAR020	ECONOMIC STATUS	.29285	.08576	.08576	.29285		-2.19622	-.13952
VAR006	PERCENT TREES	.35408	.12537	.03961	.24862		.35390	.20647
VAR005	PERCENT SIDEWALKS	.39144	.15323	.02785	-.20933		-9.84284	-.44791
VAR023	AMOUNT OF ROAD LINES	.42252	.17853	.02530	.11693		.72301	.48944
VAR018	NUMBER OF COMMERCIAL SIGNS	.49922	.24922	.07070	-.25903		-6.42653	-.84736
VAR017	NUMBER OF COMMERCIAL OUTLETS	.51569	.26594	.01671	.06829		2.76278	.88353
VAR013	NUMBER OF CHILDREN	.59487	.35387	.08793	-.00281		-17.13047	-1.08435
VAR021	DIVERSITY OF VIEW	.62296	.38807	.03420	-.07385		6.66135	.73674
VAR024	AMOUNT OF CURBS	.64840	.42042	.03235	.02282		.46324	.27175
VAR007	PERCENT BUILDINGS	.66665	.44442	.02399	-.17583		-.64832	-.28306
VAR014	CLEANLINESS	.69288	.48009	.03567	.10089		3.62740	.16839
VAR016	AGE OF HOUSES	.69931	.48903	.00894	.00080		-1.86911	-.16631
VAR002	PERCENT ROADWAY	.70438	.49615	.00712	.00703		.39917	.14742
VAR012	NUMBER OF ADULTS	.70929	.50310	.00694	.07150		7.80973	.99873
VAR010	NUMBER OF AUTOS	.73388	.53859	.03549	-.01984		-2.01518	-1.07949
VAR001	STREET TYPE	.74575	.55614	.01755	-.01761		2.72917	.27170
VAR004	PERCENT SHOULDERS	.74729	.55844	.00230	-.00604		.87427	.18512
VAR003	PERCENT GRASS	.75103	.56405	.00561	.09032		.81634	.12755
VAR011	NUMBER OF TRUCKS	.75245	.56618	.00213	.00793		1.36740	.24146
VAR008	TYPE OF ROAD SURFACE	.75372	.56810	.00192	-.05639		-2.40135	-.08721
VAR022	AMOUNT OF UTILITY WIRES	.75477 *	.56968	.00158	-.01528		-.03693	-.03272
VAR019	NUMBER OF APARTMENTS	.75516	.57026	.00059	-.00904		.05825	.06444
VAR025	NUMBER OF UTILITY POLES	.75536	.57057	.00031	.06888		-.13320	-.04553
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.75549	.57077	.00020	-.07890		-.15404	-.02068
(CONSTANT)							-59.63720	

* SIGNIFICANT AT THE .05 LEVEL

Comparison of Findings from Paired Comparison and Multiple Regression Analysis

The results yielded by both types of analysis support each other quite well. Negative attitudes to economic status, high density development and quantity of sidewalks is borne out by the choice of unfinished arterial streets as most preferred walkways revealed by Paired Comparison. Ranking of finished planned local street in second place also bears out the results of the Multiple Regression because, although this street type may rank highly in economic status, it seldom has sidewalks, except on collector streets within housing developments is always in a low density area. The positive attitudes revealed by Multiple Regression to trees, traffic control pavement markings, commercial establishments, broad roadways and curbs, with a diversity of visual stimuli confirms the choice of finished arterials and finished through highways in ranks 3 and 4 of the preference order from Paired Comparison. Preference for unfinished through highways, unfinished planned local streets also bears out this group's apparent disinterest in sidewalks. The ranking of unfinished through highways and unfinished planned local streets ahead of both categories of unplanned local streets suggests that the group's apparent liking for areas of low density development was an important influence in their choices.

The Ryerson group made some very positive statements as to the type of pedestrian route they prefer. Sidewalks are not apparently of great importance to the group which suggests that safety may not be a prime concern. Coming as they do from an area of high economic status, these children show an apparent negative attitude toward high-class areas and older homes which are what they encounter daily in their

local travels. However, once again, as with other schools examined so far, busy traffic routes, i.e., through highways and arterial streets are high on the priority list of preferred pedestrian routes.

(8) Bishop Townsend Public School

The Townsend School service area contains part of Census Tracts 17 and 18. Approximately 80 percent by area of the school district is contained in Tract 18 and since a military installation occupies the greater part of Tract 17 which is in the school district, it is taken that, for all practical purposes, the school population is drawn from Tract 18. Thus, data on the population of Tract 17 are omitted from the socio-economic profile of the area.

In 1961 average per family income in Tract 18 was $5,021, slightly below the Metropolitan average of $5,335. The median value of owner occupied dwellings was $10,450 as compared to a Metropolitan average of $13,128. The constitution of the labour force in the area was:

Occupational Category	Tract 18 % of labour force	Metro Average % of labour force
Managerial	4.74	8.86
Professional & Technical	9.10	11.63
Clerical	18.46	13.54
Sales	7.48	8.81
Service & Recreational	14.74	15.61
Transportation & Communication	7.42	5.55
Primary	0.26	2.39
Crafts	31.53	23.83
Labourers	4.09	3.91

The population of the school service area is below the Metropolitan average in income and the value of owner occupied homes is likewise below that of the urban area as a whole. The labour force is heavily represented in clerical and craft occupations.

School Population Preferences for Street Types

Bishop Townsend data subjected to Paired Comparison Analysis resulted in the following findings:

Sample size	176
Number of subjects with $K<0.25$	71
Number of subjects included in analysis	105
Consensus ranking of street types	5 3 2 6 7 4 1 8
Coefficient of Concordance (W)	.2141
Significance level of W	.001

Interpretation

The subject group from Bishop Townsend School show a clear preference for the older areas of town in their choice of preferred pedestrian routes, placing old, well established streets in three of the first four positions in their preferred ranking. The placing of finished streets in the first and second ranks suggests some concern with the pedestrian safety factor in their choice of travel routes. Residential streets rate highly with this group as preferred routes, occupying three of the first five positions in the ranking. Some indication is given of a preference for the semi-rural image in the high rank given to unfinished through highways (type 2), which normally occur on the fringe of the city. Relegation of finished through highways to seventh rank is surprising in that this type of street has not been so downgraded by other groups dealt with so far.

The children of Townsend School seem remarkably conservative in their choice of pedestrian routes generally placing their preference in the old areas of the city with some deference to the pedestrian safety aspects of their chosen walkways.

Characteristics of Streets that May Influence Preference

In the Stepwise Multiple Regression using Townsend data, 14 independent variables gave a Multiple R = .63087, significant at the .05 level. Thus, 39.8 percent of the variance in Y was explained (see Table 6.8). The group showed a marked negative attitude towards commercial signs (V 18) on their travel routes and seemed strongly influenced in their choices by paved streets (V 8), cleanliness (V 14), older houses (V 16) and absence of high density development (V 7). They do not seem averse to commercial establishments (V 17) and prefer an urban vista with variety (V 21). They do not seem to favour wide streets (V 2) and show some aversion to utility wires (V 22), although not to utility poles (V 25). The latter suggests that trees, which hide wires but not poles, may be a positive factor in influencing choice. This seems at variance with the negative regression coefficient of the trees variable (V 6). However, the b coefficient is not statistically significant for variable 6 and the sign of the coefficient is therefore not dependable. Sidewalks (V 5) seem important to the group and the amount of open space (V 3) may not be of great concern.

Comparison of Findings from Paired Comparison and Multiple Regression Analysis

Seven independent variables explained 30.475 percent of the

TABLE 6.8

R TOWNSEND SCHOOL CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. VAR026 CHILDREN'S CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	B	BETA
VAR018	NUMBER OF COMMERCIAL SIGNS	.21691	.04705	.04705	-.21691	-4.72323	-.64066
VAR008	TYPE OF ROAD SURFACE	.36012	.12968	.08263	.20172	2.31728	.08657
VAR014	CLEANLINESS	.40140	.16112	.03144	.19172	13.96932	.66713
VAR016	AGE OF HOUSES	.45460	.20667	.04554	.14442	1.15308	.10554
VAR007	PERCENT BUILDINGS	.49167	.24174	.03507	-.21437	-1.06374	-.47777
VAR017	NUMBER OF COMMERCIAL OUTLETS	.53235	.28340	.04166	.00903	1.71867	.56541
VAR021	DIVERSITY OF VIEW	.55204	.30475	.02135	.01209	.36869	.04195
VAR002	PERCENT ROADWAY	.56626	.32065	.01590	.01692	-.33561	-.12751
VAR025	NUMBER OF UTILITY POLES	.57448	.33003	.00938	.01770	1.47727	.51951
VAR022	AMOUNT OF UTILITY WIRES	.60206	.36248	.03245	-.21022	-.45949	-.41884
VAR005	PERCENT SIDEWALKS	.61410	.37712	.01464	.05345	6.20781	.29061
VAR003	PERCENT GRASS	.61976	.38410	.00698	.08705	-1.29242	-.20774
VAR023	AMOUNT OF ROAD LINES	.62544	.39118	.00708	.00231	-.39240	-.27327
VAR006	PERCENT TREES	.63087	.39800	.00682	.19417	-.10455	-.06275
VAR001	STREET TYPE	.63969	.40921	.01121	.00627	-2.46188	-.25213
VAR004	PERCENT SHOULDERS	.64638	.41781	.00860	-.20746	-.95153	-.20726
VAR024	AMOUNT OF CURBS	.64975	.42218	.00437	.19383	-.34247	-.20668
VAR013	NUMBER OF CHILDREN	.65235	.42556	.00339	.15372	-3.04107	-.19803
VAR015	NUMBER OF HOUSES	.65550	.42968	.00412	.11558	1.17753	.30447
VAR019	NUMBER OF APARTMENTS	.65860	.43375	.00407	-.09928	.15938	.18140
VAR011	NUMBER OF TRUCKS	.66045	.43619	.00244	.13191	5.39397	.97986
VAR010	NUMBER OF AUTOS	.68442	.46843	.03224	.05980	-.89127	-.49115
VAR012	NUMBER OF ADULTS	.69136	.47798	.00955	.19125	-3.65704	-.50742
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.69175	.47852	.00054	-.00734	-.24526	-.03388
(CONSTANT)						14.90836	

* SIGNIFICANT AT THE .05 LEVEL

variance in Y in the Multiple Regression. For purposes of the comparison of results from both modes of analysis, these will be taken as the most significant variables influencing choice of street as a pedestrian travel route. Townsend children show a strong negative reaction to commercial signs (V 18) and dense development (V 7). They seem to favour paved roadways (V 8), older buildings (V 16) and a clean (V 14) diversified (V 21) environment. Although commercial signs seem in disfavour, the presence of commercial establishments (V 17) meets with their approval. These children ranked street types in the following preference order:

(1) Finished unplanned local streets
(2) Finished arterial streets
(3) Unfinished through highways
(4) Unfinished unplanned local streets
(5) Finished planned local streets
(6) Unfinished arterial streets
(7) Finished through highways
(8) Unfinished planned local streets

Finished unplanned local streets normally conform to five of the seven preference criteria listed above. They are devoid of commercial signs and usually do not accommodate high-rise development. Because they are finished, the city works department flushes and sweeps them. The buildings on such streets in London are normally older structures since the majority of post-1950 housing construction in the city has taken place in planned subdivisions. It would seem, therefore, that the most preferred street type meets the criteria for desirability as pedestrian right-of-way in most regards. Finished arterial streets ranked in second place, also seem to meet five of the seven criteria

listed. The paved roadways of this street type serve older buildings and some minor commercial developments but commercial signs are not a problem. However, because of the functional nature of these streets, the scene can be quite diversified.

The third most preferred street type, unfinished through highways, is found exclusively on the outskirts of the city. The roadways are paved and not densely developed being given over to low-rise strip commercial in most cases. The contrast of semi-rural openness with sometimes garish commercial outlets make for variety in visual form of this street type. Thus, four out of seven criteria of desirability may be met by unfinished through highways.

The street type ranked in fourth position, unfinished unplanned local streets, also seems to meet four of the seven specified criteria. Commercial signs and dense development are seldom found on these streets which give access to older (over 25 years) houses normally. Because of the lack of traffic and commercial outlets, litter is not an important problem.

Finished planned local streets are ranked fifth in preference by this subject group. On the average, this street type is paved, clean, gives access to low density development and is devoid of commercial signs thus meeting four of the seven conditions for desirability as pedestrian walkways.

Sixth rank is given to unfinished arterial streets. As with unfinished through highways, this street type occurs on the edges of the city. Commercial signs and high density development are not usual on unfinished arterials. Some commercial development, such as the

Oak Ridge Shopping Centre on Oxford Street West, is not unusual and can add diversity to the scene. Thus, three of the criteria for desirability are met with some possibility of a fourth. Finished through highways ranked in seventh position meet four of the conditions in normal circumstances. They are paved and access older buildings, many of which are serving commercial purposes. The visual impact of such streets is usually very diversified. The least preferred street type, unfinished planned local streets, occurs mostly on the fringes of the city. Such streets service low density areas, are devoid of commercial signs and usually relatively litter free. However, although they meet three of the seven criteria for desirability as pedestrian routes, they are given low priority by Townsend children as they are by every other school group interviewed.

In general, the rankings from Paired Comparison Analysis are borne out by the findings from the Multiple Regression Analysis. There seems little doubt that the subject group has demonstrable likes and dislikes when asked to choose a desirable pedestrian travel route. In most cases, their choices reveal few contradictions in their criteria for preference.

(9) Woodland Heights Public School

Woodland Heights Public School services part of Census Tracts 37 and 38. Average per family incomes in these areas in 1961 were $5,325 and $6,096 respectively, compared to a Metropolitan average of $5,335. Median value of owner occupied dwellings were $9,813 for Tract 37 and $14,704 for Tract 38 against a Metropolitan average of $13,128. Labour force composition in this part of the city was:

Occupational Category	Tract 37 % of labour force	Tract 38 % of labour force	Metro Average % of labour force
Managerial	9.38	15.64	8.86
Professional & Technical	9.69	14.57	11.63
Clerical	15.83	9.05	13.54
Sales	11.48	15.50	8.81
Service & Recreational	12.28	9.21	15.61
Transportation & Communication	2.12	1.87	5.55
Primary	1.25	1.28	2.39
Crafts	28.04	17.35	23.83
Labourers	.77	.63	3.91

This school services an area which ranges from average for the city in the east end to above average in the west end in socio-economic terms. It boasts low density development and the most open space and parkland of any area in the city. It includes Springbank Park, the city's largest park, the nurseries of the Public Utilities Commission, Woodland Cemetery and is immediately adjacent to Greenway and Reservoir Parks. The majority of the housing in the area is in planned sub-divisions with some recent high-rise apartment developments. The entire school district conveys a sense of openness and has a rural character which is not common in other areas of the city.

Revealed Preferences for Street Types

When subjected to Paired Comparison Analysis data from Woodland Heights School yielded the following results:

Sample size	557
Number of subjects with $K<0.25$	253
Number of subjects included in analysis	304

Consensus ranking of street types	1 4 2 8 3 5 7 6
Coefficient of Concordance (W)	.2692
Significance level of W	.001

Interpretation

Students at Woodland Heights School show a strong preference for the older well travelled streets as pedestrian routes placing through highways and arterials in four of the first five places in their preference order. Local residential streets are given the lowest priority. The finished through highway with its high density commercial development is most appealing to this group closely followed by unfinished arterial streets and unfinished through highways, both found most often in the fringe areas of the city. The placing of unfinished local planned streets in fourth rank suggests that this group is influenced in their preferences by openness and low density development in their secondary choice of a pedestrian route. Unplanned local streets do not seem to impress this group but within this street classification the finished streets are preferred to the unfinished. This suggests some preference for streets with proper facilities for pedestrians. However, in London, it may have another connotation in that unfinished unplanned local streets are normally of lower economic status than the finished variety. However, this position is reversed when it comes to planned local streets where the finished are rated below the unfinished. This may reflect a preference for the more rural type of street. Subdivisions in London in which the streets are unfinished are generally older than those with finished streets. They also tend to have more mature trees than the newer housing areas, all

of which contribute to the rural character of these older subdivisions. Thus, the children of Woodland Heights seem impressed by urban vistas very similar to those found in their own area.

Characteristics of Streets that May Influence Preference

The Woodland Heights subject group data were subjected to Stepwise Multiple Regression Analysis and yielded a Multiple R = .65459, significant at the .05 level. Fourteen independent variables (X_1.....X_{14}) explained 42.848 percent of the variance in Y. The children opted for streets with high economic status (V 20), a diverse vista (V 21), clean appearance (V 14) and abundant trees (V 6). A positive attitude was taken to the number of apartments (V 19), road traffic control lines (V 23) and private houses (V 15). Negative reactions were apparent to presence of children (V 13), quantity of road shoulders (V 4), number of commercial signs (V 18), area of sidewalks (V 5), amount of curbs (V 24) and number of traffic signs (V 9). Street type (V 1) was also negatively evaluated suggesting some aversion to local streets as pedestrian routes.

The group's preferences lean towards older established routes with medium to heavy traffic loads. This statement would seem to conflict with the group's approach to traffic signs (V 9) which produced a negative b- coefficient in the Regression Analysis. However, once again, the coefficient is not statistically significant and the validity of its sign is questionable. Variable 9 is, therefore, excluded from further consideration.

TABLE 6.9

WOODLAND SCHOOL CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. VAR026 CHILDREN'S CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	F	BETA
VAR020	ECONOMIC STATUS	.38471	.14801	.14801	.38471	4.71697	.26269
VAR021	DIVERSITY OF VIEW	.43650	.19053	.04253	.08337	3.92312	.38037
VAR014	CLEANLINESS	.47270	.22345	.03291	.18652	4.93240	.20073
VAR013	NUMBER OF CHILDREN	.51206	.26220	.03876	.20355	-1.64601	-.09134
VAR006	PERCENT TREES	.54284	.29468	.03247	.19441	.60052	.40942
VAR019	NUMBER OF APARTMENTS	.55849	.31236	.01768	.12218	.23367	.22664
VAR004	PERCENT SHOULDERS	.58203	.33876	.02640	-.13971	-1.55286	-.28917
VAR023	AMOUNT OF ROAD LINES	.59619	.35544	.01668	.14376	.57467	.34103
VAR018	NUMBER OF COMMERCIAL SIGNS	.61412	.37714	.02170	-.11520	-1.15497	-.13350
VAR015	NUMBER OF HOUSES	.62381	.38914	.01200	.08771	.97387	.21458
VAR005	PERCENT SIDEWALKS	.63816	.40725	.01811	-.07663	-6.12390	-.24430
VAR024	AMOUNT OF CURBS	.64311	.41359	.00684	.12710	-.12127	-.06237
VAR001	STREET TYPE	.64853	.42059	.00700	-.08490	-1.76932	-.15441
VAR009	NUMBER OF TRAFFIC CONTROL SIGNS	.65459	.42848	.00789	-.02333	-.90187	-.10616
VAR016	AGE OF HOUSES	.65743	.43222	.00373	.06709	-1.59643	-.12452
VAR022	AMOUNT OF UTILITY WIRES	.65996	.43555	.00333	-.05383	.19896	.15455
VAR012	NUMBER OF ADULTS	.66067	.43648	.00093	.25142	6.33824	.71056
VAR011	NUMBER OF TRUCKS	.66766	.44577	.00929	.13807	-3.36558	-.52099
VAR002	PERCENT ROADWAY	.67025	.44923	.00346	.05105	-.12205	-.03951
VAR008	TYPE OF ROAD SURFACE	.67245	.45219	.00296	.19041	2.62492	.07083
VAR025	NUMBER OF UTILITY POLES	.67370	.45387	.00168	.07106	-.43104	-.12917
VAR003	PERCENT GRASS	.67518	.45586	.00199	.07830	.53662	.07350
VAR017	NUMBER OF COMMERCIAL OUTLETS	.67617	.45720	.00134	.15728	-.56498	-.15839
VAR007	PERCENT BUILDINGS	.67681	.45807	.00087	.01042	.25058	.09591
VAR010	NUMBER OF AUTOS	.67753	.45905	.00097	.16506	-.31022	-.14568
(CONSTANT)						-36.25370	

* SIGNIFICANT AT THE .05 LEVEL

Comparison of Findings from Paired Comparison and Multiple Regression Analysis

The Paired Comparison Analysis of Woodland Heights data yielded the following ranking of street types beginning with the most preferred.

Rank	Street Type	Description
1	1	Finished through highways
2	4	Unfinished arterial streets
3	2	Unfinished through highways
4	8	Unfinished planned local streets
5	3	Finished arterial streets
6	5	Finished unplanned local streets
7	7	Finished planned local streets
8	6	Unfinished unplanned local streets

Findings from the Multiple Regression Analysis suggest that the subject group prefer streets of high economic status, abundant trees and a clean, diversified appearance. However, their apparent liking for apartment buildings, traffic control pavement markings and single family dwellings coupled with a dislike of children in large numbers, of large areas of sidewalks and curbs, narrow considerably the areas of the city in which their most preferred routes would be likely to occur.

Traffic control markings are only found on the pavement of routes carrying heavy vehicular traffic. This suggests that the group prefers through highways and arterial and collector streets, all of which carry heavier traffic loads than local streets. Presence of sidewalks does not seem to appeal to the children which narrows still further the range and location of their preferred routes to streets near the fringes of the city since these are the areas where:

(a) Unfinished through highways and arterial streets occur most frequently,

(b) High status neighbourhoods are found, and

(c) Sidewalks are not as ubiquitous as they are in the central area of the city.

The street type rankings by this group conform quite closely to the criteria listed above. Through highways and arterial streets are ranked in four of the first five places in their preference order and unfinished streets are in three of the first four ranks. Local streets do not rate highly with Woodland Heights children as pedestrian routes. These are normally the street types on which one finds children since:

(a) They are primarily residential, and

(b) They are safer for children than the more heavily travelled routes.

It will be remembered that the Multiple Regression showed a negative attitude on the part of the subject group to presence of children in displays. This fact bears out their relegation of local streets to four of the last five places in their preference order. It is also worthy of note that three of the last four street types in their ranking are finished which agrees with the negative attitude to sidewalks as revealed by Multiple Regression.

Generally, the children of Woodland Heights School show a preference for busy streets near the outskirts of the city as pedestrian routes. As with children from other schools sampled, local streets do not rate highly as walkways. Of the local streets, the semi-rural unfinished planned variety are most preferred and the low status unfinished unplanned streets of the central city are given lowest priority. These children are relatively unequivocal in their preferences. They

like affluence, cleanliness, the fringe of the city and the variety and liveliness of a well travelled street. They seem, in fact, to be opting strongly for streets in their own area of the city.

(10) Wortley Road Public School

Wortley Road School serves part of Census Tracts 3 and 4. In 1961 per family earnings in the tracts were $6,054 and $4,713, respectively, and median value of owner occupied dwellings were $14,842 and $11,084. The school area is divided into two very distinct socio-economic neighbourhoods, the dividing line between the two being Wortley Road. The make-up of the labour force in the two census tracts in 1961 was as follows:

Occupational Category	Tract 3 % of labour force	Tract 4 % of labour force	Metro Average % of labour force
Managerial	12.25	6.54	8.86
Professional & Technical	20.69	9.58	11.63
Clerical	24.47	19.42	13.54
Sales	11.66	8.97	8.81
Service & Recreational	10.69	16.29	15.61
Transportation & Communication	3.53	5.56	5.55
Primary	.19	.60	2.39
Crafts	3.89	8.00	23.83
Labourers	1.81	3.90	3.91

The Wortley Road School District is an old neighbourhood which in recent years has seen some renewal which has introduced some high-rise, high density development.

Revealed Preferences for Street Types

Paired Comparison Analysis of Wortley Road data gave the following results:

Sample size	228
Number of subjects with K<0.25	98
Number of subjects included in analyses	130
Consensus ranking of street types	4 1 2 8 3 5 7 6
Coefficient of Concordance W	.3599
Significance level of W	.001

Interpretation

The children of Wortley Road School show a marked preference for the older more heavily travelled streets as preferred pedestrian routes ranking through highways and arterial streets in four of the first five places in their preference order. It would seem that streets on the ~~fringe of the city (types 4, 2 and 8) appeal~~ to these children more than streets within the central city. An apparent lack of preoccupation with pedestrian safety is revealed in their placing of three unfinished street types, i.e., those lacking sidewalks, in three of the first four positions in their preference order. Local, i.e., residential, streets do not seem to appeal to the subject group and are relegated to four of the last five positions in the ranking.

Although agreement within the group is high (W = .3599), there appears to be little consistency in the choices they made between finished and unfinished streets, sometimes choosing the finished over the unfinished of one street type, e.g., through highways and unplanned local streets and reversing that order in the case of arterial and planned residential streets. This apparent inconsistency, however,

only serves to strengthen the opinion that criteria other than pedestrian safety weighed heavily with this group in their preferences. These will be examined more closely in the following section.

Characteristics of Streets that May Influence Preference

Multiple Regression using Wortley Road data yielded results summarized in Table 6.10. A Multiple R = .69509, significant at the .05 level, was obtained with 14 independent variables. Thus, 48.315 percent of the variance in street choice (Y) was explained. The group favoured streets with high economic status (V 20), a diverse vista (V 21) and many trees (V 6). They chose streets that were clean (V 14), highly developed (V 15 and V 19), and likely to carry a heavy traffic load (V 23). Finished streets with curbs (V 24) and sidewalks (V 5) do not seem to appeal strongly to the group and older houses (V 16) do not appear favoured. A negative attitude to street type (V 1) suggests that residential streets are not favoured as pedestrian routes by the children. Variety with economic status seems to be the watchword of this group in their choice of a pedestrian route.

Comparison of Findings from Paired Comparison and Multiple Regression Analysis

Paired Comparison Analysis revealed that the Wortley Road children rated busy streets, i.e., types 4, 1, 2 and 3, very highly in their preference order as pedestrian routes and downgraded the residential (local) streets. This agrees quite well with the findings from Multiple Regression in that the top rated streets tend towards diversity, heavy traffic and dense development. They also tend to be the

TABLE 6.10

MORTLEY RD SCHOOL. CHOICE PATTERN VERSUS DISPLAY ATTRIBUTES

* M U L T I P L E R E G R E S S I O N *

DEPENDENT VARIABLE.. VAR026 CHILDRENIS CHOICE PATTERNS

SUMMARY TABLE

VARIABLE		MULTIPLE R	R SQUARE	RSQ CHANGE	SIMPLE R	B	BETA
VAR020	ECONOMIC STATUS	.40353	.16284	.16284	.40353	4.88056	.27836
VAR021	DIVERSITY OF VIEW	.46961	.22054	.05770	.11028	5.10434	.90684
VAR018	NUMBER OF COMMERCIAL SIGNS	.50643	.25647	.03593	-.15287	-1.11289	-.13174
VAR014	CLEANLINESS	.53969	.29126	.03479	.14604	8.58733	.19119
VAR001	STREET TYPE	.56311	.31710	.02583	-.12282	-2.64778	-.23666
VAR015	NUMBER OF HOUSES	.58968	.34773	.03063	.07743	1.46241	.33000
VAR006	PERCENT TREES	.62292	.38803	.04030	.22945	.86403	.45257
VAR019	NUMBER OF APARTMENTS	.63795	.40699	.01896	.13131	.31598	.31386
VAR023	AMOUNT OF ROAD LINES	.64897	.42116	.01418	.13363	.58554	.35588
VAR016	AGE OF HOUSES	.65537	.42951	.00835	.03572	-3.17466	-.25360
VAR004	PERCENT SHOULDERS	.66465	.44176	.01225	-.07962	-1.59688	-.30356
VAR024	AMOUNT OF CURBS	.68023	.46271	.02095	.06083	-.20040	-.10555
VAR005	PERCENT SIDEWALKS	.68756	.47274	.01003	-.07382	-6.83335	-.27918
VAR011	NUMBER OF TRUCKS	.69509 *	.48315	.01041	.09135	-3.57259	-.56639
VAR022	AMOUNT OF UTILITY WIRES	.69702	.48584	.00269	-.02439	.20233	.16096
VAR003	PERCENT GRASS	.69895	.48854	.00270	.07186	.71375	.10013
VAR012	NUMBER OF ADULTS	.70215	.49301	.00447	.19596	5.81801	.66798
VAR017	NUMBER OF COMMERCIAL OUTLETS	.71005	.50417	.01116	.11168	-1.04902	-.30119
VAR025	NUMBER OF UTILITY POLES	.71216	.50717	.00299	.09199	-.47433	-.14558
VAR010	NUMBER OF AUTOS	.71436	.51031	.00314	.11130	-.35119	-.16890
VAR002	PERCENT ROADWAY	.71478	.51091	.00060	.04581	-.14424	-.04783
VAR008	TYPE OF ROAD SURFACE	.71490	.51109	.00018	.16417	.72151	.02353
(CONSTANT)						-40.23650	

* SIGNIFICANT AT THE .05 LEVEL

street types that are lined with mature trees in London. It is not possible to generalize on the relationship between street type and economic status since this varies widely from street to street; however, it is usual in London to find that unfinished arterials and through highways are located on the fringe of the city and, in general, are areas of expensive housing such as Richmond North and Oxford West. The relegation of residential streets to four of the last five places in the preference order certainly agrees with the negative attitude to street type revealed by Multiple Regression.

The apparent indifference of Wortley Road children to the pedestrian safety aspect of the pedestrian routes chosen is puzzling. The school is located in a high density area on a relatively busy street, which many of the children must travel to school. This fact would normally be expected to make safety a prime consideration in the choice of a walkway. It would seem, however, that considerations of status and diversity of view weigh more heavily than safety with this group since the first seven variables to enter the regression, explaining 38.8 percent of the variance in Y, all point towards an interest in good appearance as the prime attribute of a preferred pedestrian route.

Summary

The results of the analysis conducted on data collected from the students of ten elementary schools in London, Ontario, regarding their preferences for various types of city streets as pedestrian travel routes make some clear statements as to the characteristics of preferred walkways. Although some spatial variation in expressed preferences is evident, it does not seem to form any easily discernible pattern. The

universality of consensus across the entire sample, despite background differences amongst the children, is worthy of note.

Streets most commonly rated highly as pedestrian routes by the entire subject group are:

(1) Finished through highways

(2) Finished arterial streets

(3) Unfinished arterial streets

(4) Unfinished through highways

The ordering of these four street types is interesting. Although all four would be expected to carry heavy traffic loads requiring them to be paved, there the similarities tend to become less obvious and dissimilarities become easily recognizable. Finished through highways are the commercial areas of London with only a few exceptions. These are the shopping streets, and shops seem to appeal to the subject group, a fact that will be dealt with further in Chapter VII. Finished arterial streets may also have shops but not as many or as varied as those located on through highways. However, these arterials normally have paved roadways, sidewalks, broad boulevards and mature trees, all of which are regarded as positive features of a busy thoroughfare by a majority of the subjects (see Table 7.5). Unfinished arterial streets and unfinished through highways are only found on the fringes of the urban area in London. They tend to be rural or semi-rural in character with some attributes which are common such as an apparent openness not found in the central city, low density development and a lack of worthwhile arrangements for pedestrians. Unfinished arterials are not commercial streets, although they do have the occasional variety store

or shopping centre, but these are isolated and accessible largely by automobile. Unfinished through highways, on the other hand, are characterized by commercial strip development of the type that may not normally be accessible to or hold much interest for children, such as motels, auto sales lots and various types of home service outlets all of which advertise their presence with a motley collection of commercial signs, a feature of city streets that the subject group does not seem to favour. The ordering of these four street types, therefore, seems logical and understandable, even to the adult mind.

Local streets, whether they be planned (curvilinear housing development) or unplanned (grid pattern) do not seem to be attractive pedestrian routes. The principal criterion determining choice of one local street over another seems to be the way the street is finished. Thoroughfares that are paved and equipped with curbs, gutters and sidewalks are preferred over their counterparts that are simply oiled and do not have sidewalks. This apparent consensus of the total sample may be due to the inherent safety factor on routes with proper walkways or to the neater appearance of finished streets. There is some reason to believe that the latter may be true. In London, Ontario, cleaning of streets by flushing with high pressure equipment or brushing with power devices by the city works department is totally confined to finished streets.[3] This fact alone tends to make finished streets cleaner than the unfinished variety. Couple this with the clearcut lines of curbs and sidewalks relative to the ragged, dusty appearance of shoulders and

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[3] Telephone interview with Mr. Coburn, City Engineer's Department.

it is understandable why finished streets are more attractive in appearance than comparable unfinished streets. As will be seen in Chapter VII, the cleanliness factor is important to children in their choice of pedestrian routes.

However, there are cases where an unfinished street is chosen over a finished one of the same type, e.g., unfinished arterial over finished arterial. This is most likely attributable to the environs of the street rather than the street itself. Thus, in one instance of which the writer is aware, a small boy made it clear that under no circumstances would he walk along a particular street because a hospital was visible in the picture.

Clearly, the reasons why children choose one street over another as a travel route are very complex and changeable. Some aspects of desirable walkways can be clearly identified from the results of this study. These particular characteristics explain much of the variance in choice patterns and some show a remarkable consistency of occurrence over the entire subject group. The following chapter will examine these characteristics of preferred pedestrian routes and will endeavour to paint a word picture of such a route as seen through the eyes of a child.

CHAPTER VII

CONCLUSION: EVALUATION OF FINDINGS AND IMPLICATIONS

> Environment always has an ambience, an atmosphere, difficult to define, but overriding in importance.
> (Ittelson, 1973, p. 15)

Lowenthal has stated that "different as they are from our own, the perceived milieus, say, of most children of the same age may closely resemble each other" (Lowenthal, 1961, p. 245). On another occasion, the same writer suggests that "Young people tend towards highly emotional, often negative, environmental responses but do not express them very decisively and agree relatively little in their judgments" (Lowenthal, 1972e, p. 59). These two statements present the reader with a dilemma. If the "perceived milieus" of children of the same age closely resemble each other, why then do "young people...agree relatively little in their judgments" of these milieus? It is suggested that the discrepancy may very well be a function of research technique. Lowenthal relied heavily for his raw data on verbal responses and language based judgments from his subjects. He states that "There is no adequate statistical surrogate for the pictures of each city supplied orally and in writing by observers themselves or for the pictures abstracted from their own descriptive terms" (Lowenthal, 1972e, p. 55). If children "agree relatively little" in their judgments related to environment, given that these judgments are linguistically expressed,

it may be that the lack of significant levels of agreement is due, at least in part, to differences in the subjects' facility with language. Piaget and Inhelder have issued an unequivocal warning in this regard. "It is essential not to limit oneself to the spontaneous remarks of children in general--experience shows that interpreting them is not always easy" (Piaget & Inhelder, 1969, p. 121). It would, therefore, appear that the apparent contradiction in Lowenthal's findings might be attributable to his use of subjects' verbal and written responses as basic research material. The writer, based on his own experience with elementary school age children, subscribes strongly to the opinion expressed by Piaget and Inhelder. It was this conviction that led him to seek a methodology for this study which eliminated any dependence whatever on language as a medium of response to environmental stimuli by children. The search led to the use of the combination of Paired Comparison and Multiple Regression techniques already described. That the methodology has some shortcomings goes without saying and some of these will be described later. However, the results obtained are considered significant in the light of the exploratory nature of the study. A summary of findings is outlined below.

Summary of Findings

The most obvious conclusion that can be drawn from this research is that, given an appropriate data collection technique, significant levels of intra-subject agreement in certain environmental judgments can be achieved with juvenile respondents. It is apparent that the consensus of this subject group indicates preference for heavily travelled streets over local streets as preferred travel routes.

Invariably finished streets, i.e., those that are paved, equipped with curbs and gutters and, in most cases, provided with sidewalks, are rated more desirable than unfinished streets. Table 7.1 shows an aggregation of the rankings of the eight street types studied from each of the ten schools' subject groups. It will be noted that street types 1 through 4, i.e., through highways and arterial streets, are ranked in the first four ranks 26 out of 40 times, or 65 percent of the time. Finished streets, types 1, 3, 5 and 7, are ranked 1 through 4 in 25 out of 40 instances or 62.5 percent of the time. This would seem to indicate substantial agreement in preference patterns amongst subjects quite widely separated spatially and socio-economically across the city. The ratios of concurrence between observer groups are almost identical to those found by Lowenthal in his study of urban environment perception.

> The frequency with which groups in any city concur in their style of judgment is an indicator of the extent to which the urban environment overrides background differences among observers. Overall, observer groups accorded with other groups in the same city in their style of judging environmental qualities in two-thirds of all instances. (Lowenthal, 1972e, p. 51)

There is one important point that should be noted when comparing results obtained by Lowenthal with those found in this study. His subject group was predominantly adult, 65.4 percent of interviewees being 20 years of age or over and none were under age 10 (Lowenthal, 1972e, p. 5). It is, therefore, suggested that, given a data collection method comprehensible to children, which does not depend upon language as a response mechanism, concurrence in certain facets of environmental judgments amongst the young may equal those of adult subject groups. This is not

TABLE 7.1

Aggregated Street Type Preferences

Street Type	Description	Occurrences in Ranks 1 to 4	Occurrences in Ranks 5 to 8
1	Finished through highways	7	3
2	Unfinished through highways	6	4
3	Finished arterial streets	8	2
4	Unfinished arterial streets	5	5
5	Finished unplanned local streets	5	5
6	Unfinished unplanned local streets	2	8
7	Finished planned local streets.	5	5
8	Unfinished planned local streets	2	8
	Total Occurrences street type 1 to 4	26	14
TOTAL	Total Occurrences street types 5 to 8	14	26
	Total Occurrences street types 1, 3, 5 and 7	25	15
	Total Occurrences street types 2, 4, 6 and 8	15	25

SOURCE: T. J. Underwood

to say that revealed preferences did not show some differences amongst children from different areas of the city, as will be seen from the examination of school group preference rankings which follows. It will be remembered that during data collection for this study, schools were divided into four groups as described in Chapter II. It was postulated that this grouping would aid in isolating differences in preference patterns that might be attributable to locational and/or socio-cultural aspects of the various school populations involved.

School Group Preference Patterns

Group 1: Woodland Heights and Wortley Road Schools

The backgrounds of the populations of these two schools have been discussed in some detail in Chapter VI of this study. It will be remembered that both spatially and socio-economically the two student groups have much in common. The principal difference between them is in the developmental nature of the school districts in which they live. Wortley Road serves an established densely developed area which is currently being subjected to some encroachment by high density redevelopment. Woodland Heights, on the other hand, is located in a developing low density suburban area with an extremely high ratio of open to built-up areas. Reference to Table 5.1 shows that, in their original pairwise choices over the entire range of 28 display pairs used during data collection, the two school populations show a great deal of unanimity in preference. A Simple Correlation between percentage of the total sample from each school opting for a certain display in each of the 28 pairs yields R = .96, significant at the .001 level. This high level of agreement was made equally evident by the result of

Paired Comparison Analysis which gave the following consensus ranking of street types based on the responses of those children from each school sample who showed a satisfactory level of consistency ($K \geq 0.25$) in their individual choice matrices.

School	Ranking of Street Types
Wortley Road	4 1 2 8 3 5 7 6
Woodland Heights	1 4 2 8 3 7 5 6

Table 7.2 shows Spearman Rank Correlation Coefficients between street type rankings from all school populations covered in this study. It will be noted that Wortley Road and Woodland Heights rankings correlate at 0.7857, significant at the .01 level. It can be concluded, therefore, that preference patterns from both schools show substantial concurrence. This lends some strength to the suggestion that, given limited locational and socio-economic differences amongst subject groups, the nature of development in the children's home neighbourhoods may not be a significant determinant of preference for different kinds of city streets as pedestrian travel routes.

Group 2: Arthur Ford and Aberdeen Schools

Arthur Ford School serves a new, lower-middle-class housing subdivision in south London. Aberdeen School is located in an old, unplanned, deteriorating residential area on the fringe of the city core. Populations from these schools are, therefore, quite widely separated both spatially and socio-economically. Table 5.1 shows that the percentage of each school sample choosing in the same way from each of the 28 display pairs shown correlated at R = .90, significant at the

TABLE 7.2

SPEARMAN RANK CORRELATIONS BETWEEN RANKINGS BY SCHOOL

SPEARMAN CORRELATION COEFFICIENTS

VARIABLE PAIR		VARIABLE PAIR		VARIABLE PAIR		VARIABLE PAIR		VARIABLE PAIR		VARIABLE PAIR	
MORTLEY	.7857	MORTLEY	.4524	MORTLEY	.6905	MORTLEY	.0476	MORTLEY	.6190	MORTLEY	-.1667
WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)
WOODLAND	SIG .011	FORD	SIG .131	ABERDEEN	SIG .029	BRENTON	SIG .456	EALING	SIG .051	RYERSON	SIG .347
MORTLEY	.0359	MORTLEY	.5234	MORTLEY	.0838	WOODLAND	.3095	WOODLAND	.8333	WOODLAND	.1905
WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)
EMPRESS	SIG .467	CHIPPEWA	SIG .218	TOWNSEND	SIG .422	FORD	SIG .228	ABERDEEN	SIG .006	BRENTON	SIG .326
WOODLAND	.4048	WOODLAND	.0476	WOODLAND	.0359	WOODLAND	.5234	WOODLAND	.0858	FORD	.2381
WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)
EALING	SIG .160	RYERSON	SIG .456	EMPRESS	SIG .467	CHIPPEWA	SIG .218	TOWNSEND	SIG .422	ABERDEEN	SIG .286
FORD	.1905	FORD	.8095	FORD	-.5476	FORD	-.4311	FORD	-.5749	FORD	.4311
WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)
BRENTON	SIG .326	EALING	SIG .008	RYERSON	SIG .081	EMPRESS	SIG .144	CHIPPEWA	SIG .069	TOWNSEND	SIG .144
ABERDEEN	.1429	ABERDEEN	.2381	ABERDEEN	.3571	ABERDEEN	-.3832	ABERDEEN	.0479	ABERDEEN	-.2395
WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)
BRENTON	SIG .368	EALING	SIG .286	RYERSON	SIG .193	EMPRESS	SIG .175	CHIPPEWA	SIG .456	TOWNSEND	SIG .284
BRENTON	.4286	BRENTON	.3810	BRENTON	-.1677	BRENTON	-.0958	BRENTON	-.0719	EALING	-.5000
WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)
EALING	SIG .145	RYERSON	SIG .176	EMPRESS	SIG .346	CHIPPEWA	SIG .411	TOWNSEND	SIG .433	RYERSON	SIG .104
EALING	-.2515	EALING	-.1796	EALING	.1317	RYERSON	-.1557	RYERSON	.1317	RYERSON	-.3952
WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)	WITH	N(8)
EMPRESS	SIG .274	CHIPPEWA	SIG .336	TOWNSEND	SIG .378	EMPRESS	SIG .357	CHIPPEWA	SIG .378	TOWNSEND	SIG .167
EMPRESS	.7831	EMPRESS	.5735	CHIPPEWA	-.0602						
WITH	N(8)	WITH	N(8)	WITH	N(8)						
CHIPPEWA	SIG .011	TOWNSEND	SIG .182	TOWNSEND	SIG .444						

.001 level. Thus, on whatever basis the choices were made, the subjects from both schools revealed very similar preferences. Paired Comparison Analysis of responses from children whose level of individual consistency of choice $K \geq 0.25$, based on functional designation of streets displayed, yielded the following rankings:

School	Ranking of Street Types
Arthur Ford	5 3 1 7 8 2 6 4
Aberdeen	3 5 1 7 2 6 8 4

As can be seen, the rankings do not differ to a great extent. However, the Spearman Rank Correlation between the two is remarkably low (see Table 7.2) at .2381, which is not statistically significant. This suggests a very low level of agreement between the two subject groups. Differences in rankings, however, are more apparent than real and the low correlation is a function of the Spearman Technique which places strong emphasis on individual rank differences rather than on overall similarities in the rank orders. It is, therefore, suggested that real differences between the revealed preferences of the two subject groups are not of great practical significance despite the low value of the Spearman statistic and that the preferences of the two groups are remarkably similar as suggested by the relationships between original choice patterns revealed in Table 5.1. If it is accepted that the two groups reveal similar likes and dislikes in their choice of pedestrian routes, it would seem that children quite widely separated spatially and socio-economically within the city may not differ greatly in their preference patterns.

Group 3: Clara Brenton, Ryerson and Ealing Schools

These three schools form a west to east traverse across the city and are quite widely separated spatially. Socio-economically, the service areas of Clara Brenton and Ryerson are similar, both schools serving high income families. However, the former is located in a new planned subdivision in the extreme west end of the city and the latter serves an old, well established, unplanned residential neighbourhood in the central city. The Ealing district is in the southeast end of the city and, like Clara Brenton district, adjoins open country. Ealing area housing is old and, due largely to commercial and manufacturing encroachment, ranks quite low on the scale of residential desirability as measured by average house value. Table 5.1 shows that in their original pairwise choices, the children of all three schools show strong preference similarities. The percentages of each sample choosing in a particular way from the 28 display pairs yielded the following Simple Correlations:

Brenton/Ryerson	.89, significant at the .001 level
Brenton/Ealing	.83, significant at the .001 level
Ryerson/Ealing	.93, significant at the .001 level

Paired Comparison Analysis of the choice matrices of those students from each school whose level of consistency $K \geq 0.25$ gave the following rankings of street types from each school sample:

School	Ranking of Street Types
Clara Brenton	2 4 3 1 7 5 8 6
Ryerson	4 7 3 1 2 8 6 5
Ealing	4 1 3 6 7 2 8 5

Reference to Table 7.2 shows that Spearman Rank Correlations between the above are low and are not statistically significant. However, as before, there are similarities in the rankings which the Spearman technique tends to mask. If it is assumed that streets ranked 1 to 4 are preferred to those ranked 5 to 8, an aggregation of ranks as shown in Table 7.3 is quite revealing and shows broad patterns of similarity within the rankings.

It will be noted that street types 1, 3 and 4 are consistently ranked highly and types 5 and 8 are deemed less desirable with equal regularity. Street types 2, 6 and 7 are ranked in the less desirable category two out of three times. Subjects from all three schools can, therefore, be assumed to prefer finished through highways, and finished and unfinished arterial streets to local streets of all types as pedestrian routes. It may seem anomalous that type 4 streets (unfinished arterials) are ranked higher than type 2 streets (unfinished through highways) so consistently, since both have much similar traffic patterns, do not tend to be densely developed and are both found mainly on the fringes of the city. There is, however, one difference which seems to have weighed heavily in the childrens' expressed preferences. Unfinished through highways in London accommodate an amorphous mix of strip commercial development which is not a feature of unfinished arterials. Children from all subject groups, save two, show negative attitudes to visible commercial signs in their street choices, a fact that may account for the lack of enthusiasm for type 2 streets. This problem will be discussed later in dealing with components of streets that may have influenced choices of preferred pedestrian routes.

TABLE 7.3

Aggregation of Street Type Rankings from Brenton, Ryerson and Ealing

Street Type	Number of Occurrences Ranks 1 to 4	Number of Occurrences Ranks 5 to 8
1	3	0
2	1	2
3	3	0
4	3	0
5	0	3
6	1	2
7	1	2
8	0	3

Source: T. J. Underwood

Rankings given to residential streets vary quite widely amongst subjects from the three schools in this group. Although Clara Brenton children rank local streets in the last four ranks of their preference order, it is interesting to note that type 7 streets, finished planned local streets, are preferred to all other local types. This is the street type which is found exclusively within the Clara Brenton service area. Next to this, type 5, finished unplanned local streets, are preferred. Thus, it is suggested that the appeal of a finished local street to Clara Brenton children seems quite strong. Ryerson children also live in an affluent area of the city. Their preferences for residential streets as pedestrian routes show that they rank planned local streets above unplanned local streets consistently and that finished local streets, the most common street type in the Ryerson area, are held in lowest esteem of all. It may be that children of affluent parents see the suburbs in a more favourable light than the central city and opt for suburban local over central local streets as preferred walkways. Ealing children ranked unfinished unplanned local streets highest of all local types followed by finished planned local streets, unfinished planned local streets and finished unplanned local streets. The most preferred local street type is common in the school area which suggests the possibility that familiarity breeds tolerance for street types. Children from both Clara Brenton and Ealing Schools show some preference for local street types with which they are very familiar. Ryerson children, on the other hand, are quite clear in their preference for local street types which, in London, are spatially quite far away from their home area.

Taken as a whole, there are some strong similarities in the preference patterns of students from all Group 3 schools.

Group 4: Empress, Townsend and Chippewa Schools

These three schools serve areas of the city which are widely dispersed. Empress and Townsend are both located in the central city and serve socio-economically comparable areas of lower to lower-middle class housing. Empress is an old school serving a densely developed area of older housing than that found in the Townsend area where both the school and the majority of houses are of more recent, low density development. Oxford Street, which forms the northern boundary of the Townsend service area, suffers from some largely unplanned strip commercial development which does little to enhance the visual character of the area. Chippewa School is located in a still developing area in northeast London. The school is new as is the low density, mostly single family, housing it serves. The area contains a small number of walkup apartment buildings and a small shopping centre. The entire development is relatively isolated from the city proper and is surrounded on three sides by open agricultural land.

Table 5.1 shows the relationships between the choice patterns of subjects from all three schools as revealed by the percentage of each sample choosing a particular display in each of the 28 pairs used in data collection. Simple Correlations between these percentages are:

Empress/Townsend	.91, significant at the .001 level
Empress/Chippewa	.91, significant at the .001 level
Townsend/Chippewa	.89, significant at the .001 level

Given the high level of agreement above, it might be expected that rankings of preferred street types derived from Paired Comparison Analysis of choice matrices of subjects from each school whose individual levels of Consistency $K \geq 0.25$ would show a high degree of similarity. This, however, is only partially true. Derived street type rankings were as follows.

School	Ranking of Street Types
Empress	3 2 7 5 4 6 1 8
Townsend	5 3 2 6 7 4 1 8
Chippewa	3 2 7 5 1 6 4 8

Spearman Rank Correlations between the above rankings are .7831, significant at the .01 level, between Empress and Chippewa and, as can be seen from Table 7.2, not statistically significant in the Townsend/Empress and Townsend/Chippewa combinations. However, despite the apparent lack of significant statistical relationships in the latter two cases, there are obvious practical relationships which are not discoverable using rank correlation techniques. An aggregation of occurrences of each street type in the first and last four places of the rank orders for each school is quite revealing (see Table 7.4). Once again, assuming that most preferred streets will appear most often in the first four places of the rank order and less preferred street types in the last four places, some obvious regularities in the choice patterns of the three schools become apparent. Subjects from all three schools consistently rate unfinished through highways (type 2), finished arterials (type 3) and finished unplanned local streets (type 5) amongst the more desirable pedestrian routes. With equal regularity

TABLE 7.4

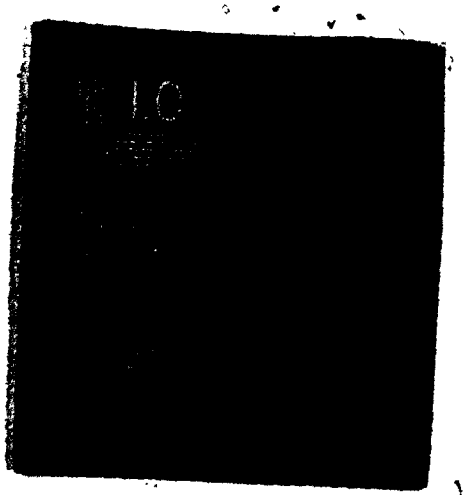
Aggregation of Street Type Rankings from Empress, Townsend and Chippewa

Street Type	Number of Occurrences Ranks 1 to 4	Number of Occurrences Ranks 5 to 8
1		3
2	3	
3	3	
4		3
5	3	
6	1	2
7	2	1
8		3

Source: T. J. Underwood

3 3

OF/DE



finished through highways (type 1), unfinished arterials (type 4) and unfinished planned local streets (type 8) are rated less desirable. In two out of three instances, unfinished unplanned local streets (type 6) are ranked in the less desirable category and finished planned local streets (type 7) are deemed desirable. In general, then, it can be stated that the three subject groups show substantial agreement in their preference patterns for different street types as pedestrian travel routes.

The high levels of agreement between Empress and Chippewa rankings lend some credence to the opinion expressed in regard to preferences of the Ford/Aberdeen groups that locational and age differences of neighbourhoods may have only marginal effects on preference patterns of children resident in the areas.

Intra-Group Comparisons--A Summary

If there is one impression that dominates in the above perusal of intra-group preference rankings it is that similarities in preference patterns on the broad scale outweigh dissimilarities in all four school groups. It must, therefore, be concluded that, although results from Phase 1 of this research suggest that socio-cultural factors such as school attended and, therefore, home location within the city and social status, influence the preference patterns of the children, differences in those patterns are such that it is not possible, given the present data set, to attribute such differences to specific socio-economic or locational characteristics of the subject groups. In fact, it seems likely that differences in preference patterns from school to school are more statistical than real. This contention is borne out by the

findings of Lowenthal who says that "The urban environment overrides background differences amongst observers" and that "observer groups accorded with other groups in the same city in their style of judging environmental qualities in two-thirds of all instances" (Lowenthal, 1972e, p. 51).

Characteristics of Streets that May Influence Preference

The series of ten Multiple Regressions described in Chapter VI, in which 26 independent variables representing quantifications of display components were used to explain variance in choice across the range of 28 display pairs for each of the ten sample schools, produced results summarized in Table 7.5. It will be noted that certain of the independent variables appear consistently as major explicators of variance in choice across the entire range of school subject groups. These are listed in Table 7.6 but are limited to those variables that entered six or more of the regressions at statistically significant levels explaining variance in choice patterns. It will be noted that attitudes to street components and characteristics as revealed by the sign of the regression coefficient (b) are very clear-cut in some instances, while in others they are unclear and suggest varying degrees of ambiguity. Thus, a positive attitude to commercial establishments is revealed in every instance where the variable was significant, while an equally unequivocal negative attitude to commercial signs is also apparent. These, on the surface appear as contradictory statements. This, however, is not necessarily so. In enumerating commercial signs those attached to buildings announcing ownership, trade names or service functions of those buildings were not included as commercial signs.

TABLE 7.5

Variance in Preference Explained by Street Components

*School	AB		BR		CH		EA		EM		FO		RY		TO		WO		WR	
	**Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %
1. Street type					11	+ 3			12	- 2	11	- 1	16	+ 2			13	- 1	5	- 3
2. % Roadway	2	- 11			13	- 1	11	+ 1			2	- 12	13	+ 1	8	- 1				
3. % Green space	11	+ 1													12	- 1				
4. % Shoulders	1	- 23	4	+ 2	4	- 3	8	+ 5			1	- 13					7	- 3	11	- 1
5. % Sidewalks	8	- 1	3	- 4	12	+ 1	1	- 7	16	+ 1	9	- 1	3	- 3	11	+ 1	11	- 2	13	- 1
6. % Trees	6	- 1	2	+ 7	2	- 7	2	+ 9					2	+ 4	14	- 1	5	+ 3	7	+ 4
7. % Buildings					7	- 3	10	- 4	5	- 3			10	- 2	5	- 4				
8. Road surface			8	- 2	1	+ 6	12	- 1	1	+ 6					2	+ 8				
9. # Traffic signs	7	+ 1	19	+ 1							4	+ 3					14	- 1		
10. # Automobiles			13	- 3			15	- 3	15	- 2			15	- 4						
11. # Trucks	9	- 1							14	+ 1									14	+ 1
12. # Adults			12	- 2			14	+ 1					14	+ 1						
13. # Children			10	- 4			7	- 10	8	- 2	12	- 1	7	- 9			4	- 4		
14. Cleanliness			18	+ 1	6	+ 4	9	+ 3	3	+ 5			11	+ 4	3	+ 3	3	+ 3	4	+ 3
15. # Houses			17	- 1					13	+ 1	10	+ 1					10	+ 1	6	+ 3
16. Age of houses	3	+ 3	7	- 1					4	+ 7	8	+ 3	12	- 1	4	+ 5			10	- 1

(Cont'd)

TABLE 7.5 (Cont'd)

School	AB		BR		CH		EA		EM		FO		RY		TO		WO		WR	
	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %	Step	C %
17. # Commercial establishments	12	+ 1	9	+ 1	9	+ 2	6	+ 3	7	+ 3	6	+ 2	6	+ 2	6	+ 4				
18. # Commercial signs			6	- 2	3	- 4	3	- 2	2	- 8			5	- 7	1	- 5	9	- 2	3	- 4
19. # Apartments			11	- 3					10	+ 1							6	+ 2	8	+ 2
20. Economic Status	10	- 0	16	- 1	14	+ 1							1	- 9			1	+ 15	1	+ 16
21. Diversity	4	- 2	5	+ 1	5	+ 2	5	+ 4	6	+ 2	7	- 2	8	+ 3	7	+ 2	2	+ 4	2	+ 6
22. # Insulators	5	- 1			8	- 3			9	- 1	5	- 3			10	- 3				
23. Road lines	13	- 1	1	+ 10	10	+ 1	4	+ 7	11	- 1	3	- 4	4	+ 3	13	- 1	8	+ 3	9	+ 1
24. Curbs			15	+ 1			13	+ 1					9	+ 3			12	- 1	12	- 2
25. # Hydro Poles			14	- 3											9	+ 1				
Number of Variables	14		19		14		15		16		12		16		14		14		14	
Percent of Variance Explained	47		50		40		59		45		44		56		40		43		48	

*School Code: AB = Aberdeen, BR = Clara Brenton, CH = Chippewa, EA = Ealing, EM = Empress, FO = Arthur Ford, RY = Ryerson, TO = Bishop Townsend, WO = Woodland Heights, WR = Wortley Road.

**Column Caption Code: Step = Step variable entered in regression.
C = Sign of regression coefficient (b).
% = Percent explanation of variance in dependent variable (Y) added.

NOTE: All percentages entered in Table 7.5 have been rounded to the nearest whole number.

TABLE 7.6

Variables Most Frequently Explaining Variance in Preference

VARIABLE	Frequency of Entrance in Regressions		
	Negative b	Positive b	Total
Diversity of Vista	2	8	10
Area of Sidewalks	7	3	10
Amount Road Markings	5	5	10
Number Commercial Signs	8	0	8
Number Commercial Est.	0	8	8
Degree of Cleanliness	0	8	8
Amount of Trees	3	5	8
Area of Shoulders	5	2	7
Age of Buildings	3	4	7
Number of Children	6	0	6
Area of Roadway	4	2	6
Street Category	4	2	6

Source: T. J. Underwood

being considered legitimate adjuncts to the premises themselves. Free standing signs or signs protruding from buildings into the street advertising a specific product by name were taken to be commercial signs. Where a sign included the name or function of an establishment combined with advertising for a specific product, the sign was considered commercial. Because of this distinction, it was possible to have a commercial establishment present in a street display without the presence of a commercial sign as designated. This action was taken in an effort to isolate the two functions of business, and pure advertising, as separate street components. Cleanliness of streets received clear approval in every case in which it constituted a significant variable. Presence of children on a street was invariably accompanied by disapproval of that street. This, of course, cannot be construed as meaning that children dislike the presence of other children; it may simply be that children are more often found in numbers on local streets which are not favoured as pedestrian routes by any of the sample groups. All other variables listed show some mix of positive and negative attitudes. Street scenes showing a high diversity of content are favoured eight out of ten times. Large areas of sidewalk receive negative responses seven out of ten times, which may not mean that children dislike streets with sidewalks since they also react negatively to large areas of road shoulders five out of seven times. Large areas of sidewalks are a feature of core area streets in London where boulevards and trees are not normally present and the negative attitude to large areas of sidewalks may be a surrogate for negative attitudes to central city streets as pedestrian routes. Presence of trees as a

major landscape feature receives positive reaction five out of eight times. Older houses are preferred to newer ones four out of seven times and busy streets are favoured over local quiet streets four out of six times. Street scenes with broad traffic surfaces receive negative attitudes four out of six times. In the case of other variables, positive and negative attitudes are evenly divided or else variables entered equations less than six out of ten possible times. Given this array of attitudes to street characteristics, it is possible to draw a word picture of the most preferred type of pedestrian walkway as seen by the children included in this study.

Subjects' Preferred Travel Route: A Word Picture

The consensus of the children sampled suggests that they prefer to walk along streets that have a fairly narrow, probably two-lane, vehicular roadway which is heavily used. Traffic is regulated by various types of traffic control systems. The most desirable street is generally tree-lined and has narrow sidewalks and boulevards. The roadway is paved, has finished edges and an overall clean aspect. The view is varied with a mix of private houses and some commercial establishments. Product advertising in quantity is not a feature of preferred walkways.

The street type most likely to meet these criteria in London is a finished arterial street within the central city but outside the immediate central business district. In London this type of street tends to be a former residential area where some of the private homes have been converted to business use. They are also the street types that accommodate corner variety stores and gasoline stations with the

occasional shopping centre, often on land formerly occupied by private houses.

The apparent conservatism displayed in the children's revealed preferences led to a general repudiation of the street types normal to the two extremes of the urban scene, namely, the downtown area and the suburbs, as desirable pedestrian walkways. It is easy to understand the latter because as one writer put it "There is nothing exciting [for older children] in a neighbourhood designed for toddlers" (Michelson, 1970, p. 102). "The suburbs are a crashing bore and a desolating disappointment" (Carver, 1962, p. 3) and boredom kills interest in any activity, especially for children. The apparent lack of interest in streets in the downtown area as walkways may not reflect any particular dislike for this street type. It is possible that the subject group views downtown streets, with their crowded busy thoroughfares, as interesting places to browse or be with friends but not as conducive to purposeful walking. This, of course, is simply conjecture, but observation of young people in pedestrian areas, such as malls or streets that are closed to traffic, reveals a tendency on their part to sit or stroll in leisurely fashion with little inclination to brisk walking, except in travel to and from the place of interest and, then, only if a ride is not available.

In general, the writer has to agree with Clay who wrote that "Even in childhood, perception [of the environment] is strongly colored by associations of social status: by 'niceness', by cleanliness, by upkeep and by money" (Clay, 1969, p. 137), factors which seem to have been influential in determining the preferences of this subject group

for various types of city streets as pedestrian travel routes.

This completes the study from a substantive point of view; however, some comments regarding methodology used, possible improvements and future work in this area seem desirable and these are laid out below.

A Critique of the Study Methodology

There seems little doubt that the methodology used in this study, in common with those used in many other works, has its own combination of strengths and weaknesses. Its main strength lies in the method of data collection used, in that the subject group was given only a simple task which would be understandable, even to the youngest child involved. Linguistic responses were not required, which obviated the possibility that differences in facility with language might produce marked differences in response patterns to environmental displays, engendered by language difficulties rather than by specific characteristics of displays. Secondly, the nature of the responses made accurate, rigorous analysis possible with little probability of researcher-induced bias. But, in common with all other studies involving perception of environment, stimulus presentation had its own problems.

Choice of Environmental Displays

In any investigation of stimulus/response, the most appropriate technique must be exposure of the subject directly to the stimulus, followed by monitoring of response by whatever method is most suitable. The introduction of any artificial connection between the actual stimulus and the subject must do one of two things:

(1) It must screen out, or mask, some aspect of the original stimulus, thus creating a new stimulus which is only a surrogate for the first.

(2) It must introduce an element of 'noise', of perceptual distraction, between the subject and the stimulus.

In the case of perception of the environment, the stimulus object is the environment itself, and the above objections to techniques other than direct exposure of subjects to the stimulus seem equally valid. "Environments...are always multi-modal" (Ittelson, 1973, p. 13); they are perceived by more than one sense. Thus, ~~if subject stimulation is~~ by any means other than direct exposure to the actual physical environment, something is always lost. However, often what is lost may be redundant. "Environments always provide more information than can possibly be processed" (Ittelson, 1973, p. 14). If, therefore, the researcher is concerned with the visual character of the environment, it might be argued that elimination of all sensory inputs, other than visual, might prove advantageous. There is also some evidence that in environment perception, the eyes are the most important receptors of information. "Man is truly a visual animal with respect to his environment. He learns more, reacts more and appreciates more through his visual system than through any other sense" (Newby, 1971, p. 68). Newby is by no means alone in this contention which is also held by writers such as Lindley, 1961, p. 19; Portman, 1969, p. 115; and Cullen, 1961, p. 10. Because the author was primarily concerned with response to the visible environment in this study, it was decided that all modes of stimulation other than visual could be eliminated from the stimulus presentations,

a decision that led to the use of photographic representations of the environment as response generators. Some other considerations also carried some weight in this decision. The logistical problems of exposing subjects to actual environments place powerful constraints on the number of subjects whose responses can be monitored. Appleyard, Lynch and Meyer in their classic work in the field of environment perception mention 20 subjects as their "somewhat wider sample" (Appleyard, Lynch & Meyer, 1960, p. 27). Lowenthal in his assessment of perception of four city environments based his study on responses from 66 subjects from New York, 94 from Boston, 92 from Cambridge, Massachusetts and 40 from Columbus, Ohio, for a total of 292 subjects (Lowenthal, 1972e, p. 5). It is probable that logistical difficulties were considerations in determining sample size in all cases. One ambition of the writer in embarking on this study was to procure a sufficiently large sample so that findings might be deemed, with acceptable statistical certitude, to be representative of the opinions of the entire population from which the subjects were drawn. Thus, so that all subgroups of the sample population as defined by age, educational level, sex, school attended and home location might be adequately covered, a sample of ten percent of the total population of London Public Schools in Grades 2 to 8 was sought. This amounted to approximately 2,800 students. This fact alone made observation in the field a logistical impossibility. Also of concern was the influence of 'noise' created by movement of subjects from one area of the city to another. "Aside from the logistical problems connected with transporting people to a field setting, there is the more critical issue of determining the nature of the environmental inputs under such uncontrolled conditions" (Winkler, 1973, p. 57).

Having decided on photographic displays, the problem of choice of display content and mode of presentation remained.

Photographic Displays

As has been described in Chapter III, selection of environmental display content left the possibility open for researcher-induced bias. This dilemma presents itself regularly to most researchers and is dealt with simply by introducing some form of randomization to the choice of specific study objects. In this study, streets, locations and directions of shooting were all randomized in an effort to obviate the possibility of bias. The writer is convinced that all possible controls were exercised and that the displays presented can, therefore, be considered to be as bias-free as they could be. The problem of display selection having been solved, the mode of presentation had to be decided on. There were two possibilities:

(1) Actual photographs could be shown to subjects, or

(2) The pictures could be projected from slides.

The latter format was chosen partly because of its interest-generating capability for children and partly because of the difficulty of preventing wear and tear on photographs. It was also felt that a picture of a street projected on a large screen was more in scale with the actual environment than a photograph would be by virtue of size alone.

Evaluation of display characteristics which is an important part of this study presented some unique problems of its own.

Environmental Display Characteristics

The effort to assess the possible impact of environmental display

characteristics on expressed preferences of the subject group led to the quantification of 26 factors in each display. It is acknowledged that the number of display characteristics thus measured was limited by the inability of the writer to devise defensible methods to quantify some of the more nebulous aspects of environment, or even to recognize all, or nearly all, of the important variables. Amongst the more important of these unmeasured characteristics were colour and what Ittelson has termed the "ambience" (Ittelson, 1973, p. 15) of each display. Although the author believes that both play an important role in the visual impact of any vista, they proved to be impossible to quantify. Prior to data collection, these two variables were considered. The colour problem could have been eliminated by working with black and white displays; however, the idea was abandoned since:

(a) Much of the realism of displays is lost when colour is left out.

(b) Certain components of city streets such as traffic lights and signs and pavement lines which might be expected to reveal something of the functional character of streets to the observant subject, thus perhaps influencing preference, are largely dependent upon colour for prominence in the maze of urban paraphernalia. Since the functional character of streets was of prime importance in this research, it was considered that retention of colour in displays, despite any difficulties it might engender, was necessary to maintain the visual impact of traffic control components of street displays.

"Ambience", that feeling or atmosphere that streets always possess, proved to be an unquantifiable enigma, at least with the present data set. At the time of data collection, some thought was given to

obtaining a useful surrogate for a measure of ambience. This might have been possible, if, subsequent to collection of the principal data set, the same display format had been presented to the whole or some part of the subject group once more. On the second presentation, subjects would simply have been asked to express preference amongst the displays without the addition of any constraint on choice such as the qualification as to desirability for pedestrian use, which was an important part of the original data collection sessions. This second data set, subjected to Multi-dimensional Scaling, might have yielded a defensible surrogate for a measure of the appeal of each display. However, this idea had to be abandoned for a number of reasons:

(1) Given 56 displays, a larger number of slide (pairwise) changes, probably about 20, would have been necessary to produce a comparison matrix which could be scaled with an acceptable level of statistical significance (stress). Thus, a large number of data collection sessions would have to be arranged and this was not possible due to school authorities' reluctance to further disrupt school schedules.

(2) The writer could not be sure that there would not be some mental connection established between the first (principal) and second data collection sessions which might have biased preferences expressed in the second session.

(3) Since scale values obtained from the methodology described could not be construed as actual quantifications of the ambience of each display but only as a possible surrogate, and since it would have added only one more independent variable to the existing 26, the problems posed by any effort to obtain the necessary data seemed to outweigh any

possible advantage that might have accrued from it. The matter was, therefore, not pursued further.

However, it is suggested that, in future research of this nature, the possibility of devising a simple technique for the measurement of the total impact of each of an array of displays should be investigated. The importance of the impact of the whole scene has been emphasized by Cullen.

> The key to our modern conception of townscape lies in the fact, the simple but surprising fact, that the items of environment cannot be dissociated the one from the other. Further, the effects of juxtaposition are in themselves as exciting as the objects juxtaposed--often more so.
> (Cullen, 1961, p. 189)

The problem is complex, as complex as the environment itself, the ambience of which is an ephemeral thing, subject to the vagaries of weather and the whims of man. The sheer volume of sensory information emanating from an environmental display created another problem for the writer in that intra-display regularities which seemed obvious to the adult mind escaped the attention of at least some of the subjects. This led to some difficulty in recognition of functional typology of streets which, in turn, may have been responsible for low levels of individual consistency in choice, at least in the case of some subjects.

Street Categories

As has been outlined in Chapter III, this study involved an examination of four main street types each divided into two sub-types for a total of eight categories in all. Seven different instances of each category were evaluated for desirability as pedestrian routes during data collection, giving a total of 56 street displays altogether.

It was assumed that the functional typology of the streets displayed would be revealed by visual cues in each display. For instance, through highways are designated as such by characteristic signs and, because of traffic load, the roadways are paved and lined for control purposes. On the other hand, arterial streets, although quite similar in all other aspects of the roadway to through highways, are devoid of highway identification signs. From the results of Paired Comparison Analysis, it would seem that, to at least some of the subjects, these visual cues were not sufficient to reveal the functional character of streets at all times, or characteristics of streets other than prime function carried more weight as determinants of preference than was originally assumed. This led to low levels of individual consistency of choice (K), based on the criterion of prime street function, for some subjects. It might be possible to correct this problem by devising some other street typing criterion regardless of official designation, but this would produce results which would be difficult to equate with current conventions in street categorization. It may also be that, despite the best efforts of the researcher to categorize environmental displays which are not possessed of highly individualistic characteristics, certain children may have difficulty in remaining consistent in choices based on multi-dimensional judgments. It may also be, as White suggests, that "Younger children probably do not notice recurrent regularity in the midst of noise" (White, 1966, p. 118). It is, therefore, considered, despite the methodological problems it may have caused, that the categorization of street types according to official functional designation was the best that could be devised for purposes of this study.

No doubt, the reader will have discovered weaknesses in this research which are not enumerated in the above resume. It should be emphasized, however, that the strength of the project lies in:

(a) The simplicity of the stimulus presentation procedure,

(b) The precise nature of the response recording instrument,

(c) The rigorous analytical techniques to which the response data lent itself, and

(d) The size of the sample, larger by a factor of ten or more than those of previous studies in the field.

All of these have enabled the writer to achieve his hypothesized goals at statistically acceptable levels in most cases.

Suggestions for Future Rese[illegible]

The entire field of environment perception is so open that almost any facet one cares to choose offers myriad opportunities for worthwhile research; worthwhile because as Parr has suggested,

> It is high time to insist that the behaviour of men, and the needs of the human mind be...made the first objects of study in planning environments in which our minds must function and our lives will be contained.
> (Parr, 1966, p. 45)

The stage of development of the field of environment perception is, as pointed out by Saarinen, only in its infancy, "...scarcely beyond the stage of the first exchange of bibliographies" (Saarinen, 1969, p. 3). When one examines the spectrum of work already completed in children's perception of the environment, the almost total neglect of this vital area of research is striking indeed. This is surprising in the light of the fact that the "psychological influence of environment on behaviour and development of the child is extremely important" (Lewin, 1935, p. 66).

and has been recognized for such a long time.

> An important body of contemporary literature suggests that cognitive development is interfered with by monotonous and impoverished environments and enhanced by environments containing complexity and variation. (White, 1966, p. 95)

Despite the fact that the impact of his surroundings on the child has been established, mostly by clinical experiment, the incursions by researchers into the child/everyday environment field have been limited. The author knows of only one major work, that by Cisek, 1966, which has been totally concerned with children in their day-to-day habitat. This is surprising but may be explicable:

(1) Adults are vocal about their environmental likes, dislikes and needs, children are not; they depend upon their elders, who often do not know the needs of today's child or consider catering to them as pampering, to champion their causes. Public authorities wonder about the problems with young people today but seldom encourage the kind of research and development which might pinpoint and/or alleviate some of these very problems.

(2) Research involving children in the environment is difficult in that proven methodologies that give significant results using adult subjects often fail with children, leading to the impression that the young are emotional, negative and indecisive in their environmental judgments (see Lowenthal, 1972e, p. 50). These apparent difficulties may serve to discourage some researchers who might otherwise consider this a worthwhile field of endeavour.

The writer's suggestions for further research in this field will, therefore, not centre on identification of specific study areas that may offer rewarding research opportunities; the field is open. He will

instead, focus on approaches to data collection using juvenile subjects.

Data Collection Methods

> The main problem in studying people's perception is that of measurement, since people often have difficulty articulating the conscious or unconscious feelings, attitudes or ideas associated with perception. In many cases, perception must be inferred from behaviour or otherwise sought in indirect ways. (Saarinen, 1969, p. 5)

Two aspects of the above statement embody the entire thrust of the writer's approach to data relating to children's perception of environment:

(1) The data should aim at aiding in measurement of perception. If this is so, the data itself should be rigorously, and directly quantifiable as far as this is possible. This prerequisite would seem to rule out the use of all but the most simple forms of language responses in data collection. In general, children's language ability is still in the formative stage and suffers from imprecision and, as Lowenthal noted, emotional extremes (Lowenthal, 1972e, p. 59). If the researcher uses as his data base, responses couched in imprecise language, the quantification of which is subsequently dependent, to some degree, upon subjective judgment by the researcher, it is difficult to imagine how one could expect a high degree of precision in the findings from any analysis that might follow. In the search for simple methods of response to environmental displays, one might be tempted to use the Semantic Differential technique as used by Lowenthal and Riel in their Walk Questionnaire (see Lowenthal & Riel, 1972e, pp. 31-32). It is easy to imagine the confusion in the mind of a ten year old (the youngest child in their subject group) when faced with rating a display on

a five-point scale between such descriptive concept pairs as contrast/ uniform, appearance/ meaning, ordered/chaotic, self-awareness/awareness of surroundings, and clean/dirty, to list but a few used in the above study. An immediate problem that strikes the writer is that in some of the concept pairs used, judgments by children might be suspect if not impossible. In judging an environment clean or dirty, so much must depend upon the normal daily experience of the child that any judgment he might make could be open to the criticism that it was biased by the subject's own circumstances. It is the writer's considered opinion, based on his own experience and study in child education that, under normal circumstances, the Semantic Differential technique may not be very useful in perception research with young children because of both individual language difficulties and group language differences between children from different socio-economic and locational backgrounds.

Simple questionnaires which do not require long periods to complete, and to which long and involved verbal answers are not required, may be the most useful, language based, response gathering instruments for use with children.

(2) The second aspect of Saarinen's statement which the writer feels is germane to the problem of data collection from a young subject group is that perception may have to be inferred from behaviour or otherwise sought by indirect means. In his search for an indirect method of assessing children's perception of environment, Cisek, 1966, resorted to drawings by children of various aspects of their home surroundings. However, he found that drawings were difficult to interpret because of the idiosyncratic nature of each young artist's style, which required the presence of the artist to help interpret each drawing (Cisek, 1966, p. 20).

Techniques That Seem Promising

(1) Paired Comparisons

The Paired Comparison technique used in this study seems to offer some advantages in the investigation of children's perception of environment. However, it does suffer, particularly when examining the urban environment, from the difficulty that will always face the researcher when dealing with real environments, that of classifying the displays. Regularities in displays can be masked by the 'noise' that surrounds them in representations of the real environment, such as photographs. This difficulty might be partially overcome by 'creating' environments. This could be done by setting up a miniature, puppet-size stage to which components could be added to create different kinds of environments. This would give the researcher absolute control over content of displays which would be an advantage, but would introduce the concomitant disadvantage of artificiality, and would be very sensitive to researcher-induced bias. Thus, a rigorous system of controls on the content of each display would be needed to ensure impartiality. Another difficulty in creating environments would be that results from the experiment would relate to the artificial environments and could be difficult to relate convincingly to the real world.

(2) Environmental Mapping

That children develop an understanding of, and a love of working with, maps at an early age has been well established. Blaut, McCleary and Blaut, 1970, found a high degree of understanding of maps amongst young children, aged six years, even when maps were rotated in both horizontal and vertical planes. They also found it possible to relate

the actual world to that depicted in maps quite easily. Such a technique would, therefore, seem to offer the possibility of substantial rewards to the researcher in the field of environment perception.

(3) Sketches

Cisek found that "Children respond best to sketches, choices to mark (sic)...and a limited number of major issues for consideration [two or three]" (Cisek, 1966, p. 197). Sketches to choose from, although closely related technically to the puppet stage idea described earlier, offer another variant on the method of presenting displays. Although the technique suffers from the same problems as the stage method, it does have the advantage that, given the artistic ability, the researcher can build his representation of the environment before the subjects' eyes, a technique which, any experienced educator will agree, is an excellent way of capturing and holding the attention of young children. It also has the advantages of low cost and instant availability.

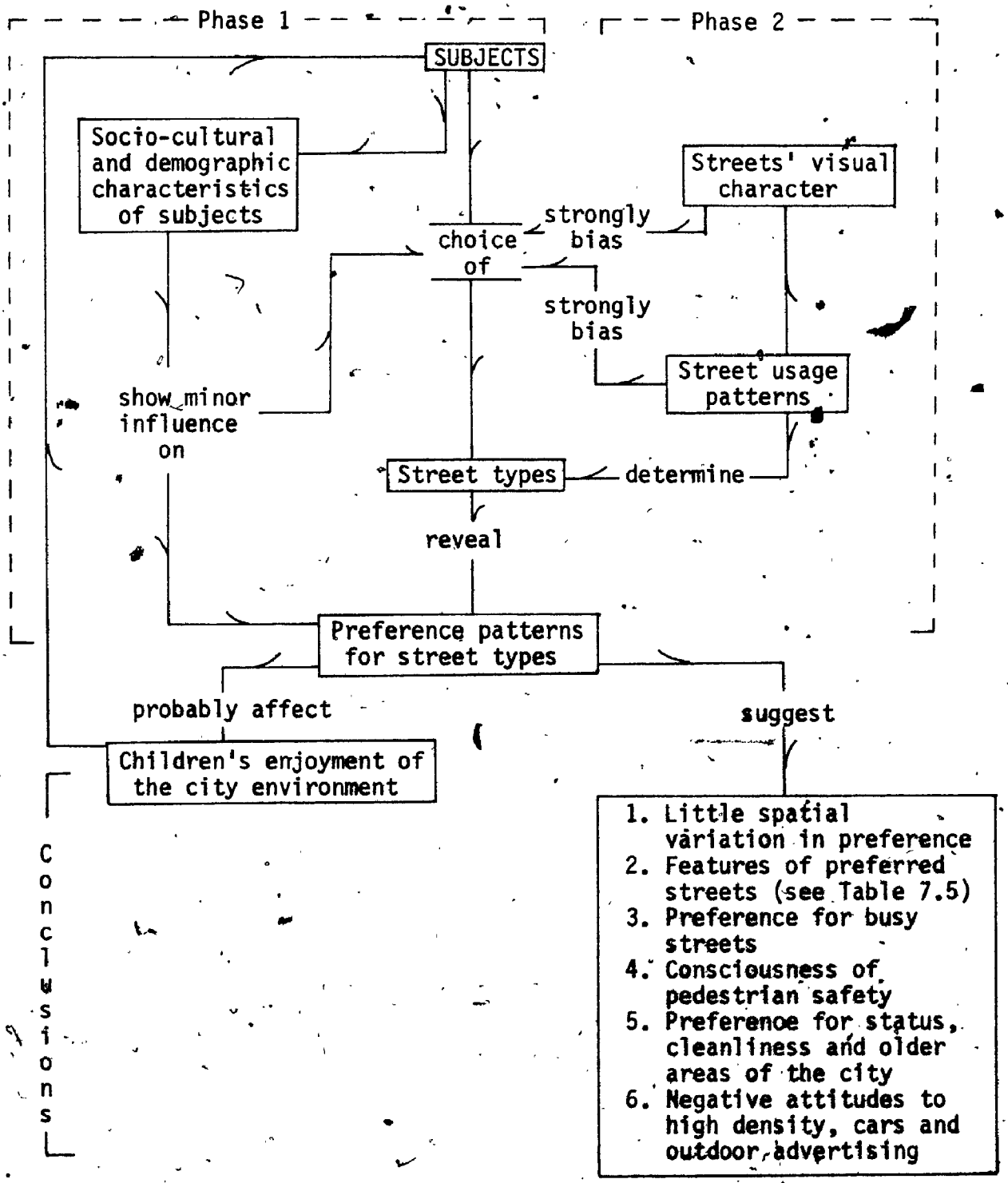
Whatever technique he devises for data collection, it behooves the researcher dealing with elementary school age children to remember that the demands made on his subjects must be clear, uncomplicated and simple to fulfil. The amount of time a child can spend on any activity, his attention span, is short, for seven year olds seldom exceeding 20 minutes, and increasing gradually with age to about 30 to 40 minutes at age 14. Thus, data collection sessions with children must be crisp, well organized and well timed.

The Study Findings and the Conceptual Model

The reader is referred back to the Conceptual Model (Figure 1.1). It postulated that the way in which children view the streets of their city is conditioned by certain aspects of their socio-cultural and demographic backgrounds, and by the functional and visual characteristics of the streets themselves. The results of the analysis undertaken by the writer, which are broadly outlined in Figure 7.1, confirm some of his original premises while placing others in some doubt. It was found that, although age, educational level, home neighbourhood and home street type of subjects related to preferences expressed at statistically acceptable levels of significance, the differences in preferred street type rankings between school samples were outweighed by similarities in the various hierarchies of preferred street types deduced from subject choice patterns. This contention is supported by the results of Simple Regression Analysis of the original inter-display choice patterns of subject groups by school, shown in Table 5.1. This finding accords with that of Lowenthal, noted earlier, that "The frequency with which groups in any city concur in their style of judgment [of the urban milieu] is an indicator of the extent to which the urban environment overrides background differences amongst observers" (Lowenthal, 1972e, p. 51). The subject group in the Lowenthal study was predominantly adult (Lowenthal, 1972e, p. 5). Combining the findings of both studies suggests that spatial differences in preference patterns for urban environment are outweighed by similarities in those preferences for young and old urbanites alike. The results of Multiple Regression Analysis, detailed in Chapter VI, suggest that the visual

FIGURE 7.1

Research Findings in the Context of the Conceptual Model



Source: T. J. Underwood

character and usage patterns of streets are important determinants of the preferences of children for the various street types studied in this work. It will be remembered that 26 visual attributes of the displays used in data collection were quantified and the data obtained were input, as independent variables, to Multiple Regression Analysis where the dependent variable, in each case, was the percentage of options for each display by the subject group from each school sample. Although it was not possible to quantify, or obtain useful surrogates for measures of certain, undoubtedly important, visual characteristics of displays, such as colour mix and ambience, that nebulous aura a street transmits to an observer and which probably influences his enjoyment of it, the 26 variables quantified explained from a low of 40 percent of the variance in display choices by subjects from Chippewa School to a high of 59 percent for students of Ealing School. It seems clear, therefore, that in their assessments of city streets children in the seven to fourteen year age group are strongly influenced by the visual content of the vista itself. Preference, almost inevitably, varied with amount of human activity evident in displays viewed. A few notable exceptions to this rule were observed. High density development, particularly of a commercial nature, and copious outdoor advertising were features of less favoured streets in the majority of cases. The children generally opted for travel routes, devoid of the traffic congestion and dense commercial development of the core area, where a mix of older residential and light commercial usages, set in mature trees, lends diversity, heightened by visible adult activity, to a lively scene. In the light of the findings of the study, it is

suggested that the postulates set out in the Conceptual Model, with one possible exception, have been validated. The apparently slight influence of socio-cultural and demographic characteristics of subjects on preference patterns for urban streets cannot, in the light of the research findings, be considered overly significant.

Implications of Study Findings

If, as has been suggested, the preferences of city children for certain aspects of the urban scene do not vary greatly with social background or spatial distribution of subjects within the city, it may be that the urban environment has a leveling effect on the perceptions of its inhabitants as suggested by Lowenthal, 1972e, p. 51. However, there are other possible explanations for this phenomenon. The apparent agreement in preference patterns may be influenced, at least in part, by modern communications systems, the uniformity of educational opportunity and the mobility of western society today. Whatever the reason, the implications for the future are noteworthy.

In the case of research projects which seek to assess the opinions of the juvenile population, stratified random sampling of the total population may not be essential to the success of the investigations, a definite advantage when such sampling may be difficult to implement and, if Lowenthal's suggestion cited above is valid, the same may hold true for studies involving the adult population as well. If this is true, then the recent trend towards macro-scale public opinion surveys regarding future developments, such as that undertaken for the London Transportation Study 1973-74, may simply be perpetuating exercises, the results of which could just as easily be obtained, and be just as

valid, if taken on the basis of a much smaller sample of the population than has been utilized in some studies heretofore. The savings in time and money achieved would probably be considerable.

The implications of the study findings for urban dwellers themselves and for city authorities in their capacity as the moulders of oppidan space, may also be important. Analysis revealed that children inevitably opted for busy, well travelled streets as travel routes. Pedestrian travel arrangements and traffic control equipment were features of preferred routes. Streets whose primary function was access to residences were not favoured as travel routes. This finding tends to offer food for thought to those who advocate total separation of pedestrian and vehicular traffic. It is likely that such separation would remove some of the diversity which seems to have been an attribute of the popular street types. Perhaps separation would create safer travel and relieve congestion in core areas of cities; it might also help to lessen the attractiveness of the downtown area. The achievement of a balance between safety, utility and dullness in the busier city arteries should be a prime consideration for the future and will require experimentation and research.

The almost total rejection by the subject group of suburban street types as travel routes suggests that they do not prove attractive to children. Carver has characterized the suburbs as "a crashing bore and a desolating disappointment" (Carver, 1962, p. 3). The findings of this investigation suggest that children might well think of the suburban street in similar terms. This opens up what may be a fruitful area for research. If children do not find the stimulation they expect

from the street in the suburbs it may be that other facets of suburbia also fall short of their expectations and needs. Research on the effects of suburban living on the juvenile population might tend to show that these areas are less than ideal places to raise children.

As is apparent from an examination of Table 7.5, the children involved in this study showed some remarkable consistency in their liking of or aversion to streets with certain attributes. For example, outdoor advertising on a street was generally accompanied by a negative response to that street. This finding invites speculation as to why this should be. Can it be that today's generation of children has been so bombarded with advertising that they are bored by it, do they object to the blighting of the visual environment by billboards and signs or are they less materialistic than their forebears? If any or all of these are true, it is probably a healthy sign. But more research is needed to help clarify children's reactions to all facets of the urban environment including nonessential intrusions such as advertising.

That we need to know more of the child/city relationship is not in doubt. The young seem to become more alienated daily from the urban way of life. This may be attributable to the effects of crowding in densely populated areas, the physical environment of the city itself or the depersonalization of today's way of living. We do not know. The scope of possible areas of research in this field is matched only by our present ignorance of the child/city synergism.

The future of any society is vested in its children. The future of western industrial society seems inextricably linked to urban children. The least we can do is to try to design the city in such a

way that its inhabitants, particularly children, can find in it the congenial living space so essential to both physical and mental health. "Our future security may depend less upon priority in exploring outer space than upon our wisdom in managing the space in which we live" (Sears, 1969, p. 63). Good management is based on knowledge and knowledge comes only with painstaking research.

APPENDIX A

SAMPLE RESPONSE SHEET

STREETS I WOULD LIKE TO WALK ALONG

MY SCHOOL IS: _____

MY GRADE IS: _____ I AM ___ YEARS OLD.

I LIVE AT: _____

WHEN I SEE THE PICTURES I WILL CHOOSE FROM EACH PAIR OF STREETS THE ONE I WOULD PREFER TO WALK ALONG AND I WILL MARK MY CHOICE WITH A BIG X IN THE PROPER SPACE ON THIS SHEET.

IF I PREFER THE STREET ON THE LEFT I WILL MARK THE SQUARE ON THE LEFT.

IF I PREFER THE STREET ON THE RIGHT I WILL MARK THE SQUARE ON THE RIGHT.

1 – ☐ ☐	8 – ☐ ☐	15 – ☐ ☐	22 – ☐ ☐
2 – ☐ ☐	9 – ☐ ☐	16 – ☐ ☐	23 – ☐ ☐
3 – ☐ ☐	10 – ☐ ☐	17 – ☐ ☐	24 – ☐ ☐
4 – ☐ ☐	11 – ☐ ☐	18 – ☐ ☐	25 – ☐ ☐
5 – ☐ ☐	12 – ☐ ☐	19 – ☐ ☐	26 – ☐ ☐
6 – ☐ ☐	13 – ☐ ☐	20 – ☐ ☐	27 – ☐ ☐
7 – ☐ ☐	14 – ☐ ☐	21 – ☐ ☐	28 – ☐ ☐

APPENDIX B

SAMPLE PHOTOGRAPHS OF STREET TYPES

THROUGH HIGHWAYS

Finished Through Highway - York Street

Unfinished Through Highway - Dundas Street East

ARTERIAL STREETS

Finished Arterial - Oxford Street

Unfinished Arterial - Huron Street

LOCAL UNPLANNED STREETS

Finished Local Street (Unplanned Neighbourhood) - Maitland Street

Unfinished Local Street (Unplanned Neighbourhood) - Whitney Street

LOCAL PLANNED STREETS

Finished Local Street (Planned Neighbourhood) - Michael Street

Unfinished Local Street (Planned Neighbourhood) - North Mile Road

APPENDIX C

STREET TYPE DESIGNATIONS

IN LONDON, ONTARIO

PREVIOUSLY COPYRIGHTED MATERIAL,

LEAF 217,

NOT MICROFILMED.

A.D. Margison and Associates Limited, London Area Traffic Plan 1959-1980, Corporation of the City of London, Ontario, 1960, pp. 37-38.

Planned and Unplanned Local Streets

In this study, for the sake of brevity, local streets are referred to as Planned or Unplanned Local Streets if they are found in planned or unplanned neighbourhoods respectively. A neighbourhood is considered planned if its streets are not on a regular grid pattern and if they are laid out in such a way as to clearly identify the limits of the neighbourhood. This generally involves the introduction of some curvilinear streets into the overall pattern. If, however, the street layout of a neighbourhood is on a regular grid pattern so that they merge into the larger street system of the city, without clearly delimiting neighbourhood boundaries, then the neighbourhood is deemed to be unplanned.

NOTE: For the purposes of this study, local streets are taken to be local residential streets only. Although streets serving industrial areas can often be considered local, under the definition cited above, they are not included in this research on the grounds that such thoroughfares do not normally constitute travel routes for children because of locational and functional characteristics.

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