SPATIAL IMAGES AND ACTIVITY AREAS IN AN URBAN ENVIRONMENT

A thesis presented in partial fulfilment
of the requirements for the degree
of Master of Arts
in Geography at
Massey University

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1981

'Two roads diverged in a wood, and I -
I took the one less travelled by,
and that has made all the difference.'

Robert Frost.

ABSTRACT

Cognitive-behavioural concepts and their introduction into geography are considered. A proposed schema suggests, and Research Hypotheses propose that the spatial schemata and activity area of individuals are interrelated and that constraints act upon this complex. Data are obtained, by means of a questionnaire/interview, for a population of 50 and evaluation of operational hypotheses is made with respect to this population.

Analysis of the data provides strong support for the interactive association of direct experience in and cognition of an urban environment. For the individual, physical distance appears to be a poor proxy for cognitive distance, though a 'group image' is suggested. Temporal constraints are seen to operate as are social constraints on the immediate neighbourhood scale. Socio-economic and personal constraints are not in evidence, which further supports the role of direct experience in the development of spatial schemata. The need to differentiate between the nature and function of the spatial schemata and image is clearly shown.

ACKNOWLEDGEMENTS

I am indebted to four people:

I thank my supervisors Mr. E.G. Thomas and Dr. B. Wheeler for their untiring patience, encouragement, valuable criticism and stimulus.

I thank Professor K. Thomson for his support in allowing me to follow this interest.

My gratitude goes to my wife, Christine, both for her unselfish tolerance and for practical assistance in proofreading and typing this manuscript.

In addition I wish to thank Nicholas, Patrick and Timothy for putting up with me being a part time father; the cost of being a part time student.

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CHAPTER 1

INTRODUCTION

AIMS OF THE STUDY

The fundamental assumption that underlies the cognitive-behavioural approach, adopted within geography to explain human activities, is the association between the cognition of the environment in which activity occurs, the cognitive representation of that environment, and the activity in that environment. Most 'cognitive-behavioural' research in geography has focussed on the relationship between the cognitive representation of the environment and activity in that environment.

The stimulus for this thesis arose from a comment in Francescato and Mebane's paper in Image and Environment (Eds: Downs and Stea, 1973. 147) regarding the 'role direct experience with different parts of the city plays in one's image and schemata', which re-emphasised that activity in an environment (direct experience) provides information that may influence the cognition of that environment.

This investigation seeks to evaluate the nature of the interactive association between elements of the cognitive representation of an urban environment and behaviour within that environment. The research framework also proposes that constraints operate to limit the development of the cognitive representation-behaviour complex and the study therefore seeks to evaluate the nature of such constraints.

Approach

Since the early nineteen sixties there have been expectations in human geography that more 'powerful' theories to provide explanation were soon to be developed. First the 'quantitative revolution' was expected to provide objective insights into the processes underlying spatial behaviour, but frequently only provided greater precision in description. The 'quantitative revolution' did serve however to highlight conceptual inadequacies (Harvey, 1967), and this encouraged the employment of cognitive-behavioural approaches in the explanation of human behaviour. Although knowledge of the processes underlying behaviour is presently fragmented and incomplete (Harvey, 1969) Golledge, Brown and Williamson (1972) suggest that the potential for realistic explanation of spatial behaviour is the basic reason for adopting behavioural approaches. Disappointment and reservations have been expressed at progress to date (Downs, 1970; Graham, 1976; Bunting and Guelke, 1979), nevertheless the approach seems to offer one of the most viable means of explanation and has therefore been adopted in this study.

This investigation proceeds within a logical positivist framework which has in other research proved to be extraordinarily effective with respect to the puzzles it has solved and the efficiency with which it has solved them (Harvey, 1969). 'Scientific' explanation is not the only means of explaining human events. Doubts over its suitability have been expressed by many, and alternative means of explanation have been utilised; the phenomenological as exemplified by Tuan's (e.g. 1974 a & b, 1977, 1978) efforts to understand subjective meanings, and the Marxist as exemplified by Reiser (e.g. 1973)

who sought explanation through dialectic analyses of social process.

The logical positivist mode of explanation offered two advantages in meeting the aims of this study. The first is that it uses a language of precise terminology that is understood; this is of importance when concepts are drawn from several disciplines. When the relationship of language to culture, as noted by Whorf (1940) is considered it is apparent that 'scientific' language has become so much a part of Western culture that 'scientific' explanations have become more effectively communicated. Further, doubts have been expressed (Wheeler, 1980) about 'our' ability to think outside the precepts of scientific understanding. The second advantage is that the logical positivist mode of explanation, in contrast with other explanation forms, uses a well developed methodology.

A characteristic of behavioural geography is that it tends to focus on the individual rather than approach problems at, for example, the level of the social group. This study seeks to employ a methodology which allows an intensive study of the relationships found within a limited group of individuals to be made, rather than one which aims to produce statements applicable to some larger 'natural' population.

Development of Investigation

In order that the stated aims could be realised using the approach proposed, a schema was formulated from which two Research Hypotheses were derived, one concerning the cognitive representation-spatial behaviour complex and the second concerning constraints upon that complex. As these were not amenable to direct testing a set of operational hypotheses

was established and data were collected on both the cognition of the urban environment and on the regular day to day spatial behaviours in that environment for a group of individuals. The investigation specifically sought to avoid the consideration of specific modes of spatial behaviour (e.g. shopping trips) that is in evidence in much research within behavioural geography; it sought rather to consider spatial behaviour in an aggregate, generalised sense. In integrating spatial behaviour within the limitations of a space-time framework it was possible to invoke the concept of time being a scarce resource as used by the Lund school. Constraints have rarely been considered in the cognitive-behavioural approach, although some research has considered aspects of their influence (e.g. Boal, 1969). In addition to time the investigation sought to measure and evaluate the nature of other possible constraints; social, economic and personal, upon the cognition-spatial behaviour relationship.

The study also sought the ability to make statements with a high level of certainty about relationships or processes discovered. As such the individuals from and about whom information was gained were a limited, artificially defined population for which statements could be made (from the evidence gained) with certainty, but from which formal, non-deductive inference to some 'natural' population could not be made. Procedures for the collection of information required to realise the aims of this study are described in Chapter 4.

CHAPTER 2

DEVELOPMENT OF THE PROPOSED SCHEMA

DEVELOPMENT OF CONCEPTS WITHIN BEHAVIOURAL GEOGRAPHY

Early Stimuli, pre 1960

The realisation that individuals as 'decision makers operating in an environment base their decisions on the environment as they perceive it, not as it is.' (Brookfield, 1970. 53) has a long history in geographical thought[1], as has the realisation that the results of such decisions are enacted in the objective rather than subjective environment. The concept of the environment as perceived has entered geography by many different routes (Brookfield, 1970). The adoption of such a concept could not occur however through early environmentalism, since this paradigm embodied concepts of natural design. The perceived environment could only feature in such formulations as a measure of the degree of error. As such a measure it may have been expected to emerge with the rise of possibilism, for 'man, as the master of possibilities, is the judge of their use' (Febvre, 1932. 236), for if man were to make optimal decisions from nature's choice he would need absolute rationality. The notion of the image as a perceptual construct was introduced by Trowbridge (1913) but this was not taken up until the late nineteen forties when three important papers were published. The first, by the sociologist Firey (1945) had as its stated purpose 'to describe certain ecological processes which apparently cannot be embraced in a strictly economic analysis' and revealed space at times being symbolic for cultural values. These concepts, Firey claimed,

must supplement economic concepts of ecology (prevalent at that time). Within geography Wright (1947) called for alternatives to the 'scientific' paradigm, suggesting that inquiry into the world of subjective experience through imaginative literary expression could provide such an alternative. This argument produced the seed for phenomenological geographic thought, later taken up by Lowenthal (1961). The third paper formed part of the European alternative to the psychologist Skinner's concept of behaviourism. In a paper published in 1948 Tolman proposed that in negotiating the real environment, a 'cognitive-like map' (p.191) is learned. Tolman thus suggested that, rather than Skinner's stimulus-response model of behaviour (whereby the negotiation of an environment is learned through reinforced responses to successive stimuli), in the course of learning 'something like a field map of the environment gets established in the rat's brain' (p.192). Tolman agreed that the rat responds to stimuli but that the stimulus-response is not direct, rather cognition occurs between stimulus and response. It was also proposed that comprehensive 'maps' develop through 'moderate motivation' (p.208). The theory proposed had close theoretical affinities to the classical Gestalt theories and derived much from Lewin's topological concepts. Though the bulk of the paper focussed on the behaviour of rats, Tolman concluded by outlining parallels with men, and proposing some psychological mechanisms that may narrow our cognitive maps. In geography a first and important recognition of an internal environment was made by Kirk (1952) who wrote of a 'behavioural environment' (conditioning behaviour) as a product of group culture and the act of observing the physical environment. Kirk's model drew heavily from

Gestalt theory.

The behavioural environment was viewed as a 'psycho-physical field in which phenomenal facts are arranged into patterns or structures (Gestalten)' (Kirk, 1963. 366). The Gestalt nature of the model with its emphasis on holism derived from phenomenological philosophy appears to have delayed the entry of the model into Western science. Kirk regarded the behavioural environment as the basis of rational behaviour and Lloyd and Dicken (1972) consider that the model's use for geographers was increased when the Gestalt overtones were dropped. Economist Keith Boulding (1956) introduced the concept of the image (which he saw as the cognitive map, comprised of subjective knowledge which 'largely governs my behaviour' (1956. 5-6)) stressing the importance of values in image formation; 'for any individual organism ....., there are no such things as 'facts'. There are only messages filtered through a changeable value system.' (1956. 6).

In 1957 another economist, Simon, proposed the concepts of satisficing and bounded rationality which altered the assumptions on which models of decision making behaviour were based. The realisations that information is not free but involves temporal and economic costs through search behaviour and that decision makers have both limited information and a limited capacity to process information, were not introduced into geography until Wolpert's consideration of migration as a satisficing behaviour in 1964. These concepts related to the cognitive capacities and the access to information possessed by man have become widely accepted in environmental cognition studies.

By the early nineteen sixties behavioural concepts had

been introduced into geography and during the following two decades these concepts were to be used in examining an increasingly diversified range of geographical questions. Within the scope of this investigation it was those researches into the nature of the image of the spatial environment and those relating spatial behaviour to the image that were of prime interest.

Research into the nature of the image of the spatial environment

Concerned with man's orientation in his environment, Lynch (1960) investigated the visual images of the inhabitants of three American cities, with the work revolving around the concepts of 'legibility', or ease of organising the elements of the visual environment and 'imageability', that is the quality of the objective environment which gives it a high probability of evoking a strong image in a given observer.[2] Carr and Schissler (1970) suggested that differentiation of the object from its surroundings and the time it can be viewed were key elements in the creation of imageability. Continuation of the interest in perception of the urban environment was made by Appleyard's further analysis (1969) of urban perception types where a differentiation was made between those cues that evoke a strong response in individuals (imageable cues) and those cues that are internalised by the individual to allow him/her to negotiate the urban environment (functional cues). The latter recognised the need for the individual to orientate himself in the environment, orientation having two dimensions; distance and direction. The geographer Brennan's (1948) observation that shoppers in an English city violated the principle of least effort in preferring to

patronise downtown facilities even though they may be more distant than out of town facilities was taken up and stimulated interest in cognitive distance. The relationship between objective and cognitive distance, however, remains unclear with conflicting evidence supplied by Lee(1970), Briggs(1973), Rapoport (1976) and Cadwallader (1976b). This interest in cognitive distance was part of an increasing concern with the image and its relationship with the objective environment (e.g. Orleans, 1973; Pacione, 1976; Wakefield, 1977; Cadwallader, 1976b). At the same time there was an increased concern with the measurement of the image (e.g. Hudson and Pocock, 1978; Murray and Spencer, 1979; Tranter and Parkes, 1979) and its relationship with the conceptualisation of space (e.g. Welsh, 1978).

RESEARCH INTO THE RELATIONSHIP OF IMAGE AND BEHAVIOUR

Impetus for research into the relationship between image and behaviour came from interest in decision making. Arising from his dissatisfaction with interaction modelling Huff (1960) suggested that spatial behaviour is dependent upon the individual's evaluation of the environment by introducing the twin concepts of 'consumer space perception' and 'consumer space preference'. This represents an attempt to employ more realistic concepts of man's motivations in the analysis of human spatial behaviour. The use of imperfect information by decision makers who had a varied ability to make 'optimal' decisions was integrated by Pred (1967) in his presentation of the behavioural matrix. In examining the behaviours of individuals at the neighbourhood level in relation to those individuals' perception of the neighbourhood, Boal (1969, 1971) chose to focus on the relationship of perception/cognition

with outcomes of decisions made rather than the decision making process. This relationship was also examined by Aldskogius (1977) in relating perception/cognition of recreational resources with spatial recreational behaviour, Cadwallader (1975) with respect to consumer behaviour and Jones (1978) with respect to intra-urban migration.

In a sense the assumption that a strong relationship exists between the cognitive image and actual behaviour is simply axiomatic and there is little to quibble with. Bunting and Guelke (1979. 455), however, 'take exception with the manner in which this assumption has been used or misused as a guide to developing research', for there 'is hardly any work that actually concerns itself with the inter-relationships between cognitive and overt behaviours'. Whilst Bunting and Guelke have urged a return to a thorough description of overt human geographical activity as a starting point in cognitive-behavioural studies, Rushton (1979. 463) has replied that 'Cognitive-behavioural geography, however, compels attention to the concepts of decision making, perception, attitudes, beliefs, learning and preference. A decision to abandon any interest in these concepts is a decision to abandon this domain'.

CONCEPTS AND TERMS

Behavioural geography grew from a number of diverse disciplines (Gold, 1980) and from this diversity confusion has arisen from loosely defined terms or terms with differences in meaning for differing disciplines. Nonetheless Harvey (1969) claims that from this diversity a common theme emerges. The term 'behavioural' describes an approach rather than a subject matter (Hurst, 1974). The behaviouralist views

(and here the theme emerges) the individual as a thinking being, that is one whose actions are a product of cognitive processes rather than omnipotent rationality. As such the so-called 'behavioural revolution' represents a major shift in the conceptual approach to understanding human spatial behaviour. Man was no longer considered a 'black box' in the environment/behaviour relationship. Thus Downs (1970a) claimed that the behavioural approach uses concepts whereby man becomes a crucial intervening variable in explaining the environment-spatial behaviour relationship. This has been specifically restated as '... human spatial behaviour is dependent on the individual's cognitive map of the spatial environment' (Downs and Stea, 1973. 9). A clarification of concepts and terms appears essential (Wheeler, 1980).

The 'environment' (and its synonyms; objective environment or real world) is a macroscale surface, complex in the categories, types, distribution and non ubiquitous nature of 'bits' of information present (Downs and Stea, 1973). It is measurable and quantifyable as measurement 'in the most general terms can be regarded as the assignment of numbers to objects (or events or situations) in accord with some rule' (Kaplan, 1964. 177). The behavioural environment can be defined as 'that part of the environment of which the individual is aware which also elicits a behavioural response or towards which a behaviour is directed' (Sonnenfeld, 1973. 249). The response or directed behaviour is one where man is seen as a thinking individual whose interaction with the environment is moderated by cognitive structure and process (Gold, 1980). Downs (1970a) proposed a conceptual schema (Fig. 1) which related some aspects of the cognitive structure and process.

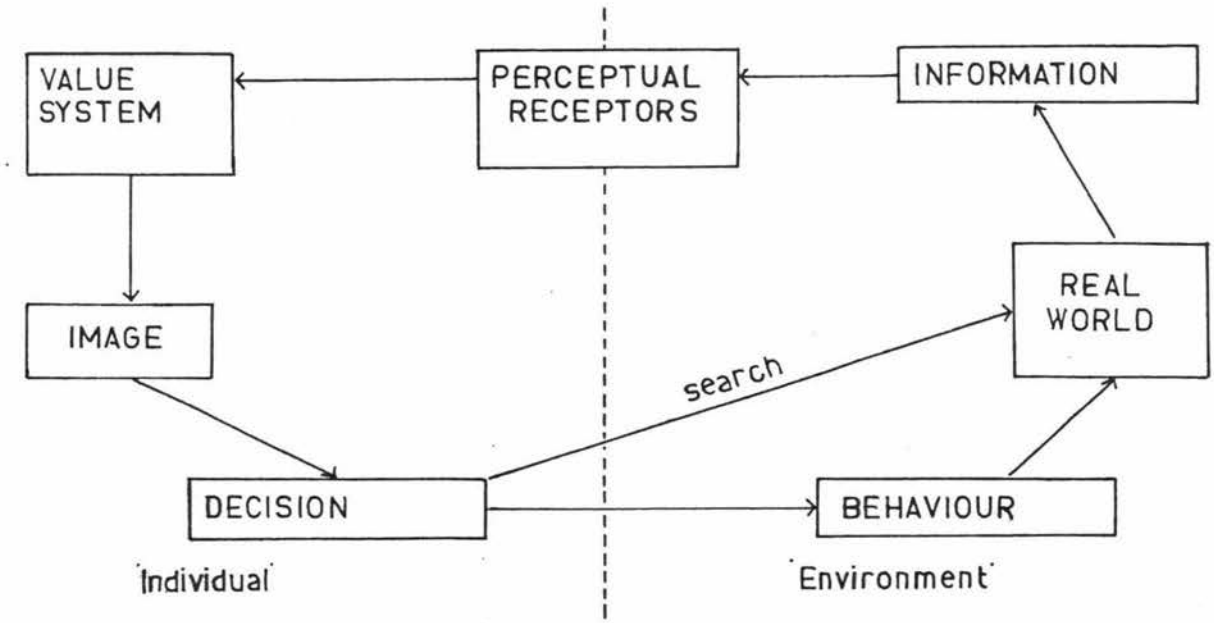

FIGURE 1. A Conceptual Schema for Research into Geographic Space Perception. (After Downs, 1970 a. 85.)

This model focusses attention on the image as an input into decision making, where the image is a product of cognition not physiological perception.

Much confusion has arisen in the literature from the looseness with which the terms perception and cognition have been used. Proshansky (1976) questioned the relevance of traditional subtopics within psychology when considering the environmental scale and that the distinction between perception and cognition is not a fundamental dichotomy. Cognition can be regarded as a wider term which, inter-alia, includes perception. Cognition relates to psychological processes whereby individuals collect, store and act upon information. Perception is taken to be more specific in being the psychological process that enables the individual to convert sensory

stimulation into coherent experience; it occurs in the presence of the stimulus. Bevan (1958) sees motivation and past stimulation as essential to this process. The image was referred to by Boulding (1956) as being subjective knowledge. The term image is frequently used as a synonym for an individual's subjective interpretation of the external environment (Gold, 1980). It has been used as such by Lynch (1960) emphasising the visual or seeing aspects of imagery, this generating contributions by Orleans (1973) and Francescato and Mebane (1973), leading erroneously to some workers equating imagery with the cognitive equivalent of vision (Downs and Stea, 1973. 80). Boulding (1956) identified seven components to the image: spatial, temporal, relational, personal, value, affectional and emotional.

As an alternative to 'image' the term 'cognitive map' as a more general concept was proposed by Downs and Stea (1977) as representing the environment as some person believes it to be at a given time. The term 'cognitive map' has suffered from two assumptions, the first derived from Tolman's (1948) original analogy with a cartographic map so that there is a belief that the individual carries an image of space in his head which may be studied. But as Stea (1969. 230) stated

> 'we have no reason to suppose that we will find patterns isomorphic to the larger world, or portions of the larger world, on the cerebral cortex'.

Although the physiological and psychological processes that form the cognitive map are unknown 'we believe that a cognitive map exists if an individual behaves as if a cognitive map exists' (Downs and Stea, 1973. 10). The cognitive map is

as such a justifiable model. The focus of attention is on a cognitive representation which has the functions of the familiar cartographic map but not necessarily the physical properties of such a pictorial graphic model (Blaut, McCleary and Blaut, 1970).

The second assumption was that maps in minds can be externally represented by asking people to draw cartographic maps as representing their cognitive maps. This will be more fully considered in Chapter 3. Gold (1980) proposed a model of man-environment relations (Fig. 2). Within the model two specific notions were employed to differentiate between modes of cognitive representation. They may usefully be regarded as extremes on a continuum of cognitive representations. The first was a redefinition of the term image as 'the mental picture that may be called to mind when the object, person, place or area is not part of current sensory information' (Gold, 1980. 41). Such an ability had been previously criticised as relying on memory (Graham, 1976. 261): 'the fact that we can see objects and hear sounds at one time and recall them later does not imply that they (as a memory) have been stored somewhere'. This, however, was to ignore the evidence of neurophysiology[3] (Gerard, 1953; Sagan, 1977).

The second notion Gold employed was that of the spatial schemata which can be viewed as 'the frameworks within which people organise their knowledge of the spatial environment' (1980. 261). Spatial schemata may be differentiated from images by their association with the everyday environment and with the accumulation and organisation of spatial knowledge upon which day to day behaviour in that environment is based. The image and the spatial schemata represent opposite ends of

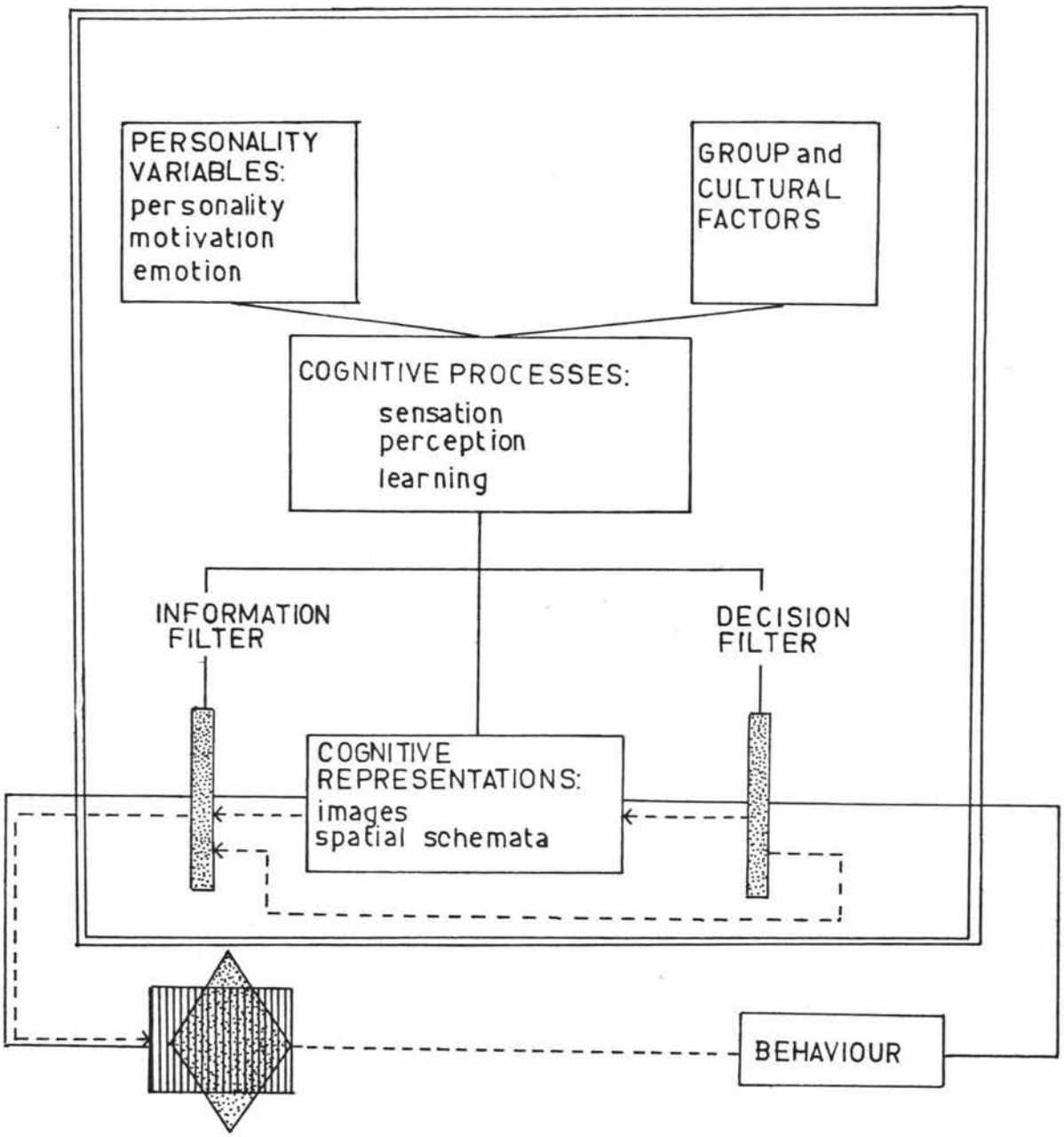

FIGURE 2. A Paradigm of Individual Spatial Cognition and Behaviour.
(After Gold, 1980.42.)

a continuum upon which models of cognitive representations of the spatial environment can be placed. It is a useful distinction for it seperates those aspects of the cognitive map that are derived from learning through experience in the individual's daily environment from those aspects of the cognitive map derived from indirect experience or imagination.

Initial questions about spatial schemata have focussed on the orientation of the individual in his environment. The cartographic map has had undue effect on our concept of the spatial schemata (Downs and Stea, 1973) and this is evident in the interest in cognitive direction and cognitive distance. The perception and cognition of direction is complex, being in part culturally inherited (Lynch, 1973) and varying with age and familiarity (Rapoport, 1976). In comparison with cognitive distance, cognitive direction has been only briefly examined.

Research into cognitive distance has revealed confusing results: Lee (1970) in Britain concluded that people overestimate distances to 'out of town' facilities whilst in North America the reverse would seem to be true (Golledge et al, 1969; Briggs, 1973). Meyer (1968) argues that attractiveness may underlie underestimation of distance and this is supported by Rapoport (1976) though reservations have been expressed by Cadwallader (1976). A variety of techniques have been used to measure differing cognitive abilities under the guise of cognitive distance. The conclusions to date are contradictory and inconclusive. This has been a product of both the diversity of measuring techniques and the propensity to examine the cognitive distance-real distance relationship with reference to an external frame of reference, for example to

CBD/away from CBD, rather than to a personal frame of reference where the variables of familiarity and motivation may be important in making assessments. This is supported by the variations of individuals' cognitive distance through the day (Tranter and Parkes, 1979) as priorities change.

Briggs (1973) suggested five possible means by which the individual generates cognitive distance: motory response, time and velocity, perception (the addition of all perceived distance on the route), the use of patterns in the structure of the physical environment and symbolic representations. Briggs favoured the role of perception. This requires a legible environment, that is an environment from which elements can be readily synthesised into a cognitive map. Lynch (1960) considered the legibility and proposed a typology of spatial cognitive elements; being paths, edges, districts, nodes and landmarks, which were the components out of which individuals synthesise their cognitive representations. As Lynch's typology has an intuitive theoretical basis it has been subject to justifiable modification. Pocock (1975) classified the elements of elicited responses as point features, linear features and areas. Gold (1980) notes that in urban spatial schemata these correspond to buildings, paths and areas.

In the individual's daily travel through the urban environment the paths most usually followed are roads, whatever the means of transport. The mode of transport will affect the environmental information used. Whilst the pedestrian uses a full range of sensory stimuli (Burgess and Hollis, 1977) Appleyard et al (1964) considered the visual input to perception-cognition to be dominant for the motorist, the car removing the audio and olfactory stimuli. Appleyard et al

noted that the driver had a narrow channel of vision using landmarks as signposts, being able to drive almost by remote control and being able to undertake a journey switched off - almost in a state of sleep (Fischer, 1976). The key finding of Appleyard's exploratory study was the use by the motorist of visual cues from the environment to complete a necessary trip, whilst ignoring redundant information though being aware of the overall environment.

Paths, that is the routes individuals follow, play two roles in the development of spatial schemata in that they help organise spatial knowledge through the integration of information, providing a matrix around which other elements are arranged. Spatial information is learned through experience (Piaget and Inhelder, 1956) and the active navigation of paths creates corridors of spatial knowledge (Gold, 1980). This is an indication of how spatial schemata are formed and reinforces Briggs's (1973) supposition concerning the development of cognitive distance.

Buildings also serve two functions in the formation of spatial schemata. One is to serve as landmarks or guideposts in way finding. In this sense the context of the building within the urban setting may be significant (Canter, 1977). It is those buildings that are strategically important on the route rather than those visually dominant that are used as landmarks (Pocock, 1975). Moreover, these strategically important buildings need to be legible, that is both differentiated in some way from their immediate environment and temporally dominant in the visual field (Carr and Schissler, 1970). Secondly, a group of residential buildings within a given area that carry congruous attributive information are frequently

perceived as residential neighbourhoods. The concept of a residential neighbourhood, however, is poorly defined. Neighbourhoods are often defined in social terms, and in this sense the term is interchangeable with the word community, as both share a sense of homogeneity. The criteria that define the limits of a neighbourhood may be difficult for an outsider to define, except in the case of mutual antipathy on the junction of residential areas (Boal, 1969). Although it has been shown that the neighbourhood is an important unit for social interaction (Suttles, 1968; Taylor and Townsend, 1976), Webber (1964) indicated the influence of technological developments, especially in communication, on the physical patterns of social interaction outside the neighbourhood unit.

Residence within a given neighbourhood and the expected associated spatial behaviour resultant from social interaction within that neighbourhood may influence the individual's spatial schemata. Class differentials in mobility were noted by Webber (1964) and this mobility differential is perhaps reflected in the differences in environmental cognition of Los Angeles by various neighbourhood residents. In addition Everitt (1976) suggested that the location of workplace in relation to the neighbourhood had a major role in the development of spatial schemata.

Movement from the residence to out-of-neighbourhood destinations may not necessarily be by the most 'economic' route. Boal (1969, 1971) observed an avoidance by individuals of adjacent urban areas perceived as antipathetic, where the antipathy was based on cultural/political differentiation (1969) and socio-economic segregation of residential areas based on the observed variables of occupation and income (1971),

and though the 'preferential' aspect of spatial cognition may be part of the image it may also act to influence/limit the pattern of spatial behaviour and the spatial schemata. Social distance has been considered a constraint that can be subsumed into Hägerstrand's (1970) authority constraints (Klingbeil, 1980). Whilst this category may be more difficult to assess than environmental constraints (Hägerstrand, 1970), concepts concerning the social environment have been indispensible in the formation of spatial theory. A territorial imperative has been suggested as a useful conceptual tool in explaining aspects of spatial behaviour at the neighbourhood level (Boal, 1969; Suttles, 1972). In human contexts, however, territoriality is best considered an analogy with animal territoriality (Gould, 1978). Territoriality in urban space has been frequently considered a group phenomenon (Ley and Cybriwsky, 1974; Patrick, 1973) whereby through defended space shared values are reinforced. Gould (1978) warns of generalising out of context and using territoriality as an explanation, whereas more complex cognitive systems may be operating.

Although the neighbourhood may be the base for an individual's daily activity routines such as journey to work, recreational or social activities and consumer activities, these may extend beyond the neighbourhood boundaries. To date, within behavioural geography, these activities have tended to be considered seperately, but in day to day behaviour an individual, in carrying out his various roles, will engage in several activities at various locations. Nested within the behavioural environment is the individual's activity space, defined by Horton and Reynolds (1971. 31) as '.... the subset of all urban locations with which the individual has direct

contact as a result of day-to-day activities'. Though attempts have been made to use the concept of activity space for limited activities aggregated for a group, for example Aldskogius (1977) in examining the spatial pattern of recreational behaviour for the residents of Upsalla, the concept has greater value in examining the individual's aggregated behaviour, that is relating all destinations to all spatial behaviours of the individual.

The 'Activity Space', however, is a relational notion which includes the association of individuals and places. It (as defined by Horton and Reynolds) does not, though could, include a reference to area, since the locations associated with activities are treated as isolated points. Klingbein (1980) emphasised the difference between the 'activity space' that is nested within the behavioural environment and the transportation of this into everyday spatio-temporal activity patterns (which exist in the physical environment). The spatio-temporal activity pattern as the result of the realisation of activity goals within available means 'is far more accessible with methods of geographical analysis' (Klingbein, 1980. 50). The term activity pattern has thus come to indicate the extent of activity in time and space. Though interested in time as a constraint the study was primarily interested in the spatial pattern of everyday behaviour established by the individual and the term activity area was proposed and used to denote this spatial element of the activity pattern. The activity area is distinct from activity space insomuch as it exists in physical space and it includes not only the destinations and locations associated with everyday behaviours, but also the space occupied (routes taken) in reaching such

destinations and locations.

The activity area would be expected to vary from individual to individual. Also, as it represents the sum of the individual's day to day spatial behaviours, it would be expected to be closely related to his/her spatial schemata.

Time, though, has importance for as the axioms of the Swedish time-geography demonstrate; 'time' represents not only an additional dimension, but, particularly through the assumption of the indivisibility of the individual, 'time' and 'space' prove to be closely connected (Thrift, 1977. 429). Time may be treated in both a mechanistic sense, that which seperates cause and effect and in an economic sense, as a scarce resource (Cullen, 1978). One of the products of the 'quantitative revolution' of the nineteen sixties has been a growth in the explicit references to temporal sequence to attempt prediction of the future in an accurate numerical form. One of the failings of contemporary behavioural geography has been the appropriation of this mechanistic approach leading to superficial and inconclusive statistical snapshots aimed at further refinement and calibration of models rather than explanation; that is, there has been no consideration of time itself. The problem of integrating differing viewpoints of time can be overcome by considering the differing natures of long and short term behaviour. Long term behaviour is related to decisions about life choices, time can be conceived as seperating cause and effect, whereas short term behaviour can be seen as the routine daily pattern of activities and time can be conceived of as a scarce resource. When considering time a scarce resource time and space can be jointly treated as activity occupies both. Time, space and activities have come

under the scrutiny of the Lund school in the development of a time geographic focus on people, their event sequences and a concern for freedom of action implications for individuals. The individual's activities are limited in time by authority constraints; some organised activities only operating at specific time-space locations. Transport resources define when and where the individual can appear in geographic space (Ellegård et al, 1977). Households have varied transport resources and 'the household which has to make do with public transport is channelled into a comparatively small range of choices' (Ellegård et al, 1977. 149). This reflects the difference in ability of various groups to overcome the restrictions of time (Carlstein and Thrift, 1978).

THE PROPOSED SCHEMA

The central proposition of this thesis is that the spatial schemata and activity areas of individuals are interrelated and that the spatial schemata-activity area complex is constrained by individual, social, economic and temporal characteristics and constraints. In order to evaluate this proposition two Research Hypotheses are proposed:

Research hypothesis I

> 'that the spatial schemata and activity area of individuals are interrelated.'

This hypothesis seeks to test the contention that behaviour within and cognition of, an environment are interrelated. No directional causality in the spatial schemata-activity area complex is inferred.

This hypothesis may seem superfluous, for a basic assumption in the cognitive behavioural approach is that behaviour is a function of the image. Gold (1980), however, has indicated that there are seperate elements to the image and be-

haviours are not uniform in terms of the degree of decision making involved in initiating them (Cullen, 1978). Whilst the general conceptual relationship is accepted the relationship between elements of the conceptual whole are open to examination. This hypothesis, therefore, represents a 'test' of the fundamental assumptions of the cognitive behavioural approach.

Research hypothesis II

> 'that the spatial schemata-activity area complex of an individual is influenced by individual, social, economic and temporal characteristics and constraints.'

This hypothesis is essentially exploratory and this thesis attempts to ascertain something of the nature of constraints that are assumed to operate.

From these two Research Hypotheses a number of Operational Hypotheses were developed that were amenable to testing. In order to enable the testing of these operational hypotheses a set of data was gathered using photographs as iconic representations, and an interview.

FOOTNOTES

1 Brookfield was restating Kant's (1790) notion.

2 This was an exploritory analysis focussing on the visual elements of the city scape as perceived by a small sample of inhabitants from Boston, New Jersey and Los Angeles. This work has been extensively described, extended and evaluated: Gulick, 1963; Appleyard, 1964; Francescato and Mebane, 1973; Saarinen, 1976 and Porteous, 1977.

3 Evidence points to distinct memories being stored in networks of brain cells with redundancy operating and to recall being able to be provoked by electrical stimulus.

CHAPTER 3

MEASUREMENT OF THE VARIABLES

A positivist approach to an evaluation of the spatial schemata-activity area and constraints upon it required both an incorporation of an analysis of hypotheses and an experimental testing of those hypotheses. In their stated form the proposed research hypotheses were not amenable to empirical testing. The objective of this chapter is to translate general conceptual constructs into testable ones and to define an operational procedure to test the derived hypotheses and as such it corresponds to Harvey's concept of empirical translation (Harvey, 1969).

Measurement

Some initial consideration was given to the concept of measurement, for this underlay the development of the operational definitions required for 'empirical translation'. Various definitions have been given to measurement; Nunally (1967. 2) called it 'rules for assigning numbers to objects to represent quantities of attributes' and Kaplan noted 'Measurement not only determines an amount, but fixes what it is an amount of' (Kaplan, 1964. 77). The latter posed problems for measuring 'spatial schemata' in that the object of the measurement was 'in the head' and it had fundamental implications in the development of operational definitions. It was in the fixing the 'of' that the link between the conceptual framework and the measurement procedure was established.

Measuring cognitive representations

The cognitive-behavioural stance has a fundamental concern with cognitive representations: variables that are said to

exist primarily in the minds of individuals. These variables, being non-physical, require measuring instruments which are fundamentally different from those traditionally employed by geographers in examining the 'objective environment'.

As previously noted, it has been proposed that differences exist in cognitive representations of the environment, depending on the familiarity of the individual with, and scale of, that environment. This required the development of different measuring techniques. To a great extent, the instruments that have been previously developed to measure specific attributes are based on such self reporting devices as interviews or questionnaires. These are susceptible to bias (Webb et al, 1966) as the observer frequently projects himself into the measurement situation and thus the measure may contain a bias according to the observer; that is, a systematic rather than a random error. The problem of observer interference cannot be overlooked. Blazek et al (1974) noted that in all complex interactive measuring situations the process of observation alters that being observed. Observer interference needs to be recognised and endeavours made to minimise it. The key question is not 'is bias acceptable?', but 'what degree of bias is acceptable?', and arising from this is the need to assess how much bias there is and what effect it is having on the measurement. The problem of bias is fundamental for inferences are made from measurement, and therefore in order to increase the validity of statements made, problems involved in 'interactive' measurement should be stated. The concern is for sources of error which are uncontrollable and hard to identify, which can enter a situation when measurements of psychological attributes are sought.

Measurement error

All measurements are subject to error and the magnitude of error limits the usefulness of the measure in a given situation. The aim is to reduce the magnitude of error so that it can be ignored in a given situation. Harvey (1969) examines four sources of measurement error 'that are inherent in any measurement procedure' (Harvey, 1969. 322). Observer Error; in the questionnaire situation results from the observer projecting himself into the measurement situation: the error in such a situation is systematic and is best considered a bias. The use of a standard format in the questionnaire is an attempt to reduce this bias and was used in this study. Instrumental Error; results from biases in the instruments used in measurement and is proportionately of little influence in a questionnaire: though with the use of colour photographs a degree of instrumental error is inevitable, in this study it was considered negligable. Error due to the Environment; in the social sciences is difficult to control. A change in the social, economic and even climatic environment of the individual as well as time of day and day of the week can alter a person's view of a place. Changes in the social and economic environment of the individual are beyond control. In an attempt to reduce the temporal influence all interviews were carried out on Saturdays/Sundays and Public Holidays during May and early June 1981. The times were restricted to 10.00a.m. to 12.30p.m. and 1.30p.m. to 4.00p.m. and undertaken when convenient to the interviewee. Error due to observed; in questionnaire work the indeterminacy principle appears to be very general: the interviewee is almost certainly going to be influenced by the interviewer since they are placed in

a highly reactive situation (Harvey, 1969). Whatever controls are introduced it is most unlikely that the error will be eliminated. In this study control was attempted by all interviews being undertaken by the researcher; this altering error to bias, the reduction of which was attempted through the measures noted above.

An underlying problem facing researchers pursuing the cognitive-behavioural approach is: an open ended mode of measurement is susceptible to bias, whilst a highly structured mode of measurement may miss important variables. As data were elicited from individuals by means of a questionnaire its construction sought both to elicit information regarding aspects of the spatial schemata via a structured mode of measurement and yet provide a less structured mode to measure the activity area. In this way it sought to gain advantage from both modes of measurement.

Measuring spatial schemata

In attempting to assess the extent of residents' spatial images of their urban environment Orleans (1973) asked respondents to draw a map of the city, whilst Lee (1968) asked respondents to draw an enclosing line on a map. Biases have been discerned in these approaches with criticisms directed towards variations in graphic ability (Murray and Spencer, 1979) and familiarity with the map format. Despite this, Lee's request is presently being repeated by Pacione (current research).

Early, promising approaches in measuring the image using photographs or iconic representations (Reiser, 1972) have been undeveloped. They are based on the idea that most information is received from the environment through the eyes (over 90% according to Dodwell, 1956), so perception is dominantly visual

and recall can be prompted by visual stimulus. Sonnenfeld (1961) used pairs of photographs to examine landscape preferences to reveal significant differences between immigrants and indigenous peoples in Alaska. In seeking to elicit information on the individual's spatial schemata it was proposed that iconic representations could be used as stimulus for specific recall. Landmarks are used for orientation and way-finding in the city and so are an integral part of the individual's spatial schemata. Landmarks that are part of the spatial schemata are retrievable and so open to measurement. For the purpose of this study a landmark had to meet certain criteria for a photograph of it to be included as stimulus, the criteria being:

(1) it must be visible from normal routes.

(2) it must be visible for sufficient time for waybearing (at least 4 seconds, which at normal speeds gives up to 60m visibility).

(3) it must be visibly differentiated in some way from its immediate environment (by colour, shape, size, etc.).

Colour photographs as iconic representations of landmarks have an advantage in that they carry a large number of 'bits' of information of the landmark and its immediate surroundings with accuracy. They are also usually familiar to individuals (the familiarity of maps is more open to question). The photographs used measured 13cm X 18cm.

Choice of landmarks

To gain a regular distribution of landmarks through the city it was seperated into concentric bands 1Km wide and centred on the Pahiatua Street-Crewe Crescent intersection, the inner 'band' forming a circle of radius 1Km. Four landmarks

selected from each band and four at a distance greater than 4Km from the intersection. (Fig. 3)

There is a fundamental problem of bias in a single researcher selecting landmarks - to what extent do they represent the researcher's image of the city? The bias can be minimised by preselection of formal criteria by which landmarks may be selected. Also there was no reason to believe that the researcher's image of landmarks would differ greatly from the population's, Lynch's (1960) work having revealed a commonality of 'elements' of the city image.

Measuring cognitive distance

A conceptual problem that had to be examined prior to a consideration of an operational definition of cognitive distance was the nature of concepts of space. Welsh (1978) noted that concepts of space are human constructs. Tuan (1977b) argued that the language of geometry is a man construct and can describe only human spaces. The description of space (geometry) used formulates the mode of measurement. Piaget and Inhelder (1956) suggested that awareness of space is, in a child, initially topological (competent in properties of proximity, order and continuity) and that later a Euclidean type of spatial relationship is appreciated (adding properties such as angularity and distance). Downs (1970) argued that non-Euclidean geometries should be used to represent cognitive space adequately and proposes a non-metric model of space in which ordinal scaling is used in measurement. Whilst certain psychologists have argued the necessity of employing non-Euclidean geometries in modelling aspects of perception (e.g. Corcoran, 1966) there were, within the context of this study, no a priori grounds for selecting between 'the potentially

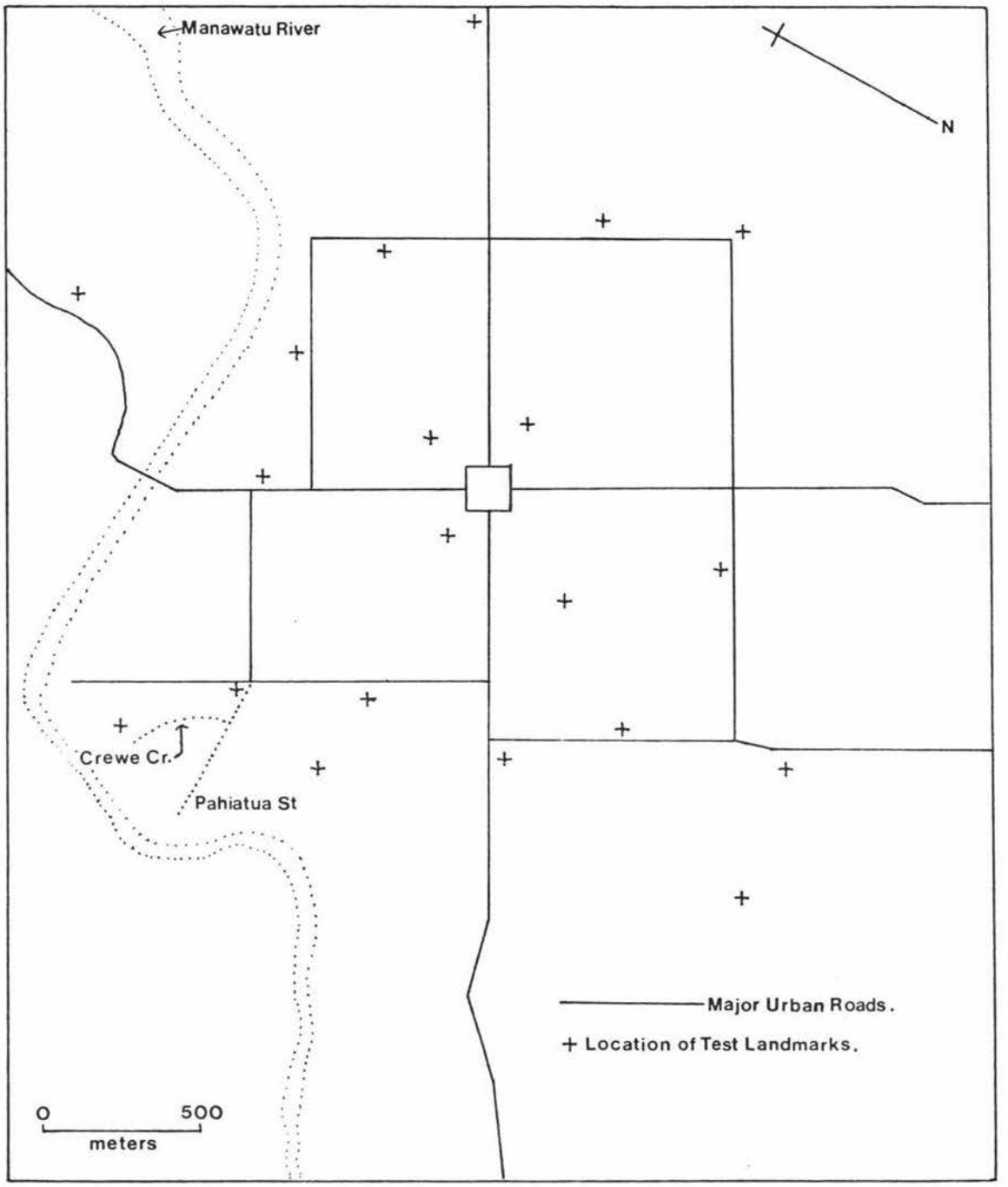

Figure 3 Distribution of Test Landmarks.

infinite number of competing non-Euclidean geometries' (Hudson, 1976. 5). The employment of a Euclidean geometry to describe cognitive space could contain Briggs's (1973) contention of cognitive distance being the addition of all perceived distance on routes taken. Cognitive estimates of distance to destinations outside the individual's activity area must then rely on cognitive processes other than summing perceived distances. As such systematic differences may be expected between cognitive estimates of distance to locations within and without activity areas. If the expectation of Euclidean constructs of space by individuals was accepted within the activity area then direct estimates of physical distance were suitable measurements, as used by Lee (1970) and Cadwallader (1975), with a systematic divergence of cognitive distance expected for locations outside the activity area.

Measuring constraints on overt behaviour

Zipf (1949) proposed that a basic element of human organisation was the principle of least effort, whereby individuals will reduce temporal and monetary costs in overcoming the friction of distance in economic spatial behaviour. This was not to invoke the concept of 'economic man' making normative decisions, but lay closer to the concept of satisficing behaviour. As Harvey (1969) pointed out the concept of satisficing is ambiguous for it is open to interpretation in three different ways:

(1) it can be regarded as a form of optimising behaviour in which the criteria used are non-economic, that is choices are made on 'personal' considerations.

(2) it could mean non-optimising behaviour.

(3) decision makers do the best they can on the basis of such information as they can acquire.

Neither of the first two interpretations offered much basis for development, but the last was close to Simon's (1957) term 'bounded rationality' and was accepted. It was noted that the information the individual acquires carries varied 'costs': in the schemata information is acquired at low 'cost', in the image information may be expensive if it involves behaviour (e.g. migration) or virtually free if obtained from the media (books, television, etc.). For example, the choice of route to a given destination would be made after searching alternative routes in the environment, but once a route is found that is deemed most satisfactory the search process ceases, for continued search involves additional time/monetary cost.

Four types of constraint on behaviour were considered: temporal, social, economic and personal. Time can be considered a limited resource (Cullen, 1978) and it would be expected that individuals would tend to reduce time costs in trip behaviour. It would be expected that trips from the home would be to more than one destination, for example to do the shopping on the way back home from taking a child to Kindergarten. This may result in the shop(s) used not being the closest to home but that/those perceived as most accessible from the home-Kindergarten route. This is modified by authority constraints (Lenntorp, 1976), those are temporal constraints placed on the opportunity for interaction, for example Trading Banks having limited opening hours. An individual, therefore, may wish to visit the Post Office and Trading Bank during his lunch break but not have time to visit both, so since the

Trading Bank has closed after he has finished work that must be journeyed to during the lunch break and the Post Office on the journey home after work.

The influence of time budgets (temporal constraints) on the formulation of the activity area-spatial schemata complex was considered. The completion of multiple destination trips by the individual was taken to signify time being considered and acted on as a scarce resource for that individual.

Social constraints on activity have been demonstrated by Boal (1969, 1971) where distinct segregation of activity areas correlate with social differentiation of residential areas. Where the residential segregation is less differentiated the influence on the spatial schemata-activity area may not exist or be too weak to be revealed. This study sought to establish the extent of differentiation of spatial schemata and activity areas of socially differentiated but spatially proximate sub sets of the population.

An individual's total activity pattern may be considered a set of individual behaviours, comprised of a number of sub set activity patterns derived from different functions but sometimes overlapping; for example, an individual may have a consumer activity pattern, a recreational activity pattern (see Aldskogius, 1977), an employment related activity pattern and a social interaction activity pattern. If residential segregation is the physical expression of social differentiation it may be marked by the social interaction activity spaces being segregated. Social trip destinations would not be expected to occur in the differentiated (other) social group. This has been supported in neighbourhoods sharply differentiated by cultural or socio-economic characteristics

in Belfast (Boal, 1969, 1971). In less strongly socially differentiated populations the manifestation in overt behaviour of social seperation may be better revealed by reducing the geographical scale of analysis so that the 'grain' of residential differentiation is better differentiated.

A constraint on the ability to move through the urban environment is the mode of transport available to the individual. Lenntorp (1973) noted the effect of the motor car in easing the constraints of time and hence allowing a greater range in routes and diversity of possible destinations in daily travel. Ownership and operation of a motor car requires economic resources; individuals with little capital or low income will be limited in their opportunity to use motor vehicles. Economic constraints limit choice and opportunity in spatial behaviour. Economic constraints were measured by income (the lower the income the greater the constraints, with thresholds possibly operating).

Personal constraints are those restraints upon the development of the activity area-spatial schemata complex that are derived from characteristics peculiar to the individual. If spatial schemata are learned through interaction with the environment then the greater the interaction the greater the opportunity to develop the spatial schemata. This opportunity for interaction was measured by length of residence, both

(1) at that residential location

and (2) in the city.

In changing residential location the individual is expected to carry elements of the representation of the environment from the previous residential location and integrate them in the 'new' spatial schemata (redundant elements of the old

schemata would be integrated into the image?). This may be enhanced by continuing to use, for example, consumer facilities patronised from the previous dwelling or to maintain social contacts so that the old schemata may form the framework for the new.

CHAPTER 4

DEVELOPMENT OF AN OPERATIONAL PROCEDURE

ESTABLISHMENT OF THE DATA BASE

In approaching the collection of required data, the analysis of those data and the application of the analysis in the testing of Hypotheses it was decided to use a Case Study approach rather than seek a formally derived representative sample. An urban environment was chosen and a population from within Palmerston North, a city of approximately 58,000, located in the southern North Island, New Zealand, was to be selected. A city of sufficient size (e.g. 50,000+) was deemed necessary so that individuals would not be familiar with all of the urban environment; Palmerston North was the closest such city to the researcher.

As generalisations were sought about processes rather than individuals and as stochastic processes were not involved the study of a population of individuals was acceptable and possibly advantageous. Inferring general population characteristics from this population though is not valid, for it amounts to inferring a generalisation on the basis of a sample of one (Harvey, 1969. 281-6). The Case Study approach has value in that it allows an intensive study of structure and relationship (Blaut, 1959) and linear analysis has, at times, missed vital relationships that exist at certain levels of the data, this occuring especially in the analysis of data on spatial perception and behaviour (Wilke, 1972).

In choosing to examine a population the study gained the advantage of removing sampling error from the investigation. Choosing to examine a population and making statements with

certainty about that population had implications in the use of measurements in testing experimental hypotheses. In having considered a population, statements could be made about that population in terms of has/has not and about its members in terms of have/have not, so experimental hypotheses have been written in terms of 'respondents will' or 'respondents will not'. This required that the experimental data found the experimental hypotheses true or false.

In absolute terms it would require only one exception to prove an experimental hypothesis false. However, as the study accepted degrees of support, then the problem of what is acceptable support arose. For example, if 43 out of the 50 respondents that comprised the population behaved in the expected manner was this strong enough support to accept the experimental hypothesis? In determining how good the support of 43/50 was, the answer had to be better than 42/50 but not as good as 44/50. The analogy with inferential statistical approach is that the researcher has to decide what level of confidence he will accept; if confidence relates to how well the sample statistic estimates the population parameter he must establish what is an acceptable estimation. In both situations the level of what is acceptable is the product of a subjective evaluation.

There was deemed a danger though in predetermining an inflexible, numerical level of acceptance. Rather, each situation was considered for itself. Again analogies with levels of confidence were sought and found in such areas as descriptions used by insurance assessors to fit known occurance rates; for example an occurance rate of 70% is 'strong, of 80% is 'predictable', of 90% is 'highly significant' and of 100% is

'certain'.

Means of collection of data

Having decided to consider a population of individuals two further decisions needed to be made: which population, and how to elicit the data.

In having to choose which population to use within the urban area any sub group of individuals could have been considered an appropriate population, but in order best to test the experimental hypotheses it would be advantageous for that population to have certain characteristics:

- a peripheral location so that access to the central city area and suburban centres could be cognised as alternatives
- a population that was contiguous
- a population that was spatially divided into sub groups which were socio-economically differentiated.

The population was chosen from within the Hokowhitu area of Palmerston North, a suburb of relatively high cost housing. Within that part of Hokowhitu furthest from the city centre is Crewe Crescent, comprised of State and ex-State housing. Adjacent to Crewe Crescent is Pahiatua Street which consists of privately owned housing. The population was chosen to extend along both these streets from their intersection.

A population size of 50 was chosen, to be divided between Pahiatua Street and Crewe Crescent. The size of 50 was chosen as a result of a trade-off; the desire to maximise the size of population used (the development of explanation derived from a population of 10 would be less powerful than that derived from a population of 100) against the need to ensure that the nature of the desired characteristics of the popula-

tion were maintained. An increase in population size so that it spread beyond the desired 'neighbourhood characteristics' would result in some hypotheses being less amenable to testing. Data collection continued until a population had been achieved. Only a limited number of refusals were met, so the criterion of spatial confinement necessitated by the research design was maintained.

As noted above, despite the known problems, the interview/questionnaire approach was chosen to elicit the range of information required from individuals. The presentation of the questionnaire was via interview in which the information provided by the interviewee was recorded by the interviewer on a standardised format sheet. All interviews were undertaken by the author. In order to assess the efficiency of the devised questionnaire in providing the required information, a pilot study was undertaken in Pahiatua (a small town in the North Wairarapa) in a population thought to have characteristics similar to that of the selected research population. Ten interviews were completed in the pilot study and it revealed that:

(1) the format devised provided information on the spatial schemata and normal routes and destinations in the activity pattern, but not the occasional or alternative routes and destinations of the activity pattern,

(2) the interview lasted about half an hour, which was acceptable in maintaining the willingness of the interviewee to supply the information sought and in obtaining all the information sought to test the hypotheses.

In order to obtain information on the less regular elements of the individual's activity pattern the questionnaire was extended.

OPERATIONAL (WORKING AND EMPIRICAL) HYPOTHESES

In order to establish whether the Research Hypotheses could be supported or not Working Hypotheses were developed from both Research Hypotheses to allow the development of Empirical Hypotheses. Support for the Working Hypotheses thus leads to support or refutation of Research Hypotheses.

Working hypotheses

The first five Working Hypotheses were developed from the Research Hypothesis: 'that the spatial schemata and activity areas of individuals are interrelated'.

(1) 'that individuals will travel to destinations within their activity area by the shortest perceived route.'

(2) 'that individuals will travel to destinations within their activity area by the quickest perceived route.'

These two closely associated, though not equivalent and possibly mutually exclusive hypotheses represent apparent satisficing behaviour.

(3) 'that individuals will recognise, identify and locate representations of landmarks within their activity area.'

(4) 'that individuals will not recognise, identify and locate representations of landmarks outside their activity area.'

These hypotheses proposed that in navigating the local environment the individual uses legible landmarks and that cognitive representations of these landmarks are internalised. It is proposed that those landmarks used frequently will, given the appropriate stimulus, by recall tend to be recognised, identified and located, whereas those landmarks that

are encountered infrequently will tend to go unrecognised, unidentified and not correctly located. Recognition of a representation of a landmark required the respondent to affirm/deny knowing that landmark. Identification of a representation of a landmark required the respondent to recall the identity of that landmark. Location of a representation of a landmark required the respondent to recall the absolute or relative location of that landmark.

(5) 'that individuals will estimate distances to destinations within the activity area differentially to destinations outside the activity area.'

Conflicting evidence has emerged on the relationship between cognitive distance and real distance. Mostly the relationship has been examined in relation to an external frame of reference such as orientation (direction to/from the city centre). This hypothesis examined a more fundamental explanation in that the relationship between cognitive distance and real distance may be found in a factor such as environmental experience.

The subsequent seven Working Hypotheses were developed from the Research Hypothesis concerned with constraints: 'that the spatial schemata-activity area complex is limited by individual, social, economic and temporal constraints'.

(6) 'that individuals, in organising their day to day activities will reduce perceived total time costs involved in trips.'

(7) 'that the spatial schemata-activity area complex of the individual will vary with personal mobility.'

Personal mobility was defined for the purpose of this study as the extent and frequency of travel by the individual through the urban environment.

(8) 'that the spatial schemata-activity area complex of individuals does not include residential areas differentiated from their own by residents' socio-economic status.'

A variety of measures have been used to measure socio-economic status, very common elements in such measurements being occupation and/or income and education. These were expected to differentiate adequately between sub groups of the population considered.

(9) 'that individuals within residentially segregated areas will have a restricted social component to their spatial schemata-activity area complex.'

Segregation in this hypothesis was taken to indicate residentially differentiated areas, the residents of which have little interaction with each other. Such segregation on socio-economic criteria has been substantiated in Belfast by Boal (1971). The 'social component' was regarded as both the individual's cognition of the social rank of neighbourhoods and of social trip destinations.

(10) 'that the individual's spatial schemata-activity area complex will be more developed with length of residence at that residential location.'

(11) 'that the individual's spatial schemata-activity area complex will be more developed with length of residence in the city.'

(12) 'that the individual's spatial schemata-activity area complex will vary with socio-economic status.'

Whilst the Working Hypotheses derived from the Research Hypotheses were statements expressing empirical concepts associated with the spatial schemata-activity area complex and its possible constraints they were not amenable immediately to formal testing. In their given form these Working Hypotheses could not be validated by any single experiment. In

order to gain the evidence necessary to validate these hypotheses a number of Experimental Hypotheses, amenable to empirical testing, were developed to provide such information.

The extra stage of 'Working Hypotheses' was inserted between the Research Hypotheses and the Experimental Hypotheses, amenable to specific empirical testing, in order to attempt to clarify the relationship between the 21 Experimental Hypotheses which examine various elements of the spatial schemata-activity area complex and constraints upon it and the general conceptual relationships proposed in the Research Hypotheses.

The Experimental Hypotheses were written in a deterministic rather than the probabilistic style that is usual when samples are involved. The probabilistic style best suits a quantitative mode of analysis using inferential statistical techniques. This study considered a total population, so the use of inferential statistics was therefore invalid.

Experimental hypotheses

From the first Working Hypothesis was derived:

(A) 'respondents will indicate that they travel to trip destinations by the shortest route.'

Trip destinations may be the place of work, the grocery shop, the dairy, friends' houses. If a trip has more than one destination then the total route will be indicated as the shortest.

From the second Working Hypothesis was derived:

(B) 'respondents will indicate that they travel to trip destinations by the quickest route.'

In most instances the cognised shortest route was expected to be the cognised quickest route. In some circumstances though, such as peak travel times, deviations may be taken to avoid congestion so the route becomes the 'shortest' in time though

not distance. The term 'shortest' was used to denote minimised cognised scaled distance, the term 'quickest' was used to denote minimised cognised time consumed in travel.

From the third and fourth Working Hypotheses were derived:

(C) 'respondents will recognise only those iconic representations of landmarks that lie within their activity area.'

(D) 'respondents will identify only those iconic representations of landmarks that lie within their activity area.'

(E) 'respondents will be able to locate only those iconic representations of landmarks that lie within their activity area.'

From the fifth Working Hypothesis were derived:

(F) 'respondents will display a systematic divergence in their estimates of distance from real distance to destinations within their activity area.'

(G) 'respondents will display a systematic divergence in their estimates of distance from real distance to locations outside their activity area.'

(H) 'there will be a difference between divergences in estimates of distances to destinations within and locations outside of activity areas.'

From the sixth Working Hypothesis was derived:

(J) 'respondents will make multi-destination trips from home in day to day behaviour.'

As noted in Chapter 2 day to day behaviour is related to the spatial schemata.

From the seventh Working Hypothesis were derived:

(K) 'respondents dependent on public transport will make shorter trips from home than those not dependent on public transport.'

(L) 'respondents dependent on public transport will follow fewer routes on trips than those not dependent on public transport.'

These Empirical Hypotheses recalled (previously noted) Ellegard's suggestion that public transport, through authority constraints, limits the individual's opportunity for spatial

behaviours.

(M) 'respondents dependent on public transport will correctly recognise, identify and locate fewer iconic representations of landmarks within their activity area than those not dependent on public transport.'

From the eighth Working Hypothesis were derived:

(N) 'respondents will not travel through adjacent residential areas that are different from their own by measures of income of residents.'

(P) 'respondents will not have social trip destinations in adjacent residential areas that are different from their own by measures of income of residents.'

These Experimental Hypotheses recalled Boal's (1969,1971) findings, though his and similar findings considered 'defended space'. Experimental Hypothesis 'N' was included in a sense as a Null Hypothesis; it was not expected to be supported! Whilst Boal's (1969, 1971) and others' (e.g. Suttles, 1968, Patrick, 1973) work has focussed on defended space, this study wanted to consider the possibility of social distance constraints without the constraint of defended space.

From the ninth Working Hypothesis was derived:

(Q) 'respondents within residential areas differentiated by relatively low income of residents will have most social trip destinations within that residential area.'

From the tenth Working Hypothesis were derived:

(R) 'as the respondent's length of residence at that residential location increases, the number of correct recognitions of, identifications of and ability to locate iconic representations of all landmarks will increase.'

(S) 'as the respondent's length of residence at that residential location increases, the number of test landmarks in the activity area will increase as will the proportions of correct recognitions of, identifications of and ability to locate iconic representations of those landmarks.'

From the eleventh Working Hypothesis were derived:

(T) 'as the respondent's length of residence in the

city increases, so the number of correct recognitions of, identifications of and ability to locate iconic representations of all landmarks will increase.'

(U) 'as the respondent's length of residence in the city increases, so the number of correct recognitions of, identifications of and ability to locate iconic representations of test landmarks in the activity area will increase.'

From the twelfth Working Hypothesis were derived:

(V) 'as the respondent's income increases the number of test landmarks in the activity area will increase, as will the proportion of correct recognitions of, identifications of and ability to locate iconic representations of those landmarks.'

(W) 'as the respondent's level of educational attainment (number of years post primary education) increases, the number of test landmarks in the activity area will increase, as will the proportion of correct recognitions of, identifications of and ability to locate iconic representations of those landmarks.'

The questionnaire was administered to residents of Pahiatua Street and Crewe Crescent and data obtained for a population of 50 individuals, 28 in Pahiatua Street and 22 in Crewe Crescent as well as its cul-de-sac Ross Place. The data set established was used to evaluate the Experimental Hypotheses.

CHAPTER 5

EVALUATION OF THE OPERATIONAL HYPOTHESES

CONSIDERATION OF THE HYPOTHESES CONCERNING THE SPATIAL SCHEMATA-ACTIVITY AREA COMPLEX

Experimental hypothesis A: Respondents will indicate that they travel to trip destinations by the shortest route.

The data provided strong support for the hypothesis. Of the population of 50; 42 indicated that they travelled to all regular destinations by the shortest routes, 7 indicated that they travelled to all but one regular destination by the shortest route. Of the 7; 5 indicated that the longer route chosen was believed quickest, 2 had no control over route choice, being passengers in motor vehicles. The resident choosing to take longer routes indicated a recreational value in daily travel.

Experimental hypothesis B: Respondents will indicate that they travel to trip destinations by the quickest route.

There was again evidence that provided strong support for the hypothesis:

Respondents indicating travel to all trip destinations by quickest route: 44/50

Respondents indicating travel to all but one trip destination by quickest route: 5/50

Respondents indicating travel to no trip destinations by quickest route: 1/50

Of the 5 respondents who indicated travel to one trip destination by other than the quickest route; 2 indicated no control over choice of route, 1 took a route believed shortest (in distance) but not quickest (in time) due to congestion and 2 took routes that were a product of habit. The respondent who travelled, by walking, to no destination by the quickest route

indicated a recreational value in daily travel in that it provided a break from the house and that stimulus was provided by observing other people's garden ideas.

This belief by respondents that they act rationally in their choice of routes in everyday travel in the urban area lends support to the concept of 'satisficing' accepted by this study. This behaviour as noted above may arise because of 'bounded rationality'. If individuals choose routes on the basis of those believed to be shortest/quickest, though differing individuals take differing routes to the same destination, then the route taken (behaviour) is a function of the schemata (image).

Experimental hypothesis C: Respondents will recognise only those iconic representations of landmarks that lie within their activity area.

Experimental hypothesis D: Respondents will identify only those iconic representations of landmarks that lie within their activity area.

Experimental hypothesis E: Respondents will be able to locate only those iconic representations of landmarks that lie within their activity area.

As respondents had differing numbers of test landmarks (selected landmarks for which photographs had been obtained for testing purposes) in their activity area, to enable comparisons the rate of correct recognitions (or identifications or given locations) to the total number of target landmarks in the activity area was used.

Initial examination of the proportions of iconic representations of landmarks correctly recongnised, identified and 'located' within and out of the activity areas provided support for the hypotheses (Tables 1,2 and 3).

TABLE 1: Proportion of iconic representations of landmarks recognised within and out of activity areas by respondents

Proportion	Responses for landmarks within activity areas	Responses for landmarks out of activity areas
0 - .2	0	13
.21 - .4	0	19
.41 - .6	2	9
.61 - .8	5	5
.81 - 1.0	43	4

TABLE 2: Proportion of iconic representations of landmarks identified within and out of activity areas by respondents

Proportion	Responses for landmarks within activity areas	Responses for landmarks out of activity areas
0 - .2	0	20
.21 - .4	1	19
.41 - .6	2	6
.61 - .8	9	0
.81 - 1.0	38	4

TABLE 3: Proportion of iconic representations of landmarks within and out of activity areas correctly located by respondents

Proportion	Responses for landmarks within activity areas	Responses for landmarks out of activity areas
0 - .2	0	16
.21 - .4	0	22
.41 - .6	3	8
.61 - .8	10	0
.81 - 1.0	37	4

General differences between the sets of responses were noticeable, which raised questions as to the cognitive functions related to features. As might be expected the response rates indicated a lesser overall ability to identify than to recognise landmarks, for whilst it is necessary to recognise landmarks to navigate the urban environment it is not necessary to say what they are. Repeated exposure to a landmark though is likely to reveal its identity. The ability to locate landmarks was marginally greater than the ability to identify them, suggesting that the cognitive function of landmarks is primarily that of locational cues. The ability to locate landmarks correctly was slightly less than the ability to recognise landmarks, for whilst in some cases landmarks were stated as being recognised by respondents and general area of their location given, respondents could not give the precise, or accurate relative location. This may be a product of respondents indicating that they 'knew' a landmark of which they were unsure (wishing to succeed?). It may alternatively

indicate again a difference in cueing that landmarks may provide for different individuals, so that while one landmark may be used as a locational cue another may be passed when no regular locational decision is required and so though it is recognised the individual is not able to locate it accurately. Some support for the latter notion is forthcoming from the individual differences indicated by respondents depending on their mode of travel, for the proportions of individuals recognising 3 or more landmarks than the number that can be located are: for respondents dependent on public transport:0.24, for respondents not dependent on public transport:0.06. This would indicate a greater passivity in travel for individuals travelling by public transport than those normally using cars, bicycles or walking.

Referring to Tables 1,2 and3, those respondents showing a response of less than .61/1 correct recognitions, identifications and 'ability to locate' within their activity areas were members of a small subset of the population with shared characteristics: over 65 years of age, source of income being superannuation, length of journeys and number of trip destinations limited and with infrequent travel to destinations. This could provide evidence of the link between image and behaviour and the complementary relationship between movement and locational cues, though it may also indicate that the photographs represented too broad a potential activity area for those with limited activity areas. There is also evident the need to consider temporal as well as spatial aspects of behaviour. Infrequent travel along a given route would lessen the function of reinforcement in learning and the need to embed locational cues in the schemata.

As the activity area encompasses regular day to day spatial behaviours, irregular spatial behaviours would tend to lie outside the activity area. This irregular behaviour would result in a cognition of the environment outside the activity area capable of recall, i.e. the function of the image rather than the spatial schemata. The results would indicate a greatly reduced knowledge of the environment outside the activity area. Further evidence lending support to distinctions between the nature of schemata and image is provided by the four respondents who indicated a correct response of greater than .81/1.0 for landmarks outside the activity area. Of the four, three had extensive activity areas with only one test landmark out of their activity area and that was recognised. The fourth respondent in this category appears anomalous in a number of instances having prior to the interview undergone a large reduction in activity area, previously having a city wide activity area and probably retaining the spatial schemata of the previous activity area.

Experimental hypothesis F: Respondents will display a systematic divergence in their estimates of distance from real distance to destinations within their activity area.

Experimental hypothesis G: Respondents will display a systematic divergence in their estimates of distance from real distance to locations outside their activity area.

Experimental hypothesis H: There will be a difference between divergences in estimates of distances to destinations within and locations outside of activity areas.

Evidence to evaluate these hypotheses was collected from two sections of the questionnaire. Firstly respondents were asked to estimate the distances to regular destinations during the establishment of the activity area. A 'cognitive time distance' was also sought, but many respondents avoided giving or reluctantly estimated time consumed in a trip, so the 'cog-

nitive time distance' element was eliminated from consideration. This does not indicate that people do not think in terms of time, only that they preferred to express a journey's length as distance in the interview situation. Secondly, respondents were requested to estimate the distance to ten locations distributed in a dispersed pattern. For many respondents one or more of these locations were within the activity area and in some instances were destinations.

Consideration will first be given to the cognitive distance of destinations within the activity area. Responses were given in both miles and kilometers; for consistency mileages were converted to kilometers and real distance measures used the kilometer as the unit. An apparent linear relationship was evident between cognitive distance and real distance when considering the responses of the population collectively (e.g. see Fig. 4) and orientation had no apparent influence on the association of cognitive distance with real distance (e.g. Fig. 5). However a survey of individual responses revealed no relationship between frequency of travel or means of transport and cognitive distance. Individuals also displayed little systematic order in their cognitive distance when related to real distance (Table 4).

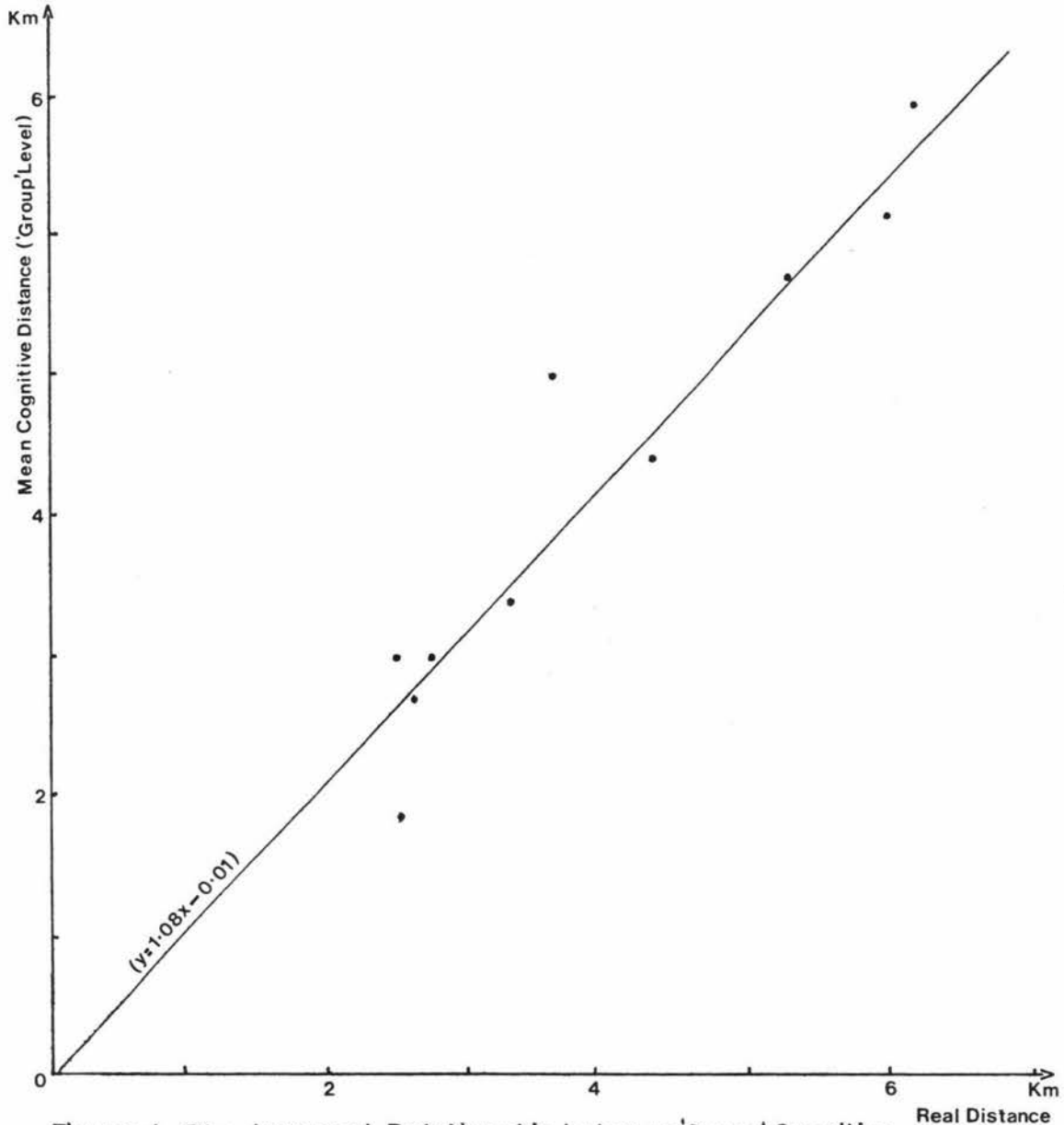

Figure 4 The Apparent Relationship between 'Group' Cognitive Distance and Real Distance to Various Locations (in Activity Areas) in the Urban Area.

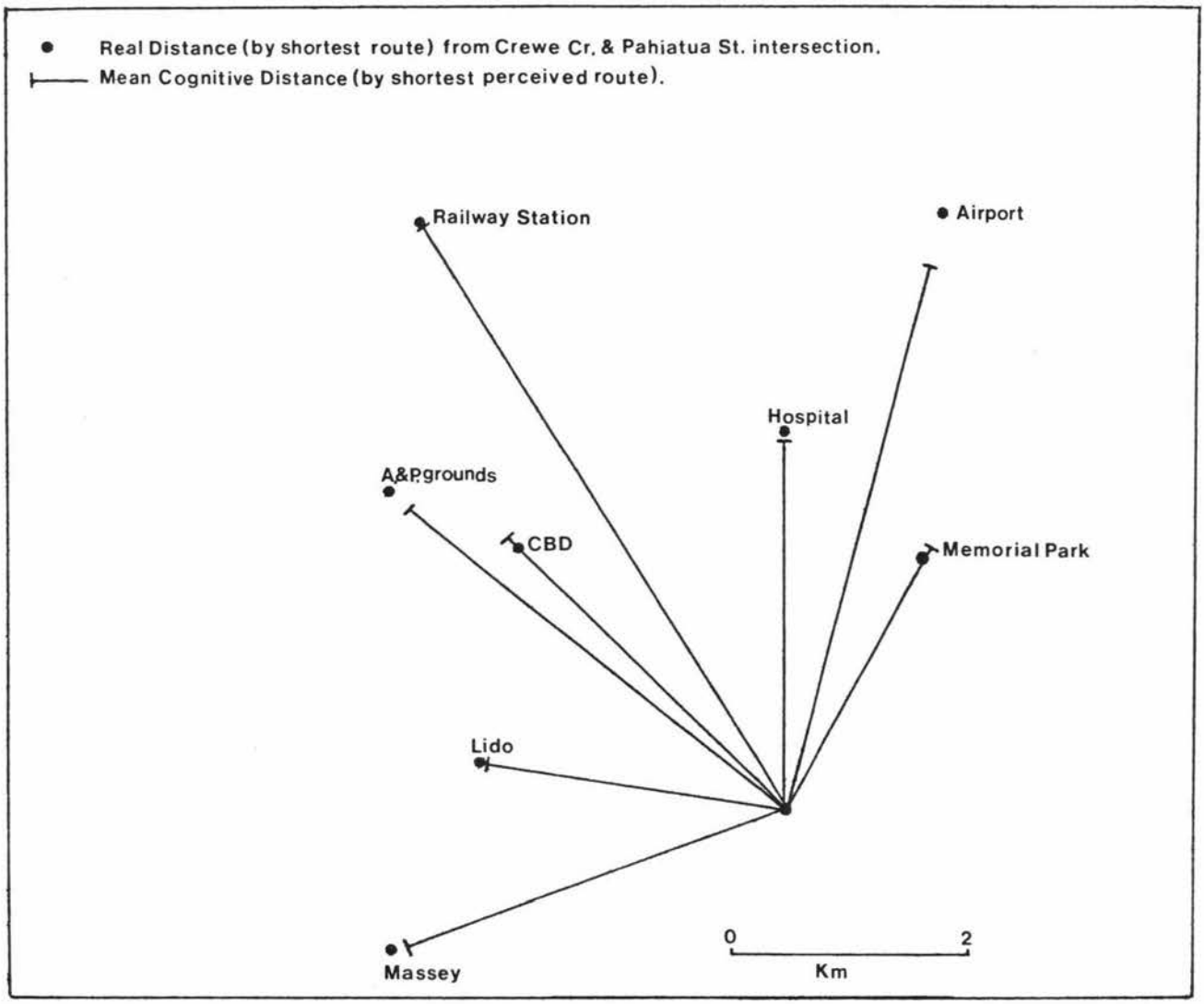

Figure 5 Ratio of Cognitive Distance to Real Distance to Locations in Respondents' Activity Areas with respect to Direction (Relative to the C.B.D.'s Direction).

Note: The location's direction is correct relative to the CBD's direction from the intersection of Crewe Crescent and Pahiatua Street. The location's real distance is measured by shortest route, though in this diagram it is displayed as 'direct' in the location's direction, as are mean cognitive distances.

TABLE 4: Relationship of cognitive distance (CD)/real distance (RD) by the individual

Relationship of CD/RD for all regular destinations	No. of individuals
All underestimated	3
Most underestimated	13
All 'correct'[1]	5
Most 'correct'	6
All overestimated	1
Most overestimated	7
No apparent regularity	15

The variation shown by individuals in their estimation of distance would further indicate that real distance is a poor proxy for cognitive distance. If cognitive distance is a function of the interaction of the individual and his/her environment then it is the product of not only the environment but also of what the individual brings to that interaction; that is, while the image is not directly tied to daily spatial behaviour, it does influence the nature of the schemata and is indirectly linked to everyday behaviour. The individual's cognition of distance to a location may not be constant. Tranter and Parkes (1979) showed the urban image varies through time and there is some indication in the results that the part of the schemata used varies over time of day. The distance to work from home may be cognised differently from the distance to home from work. The purpose of the trip (to work, to grocer's, etc.) had little apparent influence on the relationship of cognitive distance/real distance except for the hotel as destination when an orientation to underestimation can be discerned (Table 5).

TABLE 5: Relationship of cognitive distance/real distance to nature of trip destination

Purpose of trip To	Proportion of respondents that: Under-estimate	'Correctly' estimate	Over-estimate
Work	.40	.35	.25
Grocer's	.38	.40	.22
Dairy	.50	.25	.25
CBD	.28	.44	.28
Hotel	.57	.36	.07
Club	.53	.20	.27
Other	.20	.40	.40

When, however, the range of estimates of cognitive distance to a given destination, for example the CBD (Fig. 6), is examined, the mean of these estimates is seen to be 'correct'. The close relationship between the mean of cognitive distances to the CBD and real distance is evident for other destinations (Table 6).

TABLE 6: Means of real distances and cognitive distances to various destinations

Nature of destinations	Real distance/km		Cognitive distance	
	Mean	Standard deviation	Mean	Standard deviation
CBD	3.20	-	3.27	1.10
Work	3.40	1.00	3.50	1.20
Grocer's	1.12	1.04	1.07	1.03
Dairy	0.51	0.06	0.50	0.20
Hotel	3.20	1.50	2.50	1.90
Club	2.80	0.99	2.81	1.79

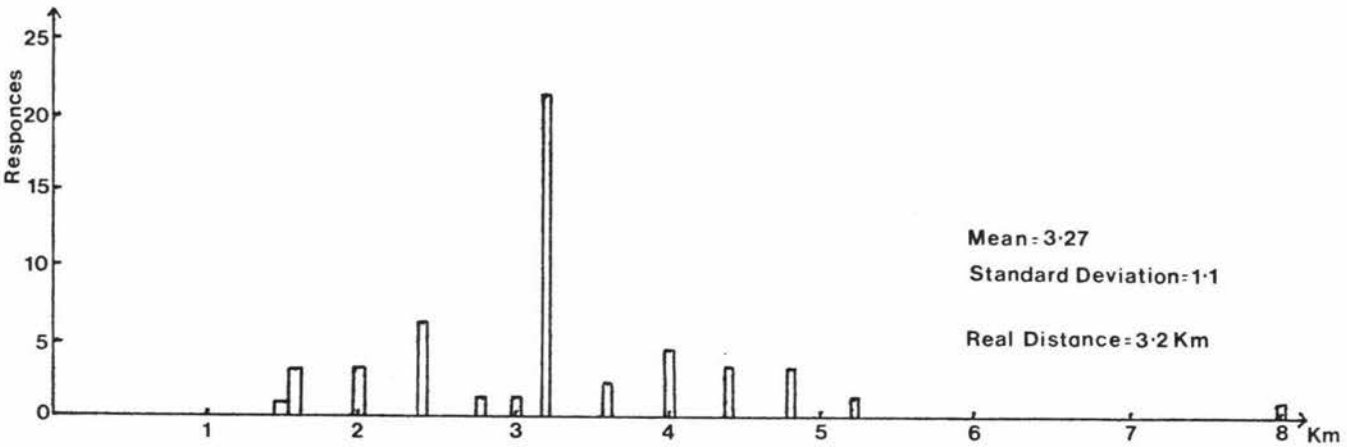

Figure 6 Estimates of Distance to the CBD.

The only clear divergence evident is that subset's tendency to underestimate the distance to the hotel as a destination. Also the larger standard deviations for the hotel and club destinations may indicate a bigger range of proxies for distance in recreational travel. No systematic divergence between cognitive distance and real distance to destinations within the activity area is evident. An alternative hypothesis can be proposed.

Alternative hypothesis 1: That respondents will display no systematic divergence in their estimates of distance from real distance to destinations within their activity area.

This hypothesis reflects the complex factors and variables that influence cognitive distance. Retesting was necessitated.

The data above revealed in the closeness of the means of cognitive distance to real distance the possible existence of a shared image.

Information collected on the cognitive distances of respondents to various locations within the city was intended to be used to evaluate the hypothesis regarding cognitive distance to locations out of respondents' activity areas. For some respondents though some locations were destinations, for all re-

spondents one or more locations fell within the activity area. This allows comparison (see Table 7) of the cognitive distance of individuals. The estimates of distance to locations within the activity area show no systematic divergence from real distance, which supports Alternative hypothesis 1. The only location for which a tendency can be discerned is Memorial Park, which most respondents slightly overestimated. This may be a result of it being on the periphery of most respondents' activity areas and lying on a route often taken when respondents were journeying out of the city (support for Briggs, 1973 and Golledge et al, 1972). In contrast the estimates of distance to locations out of the activity area display a different pattern. For most locations the largest proportion of respondents overestimated the distance, which would support the hypothesis. One destination, the railway station, had no systematic variation which may be a result of it lying just beyond the periphery of many respondents' activity areas. The second, the Teacher's College, had its distance underestimated by most respondents. Briggs (1973) noted that the attribute of the path (route) to the node (in this case location) may be an influence in explaining large deviations from the general pattern. The route to the Teacher's College is indirect (by road 2.5km/'Crowfly' 1.1km or 2.27:1, for comparison the airport is: by road 5.3km/'Crowfly' 4.0km or 1.33:1), and the indirect nature of the route may contribute to the underestimation of route distance to this location.

The general systematic overestimation of distance to locations outside the activity area as opposed to the lack of systematic variation of estimation of distance within the activity area gave support to a clear delineation of the

TABLE 7: Relationship of cognitive distance/real distance to locations within and out of respondents' activity areas

Location	Within activity area Proportion of respondents that:			Out of activity area Proportion of respondents that:		
	Under-estimate	'Correct'	Over-estimate	Under-estimate	'Correct'	Over-estimate
Massey	.08	.75	.17	.16	.14	.70
Teacher's College	.50	.50	.00	.67	.12	.21
Airport*	.20	.80	.00	.21	.30	.49
Racecourse*	.50	.50	.00	.09	.42	.49
A & P Showgrounds	.24	.48	.28	.12	.32	.56
Lido	.18	.52	.30	.06	.18	.76
Hospital	.38	.27	.35	.25	.13	.62
Railway Station	.15	.70	.15	.39	.25	.36
Cathedral	.22	.51	.27	.14	.28	.58
Memorial Park	.18	.27	.55	.14	.16	.70

Note: distances are to the main entrance of the destination where appropriate.
*5 or fewer respondents contained these destinations in their activity areas so the proportions carry less weight.

spatial schemata which corresponds to activity area and would indicate a link between behaviour and the spatial schemata whereas cognitive distance in the image is internalised through other mechanisms.

The data displayed in Table 8 provide support for the notion of shared images of individuals.

The means of cognitive distances of respondents to locations within their activity areas are similar to the real distances (the exception being the Teacher's College, see above). If cognitive distance averages out to approximate real distance this may account for many non-behavioural models of aggregate behaviour (e.g. gravity model). This may also provide some justification for disregarding the individual's effect when modelling macro scale populations. The means of cognitive distances of respondents to locations out of activity areas tend to be greater than real distance (as might be expected from Table 7). A difference can also be seen in the standard deviations of the estimates, with smaller standard deviations in the estimates to locations within activity areas. The larger standard deviations in estimates to locations outside of the activity areas could indicate a larger range of proxies for distance to locations held in the image rather than the schemata, so that while schemata may be very similar images may vary considerably.

The data presented in Tables 7 and 8 reveal an important difference in that Table 7 displays the cognitive distances of the individuals whilst Table 8 displays a group or shared schemata/image of the study's population. (It is evident that an individual's responses cannot be inferred or predicted from

TABLE 8: Cognitive distances to locations within and out of respondents' activity areas

Location	Real distance/km*	Cognitive distance			
		Within activity area		Out of activity area	
		Mean	Standard deviation	Mean	Standard deviation
Massey	3.6	3.5	0.6	5.3	2.3
Teacher's College	2.5	1.9	0.6	1.8	1.0
Airport**	5.3	(4.8)		5.9	2.0
Racecourse**	6.2	(5.2)		7.0	1.5
A & P Showgrounds	4.3	4.1	1.1	4.6	1.2
Lido	2.7	2.7	0.9	3.8	1.3
Hospital	3.3	3.2	1.1	3.8	1.3
Railway Station	6.0	6.0	0.7	6.2	2.3
Cathedral	2.6	2.6	0.65	3.2	1.2
Memorial Park	2.5	2.6	0.8	3.1	1.1

Note: distances are to the main entrance of the destination where appropriate.
*from the Pahiatua Street/Crewe Crescent intersection by most direct route.
**5 or fewer respondents contained these destinations in their activity area so the mean values carry less weight and a standard deviation is of no value.

Table 8.) Any difference in the responses given by individuals would not only change the data displayed in Table 7 but would alter the mean and standard deviations in Table 8.

This has important implications for studies on cognitive distance (e.g. Briggs, 1973) that use 'traditional' sampling where the sample's variance should aim to equalise variance in the full, 'natural' population. If a sample is used that fails to do this, either through being non selectively stratified (maybe through selection of a convenient sample) or being small, then the variance will be specific to the sample, which limits the validity of inference from the sample to the 'natural' population. The results of such studies may in fact make statements concerning cognitive distance in which the variability is the product of (e.g. the size of) the sample rather than the supposed independent variable. This provides support for the study of cognitive distance at the scale of the individual, and the consideration of a limited, artificial population; but a population for which all variation (under consideration) has been measured.

The evidence obtained from the population supports a divergence between cognitive distance and real distance to locations out of the area in overestimation. Support is given to the alternative hypothesis that estimates of distance will display no divergence from real distance to locations within the activity area. The evidence would therefore support the hypothesis proposing a difference in the nature of cognitive distance to locations within and out of activity areas.

CONSIDERATIONS OF THE HYPOTHESES CONCERNING CONSTRAINTS ON THE SPATIAL SCHEMATA-ACTIVITY AREA COMPLEX

Experimental hypothesis J: Respondents will make multi-destination trips from home in day to day behaviour.

The evidence provides support for the hypothesis. Of the 50 respondents 41 make multi-destination trips in regular day to day behaviour. Of the 9 respondents who did not make multi-destination trips:

1 worked 'out of town' and travelled only to and from work on weekdays

5 superannuitants had limited activity areas and 'spread' trips to ensure some travel each day

2 respondents made varied single destination trips for recreational purposes

1 social welfare beneficiary, like the superannuitants noted above, had a limited activity area and 'spread' trips to ensure some travel each day.

For all but one respondent who made single destination trips time was not indicated by the respondent to be a scarce resource. That the great majority of respondents organised their daily trip behaviour to reduce time costs lends support to the proponents of a time-geographic approach. As Lenntorp (1976) noted, the constraint of time varies with mode of transport, for example the car having greater ability to overcome the constraint of time than the bus. The latter also imposes authority constraints in that the times of departure and routes taken are decided by an authoritative decision maker. The individual has to consider the trade off between the temporal costs involved in the authority constraints of public transport and the cost of buying time in private (motor) transport.

The following experimental hypotheses are concerned with constraint on personal mobility.

Experimental hypothesis K: Respondents dependent on public transport will make shorter trips from home than those not dependent on public transport.

Experimental hypothesis L: Respondents dependent on public transport will follow fewer routes on trips than those not dependent on public transport.

Experimental hypothesis M: Respondents dependent on public transport will correctly recognise, identify and locate fewer iconic representations of landmarks within their activity areas than those not dependent on public transport.

The data provide support to hypotheses K and L (see Table 9 and Figs. 7 and 8).

TABLE 9: Mean length of trips by respondents dependent on public transport/not dependent on public transport

Mean length of trip/km	Respondents dependent on public transport	Respondents not dependent on public transport
0 - 1	9	0
1.1 - 2	9	8
2.1 - 3	0	16
3.1 - 4	0	8
Totals	18	32

Absolute differentiation in length of route and number of routes between those dependent/not dependent on public transport does not exist. Sufficient differentiation exists though to support the hypotheses. Those respondents normally dependent on public transport have constrained activity areas, in that journeys are shorter and less varied. Evidence also exists for less frequent journeying along longer routes, for example those dependent on public transport travel to the CBD on average once every 10 days, those not dependent on public transport on average once every 4 days. The operation of constraints on mobility have implications for models that

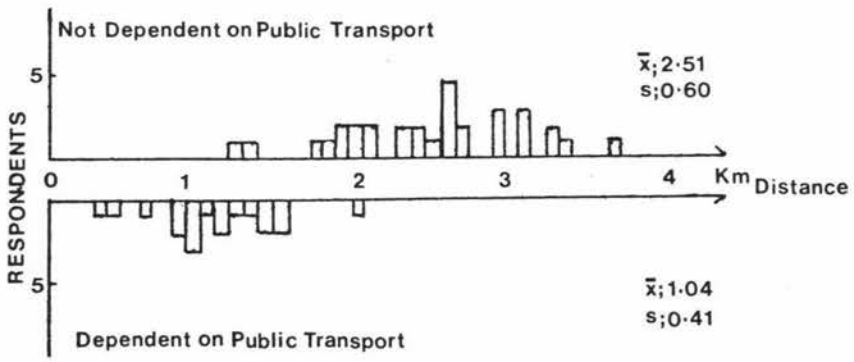

Figure 7 Mean Trip Length of Respondents

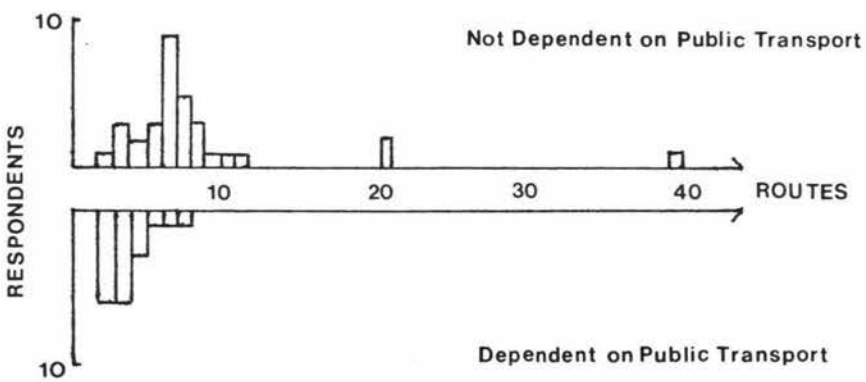

Figure 8 Number of Routes taken by Respondents for Trips to Regular Destinations.

assume equal accessibility. Though the activity area may be constrained the question remains as to whether this constraint has influence on the schemata of the activity area. Table 10 considers the numbers of individuals dependent/not dependent on public transport recognising, identifying and being able to locate the test landmarks within their activity area.

TABLE 10: The recognition, identification and 'location' of test landmarks within the activity area by respondents dependent/not dependent on public transport

Proportion of test landmarks	Number of respondents (and proportion in each subset)	
	Dependent on public transport	Not dependent on public transport
Recognised		
0 - .2	0 (.00)	0 (.00)
.21 - .4	0 (.00)	0 (.00)
.41 - .6	2 (.11)	0 (.00)
.61 - .8	1 (.06)	4 (.12)
.81 - 1.0	15 (.83)	28 (.87)
Identified		
0 - .2	0 (.00)	0 (.00)
.21 - .4	0 (.00)	0 (.00)
.41 - .6	2 (.11)	1 (.03)
.61 - .8	5 (.28)	4 (.12)
.81 - 1.0	11 (.61)	27 (.84)
Located		
0 - .2	0 (.00)	0 (.00)
.21 - .4	0 (.00)	0 (.00)
.41 - .6	2 (.11)	1 (.03)
.61 - .8	6 (.33)	4 (.12)
.81 - 1.0	10 (.56)	27 (.84)

Whilst only a slight difference exists in the response rates of recognition of test landmarks, the response rates for correct identifications and 'locations' are lower for those respondents dependent on public transport than for those not dependent on public transport. This may be the result of landmarks being less visible from a bus than from a bicycle or car. Alternatively, the difference in response rates may indicate a difference in the cues provided by landmarks for differing modes of travel. When travelling by bus no decisions on way finding between embarkation and arrival at the destination are made. In this more passive mode of travel there is a lesser need to identify landmarks or to be able to locate them, only to recognise destinations; landmarks, as locational cues, have a different function if decision making is involved (as in driving a car). As with the data concerning length of trip and number of routes followed, there is not absolute differentiation in the behaviours directed towards landmarks between the subsets but there is sufficient to give support to the hypothesis. As noted above the activity area is constrained by dependence on public transport. In addition the evidence would suggest that the spatial schemata is influenced by the mode of transport, that is, the image is a function of behaviour: indication of a feedback mechanism to the normally stated assumed relationship of behaviour being a function of the image.

The next two experimental hypotheses consider social constraints on the spatial schemata-activity area complex.

Experimental hypothesis N: Respondents will not travel through adjacent residential areas that are different from their own by means of income of residents.

Experimental hypothesis P: Respondents will not have social trip destinations in adjacent residential areas that are different from their own by means of income of residents.

There is no evidence to support the first of this pair of hypotheses. The two differentiated residential areas with the population were Crewe Crescent (mean income of respondents $5,440/p.a.) and Pahiatua Street (mean income of respondents $11,946/p.a.). All respondents in Crewe Crescent normally travelled through Pahiatua Street. Only two respondents in Pahiatua Street normally travelled through Crewe Crescent. This appears to be not the product of avoidance (such as noted by Boal, 1969), but of respondents choosing the shortest/quickest routes to destinations. For Crewe Crescent respondents destinations lay beyond Pahiatua Street while for only two Pahiatua Street respondents did destinations lie beyond Crewe Crescent. In this situation proximity would appear to dominate, over-riding possible social constraints. Information in the spatial schemata would appear to be used in decisions on everyday spatial behaviour rather than information in the image.

The second of these two hypotheses though is supported by the data. Whilst respondents from both Crewe Crescent and Pahiatua Street had city wide social trip destinations (Fig.9), social trip destinations within the population's area are differentiated (Table 11).

TABLE 11: Social trip destinations within the population's area

Respondent's residence (St.)	Social trip destination	
	Crewe Crescent	Pahiatua Street
Crewe Crescent	15	2
Pahiatua Street	2	14

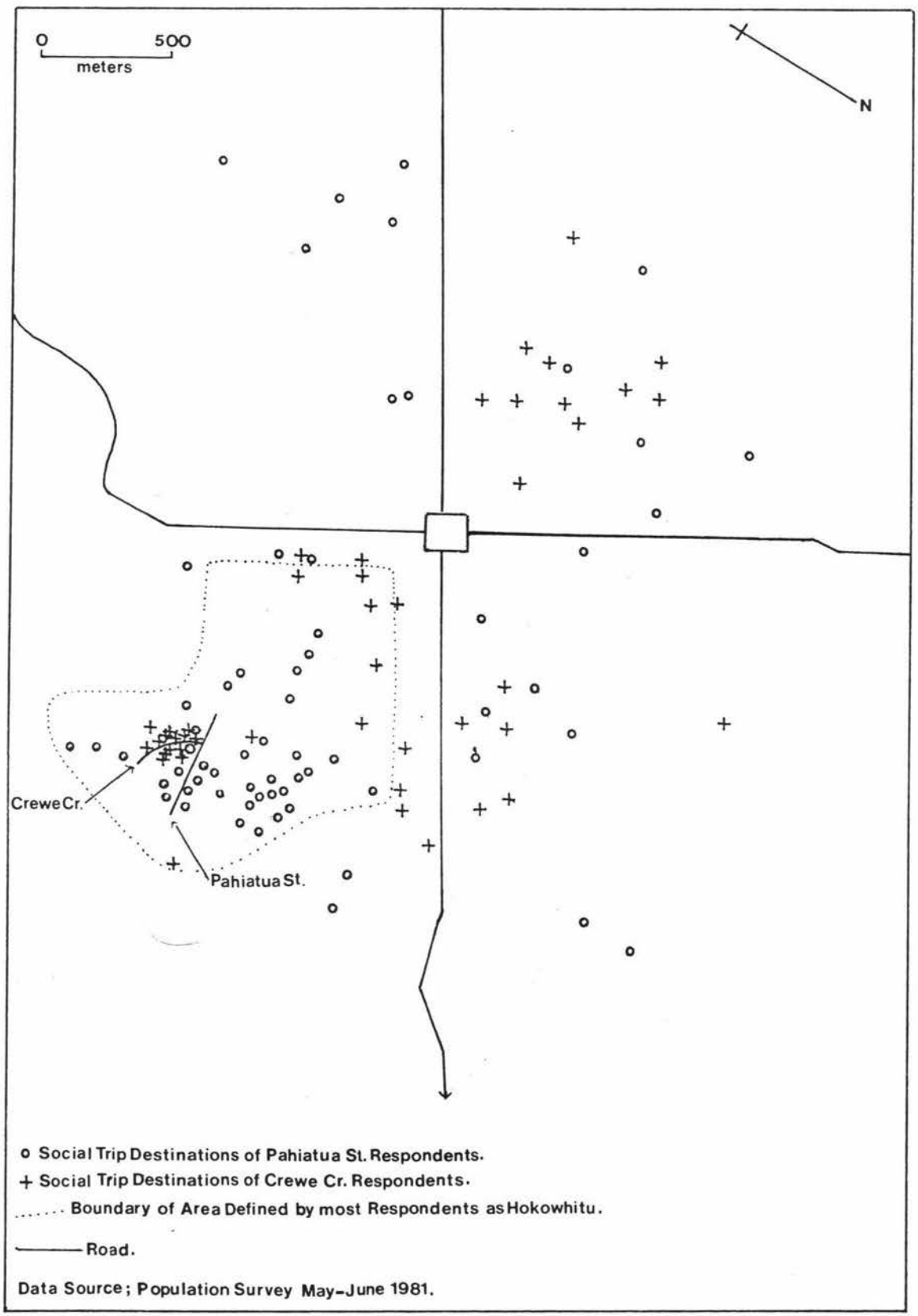

Figure 9; Respondents' Social Trip Destinations in Palmerston North.

Of the social interaction between respondents in Crewe Crescent and respondents in Pahiatua Street, the two respondents in Pahiatua Street (husband and wife) interact with one respondent in Crewe Crescent, all three being members of the same church/church group that is located on the other side of town. The second respondent in Crewe Crescent who has a social trip destination in Pahiatua Street (but outside the population) has as the destination a fellow student. Respondents in Crewe Crescent and Pahiatua Street averaged two to three[2] social trip destinations outside the population's area. Stutz (1973) noted a distance decay effect on interaction with neighbours. Examination of the spatial distribution of local (the area commonly perceived by respondents as Hokowhitu) social trip destinations of Pahiatua Street respondents reveals a spatial truncation (Fig. 10). Such a marked truncation is not evident for Crewe Crescent respondents, for their social trip destinations tend to be within the Crescent and its cul-de-sacs or outside the local area. A difference is also noticeable in the location of the social trip destinations most frequently visited; 14 of the 22 Crewe Crescent respondents gave 'Crewe Crescent locations' as their most frequent social trip destinations whereas the Pahiatua Street respondents gave locations mostly throughout Hokowhitu. The apparent 'containment' for Crewe Crescent supports 'containment' discerned in studies of working class neighbourhoods by Suttles (1968) and Taylor and Townsend (1976) as well as the high frequency of social interaction expected with neighbours as expressed by Stutz (1973). Within Crewe Crescent social and physical proximity complement each other to encourage a high rate of interaction, but when Pahiatua Street is reached,

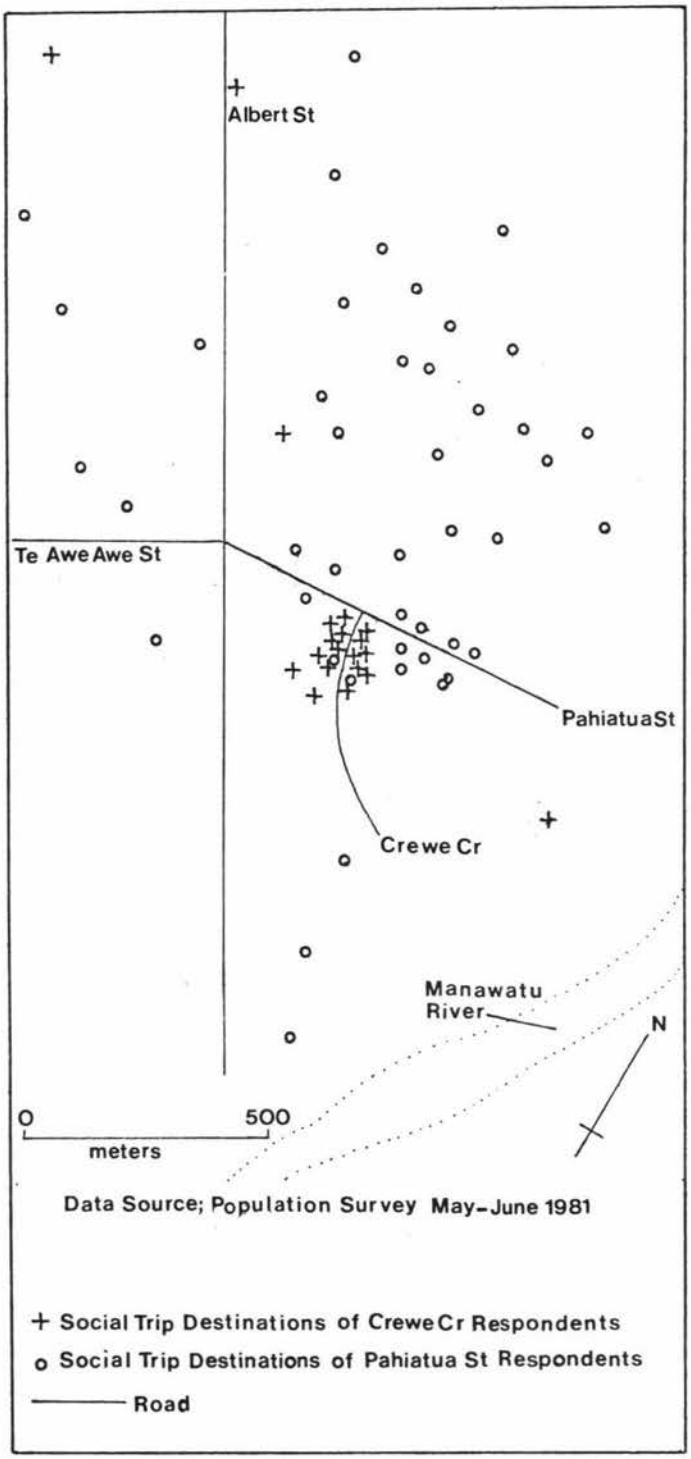

Figure 10 Respondents' Social Trip Destinations in (Eastern) Hokowhitu.

though physical distance continues to decrease uniformly, social distance increases greatly and social interaction rapidly decreases (the only interaction between the two areas being for respondents with limited social distance). The resumption of social interaction for Crewe Crescent respondents beyond Pahiatua Street may indicate the greater ease with which physical distance as opposed to social distance can be overcome. Though the social interaction field of Pahiatua Street, although showing a more dispersed immediate 'contact field' does exhibit a truncation of social interaction field, again indicative of the role of social distance. Social distance as part of the image may give information about social interaction but little about journey to work, shop, etc., while the spatial schemata give little information on social interaction and so can be seen to interact with (the cognition of) physical distance in influencing the individual's spatial pattern of (social) behaviour. The resultant behaviour though will, it is proposed, influence the formation of the individual's spatial schemata and from the evidence above it appeared that there was a tendency for individuals to overestimate distance to locations out of the activity area. This could feed back into reinforcing the constraint of social distance.

The containment and truncation revealed have important implications for some models, including for example innovation diffusion and spatial consumer behaviour.

The following experimental hypotheses were concerned with the personal constraints upon the spatial schemata-acitivy area complex in terms of the time afforded to the individual to 'learn' the environment.

Experimental hypothesis R: As the respondent's length of residence at that residential location increases, the number of correct recognitions of, indentifications of and ability to locate iconic representations of all landmarks will increase.

Experimental hypothesis S: As the respondent's length of residence at that residential location increases, the number of test landmarks in the activity area will increase as will the proportions of correct recognitions of, identifications of and ability to locate iconic representations of those landmarks.

Experimental hypothesis T: As the respondent's lenght of residence in the city increases, so the number of correct recognitions of, identifications of and ability to locate iconic representations of all landmarks will increase.

Experimental hypothesis U: As the respondent's length of residence in the city increases, so the number of correct recognitions of, identifications of and ability to locate iconic representations of test landmarks in the activity area will increase.

To assess the relationship between the respondent's cognition of the city and his/her length of residence at that location, the Pearson Product Moment Coefficient was calculated for each of the abilities (to recognise, identify and locate iconic representations of all test landmarks) with lenght of residence. The relationships found were close to random, though in each case slightly negative (Table 12).

TABLE 12: Correlation coefficients of behaviours directed towards iconic representations of landmarks with length of residence at that residential location

	Behaviour directed toward iconic representations of landmarks		
	Correct recognition	Correct identification	Correct ability to locate
For all test landmarks	r = -0.16	r = -0.17	r = -0.11
For all landmarks within activity areas	r = - 0.14	r = -0.17	r = -0.11

Note: for the number of test landmarks within the activity area and length of residence at that residential location r = -0.24.

Similar correlations were found for relationships between the defined abilities and length of residence in the city, though some differentiation is evident (Table 13).

TABLE 13: Correlation coefficients of behaviours directed towards iconic representations of landmarks with length of residence in the city

	Behaviour directed towards iconic representations of landmarks		
	Correct recognition	Correct Identification	Correct ability to locate
For all test landmarks	r = -0.24	r = -0.27	r = -0.19
For landmarks within activity area	r = -0.09	r = -0.06	r = -0.26

Note: for the number of test landmarks within the activity area and length of residence in the city r = -0.21.

These data do not offer support to the hypotheses. It would appear rather that cues are tied to behaviour, acquired for a purpose, and once a sufficient set of landmarks is internalised for way finding no more are needed and so are not added to the spatial schemata. This reinforces the linking of schemata and behaviour.

For both the preceding hypotheses the expectation of an increase in the cognition of the city and of the spatial schemata over time is based on time providing increased opportunity to interact with and 'learn' the environment. Within the population only 3 respondents had lived at that residential

location for less than one year and 13 had lived at that residential location for over ten years; the length of residence in the city extended up to sixty years. The lack of support may be the product of the population in that people need to learn to negotiate the urban environment very rapidly, and a hypothesis based on a learning process may better be evaluated considering a population that has been resident in the city at a single residential location for a short period of time, for example up to 6 months.

It is possible, with the length of residence extending to 60 years, the age of respondents varying from 14 to 83, and the slight negative correlations noted, that age may be a factor in the nature of the schemata.

Additional hypothesis 1: As the respondent's age increases, the number of test landmarks within the activity area will decrease, as will the proportion of correct recognitions of, identifications of and ability to locate iconic representations of those landmarks.

Again the evidence was not supportive, the correlations being (too) weak (see Table 14), though negative.

TABLE 14: Correlation coefficients of behaviours directed towards iconic representations of landmarks with age

	Behaviour directed towards iconic representations of landmarks		
	Correct recognitions	Correct identifications	Correct 'locations'
For test landmarks within activity area/ age	r = -0.32	r = -0.38	r = -0.29

Note: Coefficient for correlation between number of landmarks in the activity area and age r = -0.39.

The inconclusive nature of the data again suggests that all

individuals 'need' cues and so age itself does not increase/ decrease them, since it is behaviour to which they are tied. Visual inspection of the raw data suggests that an increase in both the number of test landmarks in the activity area (suggesting an increase in the activity area) and in the total number of test landmarks recognised, identified and located occurs up to the age of thirty and a decline thereafter. This could well be the product of changes in the mobility of the population. Though age may be a factor in influencing cognitive processes a distinct differentiation was evident in the 60+ age group between those mobile (with a mean of 17 test landmarks recognised; a mean of 15 test landmarks within their activity areas of which, as a mean,.98/1 were recognised) and those with restricted mobility (with a mean of 8.6 test landmarks recognised; a mean of 7.6 test landmarks within their activity area of which, as a mean, .86/1 were recognised).

If the relationship between age and activity for the population is considered then the correlation between the mean length of trips with age is very weak; $r = -0.23$. A dependence on public transport has already been identified as a constraint upon mobility; for those dependent on public transport there is no correlation between mean length of trip and age ($r = 0.002$), whilst for those not dependent on public transport there was a weak negative correlation ($r = -0.46$). The latter suggests that when not subject to authority constraints, there may be constraints upon mobility that covary with age, of which some may be personal (e.g. attitude), though the differentiation noted above in the 60+ age group belies this and indicates the danger of generalisation in consideration of means/correlations and the advantage to the

consideration of a limited, 'artificial' population. There is a suggestion present in the data that there is a hierarchy of constraints operating on the spatial schemata-activity area complex but that the personal constraints of length of residence and age have no bearing on the schemata, rather it is behaviour to which it is tied.

The final two experimental hypotheses consider socio-economic characteristics that may constrain the spatial schemata-activity area complex.

Experimental hypothesis V: As the respondents' income increases the number of test landmarks in the activity area will increase, as will the proportion of correct recognitions of, identifications of and ability to locate iconic representations of those test landmarks.

Experimental hypothesis W: As the respondents' level of education (number of years post primary education) increases so will the number of test landmarks in the activity area increase, as will the proportion of correct recognitions of, identifications of and ability to locate iconic representations of those landmarks.

The data provided no support for the hypotheses; the correlation coefficients that described the relationships between the behaviours directed towards the iconic representations of test landmarks and income all lay between 0.0 and 0.1. The correlation coefficients that described the relationships between the behaviours directed towards the iconic representations of test landmarks and level of education were very weakly positive and lay between 0.21 and 0.31. The lack of support for these hypotheses again supports the idea that behaviour, not education or any other socio-economic variable is the reason for having/needing cues.

In conducting the questionnaire interviews it seemed that a difference existed between the responses being given by male and female respondents with respect to the iconic represent-

ations of landmarks; and that the difference was most pronounced in that segment of the population not dependent on public transport.

Additional hypothesis 2: That male respondents will be able to locate a greater number of test landmarks than female respondents.

Initial examination of the data reveals little apparent difference. The population was considered as two subsets; those dependent on public transport and those not dependent on public transport. For those respondents normally dependent on public transport the median number of test landmarks is 11 with little difference between the sexes, though the respondents with more than 15 landmarks 'located' were female, who with one exception had the larger activity areas of the subset based on a large set of social trip destinations.

The median number of test landmarks that could be located by respondents not dependent on public transport was 15. Of the female respondents: 6 were able to locate 15 or more test landmarks, 13 were able to locate less than 15 test landmarks. Of the male respondents 12 were able to locate 15 or more test landmarks, 2 were able to locate less than 15 test landmarks. Whilst this may seem to support an innate sex differentiated behaviour it may indicate a role differentiation. Of the 6 women who were able to locate correctly 15 or more test landmarks all were employed outside the home or involved in community work and had the more extensive activity areas. Of the men who recognised less than 15 test landmarks both had restricted activity areas; one experiencing time as a very scarce resource, journeying almost solely between home and work, the second also having a limited activity area. It would seem that the apparent sex differentiation in behaviour

directed towards the test landmarks is in fact a product of a difference in behaviour, though the behaviour may be in part a function of sex roles.

The above results apply to a city image rather than specifically the spatial schemata. When considering the spatial schemata of those respondents not dependent on public transport; male respondents had a mean of 14.6 test landmarks in their activity areas with a mean correct response rate of .94/1 for 'ability to locate', female respondents had a mean of 11.9 test landmarks in their activity areas with a mean correct response rate of .87/1 for 'ability to locate'.

The data on the spatial schemata supports the contention that the difference in response rate (image) between male and female respondents is the product of a difference in behaviour that may be a function of role rather than an innate sex differential.

FOOTNOTES

1 A cognitive distance is accepted as 'correct' if it has an error no greater than 10% when compared to the real distance of route taken. This degree of acceptable error allows for the summing of a 5% measurement error on the part of the subject of the interview and in the measurement of objective distance.

2 Crewe Crescent respondents 2.24; Pahiatua Street respondents 3.10.

CHAPTER 6

CONCLUSION

This study has proposed that the spatial schemata and activity area of an individual are inter-related and that this is subject to constraints. The subsequent sections of this study were concerned with providing the means whereby the central proposition could be evaluated.

The support given to the experimental hypotheses by the data obtained through the working hypotheses provided support for the research hypothesis that the spatial schemata and activity area of individuals are inter-related. Evidence was forthcoming to support the widely accepted contention that spatial behaviour is a function of the spatial schemata; for example while respondents believed that they were taking the shortest/quickest route to a destination, differing respondents would take differing routes to the same destination. The temporal constraints noted by respondents would reinforce the learning mechanism in 'satisficing' in that once a satisfactory route has been established, search behaviour (for what may be the objectively optimum route) ceases and the satisfactory route is maintained.

Further, evidence was present to show that the schemata is a function of behaviour in the ability to recognise, identify and locate iconic representations of landmarks that were within as opposed to without the activity area. For many respondents the pattern of spatial behaviour produced an activity area that had 'holes' within it, in that those respondents travelled around though not through a section of the city;

thus both the schemata and the environment in which activity occurs may be thought of as being functionally discontinuous surfaces. Landmarks in these holes were infrequently recognised, the holes being outside the activity area. This reinforces the need to bear constantly in mind the definition of activity existing in physical space and including the destinations and space occupied (routes) in reaching those destinations; as such it is not a continuous surface but perhaps as Lynch (1960) suggested, a set of nodes connected by paths.

Physical distance was revealed to be a poor proxy for cognitive distance for the individual, though at the resolution of a group (shared) image a difference existed between cognition of distance within and without the activity area. The consensus between group cognitive distance and physical distance to destinations within the activity area and the disparity to destinations without could, on measures of cognitive distance based on the group, lead to conclusions of cognitive distance being the sum of perceived (experienced) distances; hence an accuracy to locations within and an inaccuracy to locations out of the activity area, as such locations are held within the image not the schemata. Disaggregation of the 'group' schemata however reveals too many individual variations to support this contention. Whilst, as noted above, the 'accuracy' of the group schemata may explain the success of models describing consumer behaviour at an aggregated level, it also reveals a danger in attempting to apply models of aggregated behaviour to microscale studies. Also, the greater range of estimates of distance to locations held in the image as opposed to schemata (indicating a greater

range of proxies for cognitive distance) may, with the questions raised about the influence of the sample used, be responsible for the conflicting evidence to date on cognitive distance. The implication is that physical distance is a poor proxy for cognitive distance, which raises the question for possible further research, of what are the proxies that independently or collectively could represent cognitive distance. It is evident that a uni-directional relationship does not exist between the spatial schemata and the activity area, rather an interactive complex exists in which feedback mechanisms appear to operate so that not only is 'behaviour' a function of the 'image' but at least in part the image (spatial schemata) is a function of behaviour. This reinforces the cyclic nature of Downs's (1970a) schema. Often emphasis has been placed on seeking to establish that spatial behaviour is a function of the 'image' (e.g. Pacione, 1976), but Downs's schema also incorporates the notion that behaviour in the 'real world' provides information via the perceptual receptors to produce/modify the 'image'. Whilst a growing number of papers have paid attention to appraisive cognitive processes such as attitudes, preferences and motivation, those research efforts into the perceptive-cognitive process, whether focussing on visual elements of the environment (e.g. Carr and Schissler, 1970), or visual and non visual elements (e.g. Burgess and Hollis, 1977) have perhaps been undervalued.

The support given to the experimental hypothesis concerning constraints was varied. Though many experimental hypotheses were not supported, the evidence gained to test these hypotheses was not without value in helping to gain insight into the nature of the relationship between the activity area

and spatial schemata.

Though time was indicated to be a scarce resource by almost all of this study's population, many respondents were unable to 'buy' time through the use of a private motor vehicle. Further, those respondents subject to the 'authority constraints' of public transport displayed relatively reduced activity areas. The dependence on public transport as a mode of travel would also appear to influence the spatial schemata in terms of the abilities to identify and locate landmarks for differing modes of travel. The cognition of the visual elements of the route's environment would appear to vary with mode of transport, supporting Lee's 1971 findings, though not to an extent that would undermine Appleyard's (1964) proposition that the primary cues are visual.

Dependence on public transport constrains not only the the activity area but it also influences the spatial schemata associated with activity area.

Though defended space was not identified at the street level the effect of social distance upon spatial behaviour at the local level was. Previous studies on the association of neighbourhood differentiation (by various measures) with activity segregation have tended to focus on a defended neighbourhood where a territorial organisation operates. This study has indicated that social seperation on a large scale serves to constrain social interaction and distort an expected (Stutz, 1973) distance decay function for social interaction with neighbours, where defended space is not seen to operate.[1] Though this social constraint seemed to have had little effect upon the full (aggregated) activity space of individuals, it may have effects upon spatial behaviour with a social compo-

nent in the immediate neighbourhood not measured: such as recreational facilities used (including children's play areas).

The very weak correlations measured between personal constraints (such as length of residence and age) and the spatial schemata would indicate that a spatial schemata is rapidly established by the individual in order successfully to negotiate the urban environment in everyday behaviour. Once a spatial schemata is internalised it may be added to or parts of it become redundant according to the demands of changes in behaviour, but length of residence and/or age in themselves have no correlative association.

Similarly, no correlation was found between the socio-economic status of individuals and their spatial schemata. This is again indicative of the importance of the association between behaviour and image. Irrespective of income or educational experience, in order successfully to negotiate the urban environment in completing everyday spatial behaviour, the individual needs to internalise adequate spatial information on the environment experienced. This would also suggest that wayfinding is a deep seated process arising out of a universal necessity and is dictated by universal processes. This also calls into question the notion of assuming that people act 'as if' an image made them behave; certainly spatial schemata seem more 'basic' and universal than geographers' present idea of image, at least for wayfinding.

Almost without exception the data has supported the need to differentiate clearly between the function and nature of spatial schemata and image, both in conceptual and empirical terms. There has been a tendency present in the literature to use the 'image' as an all-embracing concept. Whilst

information held within the image (preferences, attitudes, values and unexperienced locational and attributive information) may be used in life choice situations such as migration, or irregular behaviours such as choice of restaurant or holiday location, it is the spatial schemata, the cognitive representations of the everyday experienced environment, that is closely related to the regular, repetitive spatial behaviours of daily life. Therefore, if explanations are sought in relation to everyday spatial behaviour in the 'image' rather than the schemata, then the results are likely to be inconclusive. If the concept of the 'image' is to become of greater viable use within geography, then it needs to cease to be an 'umbrella' concept and its elements need to be isolated and those relevant in providing appropriate explanation be used.

The use of an artificial, limited population has been advantageous in that it has revealed aspects of relationships that remain hidden in samples. For example, the estimation of means (as in a sample) reveals a spurious proximity between real and cognised distance which does not exist for individuals. The spurious nature of this relationship would not have been revealed by a sample which sought to estimate a population mean. Some doubt is cast upon the validity of using stochastic sampling in examining cognitive distance in that the variance of the sample may not be the same as the variance in the population and so the conflicting findings on the cognitive distance to date could be the product of the sample and so would vary with the sample.

A number of partly fortuitous aspects of the research design can be noted, such as:

1) The use of colour photographs as representations of landmarks, both in the ease with which respondents could interpret them and the interest they generated in the interview situation.

2) The choice of Crewe Crescent/Pahiatua Street in revealing the constraint of social seperation in the activity area at the immediate neighbourhood scale.

A number of limitations can also be noted in the study. One limitation of the research is tied to one of its strengths. Whilst the microscale nature of the study was vital in demonstrating the strength of the association between spatial schemata and spatial behaviour for this group of individuals and whilst the processes and relationships can be inferred to the natural population, it cannot be forgotten that the study's population was 50. Verification and support for the findings of this thesis must come through further, similar investigations.

Despite the advantages the analysis has gained in considering an artificially defined population, within the prevailing climate of sampling quantitative analysis the inability to make formal, non-deductive inferences to the natural population may be seen as a limitation. There is a tendency to consider conclusions that can be made about the macroscale to carry more weight than those that can be made about the microscale; there is no reason to suppose though that the population of this study is any less important than any other population, or that processes and relationships revealed are atypical. The value of microscale studies within contemporary geography was recognised by Hagerstrand (1973), though his call for an intensification of study at this level has been largely un-

heeded.

A problem that emerged was a 'fuzziness' of some of the results obtained. This could have been a function of the city's size; most of the respondents knew most of the city. Better differentiation may have been achieved by considering a population nested within a larger urban area, where activity areas could be less contiguous and test landmarks more widely distributed, though the number of test landmarks in a larger urban area would need to be carefully resolved. A second problem was that of obtaining cognitive time distance, as many individuals found difficulty in expressing the time consumed in undertaking a journey. As time appeared to act as a scarce resource for most individuals it is likely that decisions on route choice may be made on cognised time information as suggested by Cadwallader (1976). Further consideration and investigation into gaining data concerning cognitive time distance would be worthwhile.

The thesis has raised a number of questions which could become the focus of further research. These include:

(i) Consideration of better proxies for cognitive distance than physical distance (e.g. time?).

(ii) Consideration of size, scope and nature of spatial schemata and activity areas of residents of large cities.

(iii) If the spatial schemata is tied to spatial behaviour, then what is the nature of the spatial schemata-activity area complex for those people with very restricted mobility, e.g. the handicapped, or those with no fixed abode?

(iv) Further investigation into the role of authority or environmental constraints on mobility and hence the activity area-spatial schemata complex.

(v) The pattern of learning a new spatial environment, for example by new residents in a city.

(vi) Given the importance of economic-structural constraints (e.g. State housing system) upon spatial behaviour and schemata, then how this relates to Marxist geographers may be important and worthy of consideration.

FOOTNOTE

1 Subsequent to the research a self help organisation has developed within Crewe Crescent that has upgraded the central playground, and in response to proposals put forward by this organisation to convert Crewe Crescent from a through road to two cul-de-sacs, the City Council is at present evaluating two possible schemes to restrict traffic flow through Crewe Crescent.

APPENDIX

FORMAT OF QUESTIONNAIRE

Listed below is the sequence of questions used to elicit the data required to test the hypotheses. Responses were recorded on seperate prepared sheets by the interviewer during the interview. Additional questions were interjected where necessary to clarify information but not to lead. Where respondents declined to answer (a rare occurance except for estimating time of travel) no enforcement or coercion was applied.

1) For each of the following twenty photographs would you please tell me:
   a) if you recognise the building (or buildings) featured?
   b) if you can identify the building (or buildings) featured?
   c) where in the city the building (or buildings) featured in the photograph is located?
2) How old are you?
3) (Sex was noted from observation.)
4) How many years post primary education have you completed?
5) What is your income?
6) How long have you lived in this dwelling?
7) How long have you lived in Palmerston North?

The following question was omitted where obviously irrelevant.

8) Are there other residences in Palmerston North in which you have dwelt for two or more years?
9) What is your occupation?

10a) Where do you work? (including street and location.)

11a) From which shop do you buy most groceries and where is it located?

12a) Which dairy do you normally visit and where is it located?

13a) Do you visit the town centre regularly?

14a) Do you visit any suburban shopping centres? If so, which?

15a) Which hotel do you normally visit and where is it located?

16a) Which club or clubs do you normally visit and where is it (are they) located?

For each of questions 10a - 15a the following questions were subsequently asked:

10 - 16

b) Which route do you normally take to reach this destination?

c) What means of transport do you usually use?

d) How far do you estimate you travel to reach this destination by the normal route?

e) How long do you take to reach this destination?

f) How often do you visit this destination?

g) Would you say you take the shortest route?

h) Would you say you take the quickest route?

j) Are there alternative routes that you take to reach this destination? If so, which?

k) How frequently would you take these routes?

17) Would you please tell me the location of neighbours, friends and relatives visited in the last month?

18) How often did you visit each of these people?

19) Which routes do you normally take to visit these people?

20a) Are there any other regular trips you make within the city; if so to where?

20 b - h as for 10 - 15 b - h.

21) Would you please estimate the distance you would have to travel to reach each of the following locations?

a) Teacher's College.

b) Massey University.

c) Airport.

d) Racecourse.

e) A & P Showgrounds.

f) Lido swimming pool.

g) Public hospital.

h) Railway station.

j) Cathedral.

k) Memorial Park.

22) Would you please describe your pattern of activity last Friday, giving your times of arrival and departure for each location, the means of transport taken, routes taken and activities engaged in? Is this a typical day's activity? If it is atypical, in what way does it differ from a typical day's activity?

23) What is the name of the area in which you live? Where would you say the limits or boundaries of this area are?

24) Address was noted upon completion of the interview.

BIBLIOGRAPHY

Adams, R.L. (1969) 'Uncertainty in Nature, Cognitive Dissonance and the Perceptual Distortion of Environmental Information : Weather Forecasts and New England Beach Trips', Economic Geography, 49. 287-97.

Aldskogius, H. (1977) 'A Conceptual Framework and a Swedish Case Study of Recreational Behaviour and Environmental Cognition', Economic Geography, 53. 163-83.

Altman, I. (1975) The Environment and Social Behaviour. Monterey: Brooks-Cole.

Amadeo, D. and Golledge, R.G. (1975) An Introduction to Scientific Reasoning in Geography. London: Wiley.

Appleyard, D. (1973) 'Notes on Urban Perception and Knowledge' in Downs, R.M. and Stea, D. (eds.), Image and Environment. Chicago: Aldine. 109-14.

Appleyard, D., Lynch, K. and Meyer, J. (1964) The View from the Road. Cambridge, Mass.: MIT Press.

Ardrey, R. (1966) The Territorial Imperative. New York: Delta.

Argyle, M. (1973) Social Interaction. London: Tavistock.

Barber, P.J. and Legge, D. (1976) Perception and Information. London: Methuen.

Beck, R. (1967) 'Spatial Meaning and the Properties of the Environment' in Lowenthal, D. (ed.), Environmental Perception and Behaviour. Univ. of Chicago, Dept. of Geography, Research Paper No. 109. 18-41.

Beck, R. and Wood, D. (1976) 'Comparitive Developmental Analysis of Individual and Aggregated Cognitive Maps of London' in Moore, G.T. and Golledge, R.G. (eds.), Environmental Knowing. Stroudsburg, Pa.: Dowden, Hutchinson and Ross. 173-84.

Berry, B. (1973) ' A Paradigm for Modern Geography' in Chorley, R. (ed.), Directions in Geography. London: Methuen.

Bevan, W. (1958) 'Perception : Evolution of a Concept', Psychological Review, 65. 34-55.

Blaut, J.M. (1959) ' Microgeographic Sampling', Economic Geography, 35. 79-88.

Blaut, J.M., McCleary, G.F. and Blaut, A.S. (1970) 'Environmental Mapping in Young Children', Environment and Behaviour, 2. 335-49.

Blazek, B.

Boal, F.W. (1969) 'Territoriality on the Shankill-Falls Divide, Belfast', Irish Geography, 6. 30-50.

_____ (1970) 'Social Space in the Belfast Urban Area', in Stephens, N. and Glassock, N. (eds.), Irish Geographical Studies. Belfast: The Queen's University. 378-93.

_____ (1971) 'Territoriality and Class : A Study of Two Residential Areas in Belfast', Irish Geography, 6. 229-48.

Boulding, K.E. (1956) The Image : Knowledge in Life and Society. Ann Arbor: University of Michigan Press.

Brennan, T. (1948) Midland City. London: Dobson.

Briggs, R. (1973) 'Urban Cognitive Distance' in Downs, R.M. and Stea, D. (eds.), Image and Environment. Chicago: Aldine.

_____ (1976) 'Methodologies for the Measurement of Cognitive Distance', in Moore, G.T. and Golledge, R. G. (eds.), Environmental Knowing. Stroudsburg, Pa.: Dowden, Hutchinson and Ross. 325-34.

Buchanan, M. (1975) 'Attitudes towards the Urban Environment : A Melbourne Study', Australian Geographer, 13. 15-22.

Bunting, T.E. and Guelke, L. (1979) 'Behavioural and Perception Geography : A Critical Appraisal', Annals of the Association of American Geographers, 69. 448-62.

Burton, I. (1963) 'The Quantitative Revolution and Theoretical Geography', Canadian Geographer, 7. 151-62.

Burton, I. and Kates, R.W. (1964) 'Perception of Natural Hazards in Resource Management', Natural Resources Journal, 3. 412-41.

Burgess, J.A. and Hollis, G.E. (1977) 'Personal London', Geographical Magazine, 50. 155-9.

Cadwallader, M.T. (1975) 'Behavioural Model of Consumer Spatial Decision Making', Economic Geography, 51. 339-49.

_____ (1976) 'Cognitive Distance in Intra-urban Space', in Moore, G.T. and Golledge, R.M. (eds.), Environmental Knowing. Stroudsburg, Pa.: Dowden, Hutchinson and Ross. 316-24.

Canter, D.V. (1977) The Psychology of Place. London: Architectural Press.

Carlstein, T., Parkes, D. and Thrift, N. eds. (1978) Timing Space and Spacing Time. London: Arnold.

Carr, S. and Schissler, D. (1970) 'The City as a Trip : Perceptual Selection and Memory in the View from the Road', Environment and Behaviour, 1. 7-35.

Corcoran, P.W.J. (1966) 'A Test of Some Assumptions about Psychological Space', American Journal of Psychology, 79. 51-80.

Cox, K.R. and Golledge, R.G. eds. (1969) Behavioural Problems in Geography : A Symposium. Evanston, Ill.: Northwestern University Press.

Craik, K.H. (1968) 'The Comprehension of the Everyday Physical Environment', Journal of the American Institute of Planners, 34. 29-37.

Cullen, I.G. (1978) 'The Treatment of Time in the Explanation of Spatial Behaviour' in Carlstein, T., Parkes, D. and Thrift, N. (eds.), Timing Space and Spacing Time. London: Arnold. 27-38.

Delong, A.J. (1973) 'Territorial Stability and Hierarchical Formation', Small Group Behaviour, 4. 56-63.

Dodwell, P.C. (1956) 'Studies of the Visual System', in Foss, B.M. (ed.), New Horizons in Psychology. Harmondsworth: Penguin.

Downs, R.M. (1970a) 'Geographic Space Perception : Past Approaches and Future Prospects', Progress in Geography, 2. 67-103.

_____ (1970b) 'The Cognitive Structure of an Urban Shopping Centre', Environment and Behaviour, 2. 13-39.

_____ (1979) 'Critical Appraisal or Determined Philosophical Skepticism', Annals of the Association of American Geographers, 69. 468-71.

Downs, R.M. and Stea, D. eds. (1973) Image and Environment. Chicago: Aldine.

_____ (1977) Maps in Minds. London: Harper and Row.

Edney, J.J. (1976) 'Human Territoriality', in Proshansky, H.M., Ittelson, W.H. and Rivlin, L.G. (eds.), Environmental Psychology, Second Edition. New York: Holt, Rinehart and Winston. 189-205.

Ellegård, K., Hagerstrand, T. and Lenntorp, B. (1977) Activity Organisation and the Generation of Daily Travel; Two Future Alternatives', Economic Geography, 53. 126-52.

Everitt, J.C. (1976) 'Community and Propinquity in a City', Annals of the Association of American Geographers, 66. 104-16.

Febvre, L. (1932) A Geographical Introduction to History, (English Translation by E.G. Mountford and J.H. Paxton). London: Kegan Paul, Trench, Trubner.

Firey, W. (1945) 'Sentiment and Symbolism as Ecological Variables', American Sociological Review, 10. 140-8.

Fischer, C.S. (1976) The Urban Experience. New York: Harcourt, Brace and Jovanovitch.

Francescato, D. and Mebane, W. (1973) 'How Citizens View Two Great Cities : Milan and Rome', in Downs, R.M. and Stea, D. (eds.), Image and Environment. Chicago: Aldine. 131-47.

Gerard, R.W. (1953) 'What is Memory?', Scientific American, 189. 118-26.

Gold, J.R. (1980) An Introduction to Behavioural Geography. Oxford: Oxford University Press.

Golledge, R.G., Brown, L.A. and Williamson, F. (1972) 'Behavioural Approaches in Geography : An Overview', Australian Geographer, X11, 1. 59-79.

Gould, P.R. (1963) 'Man against his Environment : A Game Theoretic Framework', Annals of the Association of American Geographers, 53. 290-7.

_____ (1966) On Mental Maps. Discussion Paper 9, Michigan Inter-University Community of Mathematical Geographers, Ann Arbor: Dept. of Geography, Univ. of Michigan Press.

_____ (1970) 'Is "Statistix Inferens" the Geographical Name for a Wild Goose?', Economic Geography, 46. 439-48.

_____ (1975) 'People in Information Space', Lund Studies in Geography, Series B. Human Geography, 42.

Gould, P.R. and White, R.R. (1968) 'The Mental Maps of British School Leavers', Regional Studies, 2. 161-82.

Gould, S.J. (1978) 'Sociobiology : The Art of Story-telling', New Scientist, 80. 530-3.

Graham, E. (1976) 'What is a Mental Map?', Area, 8. 259-62.

Guelke, L. (1978) 'Geography and Logical Positivism', in Herbert, D.T. and Johnson, R.J. (eds.), Geography and the Urban Environment : Progress in Research and Application. New York: Wiley.

Gulick, J. (1963) 'Images of an Arab City', Journal of the American Institute of Planners, 29. 179-97.

Hägerstrand, T. (1970) 'What about People in Regional Science?', Regional Science Association Papers, XXIV. 7-21.

_____ (1973) 'The Domain of Human Geography', in Chorley, R.J. (ed.), Directions in Geography. London: Methuen. 65-87.

Haggett, P. (1965) Locational Analysis in Human Geography. London: Edward Arnold.

Haney, W.G. and Knowles, E.S. (1978) 'Perception of Neighbourhood by City and Suburban Residents', Human Ecology, 6. 201-14.

Hart, R.A. and Moore, G.T. (1973) 'The Development of Spatial Cognition : A Review', in Downs, R.M. and Stea, D. (eds.), Image and Environment. Chicago: Aldine. 246-88.

Harvey, D.W. (1967) Behavioural Postulates and the Construction of Theory in Human Geography. Seminar Paper, Series A, No. 6. Dept. of Geography, Univ. of Bristol.

_____ (1969) Explanation in Geography. London: Arnold.

_____ (1973) Social Justice and the City. London: Arnold.

Hempel, C.G. (1965) Aspects of Scientific Explanation. New York: Free Press.

Hesselgren, S. (1975) Man's Perception of the Man-Made Environment. Stroudsburg, Pa.: Dowden, Hutchinson and Ross.

Horton, F. and Reynolds, D.R. (1971) 'Effects of Urban Spatial Structure on Individual Behaviour', Economic Geography, 47. 36-48.

Hudson, R. (1976) Environmental Images, Spatial Choice and Consumer Behaviour. Occasional Publications (New Series) No. 9. Durham: Dept. of Geography, Univ. of Durham.

Huff, D.L. (1960) 'A Topographical Model of Consumer Space Preferences', Papers and Proceedings of the Regional Science Association, 6. 159-73.

Hurst, M.E.E. (1974) A Geography of Economic Behaviour. London: Prentice Hall International.

Ittelson, W.H. (1976) 'Environmental Perception and Contemporary Perceptual Theory', in Proshansky, H.M., Ittelson, W.H. and Rivlin, L.G. (eds.), An Introduction to Environmental Psychology, Second Edition. New York: Holt, Rinehart and Winston. 141-54.

Jackson, L.E. and Johnston, R.J. (1974) 'Underlying Regularities to Mental Maps. An Investigation of Relationships among Age, Experience and Spatial Preferences', Geographical Analysis, 6. 69-84.

Johnston, R.J. (1971) 'Mental Maps of the City : Suburban Preferences', Environment and Planning, 3. 63-71.

Jones, R.C. (1978) 'Myth Maps and Migration in Venezuela', Economic Geography, 54. 75-93.

Kant, I. (1790) Critique of Judgement. Translated by J.C. Meredith. Combined Edition 1952. Oxford: Clarendon Press.

Kaplan, A. (1964) The Conduct of Inquiry. London: Chandler.

Kates, R.W. (1963) 'Perceptual Regions and Regional Perception in Flood Plain Management', Regional Science Association, Papers and Proceedings, 11. 217-27.

_____ (1967) 'The Perception of Storm Hazard on the Shores of Megalopolis', in Lowenthal, D. (ed.), Environmental Perception and Behaviour, Research Paper 109. Chicago: Dept. of Geography, Univ. of Chicago.

Kirk, W. (1952) 'Historical Geography and the Concept of the Behavioural Environment', Indian Geographical Journal, Jubilee Edition. 152-60.

_____ (1963) 'Problems of Geography', Geography, 48. 357-71.

Klingbeil, D. (1980) 'Concepts of Geographical Activity Analysis : Structures and Problems', Geografiska Annaler, 62B, No. 2. 49-67.

Kuhn, M. (1968) 'Researches in Human Space', Ekistics, 25. 395-8.

Kuhn, T.S. (1962) The Structure of Scientific Revolutions. Chicago: Univ. of Chicago Press.

Ladd, F.L. (1976) 'Black Perspectives on American Cities', in Watson, J.W. and O'Riordan, T. (eds.), The American Environment. London: Wiley. 132-43.

Lee, T.R. (1968) 'Urban Neighbourhood as a Socio-Spatial Schema', Human Relations, 21. 241-68.

_____ (1970) 'Perceived Distance as a Function of Direction in the City', Environment and Behaviour, 2. 40-51.

_____ (1971) 'Psychology and Architectural Determinism' (essay in three parts), Architects' Journal, 154. 253-61, 475-83 and 651-9.

_____ (1976) Psychology and the Environment. London: Methuen.

Lenntorp, B. (1976) 'Paths in Space-Time Environments : A Time-Geographic Study of Movement Possibilities of Individuals', Lund Studies in Geography, Series B, 44.

Ley, D. and Cybriwsky, R. (1974) 'Urban Graffiti as Territorial Markers', Annals of the Association of American Geographers, 64. 498-512.

Lloyd, R.E. (1976) 'Cognition, Preference and Behaviour in Space', Economic Geography, 52. 241-53.

Losch, A. (1954) The Economics of Location. New Haven, Conn.: Yale Univ. Press.

Lowenthal, D. (1961) 'Geography, Experience and Imagination : Towards a Geographical Epistemology', Annals of the Association of American Geographers, 51. 241-60.

Lowry, R.A. (1973) 'A Method for Analysing Distance Concepts of Urban Residents', in Downs, R.M. and Stea, D. (eds.), Image and Environment. Chicago: Aldine, 338-60.

Lubin, A. (1961) 'The Interpretation of Significant Interaction', Educational and Psychological Measurement, 21. 807-17.

Lyman, S.M. and Scott, M. (1967) 'Territoriality : A Neglected Sociological Dimension', Social Problems, 15. No. 2. 236-49.

Lynch, K. (1960) The Image of the City. Cambridge, Mass.: MIT Press.

Martensson, S. (1978) 'Time Allocation and Daily Living Conditions : Comparing Regions', in Carlstein, T., Parkes, D. and Thrift, N. (eds.), Human Activity and Time Geography. London: Arnold. 181-97.

Mawby, R.I. (1977) 'Defensible Space : A Theoretical and Empirical Appraisal', Urban Studies, 14. 169-79.

Meyer, G. (1977) 'Distance Perception of Consumers in Shopping Streets', Tijdschrift voor Economische en Sociale Geografie, 68. 355-61.

Moore, G.T. (1979) 'Knowing about Environmental Knowing', Environment and Behaviour, 11. 33-70.

Moore, G.T. and Golledge, R.G. (1976) Environmental Knowing. Stroudsburg, Pa.: Dowden, Hutchinson and Ross.

Morrison, D. and Henkel, R. (1969) 'Significance Tests Reconsidered', American Sociologist, 4. 131-40.

Murray, D. and Spencer, C. (1979) 'Individual Differences in the Drawing of Cognitive Maps, the Effect of Geographic Mobility, Strength of Mental Imagery and Basic Graphic Ability', Institute of British Geographers (Transactions, New Series), 4. 385-91.

Murton, B.J. (1972) 'Some Aspects of a Cognitive - Behavioural Approach to Environment : A Review', New Zealand Journal of Geography, 53. 1-8.

Nunnally, J.C. (1967) Psychometric Theory. New York: McGraw Hill.

O'Riordan, T. (1973) 'Some Reflections on Environmental Attitudes and Environmental Behaviour', Area, 5. 17-19.

Orleans, P. (1973) Differential Cognition of Urban Residents : Effects of Social Scale on Mapping', in Downs, R.M. and Stea, D. (eds.), Image and Environment. Chicago: Aldine. 115-30.

Orme, J.E. (1969) Time, Experience and Behaviour. London: Iliffe.

Pacione, M. (1975a) 'Through Irish Eyes, An Examination of Space Preferences', Irish Geography, 8. 111-22.

_____ (1975b) 'Preference and Perception - Analysis of Consumer Behaviour', Tijdschrift voor Economische en Sociale Geografie, 65. 84-9.

_____ (1976) 'Shape and Structure in Cognitive Maps of Great Britain', Regional Studies, 10. 275-83.

Patrick, J. (1973) A Glasgow Gang Observed. London: Eyre Methuen.

Piaget, J. and Inhelder, B. (1956) The Child's Conception of Space. New York: Norton.

Pocock, D.C.D. (1974) The Nature of Environmental Perception, Occasional Publication (New Series) 4. Durham: Dept. of Geography, Univ. of Durham.

_____ (1975) Durham : Images of a Cathedral City, Occasional Publication (New Series) 6. Durham: Dept. of Geography, Univ. of Durham.

Pocock, D.C.D. and Hudson, R. (1978) Images of the Urban Environment. London: McMillan Press.

Porteous, J.D. (1976) 'Home : The Territorial Core', Geographical Review, 66. 383-90.

Potter, R.B. (1977) 'Spatial Patterns of Consumer Behaviour and Perception in Relation to the Social Class Variable', Area, 9. 153-9.

Pred, A.R. (1967) 'Behaviour and Location, Part 1', Lund Studies in Geography, Series B, 27.

Proshansky, H.M. (1976) 'Environmental Psychology : A Methodological Orientation', in Proshansky, H.M., Ittelson, W.H. and Rivlin, L.G. (eds.), Environmental Psychology, 2nd. Edition. New York: Holt, Rinehart and Winston. 59-68.

Rapoport, A. (1976) 'Environmental Cognition in Cross-Cultural Perspective', in Moore, G.T. and Golledge, R. G. (eds.), Environmental Knowing. Stroudsburg, Pa.: Dowden, Hutchinson and Ross. 145-51.

Reiser, R. (1972) Urban Spatial Images - an Appraisal of the Choice of Respondents and Measurement Situation. Discussion Paper 42. London School of Economics. London.

_____ (1973) 'The Territorial Illusion and Behavioural Sink : Critical Notes on Behavioural Geography', Antipode, 5. 52-7.

Rushton, G. (1979) 'Commentary on "Behavioural and Perception Geography"', Annals of the Association of American Geographers, 69. 463-4.

Saarinen, T.F. (1976) Environmental Planning : Perception and Behaviour. Boston: Houghton Mifflin.

Sack, R. (1980) 'Conceptions of Geographic Space', Progress in Human Geography, 4. 313-45.

Sagan, C. (1977) The Dragons of Eden. London: Hodder and Stoughton.

Simon, H.A. (1952) 'A Behavioural Model of Rational Choice', Quarterly Journal of Economics, 69. 99-118.

_____ (1957) Models of Man. New York: Wiley.

Sonnenfeld, J. (1961) 'Environmental Perception and Adaption Level in the Arctic', in Lowenthal, D. (ed.), Environmental Perception and Behaviour. Chicago: Dept. of Geography, Research Paper No. 109, University of Chicago.

_____ (1973) 'Geography, Perception and the Behavioural Environment' in English, P.W. and Mayfield, R.C. (eds.), Man, Space and Environment. New York: Oxford University Press.

Smith, G.C. (1976) 'The Spatial Information Fields of Urban Consumers', Transactions of the Institute of British Geographers (New Series), 1. 175-89.

Stea, D. (1969) 'The Measurement of Mental Maps : an Experimental Model for Studying Conceptual Spaces', in Cox, K.R. and Golledge, R.G. (eds.), Behavioural Problems in Geography : A Symposium. Studies in Geography, 17. Evanston, Ill.: Northwestern University.

Stokols, D. (1978) 'Environmental Psychology' in Rosenzweig, M.R. and Porter, L.W. (eds.), Annual Review of Psychology, 29. 253-96.

Stutz, F.P. (1973) 'Distance and Network Effects on Urban Social Travel Fields', Economic Geography, 49. 134-44.

Suttles, G.D. (1968) Social Order in the Slum. Chicago: Univ. of Chicago Press.

_____ (1972) The Social Construction of Communities. Chicago: Univ. of Chicago Press.

Taylor, C.C. and Townsend, A.R. (1976) 'The Local "Sense of Place" as Evidenced in North-East England', Urban Studies, 13. 133-46.

Thrift, N. (1977) 'Time and Theory in Human Geography - Part II', Progress in Human Geography, 1. 413-57.

Tolman, E.C. (1948) 'Cognitive Maps in Rats and Men', Psychological Review, 55. 189-208.

Torgerson, W.S. (1958) Theory and Methods of Scaling. New York: Wiley.

Tranter, P and Parkes, D. (1979) 'Time and Images in Urban Space', Area, 11. 115-20.

Trowbridge, C.C. (1913) 'On Fundamental Methods of Orientation and "Imaginary Maps"', Science, 88. 888-96.

Tuan, Y.F. (1974a) Topophilia : A Study of Environmental Perception, Attitudes and Values. Englewood Cliffs, N.J.: Prentice Hall.

_____ (1974b) 'Space and Place : A Human Perspective', Progress in Geography, 6. 211-52.

_____ (1975) 'Images and Mental Maps', Annals of the Association of American Geographers, 65. 205-14.

_____ (1977) Space and Place. London: Arnold.

_____ (1978) 'Sign and Metaphor', Annals of the Association of American Geographers, 68. 363-72.

Wakefield, V.T.J. (1977) 'The Perception of Randstad of Holland', (Signalement), Tijdschrift voor Economische en Sociale Geografie, 68. 110-4.

Watson, J.W. (1975) 'Perception and Place', Geographical Journal, 141. 271-4.

Webb, E.I., Campbell, D.T., Schwartz, R.D. and Sechrest, L. (1966) Unobtrusive Measures : Non Reactive Research in the Social Sciences. Chicago: Univ. of Chicago Press.

Webber, M.M. (1964) 'Culture, Territoriality and the Elastic Mile', Papers and Proceedings of the Regional Science Association, 13. 59-70.

Welsh, R.V. (1978) 'Conflict, Apparent and Real : A Review of Concepts of Space in Geography', New Zealand Geographer, 34. 24-30.

Whorf, B.L. (1940) 'Science and Linguistics' in Carroll, J.B. (ed.), Language, Thought and Reality: Selected Writings of Benjamin Lee Whorf. Cambridge, Mass.; Harvard Univ. Press.

Wilkie, R.W. (1972) 'The Process Method versus the Hypothesis Method' in Yeates, M. (ed.), Proceedings of the 1972 Meeting of the I.G.U. Commission on Quantitative Geography. Montreal: McGill-Queen's University Press.

Wolpert, J. (1964) 'The Decision Process in Spatial Context', Annals of the Association of American Geographers, 54. 537-58.

_____ (1970) 'Departures from the Usual Environment in Locational Analysis', Annals of the Association of American Geographers, 60. 220-9.

Wood, L.J. (1970) 'Perception Studies in Geography', Transactions of the Institute of British Geographers, 50. 129-42.

Wright, J.K. (1947) 'Terrae Incognitae; the Place of Imagination in Geography', Annals of the Association of American Geographers, 37. 1-15.

Zipf, G.K. (1949) Human Behaviour and the Principle of Least Effort. Cambridge, Mass: Addison-Wesley.