THE DEVELOPMENT OF CHILDREN'S PERSONAL LANDMARKS: AN INDICATION OF SPATIAL AWARENESS

By

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ABSTRACT

This study examines one of the major periods of geographical exploration and learning, that is, in childhood. Such exploration and learning can occur in and around the home or in the local neighbourhood. Children and adults need to know about a place within their own environment.

Different landmarks may have significant affective potential, and over time they themselves could be subject to developmental change. The purpose of this study is, therefore, to determine which landmarks primary children recognize spontaneously and know and use in their local environment. In this way they can, perhaps, locate themselves in a complex world.

A child’s development of spatial concepts is related to the framework in which images are received. The basic research tool was that of a sample of twenty children, approximately seven years of age, who were individually shown a series of colour photographs and asked to identify the landmark or environmental feature. In a second part of the study, children mapped perceptions of the routes they followed to school. Each child was asked to indicate on a map the relevant landmarks they observed en route. Scores were obtained for both tasks and compared. In the conclusion, the results are discussed in an attempt to determine the degree of spatial competence within the local environment gained by an ability to identify landmarks. Consideration is also given to the question of
whether such competence is a skill that could, or should, be taught to young children within the normal process of education.
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CHAPTER 1

SPATIAL COGNITION: A THEORETICAL PERSPECTIVE

It is not alone the desire to try and use his power that prompts the boy at this age to seek adventure high and low, far and wide, it is particularly the peculiarity and need of his unfolding innermost life, the desire to control the diversity of things, to see individual things in their connection with a whole, bring near that which is remote, to comprehend (the outer world) in its extent, its diversity, its integrity; it is the desire to extend his scope step by step. (Froebel, 103)

Introduction

Throughout his book, The Education of Man (Froebel, 1826), seems to be aware of the exploratory urge of young children and of their relationships with the physical world. A child is born into this world and within the first decade of his life has explored much of the richness that exists within it. Young children use their vivid imaginations to explore their environment, to learn about it, and to bring meaning to it.

In order to achieve competency in the world a child must be able to develop and establish a knowledge of his spatial qualities. In his early years a child experiences many journeys in the "spatial sense"—between home and school, to friends' and relatives' homes, to shopping centres, sometimes to other towns and cities. From these many and varied experiences the child develops sets of ideas of what will be encountered as well as the spatial and temporal relations
between certain places and events. In his mind the child is
developing a map or sets of maps as he begins to piece together
the spatial parts of his world in order to make sense of them.

It is only in recent years that the study of spatial
cognition has become a semi-autonomous subfield in the study of
cognitive development. Considerable research has become
available in developmental and behavioural psychology to help
explain the development of spatial cognition. It is
appropriate that much of the current research in children’s
spatial cognition should have its roots firmly established in
Piaget and Inhelder’s study, "The Child’s Conception of Space"
(1956), in which it was demonstrated that spatial concepts,
like other concepts of time, number, and causality, are
constructed by the child through interaction with the
environment and change qualitatively with his development
(Liben. 1982). Piaget’s early research focused on the
processes of spatial cognition which utilized small table top
models of various environments in order to investigate
children’s ability to reflect space. However, since Siegel and
White’s 1975 study, considerable research has focused on the
child’s knowledge of large-scale environments.

At this point some distinction should be made between
spatial cognition and spatial perception, as both terms occur
frequently in the literature. Cognition includes all of the
modes of knowing, that is, perceiving, thinking, imagining,
reasoning, judging, and remembering. In early infancy, because
the reflective aspects of knowing do not exist, perception stands alone; but in later childhood, perception is inextricably linked to the other modes of knowing. Piaget (1963) suggests that knowledge of the world includes two aspects: the figurative, related to the percepts one images of successive states or momentary configurations of the world by direct immediate contact; and the operative, related to the operations which intervene between successive states and by which the subject transforms parts of the world into reconstructable patterns or schemas. Visual perception is one form of figurative knowing; cognition is based on the operative aspect. As development proceeds, perception becomes subordinated to higher mental processes. Cognitive structures available to the individual influence perceptual selectivity which leads to a reconstruction of the world through selected fields of attention. Spatial perception and spatial cognition, therefore, are two separate but reciprocal processes (Hart, 1979).

It is believed that Piaget and his colleagues demonstrated that a child does develop the ability to abstract qualities of the geometric spatial relationships of objects. From his research with children, which involved interviews and experiments, Piaget concluded that there was a definite order in the development of spatial concepts. He proposed that topological space was the earliest form of spatial representation to be developed. Discriminations on the basis of topological properties were made fairly early in the
pre-operational period, and then most topological relations
became integrated into stable operations around seven years of
age. Topological space is concerned with the internal
relations of individual objects emphasizing the notions of
proximity, order, enclosure, continuity, and separateness. It
does not permit location of objects within the whole space; nor
does this system allow a child to relate objects to each other.
In order to be able to do this, the concepts of projective and
Euclidian space are gradually built, achieving an equilibrium
at about ten years of age. With respect to a child's ability
to produce representations of his familiar environments, that
is, large-scale spatial cognition, Piaget states that in Stages
1 or 2 (below seven years of age) the child's responses are
egocentric, uncoordinated, and irreversible. His descriptions
of routes are related directly to his own actions. Landmarks
are not organized in terms of any objective, spatial whole. He
is also unable to rotate maps or models or to construct a route
in the reverse direction.

In stage 3a the child exhibits limited coordination so that
within clusters of landmarks, relationships are correct; but_across clusters, relationships are generally haphazard.

In stage 3b the child is able to integrate within and
between clusters, to represent routes forwards and backwards,
and to re-arrange a rotated map or model correctly. The
natural conclusion of Piaget's studies, and those of other
developmental psychologists, is that young children did not
have well developed spatial concepts. (See Figure 1.)

More recently, however, researchers have begun to use other tasks to assess a child’s knowledge of spatial cognition. These tasks are based on the theory that a young child may actually possess very good representations of his spatial world but that he is unable to demonstrate these representations because he can not meet the demands of the Piagetian-type tasks. One such task that relates specifically to the spatial ability of a young child is often referred to as the three mountains experiment. A brief analysis is included at this point.

In *The Child’s Conception of Space* (Piaget and Inhelder, 1956) the theory of the development of spatial concepts is a particular application of Piaget’s general theoretical framework of intellectual development. The study is divided into three parts corresponding to his notion of the three types of spatial concepts: topological space, projective, and Euclidian space. While theorizing about projective space, Piaget was concerned about the child’s capacity to imagine how an object might appear from different viewpoints and the child’s subsequent ability to make use of this phenomenon in solving various spatial problems. One particular experiment, commonly known as the three mountains, investigated the child’s ability to coordinate spatial perspectives. It was designed to test the child’s ability to recognize that the appearance of objects is a function of the spatial position from which they
LEVELS OF SPATIAL ORGANIZATION

TYPES OF REFERENCE SYSTEMS AND TOPOGRAPHICAL REPRESENTATIONS

Fig. 1 Schematic representation of the development of geographical orientation and topological representation. (Hart and Moore, 1971).
are observed.

Piaget's observation of a child's ability to complete the tasks associated with the three mountains experiment lead him to conclude that a young child is unable to 'decentre' in imagination. He suggests that he is bound by the 'ecoogentric illusion' as soon as he is called upon to form a mental representation of some view which he had not actually seen. Piaget further believes that the young child lives in the state of the moment, not bothering with how things were previously nor how they will be in the future.

In her book, *Children's Minds* (1978), Margaret Donaldson disputes Piaget's findings from his three mountains experiment. In conjunction with Martin Hughes she replicated the three mountains experiment using walls, policemen, and a doll. Instead of mountains they used strategies similar to those developed by Piaget: the child is asked to place the doll in certain positions to meet specific spatial criteria. Donaldson suggests that with a success rate of over 85% the results are markedly different from those achieved by Piaget. The difficulty is then to reconcile these results with Piaget's claim that a child under seven years is weak at appreciating the point of view of some other person in the literal sense of being unable to figure out what the other person can see. She suggests that the "policemen" experiment is a situation which makes sense to the child; the motives and intentions of the characters in the task are quite comprehensible. The task
requires the child to act in a human way, to hide, and thus makes sense to the child. He understands what it is he has to do and consequently performs the required task without difficulty. Conversely, however, Piaget’s ‘mountain’ task is incomprehensible to the child; there is no interplay of personal motives of any kind to make it meaningful to him. Donaldson argues that the mountain task is abstract in a psychologically important sense in that it is separate from basic human purposes, feelings, and endeavours and is, therefore, totally cold-blooded.

Such evidence suggests that the use of language is significantly important in any dealings or tasks concerned with a child. It would, therefore, appear to be a logical step to assess the child’s understanding of the language used to explain procedures of a task and to use language appropriate to the age of the child. The task must be explained in such a way that the child can bring meaning to it. If the child is given a frame of reference that it can manipulate, then the given task can be competently completed. Perhaps Piaget’s frame of reference and language are too adult for the age of the children he was testing, which may have resulted in their failure to complete the mountain experiment with a high degree of accuracy.

It was much later, in 1981, that Siegel suggested that "these techniques (for example, sketch maps, small scale models) tend to lead to underestimates of children’s spatial
competence because they confound spatial knowledge with externalizing ability and other theoretically non-relevant task loads" (p. 190). As a result of such ideas one approach has been to infer a child's spatial cognition from his ability to move through space in direct locomotive tasks, for example, getting from home to school.

Siegel and White's 1975 study of the spatial representation of large-scale environments suggests that a child progresses from learning landmarks, that is, distinctive features on the terrain, to learning routes which connect these landmarks, to integrating information about routes to form an overall representation, which is something like a map but is termed configurational knowledge. Following this study, Curtis, Siegel, and Furlong in 1981 provide evidence that configurational knowledge improves developmentally in elementary school, although landmark and route knowledge, in a familiar environment, shows fewer age related differences.

Knowledge of a child's spatial cognition has also been derived from performances on tasks that do not themselves require the direct production of an integrated spatial representation. This can be illustrated by tasks in which children are asked to make rank judgements about the relative distances of objects. Multi-dimensional scaling techniques are then applied to the child's rank-ordered judgements and the derived map is taken as a model of the child's underlying spatial cognition (Liben 1982). Liben, however, warns of the
danger that the inferred representation does not necessarily reflect the child’s internalized representation of space, and also that not all locomotive behaviours tap spatial representation.

Piaget (1956) also believes that the ability to act/move in space does not necessarily reflect the ability to represent space. He distinguishes between practical space, which is the capacity to act in space, and conceptual space, which is the capacity to represent space. Piaget states that the ability to act in space does not imply an ability to represent space. A contrary position is that the child’s ability to move through space is indeed indicative of underlying spatial representation. Acredolo, Pick, and Olsen (1975) took pre-schoolers on a walk through various environments and later asked them to return to particular locations where some keys had been dropped. The ability of the child to return to these locations accurately was taken as a measure of spatial representation. However, this point depends to some extent on what is meant by the term spatial representation. Liben (1981) suggests three main uses of the term:

1. observable, external spatial products, for example, sketch maps and scale models that represent space;

2. spatial thought which is conscious knowledge about space; that is, spatial knowledge that can be reflected upon or manipulated, for example, imagining layouts of a kitchen or living room;
3. spatial storage--knowledge about space that is stored in some form but to which the researcher does not have immediate access. (One can infer, however, that certain information about space must be stored to enable the individual to have acted in a certain way.)

One concrete example of the representation of space would be to research children in the process of moving from home to school. For a child to go successfully from home to school indicates that the child must have stored some information about the two locations; that is, he must have stored a series of isolated but precise pieces of information so that, for example, when he reaches the mail box on the corner he knows that he has to turn to the right. If this assumption is correct, then the child is interpreting a cognitive and cartographic representation of space. Therefore, identical behaviours may be taken as indicators of spatial representation by some researchers, but not by others, because of different interpretations of spatial recognition or spatial representation.

Cognitive Maps

Considerable debate in the literature has focused on the use of the term cognitive map, as a synonym for spatial cognition. The term cognitive map is, it can be argued, a misnomer as it does not necessarily refer to a map in the cartographic sense. Downs and Stea (1973) suggest that the term map be used as a functional analogue and that model or
schemata could be used as alternatives. It could be suggested that a cognitive map be viewed as an organizational construct, which a young child uses when making sense of the world into which he is born. Milburn (1983) notes that a child draws considerable input from his own perception of the physical environment. The internalization of such activity, technically called spatial cognition, occurs only when satisfactory frames of reference have been created. As experience and awareness of the environment grow, the frames of reference are complemented by the development of a cognitive map or schema within the mind--this is the interpretation of the child's real world. It is, however, necessary to remember that maps are designed for specific purposes and to a degree all are distorted representations of the real world. Cognitive or mental maps are extremely personal: they are designed by each individual to suit particular purposes or needs. Way-finding is one such purpose; another mentioned by Lynch in *The Image of the City* (1960) results from our natural fear of getting lost. By mentally mapping our environment we make our world a little more secure and safe.

Recent research has focused on way-finding as a reason for cognitive mapping and spatial cognition. Hart believes such research has resulted in a continuing underestimation of the spatial competencies of young children, because the research has been conducted in laboratory settings rather than in naturalistic environments. Such research has focused on the measurement of distances and their integration into projective
and Euclidian coordination, proportions, and symbolic conventions, that is, space that is concerned with boundaries, angularity, and perspective. Hart believes that a child can organize more complex information in the real world because he can select and use personally relevant landmarks; he can freely explore extensive large-scale areas instead of being lead through experimental environments; and he, therefore, has good, meaningful reasons for mentally mapping his surroundings. If, when teaching the subjects of the curriculum in school, the content is meaningful to the child he will learn or at least express a desire to learn. If the content is not presented in a meaningful way, then a child fails to learn or demonstrates an inability to learn. Similarly, if a child in research experiments is confronted with meaningless tasks in the aseptic, unnatural environment of a laboratory the results will differ from those achieved by the same child in a natural, known environment with meaningful tasks (Hart 1982).

The structure of the environment itself may also have some influence on the ability of a child to represent space. Some environments may be so much more imageable than others that they enable the child to use them as a reference for other places or objects in the environment (Hart 1979, Lynch 1960). The importance of bodily locomotion in learning to map cognitively an environment has also recently been considered (Acredolo 1977, Herman, and Siegel 1978). This concept is not new as it was first hypothesized by Lee (1963) as a result of his study on the effects of busing on children in an area of
Devon, England where all the children had previously walked to school. He suggested that the bus journey took them beyond their world into a space that they had had no opportunity to articulate through their own bodily locomotion through the environment. As a result the children felt separated from their mother, from home, and from physical expressions of security, which in turn produced anxiety during difficult times at school. Lee's suggestion that bodily movement is necessary to "articulate the schema" corresponds with Piaget's theory of the development of the operational basis of knowing. Hart, therefore, raises the question: "What improvements in cognitive mapping might we find if we allow children to freely and purposefully direct their own movements in an experimental setting?" (Hart 1982).

In reviewing the literature it becomes apparent that some developmental psychologists have become aware of the real problems of generalizing from laboratory research to a child's cognition of space (Hart 1982, Acredolo 1977, Herman and Siegel 1978). Hart strongly suggests that in all the experiments to date the most important factor has been excluded. The subject, that is the child, has not had control over the decision-making process. Experiments to study the development of spatial cognition have become more ingenious over the years, reaching a stage where they are able to compare a child's active versus passive learning of a route (Berzok 1980). Movement, although a crucial variable, is not the most important factor in developing spatial cognition. Perhaps more important to a
child, and indeed to an adult, is the ability to make the decision to move or not move in a particular direction. One can then ask: Is it solely by controlling that decision to move that a child develops his spatial cognition and knowledge of the environment? The answer must lie with the child. What does a child want to learn about places and for what purpose?

It would seem that the term spatial cognition is so intertwined with cognitive mapping and spatial representation that one definition of the term cannot suffice. However, Hart and Moore's (1973) definition reflects the main premise of spatial cognition used in this thesis: "the knowledge and internal or cognitive representation of the structure, entities and relations of space; in other words, the internalized reflection and reconstruction of space in thought" (Downs and Stea 1973 p. 248). By necessity, the development of spatial cognition is a part of cognitive development and will continue to be linked to it. Cognitive development in general and cognitive mapping in particular should be viewed as processes embedded in the larger social ecology of the child's world (Siegel 1982).

**Landmark and route knowledge**

A considerable amount of the literature on spatial cognition indicates that the use of landmarks in the development of a child's spatial competence is of some importance. Very few people learn to find their way through some mysterious 'instinct'; there is, instead, a consistent
organization and use of definite cues from the environment. As Lynch stated in his 1960 study *The Image of the City*

... to become completely lost is perhaps a rather rare experience for most people. We are supported by the presence of others and by special way-finding devices: maps, street numbers, route signs, bus placards. But let the mishap of disorientation once occur and the sense of anxiety and even terror that accompanies it reveals to us how closely it is linked to our sense of balance and well-being (p. 4).

Perhaps the earliest environmental cues that children use are distinctive landmarks in the local environment, either natural or man-made features. What happens to these features as the child becomes familiar with them? How do they help a child gain spatial competence?

Siegel (1976) identifies two levels of landmark knowledge. The first is recognition or identification—knowing that a landmark is familiar, that it has been seen before. The second level is the knowledge that landmarks can be used to facilitate the placement of other landmarks and events; that is, at this level, landmarks can be used to organize past and future experiences. It is this knowledge that probably shows the greatest developmental differences in the childhood years.

It has become an acknowledged fact over the years that a route is a linear representation of some part of a large scale environment. It becomes temporally and spatially integrated, constructed, and organized around landmarks. If a child forms cognitive maps in order to become spatially competent, then route learning is essential to this process. Some questions can then be raised: what is a good/bad landmark? How does a
child use landmarks to construct accurate route maps? Recent work by Siegel and associates suggests that knowledge of the environment begins with the noticing of landmarks or primary nodes that become linked in memory by action sequences called routes. These landmark-route combinations form clusters, with knowledge of intra-cluster spatial relations proceeding much more quickly than between cluster coordination. The ability to coordinate properly separate clusters within a large-scale objective frame of reference marks the final step in the development process. Familiarity with the environment affects the knowledge of the relative positions of landmarks.

In order for a child to attain some degree of spatial competence it would seem that some strategy is necessary, one that allows the child to adjust himself to the environment. Hart and Moore (1976) refer to such a strategy or—as they prefer to call it—a reference system. They indicate that three categories of reference systems exist—egocentric, fixed, and coordinated. Their research and that of others evolved from a study of Piaget’s account of the development of children’s spatial knowledge. The three reference systems, which develop from early years, are briefly described here:

1. The egocentric system of reference is a very simple and limited system in which the child uses his own body as the only system for ordering things in space. This presents some difficulty for navigational orientation because as the child moves so does the system of
2. The fixed system of reference is more efficient as the child is now able to orientate himself in space in terms of fixed elements in the environment, and can, therefore, view his environment from many different locations. Piaget found that children using this system could relate places to each other in clusters around certain landmarks or along particular routes. "Route maps" have been cited as evidence at this stage. Piaget hypothesized that a child cannot represent space beyond the immediate visually present space until he is able to logically coordinate the relationship of the independent journeys or viewpoints.

3. The coordinated system of reference depends on the transition from a series of fixed points or fixed routes for reading spatial relations to a freely transferable point of reading. This coordinated system of reference need not be compass direction as used on cartographic maps; the child may decide to use roads or rivers as coordinates. (See Figure 2.)

Hart points out that this three-way reference system is elementary and that many different systems may exist between the egocentric and the more sophisticated coordinated system. Whatever system is used, the child begins to use landmarks to
Fig. 2 Three reference systems for children's orientation in the landscape. (Hart and Moore, 1971).
anchor, organize, and coordinate his spatial knowledge or cognitive map.

Moving through space to acquire spatial competence may not only involve the use of some form of reference system but also a way of 'route learning'. Way-finding, or route learning, involves the acquisition of information about the temporal and spatial relationships among environmental features; it is essentially a matter of sequence learning (Allen 1982). Becoming familiar with a route means becoming 'unconfused' about the spatial relationships among features along that route. Gibson (1969) regards route learning as a form of perceptual learning; as such it has formed the basis for some developmental research. The ability to make use of distinctive visual features among stimuli improves developmentally, as does visual search efficiency (Bisanz and Resnick, 1978) and recognition memory (Mandler and Robinson 1978)—all are integral processes in route learning. The use of landmarks in a child's route learning and cognitive mapping ability is viewed as a powerful technique. Both an adult and a child refer to distinctive environmental features when familiarizing themselves to new surroundings. The ability to recognize and use landmarks presupposes certain skills (Pick and Rieser 1982):

1. an ability to simply associate the marker and the destination;
2. the discriminative capacity to select as
landmarks features that are distinctive and perceptually available within a particular locale versus those which are not;

3. some knowledge of spatial concepts so that alternative relations between landmark and destination can be remembered and used.

Rieser's (1979) study of six month-old infants suggests that the simple association between marker and the expected location emerges early in life. Acredolo (1979) studied similar discriminate capacities in the older child (3-7 years). She surmised that, given a choice of distinctive landmarks, an older child selects those features more remote from the destination and more permanently placed in position, whereas a younger child selects those moveable features closer to the destination. Therefore, a progression in preference of features used as landmarks appears to exist, from relatively moveable features adjacent to the destination, to permanently fixed features at a greater distance from the destination.

Pick and Rieser (1982) note that this progression may result from a child's learning to select as landmarks permanently fixed features of the environment.

The key to affective use of landmarks is the ability to discriminate between features that are distinctive within a particular context. Allan's (1979) study found that the ability to make use of the potential landmark value of environmental features precedes developmentally the ability to detect features on the basis of this potential information.
value. These findings, Allen hypothesized, form an empirical link between the area of macro-spatial cognition and cognitive development as a whole. The link is provided by the concepts of evocation and utilization, terms introduced by Flavell's (1970) study of the child's use of mnemonics. A failure to select landmarks utilizing the most useful spatial cues may be interpreted either as a problem of evocation or as a production deficiency. A failure to make use of spatial cues in a distance judgement situation may be considered a problem in utilization, that is, a mediation deficiency. Allen, therefore, concludes that the selection and utilization of landmarks embodies a mnemonic for learning real-world routes and, like other memory strategies, these skills improve developmentally in an orderly manner. Children learn about route learning itself and, with experience, they can learn which environmental features afford useful, low-effort, spatial information and which do not.

How does a child use landmarks to construct accurate route maps? This question and others were raised by Siegel (1981). From previous studies it has been indicated that adults use landmarks as organizing features within the context of spatial events and that repeated perceptual experience increases the accuracy of route maps of large-scale environments. In order to answer the above question about children and to see if there are developmental differences in what makes a good landmark Allen, Kirasic, Siegel, and Herman (1979) conducted further studies.
The research used photographic simulations of environmental routes and the technique of ordinal distance ranking followed by multiple dimension scaling analysis. Multidimensional scaling involves a set of procedures that takes proximities or distances among a set of objects as input, and attempts to reduce the complex matrix of such proximities to a simple picture that portrays spatially the interrelationships among objects. The results indicated that a young child, an older child, and an adult construct route representations from perceptual experience with large-scale environments. The routes are temporally and spatially integrated and are organized around distinctive landmarks. Also, learning a series of landmarks along a route is followed by calibrating distance relations among the landmarks; this latter process improves developmentally and over repeated experience.

The maps of a child and an adult probably differ in detail but the underlying sequential development is the same: landmarks--route maps--configurations or survey maps (the point at which routes are integrated within an overall framework). Configurational mapping is most useful when one needs to know alternate ways of reaching a number of places or to re-evaluate one's position. Siegel further suggests that routes are superordinate to landmarks but subordinate to configurations. To a child, landmarks are prominent and, therefore, route maps are arranged around them. Additional experiences allow the child and the adult to scale and metricize the distances.
between landmarks, resulting in more accurate route maps. Finally, with the development of a coordinated frame of reference, routes should become integrated into configurational or survey maps.

Research by Acredolo, Pick, and Olsen (1975) investigates the effect of familiarity with landmarks, where one landmark is taken to be as good as any other. Different landmarks may, therefore, have different affective potential and even these may be subject to developmental changes. The question can then be asked: What landmarks does a child spontaneously use in the everyday environment? Hart believes that a question such as this is best explored naturalistically.

In conclusion, it would appear that landmark knowledge and route learning develop along parallel courses. Landmark knowledge evolves from knowing that something has been seen, to knowing where that something has been seen, to a recognition that such knowledge can be useful. Route knowledge similarly goes from knowing that a particular landmark is associated with a particular heading, to knowing that a sequence of landmarks is associated in time with a sequence of headings. In both instances the processes of landmark-recognition and landmark-heading associations are present in early childhood. Knowledge of a higher order evolves developmentally as increased capability of temporal integration permits, not only a meta-knowledge of landmarks, but also the conversion of landmarks associated with headings into temporal and spatial
sequences generally called routes.

Spatial cognition is very basic to people in their everyday activities. Spatial concepts and properties of different situations are frequently used in attempting to understand, to remember, or to communicate. Route learning is one example of a linear mode of representing information. Its linearity is reflected in a temporal-spatial ordering of environmental features (Allen et al. 1979). Linearly organized information representations are important in many cognitive activities and as problem solving aids. Many of the tasks given to a child in the first years of school involve learning and manipulating linear orders, such as the alphabet and mathematical number line (Allen 1982). However, even a pre-school child actively participates in experiences with linear orders in the sense he has knowledge of and becomes familiar with routes that he travels frequently. Thus the study of how route knowledge is acquired, organized, and utilized can provide further insight into the development of a child's spatial ability. The subsequent organization of space in a wider sense is complex. Chapter 2 will attempt to illustrate the awareness of a group of children to their local environment in order to determine their use and knowledge of recognizable landmarks.
CHAPTER 2

METHODOLOGICAL CONSIDERATIONS

... often a new spatial competence is gained by identifying landmarks and envisaging the ways they are located with respect to each other. Even very young students appreciate this fact because that is how they have learned to find their own way to school (Yi-Fu Tuan 1983).

Introduction

A review of the literature on spatial cognition demonstrates that a child’s ability to represent spatial properties has generally been investigated in the abstract, rather than in the field of the child’s personal experience. If an understanding of the development of a child’s knowledge of his everyday environment is to be reached, there would seem to be a need to ground as much research as possible in observations of the child in his local, natural environment.

All beings, child and adult, experience the environment in a personal way. As a child explores, so the environment around him expands in extent and in degree of differentiation; many individual places may develop personal and social meanings. Such exploration becomes a necessary part of the lived experience of each individual and thus part of his life story. Hart (1979) suggests that the most fundamental unit of study in describing the environmental behaviour of the child should be the child and the landscape which exists for him, that is, the child’s phenomenal landscape. Because such a landscape
evolves as the child interacts with it, theoretically, it should be different for each child. Lynch (1960) proposes that environmental images help to establish an emotionally safe relationship between a person and his total environment by serving as organizers of activity and knowledge, as material for common memories which bind a group together, and as spatial referents for a sense of familiarity. Knowledge of the environment is a key factor in the unity of human experience and as such there appears to be a need to go beyond a child's basic cognitive ability in order to construct a more complete account of the development of a child's experience of the environment.

This study is intended to be exploratory rather than highly specific and structured. The hypothesis for it is that a child's knowledge of his environment and ability to represent it spatially is not based solely on intellectual development but is more dependent on factors such as the child's ability to explore freely the environment and the spatial learning and teaching that occurs during travel through it. In Chapter 1 it was noted that landmarks are used as organizing features within the context of spatial events and that repeated experiences with landmarks generally leads to the construction of route maps. Therefore, a basic question arises: What types of objects does a child use for landmarks as he experiences the environment?

However, as stated above, it is also the intent in this
project to consider the notion that spatial learning and the conscious teaching of environmental features must occur if a child is to become spatially competent and knowledgeable about his environment. Piaget et al. (1960) suggests that the development of a child's knowledge is not the result of his logical manipulation but the cumulative result of direct experiences, although it was also stated that:

... the growth of knowledge is not a matter of more accumulation, and while it is true that between the ages of four and ten children collect a good deal of information about their district, they also co-ordinate the picture, which is an infinitely more complex process of development (Piaget 1960: p.24).

It would seem possible that Piaget's notion that a child's development of spatial knowledge occurs through the exploration of his local environment is perhaps more accurate than many of the clinically based research statements which tend to be mainly cognitive in character. It would seem, however, that the nature and degree of a child's interaction with his everyday geographic environment is the greater influence in the ability to represent spatial details and knowledge of that environment. If this statement is correct, then it would appear necessary to consider the role that parents assume by allowing and helping the child to experience his environment. The opportunities for a child to explore his local environment must vary greatly, as does the extent of a child's spatial ranges and, today more than ever, his mode of locomotion through that environment. Do many of today's children actually walk through their neighbourhood or are they constantly driven through it en
route from one activity to another? It might be questioned whether parents are even aware of their local environment enough to help their children make observations and so form relationships between places. Will the teaching of the environment become a necessary component of way-finding?

Procedure

It is difficult for adults to imagine how children orientate themselves mentally to the physical environment and develop a functional framework of reference during the period prior to their capacity to read maps. We have probably long since forgotten how we built up our own original conceptual framework or models, that is, the models we habitually use when travelling over familiar ground (Roberts, as cited in Calland, 1973: p. 38).

This project is an attempt in an empirical way to study the awareness of a group of primary school children to their local environment and to explore their knowledge and use of strategic personal landmarks. One aspect of the project is to assess whether the experience and perception of the surroundings in which the children live and go to school could be revealed through their recognition of specific landmarks selected from the environment. These landmarks are presented to the children as coloured photographs of a variety of familiar landmarks.

The twenty children used in the study were Grade Two students (7-8 years), attending a public elementary school in Richmond, B.C.. The school is situated in the southwest area of Richmond, within a residential subdivision that is
approximately twelve years old. The subdivision consists mainly of single family dwellings and condominium townhouses. All the children except one live within a half mile of the school and generally walk or bicycle to the school.

The first task presented to the children was the landmark recognition test. Photographs of various features in Richmond were taken with a 50 mm. lens. Twenty-five photographs were selected to be used initially with the children and developed into 10 x 7.6 cm (4x3 inches) coloured prints numbered 1 - 25. The photographs were taken at various distances from the school, ranging from within 0.8 km (.5 mile) of the school to one or two that are approximately 5 km (three miles) distant. Each child was shown the photographs on an individual basis and asked to:

1. give the name of the landmark
2. make a suggestion about the landmark
3. suggest a possible location of the photograph
4. state if they had no idea of the landmark or possible location

The children’s responses were recorded on a grid and on a tape recorder. At a further session the photographs were shown again to the children and open discussion about them was encouraged. An analysis of the photograph recognition task will follow.

At a later time the students were asked to draw a map of
their 'Route From Home To School'. It was hoped that information shown on the drawings would help to identify some of the personal landmarks which are significant in the children's perception of the environment. On their maps the children were asked to name street names if they knew them, and to mark any features that they passed by on their way to school. A brief discussion had taken place before this activity to consider the term, landmark, as most of the students were unfamiliar with it. From the discussion the most realistic definition that emerged from the children's point of view was that a landmark is "something that doesn't move". The students were given unlimited time and no further direction as they completed their drawings. Upon completion of their maps, the students were asked to write a list of all the features around them that they considered to be landmarks. Throughout this mapping activity one was conscious that there would be considerable variation in the motor skills and graphic ability of the participating students. It was also noted that pencil and pen bring a degree of commitment to each element drawn which is unsuited to the creation of a map.
CHAPTER 3

ANALYSIS OF THE PHOTOGRAPH RECOGNITION TEST

Introduction

Out of a total of 500 possible recognitions on the landmark recognition test, 272 (54.4 percent) were considered to have been recognized; that is, accurate suggestions of the landmarks were made. When the number of exact recognitions were extracted the total of 272 was reduced to 145 (29.29 percent).

The general trend that was to be expected in such a task as this would be a decline in recognition as the subject moves away from the school base, with a concentration of recognition within a circle of approximately 1.6 to 2.4 km (1 to 1.5 miles) radius, whose centre lies where the school is situated. On analysis, the results of photograph groups A, B, and C do reflect this expected trend.

The Relation of Proximity to Recognition

Group A. Those landmarks within a 0.8 to 1.5 km (.5 to 1 mile) radius of the school, displayed the highest number of accurate suggestions of landmarks, 80, although when the number of exact responses were determined this figure was reduced to 45. All the children in the test group recognized the P & A Supermarket; several referred to it as the "corner store" and 13 provided the tester with its exact name. Photograph 5, the
Table I

Individual Scores on Photograph Recognition Test

<table>
<thead>
<tr>
<th>Students</th>
<th>Photographs</th>
<th>Total Exact Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25</td>
<td></td>
</tr>
<tr>
<td>Peter</td>
<td>/ / 0 0 ● ● 0 X X 0 0 0 0 0 X 0 0 0 0 0 0 0 0 X 0 / 0</td>
<td>4</td>
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<td>Jennifer C.</td>
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<td>4</td>
</tr>
<tr>
<td>Paul</td>
<td>X X / X X X ● X X 0 0 0 / X X / 0 / 0 0 ● X ● / 0</td>
<td>10</td>
</tr>
<tr>
<td>Lisa</td>
<td>X X / X / X O X X ● / X X X X / ● X X ● 0 / 0 X 0</td>
<td>13</td>
</tr>
<tr>
<td>Kim F.</td>
<td>X X ● X / X O X X / 0 0 X X X / 0 X X 0 0 / 0 X /</td>
<td>12</td>
</tr>
<tr>
<td>Donnie</td>
<td>X / / 0 / X O X ● X X X / 0 0 X 0 0 0 / 0 / /</td>
<td>7</td>
</tr>
<tr>
<td>Lara</td>
<td>/ X O X / / X X / 0 0 / ● X 0 0 0 0 0 / 0 / X</td>
<td>6</td>
</tr>
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<td>Michelle J.</td>
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<td>0</td>
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<tr>
<td>Gevin</td>
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<td>7</td>
</tr>
<tr>
<td>Yui</td>
<td>X / / 0 / 0 X X X / 0 0 0 0 0 0 0 0 / 0 / X</td>
<td>4</td>
</tr>
<tr>
<td>Deina</td>
<td>X X 0 X 0 0 0 X / / X X / / 0 X 0 X / / X X</td>
<td>10</td>
</tr>
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<td>Michelle M.</td>
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<td>9</td>
</tr>
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<td>Matthew</td>
<td>X X 0 0 / / 0 / / 0 X / ● 0 0 0 0 0 ● 0 / 0 / /</td>
<td>3</td>
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<tr>
<td>Garson</td>
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<td>6</td>
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<tr>
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<td>X X / 0 / / X O X O X X X ● 0 X 0 0 / 0 X X / X X X</td>
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<tr>
<td>Brian</td>
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<tr>
<td>Alison</td>
<td>X X X X / ● 0 X ● X 0 X X X X 0 0 X 0 0 0 / 0 X ●</td>
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</tr>
<tr>
<td>Sean</td>
<td>X X X X / / X X / / 0 0 / X / ● 0 X 0 ● X X 0 X 0</td>
<td>11</td>
</tr>
</tbody>
</table>

Mean 6.75
29%

Key

X Exact name
/ Accurate Suggestion
● Inaccurate Suggestion
0 No idea
### TABLE II

Results of the Photograph Recognition Test: Exact Responses

<table>
<thead>
<tr>
<th>Photograph Group</th>
<th>Possible Recognitions</th>
<th>Exact Recognitions</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>120</td>
<td>45</td>
<td>37.5 %</td>
</tr>
<tr>
<td>B</td>
<td>80</td>
<td>25</td>
<td>31.25%</td>
</tr>
<tr>
<td>C</td>
<td>60</td>
<td>11</td>
<td>18.33%</td>
</tr>
<tr>
<td>D</td>
<td>80</td>
<td>31</td>
<td>38.75%</td>
</tr>
<tr>
<td>E</td>
<td>160</td>
<td>33</td>
<td>20.62%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>500</strong></td>
<td><strong>145</strong></td>
<td><strong>29.29%</strong></td>
</tr>
</tbody>
</table>


Fig. 3. Results of the photograph recognition test: number of exact responses.

* Number of photograph
Table III

Results of the Photograph Recognition Test: Accurate Suggestions

<table>
<thead>
<tr>
<th>Photograph Group</th>
<th>Possible Recognitions</th>
<th>Accurate Recognitions</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>120</td>
<td>80</td>
<td>66.67%</td>
</tr>
<tr>
<td>B</td>
<td>80</td>
<td>47</td>
<td>58.75%</td>
</tr>
<tr>
<td>C</td>
<td>60</td>
<td>15</td>
<td>25.00%</td>
</tr>
<tr>
<td>D</td>
<td>80</td>
<td>66</td>
<td>82.505%</td>
</tr>
<tr>
<td>E</td>
<td>160</td>
<td>64</td>
<td>40.005%</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>272</td>
<td>54.40%</td>
</tr>
</tbody>
</table>
Fig. 4. Results of the photograph recognition test: number of accurate suggestions.

- Number of photograph
Steveston Martial Arts Centre was named by only 1 child. A few children, however, did recognize the building as a place in Steveston as these comments taken from the taped discussion indicate: "it's the karate place", and "it's the Chinese place in Steveston". The photograph of Art Knapp's Garden Spot (Photograph 6) was recognized by 10 children as the following suggestions indicate: "the plant store", "the fertilizer place", "the garden place". Five children were able to provide the exact name of the landmark.

Group B. In Group B, 1.6 to 2.4 km (1 - 1.5 mile) radius from the school, 47 accurate suggestions of the landmarks were provided, but just 25 children were able to give the exact names of the four landmarks in this group. London Farm (Photograph 7), situated along the Dyke Road, was not known by any of the children. Two children did attempt to guess at what the landmark might be, one stating that it was "the house by the dyke", while the other child just suggested that it was "by the dyke". London Farm, although advertised widely in local newspapers as an "Historic Landmark" and open to the public during the summer tourist season, is situated away from the core areas of Richmond and Steveston. It is visible only if one is driving or walking along the dyke road adjacent to the South Arm of the Fraser River, hence the probable reason for its not being recognized by the students. It could be stated that the probability of many adults correctly identifying this landmark is extremely low. In direct contrast to this last photograph, the one showing the
Steveston Museum and Post Office (Photograph 8) was recognized with 18 accurate suggestions and 15 exact names given. Similarly, a higher number of the students correctly identified the photograph of the docks at Steveston (Photograph 9), generally with the association of purchasing fresh fish from the fishing boats docked there at the Government Wharf. Finally in this group, although many of the children were able to recognize Photograph 10 as a church, only one child was able to provide its exact name and location.

**Group C.** With the landmarks in Group C the decline in recognition continued to the extent that only 18.3 percent of the children were able to give the exact names of those places photographed. Photograph 12 was correctly recognized by 7 children as being a part of the "dyke" that surrounds the greater part of Richmond. The Seafair Community Ice Arena in Photograph 11 was known only to two children, one of whom stated "I go to hockey there." The Buddhist Temple on Steveston Highway (Photograph 23) was built only in recent years, but it is a distinctive landmark because of its architectural style and because of the publicity it has received. One child who recognized it referred to it as "that Chinese Church".

**Group D.** However, the decline in recognition as the distance from the school was increased reversed dramatically as the results in Group D indicate; that is, the photographs taken within a 3.2 to 4.0 km (2 to 2.5 mile) radius from the school.
The percentage of accurate suggestions given increased to 82.5 percent, although that of the exact named responses increased to 38.75 percent. This apparent deviation from the expected pattern is to be questioned. In order to do this the topics of the four photographs in Group D must be considered:

Photograph 13 - Richmond Fire Department Hall No. 1
Photograph 14 - Minoru Aquatic Centre
Photograph 15 - Minoru Athletic Track
Photograph 24 - McDonald's Restaurant

As all of these landmarks received high scores on the number of accurate suggestions made about them, it would appear to indicate that these are highly significant places to all children. A factor common to these landmarks is that they are all located in close proximity to the central business area or downtown core of Richmond.

The Aquatic Centre, which provides the only indoor swimming pools in Richmond, is used frequently by many students for recreational swimming and organized swimming lessons. The McDonald's Restaurant located on No. 3 Road, just south of Granville, one of two McDonald's in Richmond, is built on the site of the first McDonald's to be located in British Columbia. An outdoor playground, a major component of this popular restaurant, was the feature which became dominant during the children's discussions about the landmark. When the children were asked if they could indicate which McDonald's was shown in the photograph their responses included these comments: "the one with the playground", "the one with the toys", and "it's
the one with all those rides". It is, therefore, quite possible to see why this particular landmark is significant to the children.

The Minoru Athletic Track is situated very close to the Aquatic Centre. It is highly visible: all elementary schools in Richmond attend an annual track and field meet there during the summer term. Hall No. 1 of the Richmond Fire Department, the largest fire hall in the municipality, is located on the west side of the athletic track. Again it is highly visible, situated on a major intersection in Richmond at Granville Avenue and Gilbert Road. Several children mentioned that they had visited it during pre-school outings.

From the data collected it is possible to suggest that these landmarks are well known to the children. Because they are not within walking distance from the school, the children would have to be driven there. These four landmarks are all located close to the main downtown shopping core of Richmond, which is strung along No. 3 Road between Granville Avenue and Alderbridge Way. It was significant that both the number of exact responses and accurate suggestions rose dramatically at this point, thus interrupting the pattern of general decline in recognition that had been apparent in the three previous groups.

The final group of photographs, those taken at distances of 4 km (2.5 miles) or more from the school, again exhibited a
significant decrease in recognition, but they did not drop to the level reached in Group C. Within this group one photograph--No. 17 of Finn Slough--did not receive any suggestions as to what or where it might be. Finn Slough is a tidal backwater located at the southern end of No. 4 Road adjacent to a small island in the Fraser River known as Whitworth Island. It is quite accessible by road; several people live there on rather delapidated houseboats. However, it is a little off the "beaten track"--not a location where many families would drive or bicycle to on the weekend.

Although many children recognized the photograph of the Richmond General Hospital, it was interesting to note that very few recognized the Minoru Chapel or the Gateway Theatre, both of which are adjacent to the hospital. Twelve children knew the hospital by its exact name, one boy obviously remembering it from personal experience as he commented: "My brother got stitches at that hospital".

Although nine children suggested that Photograph 16, Minoru Chapel, was a church, only one child was able to give its exact name. Comments about the chapel certainly indicated a sense of its place and use in general terms, for example, "it's the church where you get married near the Gateway" and "a church beside where the old ladies live in the hospital". (The geriatric ground floor wing of the hospital is located just a short distance from the chapel.) The two girls who named the Gateway Theatre correctly were probably able to do so as they
both have been involved in performances in the theatre and therefore possessed personal experience of the place: "I recognize that because I had to go tap there for the show". Another comment did indicate some knowledge of location:" a place by the hospital".

Photograph 22 was immediately recognized as Woodward's Department Store by all the students, but only five of them could state that it was located in the Lansdowne Park Shopping Centre, the newest and largest shopping centre in Richmond. Located on No. 3 Road between Lansdowne Road and Alderbridge Way, Woodward's is one of the two anchor stores of the centre, the other being Eaton's. In the photograph it can be seen that the distinctive Woodward's name is quite clearly visible, which most likely contributed to its high recognition factor. However, it would appear to be somewhat significant that the name of the whole shopping centre, that is, Lansdowne Park, was only known by one-quarter of the students. This might indicate that the locations of shopping malls are mainly known by the names of the major stores that are located within them, rather than by the name of the mall itself. One child did refer to this photograph as "Woodward's Shopping Mall". It might be suggested that this is a direct result of the parents' shopping patterns, who probably state they are going to a particular store in the Mall rather then to the Mall itself. Or, perhaps it is due to the fact that the large, highly visible neon names on the outside of the shopping malls are almost always those of the large anchor stores and are, therefore, more easily
imprinted on the young child's memory.

Photograph 20 is Fantasy Gardens, located on the northeast corner of No. 5 Road and Steveston Highway. Originally it was known as Bota Gardens when it first opened to the public approximately five years ago. One boy recognized the photograph, instantly recalling that it had been Bota Gardens. It seemed that, although neither of the two children who made an accurate suggestion about the landmark had actually visited the gardens, they were able to acknowledge that they had noticed it when passing by, as indicated by their comments: "the flower place by a gas station": "we see it when we go to my grandpa's, but I don't know what it's called." The photograph of the Richmond Nature Park, Photograph 21, was purposely taken so that the leafy trees obscured most of the name. Because the Nature Park is a popular attraction in Richmond, it was felt that many of the children would have visited it at least on one, and possibly several occasions. This did not appear to be so, however, as only four children were able to name accurately the landmark, one comment being "Is that a park? I've been there once when I was in Kindergarten".

Photograph 25, is of a view looking south along Highway 99 as it descends into the George Massey Tunnel (Deas Island Tunnel). Of the eleven children who suggested that it was a road, eight were able to identify it correctly as the entrance to the tunnel. Discussion revealed that several of these
children recognized the view as a section of a route that they had physically travelled along at sometime. It was, therefore, familiar to them as the following comments indicate: "how you get to my cousin's house"; "it goes to where my Grandma lives". One comment alluded to the physical nature of the tunnel itself: "Going in the tunnel with the lights". These children to whom the photograph of Highway 99 formed a part of a known route, conceivably, were able to orientate physically that photograph as part of a larger cognitive map that they had in their minds; it was a small part of the whole route that they knew they had travelled along to reach a certain destination.

Exact Responses: The Highest and Lowest

The tabulated results were then considered in terms of those children who produced the highest number of exact responses compared to those who had the lowest number of exact responses. (See Table IV.)

The individual with the highest total of definite and accurate responses was Lisa, who recognized thirteen out of the possible twenty-five photographs. Lisa lives within three blocks of the school. She is the elder of the two siblings in the family and is a bright, cheerful child. Both parents work at their own business, a gas station in central Vancouver, and the mother is an active aerobics instructor. The family tend to visit nearby relatives frequently and to go on family outings.
Table IV

Children with the Highest and Lowest Frequency of Exact Responses on the Photograph Recognition Test

<table>
<thead>
<tr>
<th>Highest Frequency</th>
<th>Lowest Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rank</strong></td>
<td><strong>Name</strong></td>
</tr>
<tr>
<td>1</td>
<td>Lisa</td>
</tr>
<tr>
<td>2</td>
<td>Kim F.</td>
</tr>
<tr>
<td>3</td>
<td>Michael</td>
</tr>
<tr>
<td>4</td>
<td>Alison</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Michael, together with Kim and Alison, recognized twelve of the twenty-five photographs. Michael is the older of two siblings. His father frequently travels out of town on business trips, while mother remains at home with the younger daughter. In the classroom Michael is a bright, observant child who is quite aware of all that is going on around him. He often travels in town on the weekends with his father and participates in boys' clubs and sports activities.

Alison is an intelligent child, the middle of three siblings. Both parents work at full time positions in Vancouver. Alison participates in many activities, both in and out of school; she appears to be a child that is keenly observant and knowledgeable of events that are happening around her. Kim is an only child whose mother stays at home while father works. Kim also participates in many activities after school and, as with many single children, she probably spends considerable time driving to and from a variety of places with her parents. In the classroom setting Kim is a bright, observant student.

Consideration has been given to the children who recognized the least number of photographs. One girl was not able to recognize accurately any of the landmarks. Michelle J., the younger sibling of a single parent family, generally returns to an empty townhouse each day after school is finished. She does not appear to participate in any team sports, or girls' clubs, but tends to play in and around the
townhouse complex with her older brother’s friends. Michelle J. is a lonely child in the classroom, experiencing frequent difficulties socializing with her peers. Her mother works full time to support the family; there appears to be little outside visiting or other activities. Michelle J. was followed by a second girl who recognized only two photographs accurately. However, because Michelle M. had only moved to Richmond from Surrey last September (five months ago), she was perhaps not as familiar with the municipality as she might have been had she lived in the area since birth, which is the case with most of the other children. It was, however, interesting to note that the two photographs that Michelle M. did recognize were of the Buddhist Temple on Steveston Highway and of Highway 99 leading into the George Massey tunnel, both of which are along the route she most likely would have travelled daily from Surrey to the school before her family relocated to their present home close to the school.

Matthew recognized only three out of the twenty-five photographs. His family of five lives in a small house on No. Two Road. Matthew experiences difficulty academically in school and does not take part in any team sports or clubs.

Instead he tends to play in the agricultural lands that back on to his family’s back garden. Matthew had no difficulty recognizing the first two photographs—the P & A Supermarket and the Firehall, as they are both located at the intersection of No. Two Road and Steveston Highway, less than one hundred
yards from his home. He also recognized Photograph 12, the dyke, as he seems to spend much of his time near the dyke's frog hunting in the nearby ditches. Matthew and his family do not appear to travel to other areas of Richmond on a regular basis.

Two girls and a boy recognized the next lowest number of photographs, four out of the possible twenty-five. Jennifer is an only child who lives alone with her mother. Her father works on a permanent basis in the southeastern United States. Because Jennifer lives about 0.8 km (0.5 miles) away from the school, that is, out of the school's catchment area, she is driven to and from school each day. Jennifer is a shy, quiet child whose mother tends to be quite nervous and insecure. Jennifer does not belong to any clubs and appears to stay close to home, visiting her aunt, who lives in close proximity, and playing with her cousins. Peter and Yumi who both live within a block of the school, are the middle children of three siblings. Both seem to remain close to home playing with the neighbourhood children. The parents of both children work outside the home; there does not seem to be much movement away from the school-Steveston area.

Summary

Although this analysis is in no way meant to provide a socioeconomic description of these children and their families, it has become apparent that there are several distinctions between the four children who scored the highest number of recognitions of the landmarks and those six children who
received the lowest scores. These distinctions would be an interesting area for further research, but it will not be an area of focus within the parameters of this paper.
CHAPTER 4

ANALYSIS OF THE ROUTE TO SCHOOL MAPS

Introduction and Evaluation Criteria

Data used in this section of the paper was derived from the maps drawn by the children to show their routes from home to school. Each child was able to use one or more sheets of manila drawing paper (46 x 30 cm) and a variety of pencils, crayons, and felt pens. There was no pre-set time limit within which the children were expected to have completed their maps. A qualitative analysis was performed on the maps based on the following criteria:

1. The drawing was primarily pictorial, with no spatial organization even though features such as buildings and houses are logically represented.

2. The drawing was schematic in the sense that the elements are connected by a known path or route.

3. The drawing resembled a map; it was well organized with clear connections between areas.

4. The drawing resembled a map with identifiable landmarks which exhibited spatial order; and the features were correctly related along a linear sequence and with some sense of spatial organization; that is, the relative locations were accurate so that it could be used for orientation in the area.

(From Hart 1981)

Hart (1981) suggests that there are points along a
continuum designed to describe the type and extent of spatial organization expressed in children's maps. The most valuable insights into understanding the factors which influence children's representation of space on a map are obtained from looking at each individual child's representation in relation to his knowledge of the local environment.

From associated literature it becomes apparent that houses and streets are not generally regarded as landmarks on maps. According to Lynch (1960) the use of landmarks involves the singling out of one element from a multitude of possibilities. It involves the selection of some aspects that are "unique or memorable" in a particular context. Those elements that have been determined as landmarks in the maps drawn by the children are those that may be termed "points of local reference". However, this may be a rather tenuous distinction as those particular features may not be perceived as having any value as landmarks to the particular child who included them on his map. The instructions that were given to the children were "to draw a map of the route from your house to the school and to include on it as many places and things that you notice on your way to school". The completed maps were then scored in the following way giving one point for each of these features:

a. the actual number of streets shown, provided they were connected and related to each other in reality and on the map.

b. the number of streets correctly named

c. the number of features shown
Findings

The maps of the ten children who had achieved the highest and lowest scores on the photograph recognition test were analyzed and their map results were then tabulated against their scores on the photograph recognition test. The results are shown in the following tables:

Table V
Home to School Map Scores

<table>
<thead>
<tr>
<th>Scores</th>
<th>Student</th>
<th>No. of streets</th>
<th>Street names</th>
<th>Features</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>Lisa</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Scores on Photo. Test</td>
<td>Michael</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Alison</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Kim</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Low</td>
<td>Michelle M.</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Scores on Photo. Test *</td>
<td>Matthew</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Peter</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Yumi</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Jennifer</td>
<td>4</td>
<td>1</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

*Michelle J. was unable to complete a map
In the following table the children's map scores have been set against the exact scores that they achieved on the photograph recognition test:

**Table VI**

Comparative Table of Individual Map and Photograph Recognition Test Scores

<table>
<thead>
<tr>
<th>Scores</th>
<th>Student</th>
<th>Map Scores</th>
<th>Recognition Test Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top Scores on Photo. Test</strong></td>
<td>Lisa</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Michael</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Alison</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Kim</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td><strong>Low Scores on Photo. Test</strong></td>
<td>Michelle M.</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Matthew</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Peter</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Yumi</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Jennifer</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Michelle J.</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The highest score of 11 in the map analysis was attained by Jennifer. She is the only child among the group that lives outside the school catchment area; she is driven to school each day by car. Her map quite clearly indicates the route that was
followed from her home to school. Jennifer named the street on which her house was situated, but was unable to name any of the other streets travelled along. Jennifer also included the highest number of other features on her map: a stop sign, a mail box, a pub, and a second elementary school. This information was definitely related to the route that was followed, occurring at distinctive points, mainly intersections. Jennifer, however, was one of the children who scored low on the photograph recognition test.

Lisa achieved the highest score of 13 on the photograph recognition test; on the map test she scored the third highest, a score of 8. Lisa walks to school. Although she correctly identified and named the roads on her map, the map is inward looking and quite localized, using only a small area in the middle of the paper. Lisa was unable to visualize Trumpter Drive and Kingfisher as the two main connecting roads that they are. Instead she saw them as individually connected to each other, not as part of a larger spatial connection. On her way to school, Lisa passes by a house which seems to be of some importance to her as she has deliberately made a point of drawing and colouring that house on her map in much more detail than her own house. She has also carefully drawn a fruit or blossom tree beside the house. Lisa correctly drew in the crosswalk in front of the school, a car, and a person. These details added to the pictorial dimension of her map.

Matthew and Yumi, who were both low scorers on the
photograph recognition test, drew maps that were the most pictorial. Yumi lives on the road that borders the western edge of the school field; her map clearly indicates that she just has to walk across one road and the field to reach the school. Matthew, living on No. 2 Road, has a much longer, more complicated walk to school. Only two sections of his map could be aligned and followed in reality. The centre section with its acute turns does not conform to the true route that he followed. On his map Matthew included the large field that lies behind the school, the crosswalk in front of the school, and the 'cut-through' that he uses from No. 2 Road to Puffin Court. It was interesting to note that Matthew carefully drew the houses around the Court in more detail than his own house. He did not provide the name of any roads on his map.

Alison scored only 4 on the map analysis compared to a higher score of 12 on the photograph recognition test. Her house is situated along the northern boundary of the school field. Accordingly, her map reflects the extremely short distance that she has to walk to reach the school. The major features that she passes by are the five houses that stand between her house and the entrances to the school field. Perhaps because of the lack of other features to include on her map, Alison went to great pains to draw and colour these houses in great detail. She also included the adventure playground that lies near the rear entrance to the school.

Kim scored high on both the map analysis and the
photograph recognition test. Her map, an accurate portrayal of the street pattern that she follows to school, could probably be used for orientation purposes in the area. Although all the roads that Kim walks along to school are lined with houses, Kim has only shown two others besides her own, a green house on Hummingbird, and a blue house just beside the entrance to the school. One large tree and colourful flowers were additional elements in her map.

Michael scored 6 on the map analysis, but his map is a little disjointed as the cul-de-sac that he lives on, Cormorant Court, is not seen as being connected to Kingfisher Drive which, in reality, it is. The line on the map that is seen leading to Cormorant Court is the sidewalk, which Michael walks along four times a day to and from school. However, Michael did include the crosswalk in front of the school and street lights; he also indicated that there were some townhouses to the left of the school. A large black house was drawn on the other side of the school, but no others were indicated.

Michelle M., the child who moved into the area at the end of September, scored 7 on the map analysis. She produced a map on which her house and her friend’s house were the most dominant features, other houses on the map being smaller and lacking in detail and colour. Michelle’s was mostly a pictorial map. However, the roads were connected and the route to the western edge of the school field was clearly visible. Peter scored higher on his route to school map than he did
on the photograph recognition test. His map was neat and concisely drawn; the houses were all identically drawn, including his own, and coloured attractively. The two roads that Peter walks along to school were clearly marked, named, and connected. A cross road was unnamed, and houses were not drawn along the whole route to the school.

Michelle J., who was unable to score on the photograph recognition test, was also unable to complete this exercise. After several repeated attempts she quietly crumpled up her paper, put it into the waste basket and found an alternate activity on which to work. When her paper was retrieved, it was found that all attempts to draw a map had been totally erased. This action could be interpreted in two possible ways. One, that Michelle was afraid of having to complete the exercise and was hoping that the act of destroying her attempts would remain unnoticed. Or, Michelle might simply have been unable to organize spatially the route to school in her mind and then transfer that spatial knowledge on to paper.

There was one boy in the class, Garson, who drew his map as viewed from above; it has been included in this section as a comparison with the other more pictorial maps. On Garson’s map the houses are drawn as squares with a centre line representing the peak of the roof and a small square indicating the location of the chimney. His own house is labelled, as is the school; however, there are no street names provided or extra environmental information.
Discussion

Such conclusions drawn from these comments must be tentative. Those children who scored high in the photograph recognition test generally, with the exception of Kim, scored considerably lower on the map exercise. Similarly, of those children who achieved low scores on the photograph recognition test, only two scored significantly higher on the map test. It was interesting to note that the highest overall score on the map test was achieved by the one girl who was driven to school every day and had the farthest to come. Perhaps by living further away from the school she had a better opportunity to put more information on to her map, thus scoring additional points.

Generally, it seems all the children mapped their movements along a route to the school without relation to a scale of any kind. The maps themselves differ considerably in shape; some being small and concise utilizing the centre of the sheet, while others spread to two or three sheets of paper. Most of the houses on any particular map appear to have been drawn from the same viewpoint, which corresponds to the idea that children at this age tend to show things that are important only to the person who has drawn the map and in a way that is meaningful to him.

One aspect that was noted in all the maps was that none of the children had indicated any environmental features or landmarks that were away from the route that was taken to
school. However, this did comply with the original instructions that were given to the children, which were "to draw a map of their route from home to school" rather than to draw a representation of the local area. Perhaps if the latter idea had been presented to the children, more features of the adjoining landscape might have been included, thereby tapping a wider aspect of the children's knowledge of the local area. Most of the drawings completed by the children did resemble maps in that the roads were generally topologically related even if they were not correctly orientated. Although such a task may appear to be relatively simple, the children were asked to do a number of things all at once: to observe, to recall their observations, to plot data by using original techniques, to organize data in space, and to give points of reference with some degree of accuracy (Milburn 1982).

From studying such maps the amount of input which children draw from their own perceptions of the environment becomes evident. It is this considerable input that becomes internalized to form what is technically known as spatial cognition. It can only occur if frames of reference have previously been created and utilized to solve spatial problems. From such maps it also becomes evident that some children's ability to represent their local environment on a map is more advanced than others. Michelle J. found the whole task just too overwhelming and quietly abandoned it, while Garson was able to visualize the local streets and houses in his own mind from the more developed bird's-eye view. Between these two extremes
were many varying stages, indicative of the idea that children's concepts of space and their ability to represent it vary widely at this age, and also that it is a developmental process as stated by Piaget.

It also follows the developmental stages as indicated by Piaget in that the children were moving from the later stages of intuitive or pre-operational space in which an egocentric reference system is used; that is, one in which the spatial relations between one landmark and the next can be anticipated, and entering the concrete operational period (7-8 years) in which they are able to use a simple fixed reference system based on uncoordinated routes and landmarks. Coordination of such routes and landmarks begins with the development of lateral thinking. At this stage space is manipulated through logical manoeuvres which are concrete, that is, dependent on real objects (landmarks).
CONCLUSION AND IMPLICATIONS

Perceptions and the Spatial Framework

An individual’s perception of the environment increases an awareness of the spatial framework which has been established in an attempt to organize the mass of environmental information which begins to accrue from the day of one’s birth. The development of a child’s spatial ability in his everyday environment and variations in the freedom of this spatial activity are seen as relevant forces which influence the quality as well as the extent of a child’s ability to represent the spatial relatedness of different phenomena. Hart’s research in New England (1978) enabled him to suggest that the ability of a child to co-ordinate longer, more distant areas was more influenced by the degree and nature of his transactions with the landscape than by the child’s intellectual level (Liben et al. 1981). Though there are some differences in accepting this point of view, it is possible to concede that there are great variations in a child’s opportunity to explore different environments freely. The extent of a child’s spatial range and the utility of the environment can become an important intellectual ability.

Piaget and his colleagues demonstrated that a child develops the ability to abstract qualities of the geometric spatial relationship of environmental features. However,
spatial cognition such as this cannot be assumed to form the whole of his spatial experience. All people live and act in space; frequently there is a need to abstract oneself from being in the world in order to structure it so that one may successfully locate oneself and other phenomena within it.

In finding their way in the local environment, a child may use many different references that reinforce each other in an intuitive way rather than use one or two key landmarks, which is frequently proposed in theories and research. A child may have a variety of representative and orientation strategies which are selected for a particular task or for the unique demands of the environment. The only way to find out is to ask the child.

As a constructivist philosopher, Piaget also believed that what is thought to be real is a construction of thought, a product of the interaction between a child and his environment, between maturation and socialization. In this belief Piaget was more concerned with the structure of children's thought rather than with the content of thought. There are many critics of this lack of concern with content, one of whom is Susan Isaacs (1966) who suggests that it is necessary to investigate a child's affective development together with his ability to construct the world logically; that is, one should be concerned with a child's own interests in the world. Criticism such as this is still valid; it could be applied to many areas of the education profession.
Geography in the Elementary Curriculum

In Canada it appears that geography as a subject in elementary schools is almost unknown. As Milburn hypothesizes:

Geography, therefore, is only a small component of social studies in Canadian Schools in general. Though geographical content may be defined in the curriculum guide, there is often little indication of the depth to which it will be taught. It can be given a cursory review, and it may be taught by teachers with very little geography in their own background... (1984: p.8).

A considerable amount of the current curriculum development is based on the structure and content of geography with little consideration, if any, for the spontaneous development of the child's own geographic experiences, interests, and thoughts. Young children, especially in the primary grades, go to school with their "own curriculum", their own individual lived experiences, which are perhaps misunderstood by the classroom teacher.

Curriculum developers should be aware of the fact that children learn outside as well as inside the school situation and that the children's own experiences could be used as a base on which to construct the knowledge that educators feel they should have. There should be an interactive, ongoing process between the set curriculum and the geographic interests and understanding of the child. Teachers might become the investigators, building their teaching units or themes upon the observation of their children and their spontaneous questions. The role of children's geographical experience is an area
requiring further research, according to whether they live in a
city, suburban, or village environment; to what access to
visual media they have had; and to what parental guidance has
been given in terms of environmental explanations.

Implications for Further Research

Subsequent to this thought, Denise Piche (1982), following
her research on children’s spontaneous geography, suggests that
childrens’ understanding of proximate and distant space be
simultaneously investigated for "a correct conceptualization of
here is necessarily related to a conception of elsewhere", an
area of research that could be followed in order to explore
children’s spontaneous geography beyond the home environment.

During a brief conversation, the late Dean Scarfe observed
that landmarks are a form of security to both children and
adults. This might be so because people have a fear of being
lost in an unfamiliar environment. A further interesting
comment from Dr. Scarfe was to question whether events make
landmarks, either in the physical or psychological sense.
While these two ideas are not a part of the research aspect of
this study, they do bear considerable merit; they could form
the basis for an area of further research. The interactive
nature of the child-parent relationship can assume a major role
in the spatial development of children. Hart suggests that the
spatial ranges of children are a product of direct negotiation
between parent and child (Saarinen et al. 1984).
A Role for Parents

If it is believed that spatial learning occurs during travel though an environment, whether the mode of travel is walking, cycling, or driving, then it could be suggested that the degree to which a child’s attention is drawn towards specific parts of the environment during travel is of considerable importance. It is immaterial whether the attention is directed toward natural features such as rivers, waterfalls, mountains, or toward man-made phenomena like buildings, dams, or highways. If a child is also involved in the decision about specific routes to be taken, then spatial learning becomes even more focused and practical.

If one follows this train of thought it is conceivable to consider the possibility of whether it is feasible for parents to raise a child who is environmentally competent. If a parent makes a conscious, consistent effort to share route decisions with the child, to help develop skills of observation of environmental features, to talk continually with the child while travelling between places and to encourage curiosity about places and landmarks in the environment, then a child should grow up with a degree of competence in environmental and spatial knowledge. Such conscious training of abilities in a child, however, must constitute a part of the distinct educational philosophy of the parents who wish their child to receive a practical well rounded education and who are willing to participate in the process themselves.
There is a possible correlation between the increasing length of the home-school base and the distances at which landmarks are recognized. In this study the notion that decline in recognition increases with distance away from the home-school base was unsupported. The landmarks located at a distance of 3.2 to 4 km (2 to 2.5 miles) from the home-school area received significantly higher scores on the photograph recognition test. This area is notable in that it forms part of the main core of Richmond. There is seemingly little relevance in the continuance of the suburban roads in Richmond, punctuated as they are only by traffic lights at intersections. When the children do arrive in the core area they appear to know all the relevant landmarks as places that are meaningful to them in light of their personal experience.

The children recognize the essential landmarks, but on the way they are unable to recognize the space they are travelling through, possibly because along Richmond's roads there is little in the way of significant landmarks. There appeared to be a considerable discrepancy between the place where the children started and the place where they were able to recognize several landmarks represented in the photographs. Everyone, children and adult alike, requires landmarks from which he is able to orientate himself in space. In a flat, suburban area where space must seem infinite to young children, landmarks are needed even more. However, much of today's suburbia is apparently devoid of noteworthy landmarks that can make spatial orientation relevant.
From this research it could be suggested that those parents who indicate points along a route, who converse with the child about the route taken may well stimulate an interest in landmarks and route knowledge. This knowledge should assist in the development of the child's spatial organization and further awareness so that a degree of environmental competence might be attainable.

The research also indicates that the most clearly perceived environmental images were those with which the children had had some kind of personal experience, whether in a negative way (for example, stitches at the hospital) or in a pleasurable way (for example, performing on stage at the theatre). It therefore seems that a distinct association with a particular landmark, or a repetitive experience with it, enables images of the environment or landmark to become more easily imprinted on the child's mental picture of the space in which he exists.

Summary

As previously discussed, spatial perception and orientation to the environment and its associated landmarks might possibly be reinforced by skill training in geographical education. To know an environment, to experience it through investigation, recording and interrelating the features (whether natural or man-made) within it, must help young children locate themselves in the complex world in which they live. Images of their local environment will help to provide
the perceptual framework within which cognitive images and concepts can be developed so that these discrete parts come together to organize reality.
BIBLIOGRAPHY


Photograph 1. The P and A Supermarket at the intersection of Steveston Highway and No. 2 Road.

Photograph 2. Richmond Fire Department, Firehall No. 2, at the intersection of Steveston Highway and No. 2 Road.
Photograph 3. The Windsor Pub, at the intersection of Steveston Highway and Railway Avenue.

Photograph 4. Austin Harris School, on Moncton Street.
Photograph 5. The Steveston Martial Centre, on Moncton Street.

Photograph 6. Art Knapps Garden Spot, at the intersection of Steveston Highway and No. 1 Road.
Photograph 7. London Farm House, on the Dyke Road, along the south arm of the Fraser River.

Photograph 8. Steveston Museum and Post Office, at the intersection of Moncton Street and First Avenue.
Photograph 9. Steveston Government Wharf, along the south arm of the Fraser River.

Photograph 10. South Arm United Church, at the intersection of Steveston Highway and No. 3 Road.
Photograph 11. Seafair Community Ice Rink, at the west end of Francis Road.

Photograph 12. The Dyke at the west end of Francis Road.
Photograph 13. Richmond Fire Department, Firehall No. 1, at the intersection of Granville Avenue and Gilbert Road.

Photograph 14. Minoru Aquatic Centre, at Granville Avenue and Minoru Boulevard.
Photograph 15. Minoru Athletic Track, located in Minoru Park.

Photograph 16. Minoru Chapel, located in Minoru Park.
Photograph 17. Finn Slough, located at the southern end of No. 4 Road.

Photograph 18. Richmond General Hospital, at the intersection of Westminster Highway and Gilbert Road.
Photograph 19. Richmond Gateway Theatre, located on Gilbert Road, between Granville Avenue and Westminster Highway.

Photograph 20. Fantasy Gardens, at the intersection of Steveston Highway and No. 5 Road.
Photograph 21. Richmond Nature Park, located on Westminster Highway west of No. 5 Road.

Photograph 22. Lansdowne Park Shopping Centre, located on No. 3 Road, between Lansdowne Road and Alderbridge Way.
Photograph 23. Buddhist Temple, located on Steveston Highway between No. 3 Road and No. 4 Road.

Photograph 24. McDonald's Restaurant, on No. 3 Road at Granville Avenue.
Photograph 25. Highway 99, looking south towards the entrance to the George Massey Tunnel.
Town

house

School

Michael
My Route To School
Matthew
my route to school