DEVELOPMENT OF A BUILDING IMAGE: A STUDY IN BUILDING PERCEPTION AND LEGIBILITY

BY

GARY FRIEDMAN

B.S. Pennsylvania State University, 1979

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements of the degree

MASTER OF ARCHITECTURE

Department of Architecture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1981

Approved by:

Paul Windley
Major Professor

TABLE OF CONTENTS

Chapter		Page
1.	Building Cognition	1
	Objectives of Study	
	Rationale	
	Literature Review	
	Cognitive Representations of the Built Environment	
	Physical Setting Components	
	Familiarity	
	Personal Characteristics	
	Conceptual Definitions	
	Physical Characteristics	
	Imageability	
	Familiarity	
	Personal Characteristics	
	Hypotheses	
2.	Research Design	16
	Methods of Procedure	
	Sampling of Respondents	
	Setting	
	The Instrument	
3.	Research Findings	18
	To Examine the Cognitive Maps	
	General Characteristics of the Sample	
	Report of Research Findings	
	Hypothesis 1	
	Hypothesis 2	
	Hypothesis 3	
	Hypothesis 4	
4.	Conclusion	32
	Discussion	
	Limitations	
	Implications for Future Research and Action	
	Appendix	42
	Data	
	Interview Questionnaire	
	References	

LIST OF FIGURES

Figure		Page
1.	Conceptual Model Relating the Components of Building Cognition	4
2.	Examples of Drawings by Familiairty Type	19

LIST OF TABLES

Table		Page
1.	Pearson Product-Moment Correlations Among Indices of Exterior Building Legibility	20
2.	Percent Distribution of Demographic Characteristics for 3 Familiarity Types: Workers, Users and Passersby	22
3.	Analysis of Variance for Exterior Building Legibility by Familiarity Type	25
4.	T-Test for Exterior Building Legibility Scores by Familiarity Type	26
5.	Analysis of Variance for Exterior Building Attractiveness by Familiarity Type	28
6.	T-Test for Exterior Building Attractiveness by Familiarity Type	28
7.	Analysis of Variance for Inside/Outside Building Legibility by Familiarity Type	29
8.	T-Test for Inside/Outside Building Legibility by Familiarity Type	30
9.	Pearson Product-Moment Correlations Between Exterior Building Legibility and Personal Characteristics of the Individual	31

LIST OF TABLES IN APPENDIX

Table		Page
1.	Percent Distribution of Omitted Exterior Building Elements by Familiarity Type	44
2.	T-Test for Exterior Building Omission Scores by Familiarity Type	44
3.	T-Test for Exterior Building Mislocation Scores by Familiarity Type	44
4.	T-Test for Exterior Building Distortion Scores by Familiarity Type	44
5.	Percent Distribution of Omitted Interior Building Elements by Familiarity Type	45

THIS BOOK
CONTAINS
NUMEROUS PAGES
WITH THE ORIGINAL
PRINTING BEING
SKEWED
DIFFERENTLY FROM
THE TOP OF THE
PAGE TO THE
BOTTOM.

THIS IS AS RECEIVED
FROM THE
CUSTOMER.

CHAPTER I

BUILDING COGNITION

Objectives of Study

The main objective of this study is to examine the relationship between the external physical characteristics of buildings and the mental images people have of building characteristics.

In the past decade, the study of mental images has been an area of active interest in urban perception. Studies show that people create mental maps of their physical surroundings based on personal background and experience. This research has been limited to the physical structure of cities and the perceptions held by their citizens. The mental maps studied have been of whole cities or areas, and not of specific buildings. This leaves questions to be answered concerning the perception of the physical characteristics of buildings.

The objective stated above may be realized by a careful examination of the following set of questions.

1. Which physical characteristics of a building are utilized by individuals in the development of their mental image of that building?
2. In the individual's development of mental images, are there differences between familiar building characteristics and those which are less familiar?
3. Will subjects who are more familiar with a building have greater preference and/or legibility of the building?
4. If the building is not legible, to what degree is it the result of the building's physical characteristics, the individual's personal characteristics, or a combination of both?

This thesis is a preliminary exploration of the physical characteristics of buildings and implications for environmental design and future research will be discussed.

Rationale

Following the techniques of Lynch (1960), Gould (1966) and Appleyard (1970), many studies have shown the relationship between the built environment and human cognitive processes. Cognitive representations may be viewed as a basic component of human adaptation. They allow individuals to give meaning to their observation and experience of a building. They also add distinctiveness to the relations of the various elements of a building, and they allow people to cope with the built environment in which they carry out their daily activities (Rapport and Hawks, 1970).

This study will extend knowledge about building perception in several ways. First, the long run purposes of such research will contribute to an understanding of building perception. This study is concerned with how the physical characteristics of a building are perceived. It will include individual and group characteristics important in the perception and legibility of buildings. Individual characteristics deal with the prior experience which determines a person's expectations. Group characteristics are concerned with education.

Secondly, the study of building perception rests on the assumption that architects and planners can better understand people's actions, needs and desires regarding a building if they know how the people perceive it. If planners and architects could predict how people perceive buildings, they would be in possession of a powerful design tool, for control would be gained over the design and communicable images of buildings.

Literature Review

Cognitive Representations of the Built Environment

How do people structure their mental images of a building? The answer to this question is currently incomplete, but a great deal of work has been done on the relationship between cognition and perception. The view adopted by the author is that cognitive representations about a building occur in both propositional and analogical form (Kosslyn and Pomerantz, 1977; Kaplan, 1973;

Evans, 1980). In other words, people search for and comprehend physical characteristics of buildings in relation to location and orientation decisions (propositional) affected by previous general knowledge of past buildings (analogical).

A primary function of a cognitive image is to facilitate the individual's legibility and movement within the built environment. A cognitive image also provides the individual with a frame of reference for understanding and relating to the built environment (Hart and Moore, 1971). Building images are the result of an observer's reaction to a building. The observer, with his own goals and past experiences, selects, organizes and defines what he sees (Lynch, 1960). The developed building image, due to memory of past physical characteristics, now limits and emphasizes what is seen. While the image is being evaluated against past memory to stimulate further image formation to elaborate the external building picture, it is used to interpret information and to navigate within the built environment.

The image of a building may vary greatly among different observers. However, enough overlap exists in the characteristics and experiences of individuals to ensure that a common image results. Without this common image, orderly movement within the environment would be impossible. Figure 1 describes graphically the conceptual model relating the components of building cognition.

Environmental cognition is the study of the awareness, images, impressions and beliefs that people have of buildings and the ways in which these attitudes affect subsequent behavior within and around buildings. As defined by Downs and Stea (1973) the term "cognitive mapping" refers to the process by which people acquire, code, store, recall and decode information about the built environment.

Because there is so much variation in the kinds of maps which have been used (Lynch maps, overlay maps, Gouldian aggregated preference maps, etc.), it is important to define what is meant by "mental maps." Mental maps are sketch products created by subjects. A map sums up past experience and provides a platform for future behavior. It is a personal view (utilizing

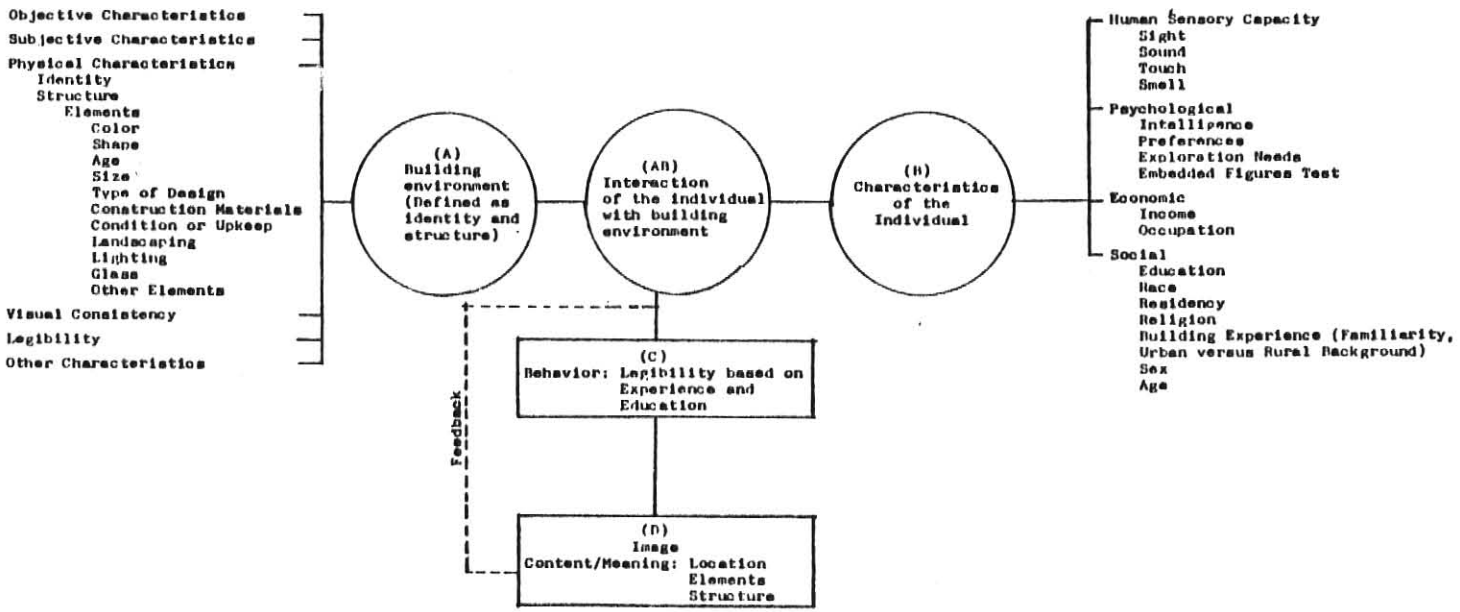

Figure 1: Conceptual Model relating the components of building cognition (This Figure is partially adapted from Zannars, 1973).

The basis for this study of building cognition has four parts: (A) building environment (structure), (B) characteristics of the individual, (C) behavior (legibility); and (D) the image of the building. The interaction of (AB) between the building (A) and the characteristics of the individual (B) determines the individuals behavior (C) which produced the image (D) which in turn affects further behavior due to experience in similiar buildings.

psychomotor, affective and cognitive skills) of a building expressed in map form. The map is taken in the same concrete sense as a road map.

Other devices to extract building perception and legibility include verbal and written reports, sketches and free-flowing conversations. For example, Lynch's work is a classic example of the use of cognitive mapping for extracting environmental knowledge. He asked city dwellers to draw a quick map of their city as if they were describing it rapidly to a stranger. Next he asked them to list elements that stand out in the central business district, then to describe how they traveled through the area and their emotional reactions. Finally, Lynch combined the data in a graphic display which he called a cognitive map. By using this technique, a public image of the city emerged. This consisted of five main elements: paths, districts, edges, nodes, and landmarks. Paths are movement channels (e.g., streets or railroads), edges are linear elements not used as paths (e.g., the coast, barriers or walls) and districts are areas identified by a common character. Nodes are focal points where paths meet (e.g., intersections) and landmarks are points of reference, usually buildings.

The use of cognitive maps as a source of data raises several methodological and procedural issues. The greatest methodological problem is determining to what degree the map is a valid representation of the existing building. In other words, how accurate is a hand-drawn sketch when compared to the existing building? Does it measure those existing building elements and show the building structure? A study examining this problem was done by Howard, et al.(1973). Howard, had adults perform one of the following tasks in familiar outdoor surroundings: 1) draw a map of the environment, 2) place objects in scale models, 3) estimate object distances, and 4) make ratio estimates of object distances by marking off a standardized line in proportion to the real distance. All four methods were reliable, with reliability coefficients ranging from .987 to .995 (Evans, 1980). Similiar results were found in a study by Rothwell (1976) in which adults

were asked to draw their apartment floor plans. These two studies suggest good reliability and some validity for hand drawn maps of small spaces. However, both studies neglected to examine the accuracy of object placement.

The use of cognitive mapping in cognition research raises a number of procedural questions. For example, when an experimenter asks an individual to draw a sketch of a building, he is asking for an exhibition of both the recall abilities and the graphic and cartographic skills of the individual. A person with limited graphic and cartographic capabilities is restricted in his ability to show his knowledge. Thus, the inferences that can be made from the use of such methods are also limited (Francescato and Mabane, 1973; Golledge, 1976; Blaut and Stea, 1974). Appleyard (1970) suggests that this is not a problem when the subjects are adult humans with the ability to structure their thoughts in an abstract fashion to produce external representations summarizing their cognition. Anderson and Tindal (1971) and Howell (1969) examined the city cognitive maps of a range of children in Toronto and New York. They found that a larger amount of detail appeared on the maps of older children.

There is also a tendency for the mapper to accumulate and exaggerate errors (Beck and Wood, 1976). For example, error created early in the base map is compounded because the mapper is unwilling to sacrifice the work made prior to the discovery of the error. The mapper may also fail to detect the error. A way to reduce this problem is to have subjects build their maps on several surfaces (e.g., creating a base map in the form of a sketch and then overlaying the attributes on another sheet of tracing paper). More responsive evaluative expressions will be included by the subjects in this way. This raises another question concerning the information provided to subjects in a sketch or map task. Some researchers have provided subjects with landmarks, whereas others have measured free recall with cues (Evans, 1980).

Finally, the scale of the drawing including such things as the size of the drawing surface and the order in which things

are drawn, has an important bearing on the cognitive map. Another point of concern suggested by investigators is that the ordering of the recall of elements on a map indicates the relative importance of the elements (Golledge, 1976). Milgram and Jodelet (1976) found a high correlation between first-drawn elements and those most frequently identified in picture recognition.

The data for the present study were obtained in a manner similar to Lynch's, although the schema was somewhat modified to overcome the Lynch study's weaknesses. For example, data analysis was performed to see if the sketch or interior map was a valid representation of the existing building. The accuracy in the drawing of the building elements and interior features were determined. One of the problems was all the exterior elements and interior features were related to one another, but they were scored in different ways which does not guarantee high correlations.

A multilayered system was used, creating a feedback loop of map-making. In other words, the mapper evaluated what he previously drew. This stimulated further image formation used to elaborate the external building picture. The use of adult subjects, as the literature suggested, produced cognitive maps that summarized the subjects external representations of buildings. Furthermore, the interaction of building legibility and personal variables such as sex, urban versus rural background, and building familiarity were not neglected. While these techniques improved reliability, questions concerning validity still remained.

Physical Setting Components

Much of the research in the perception of the built environment came from the need of architects and planners to understand both the behavior of individuals within urban structures and the way in which cities are perceived and recorded by individuals. If individuals impose a structure on their images, the types of structure imposed will influence how they use the building (Lynch, 1960).

The mental image held of a building by an individual is used

to interpret information and to guide action. For example, a legible building image gives a person the mobility to obtain goods and services within a building. A legible image will not only tell the person where the entrance is, but will give him a wider range of behavioral options. For example, the individual may enter through the front door, the side door or the underground parking lot of a building. When one's cognitive map is legible, experience gives one an important sense of emotional security (DeJonge, 1962). Lynch (1960) also speaks of the distress caused as a result of temporary disorientation in the modern city. A number of studies focusing on issues other than building perception detail important implications not only for building perception but for building cognition (a method used to study building perception) as well. For example, Lynch (1960) dealt with such elements as functional differentiation, size, density, shape and structure, all of which determine the form of cities. Other researchers (Harrison and Howard, 1972; Golledge and Zannars, 1970) have found similiar findings. Approaching the problem of cognitive mapping from a planner's perspective, Appleyard (1969) discussed attributes of buildings that were recalled by people. In the city of Ciudad Guayana, Venezuela, buildings of high use, high size contrast to their surroundings and a sharp outline and bright surfaces were recalled more frequently than others. Similiar findings were found by Pezdek and Evans (1979).

Building location may also affect recall. Buildings that are close to important road intersections or are visible from primary traffic arterials are more frequently recalled (Appleyard, 1970; Heft, 1969).

In a similiar form, Canter (1961) and others (Michelson, 1968; Lansing and Marans, 1969; Appleyard, 1976; and Collins, 1969) indicated that architects perceive buildings in a different way from the general public. They found a lack of congruence between the perceptions of the designer (reflected in the constructed building) and of those who use the building.

Finally, few researchers have examined the relationship

between legibility and preference (Evans, 1980). An exception to this was a study by S. Kaplan (1975). He found that setting features (complexity, coherence, uncertainty, etc.) that enhance map formation also increase preference.

Familiarity

A legible image may occur in several ways. There may be little in the building that is ordered or remarkable, yet its mental image may gain identity and organization through familiarity. For example, Gittins (1969) emphasizes the importance of time in such things as the formation of a building image and the acquistion of a sense of identity and psychological support enhanced by attachment to elements. Zajonc (1968) has reviewed a number of studies indicating that repeated exposure to an element enhances the individual's liking of it. In one experiment, Saarinen (1964) explored how perceptions of the Chicago Loop were affected by individual familiarity with the area. It was found that people displayed different cognitive images as a function of their experience with the loop.

In a similiar form, Carr and Schissler (1969) found that greater familiarity with the trip along an expressway in Boston tended to increase the total number of items remembered. However, the relative importance of the items remained unchanged. When a person becomes more familiar with a route, new items are added to rememberance, but those items remembered best are still those remembered initially. Banerjee (1971) and Milgram, et al. (1972) also found that the longer a person lived in Boston, the greater the number of photographs of the city he could identify. However, Ladd (1970) found that the accuracy of adolescents' maps of their neighborhood did not increase with length of residence.

Personal Characteristics

Images are not only affected by the scale of the area involved (e.g., building, neighborhood or city) but also by such things as individual differences, the time of day or season. Several dimensions of individual differences affecting people's mental images of buildings have been identified in the literature.

For example, a study done of children in Houston of Anglo-Saxon, black and Mexican-American backgrounds revealed that the images drawn by Anglo-Saxon children were more extensive than those drawn by the other groups (Maurer and Baxter, 1972).

Several other studies show differences in urban imagery due to socioeconomic status. Income, occupation and education were used in these studies to measure this status. Individuals at higher socioeconomic levels tend to include more areas of a city in their cognitive maps. In other words, wealthier people are more familiar with a greater portion of their city than poorer people. There are two explanations of these results. First, this may be a reflection of the different modes of transportation (e.g., a bus as opposed to a car) that are more likely to be utilized by the lower socioeconomic classes. Also higher socioeconomic status residents tend to be more involved with historical settings and areas of scenic beauty. Secondly, individuals of a lower socioeconomic status may have had less practice in drawing maps which may account in part for the findings (Orleans, 1973; Los Angeles Department of City Planning, 1971; and Goodchild, 1974).

Sex differences are also reflected in the research on cognitive mapping. Appleyard (1970) found that females made more errors in their cognitive maps of an urban area than did males. This finding may be a result of wives spending more time in their local neighborhood and therefore, having more interaction in a limited setting than their husbands who travel from the suburban location to work which enables them to become familiar with various sections of the city.

Many other studies emphasized the role of individual needs and values as determinants of the form of the mental image (Carr, 1966; Everitt and Cadwallader, 1972). Appleyard (1969) found that mental images are affected by several factors which include attractiveness, familiarity, scale and barriers. Perceptual style as it relates to perceptual disembedding such as field independence-dependence is another personal variable relevant to building perception, but has remained uninvestigated thus far.

Conceptual Definitions

Physical Characteristics

The present study examined physical characteristics relating to the attributes of identity and structure and their role in the mental images which individuals form of buildings. According to Lynch, the physical characteristics of a building may be separated into three components--identity, structure and meaning. This study concentrated on the physical characteristics of the building image so meaning was not analyzed. Due to the subjectivity of multitudinous individual meanings of buildings, such as power, mystery, greatness, etc., group images were deemed less likely to be consistent at the building level. This was seen by the author as a complicated analytic feat beyond the scope of this thesis. Thus this study concentrates on the identity and structure of the building image.

A clear image requires an identification of building elements capitalizing on past experience and requiring only little information from the unfamiliar building. Identity requires the bridging of the gap between those elements stored in the memory of the perceiver (Bruner, 1957; Kaplan, 1973). It requires both perception of present elements and memory of past elements. The selection of identified building elements is a form of learning. Several studies have found that individual differences are the result of differences in a person's socialization experiences. Identification of the existing building elements is a critical starting point for perception prior to any action (e.g., movement within the building) being taken.

Structure is defined as the collection of elements within a building. The arrangement of building elements in composing the structure determines the building image. Building elements include the visual sensations of color, shape, age, size, type of design, pattern, form, construction materials, condition or upkeep, landscaping, lighting and windows. Each element has many connections to the other elements. Furthermore, these connections vary in strength.

A useful image for making an exit requires the identification of elements (e.g., past experience with a particular type of door), and the perception of how those elements are connected (e.g., the perception needed to distinguish a rotating door from a house door).

Imageability

In the present study imageability is defined as how building elements are organized to form that building structure which gives an observer a legible image of the building. It is that form, color, or pattern which facilitates the making of structured and identifiable mental images of a building. It might also be called legibility--where building elements are not only seen but presented intensely to the senses. Legibility can be defined as the ease in which the building elements can be recognized and organized into a coherent pattern (Lynch, 1960). Such a building can be easily understood and the elements grouped into an overall structure. Since legibility is the clarity or visibility of elements, a legible building should be drawn by an observer with many connected elements showing the building structure. In other words, the observer will build his cognitive sketch by selecting and organizing those building elements which are meaningful to him and comparing them with the elements of the existing building.

Familiarity

For the purposes of this study, familiarity is defined as contact with a building on a regular basis. The following are examples of degrees of familiarity: 1) employees of businesses occupying the building (workers), 2) customers who regularly visit the building (users), and 3) individuals who see the building on their way to other destinations, but have never been inside (passersby). Familiarity is tied to a user continuum that workers are more familiar with their building than users who in turn are more familiar than passersby.

Personal Characteristics

The Embedded Figures Test was administered in this study to

test the individuals ability to break up the structure of a building to pick out a wanted element. The Embedded Figures Test reflects compentence at perceptual disembedding. The cognitive/perceptual style of disembedding applied here is field dependence-independence (Witkin, Oltman, Raskin and Karp, 1971). The perception of a field-dependent person is strongly dominated by the building structure and the elements are experienced as fused. In a field-independent mode of perceiving, elements are experienced distinctly from the overall structure. A field-independent person is able to overcome the building structure in order to locate a desired element.

Eleven variables comprise the personal domain. These are age, sex, race, religion, income level, education, occupational prestige, marital status, urban/rural background, years spent in Manhattan, and the Embedded Figures Test. Once familiarity has been evaluated, it is important to assess whether a person's legible image of the building is a result of the building's physical characteristics or the individual's characteristics.

Hypotheses

The purpose of the study is to test four related hypotheses that developed from the literature review.

1. Exterior and interior building legibility scores will differ among the three familiarity groups, with those most familiar with the building (workers) possessing significantly higher legibility scores than those least familiar with it (passersby).

   Rationale. Several researchers have examined the effects of setting familiarity on cognitive maps and unfortunately, the results conflict. Several studies previously discussed in the literature have found that accuracy of cognitive maps tends to increase as the degree of familiarity increases. However, there are researchers who have found that greater cognitive map accuracy did not result due to familiarity with the area. This study will contribute to the existing body of research dealing with the relationship between building familiarity and legibility or accuracy.

2. Regardless of familiarity type, subjects with higher legibility scores will also have higher building preference scores. This implies that as familiarity increases so does the respondents legibility as well as their preference.

   Rationale. Architects and planners have assumed that buildings which facilitate legible cognitive maps are preferred (Evans, 1980). Research is lacking in this, however. An exception is the research by S. Kaplan. Therefore, this study will contribute to a better understanding of the relationship between building legibility and preference.

3. Regardless of familiarity type, subjects' scores on interior legibility will be greater than scores on exterior legibility.

   Rationale. To date, no research exists on the relationship between the exterior and interior of a building as it relates to legibility. For example, why would the interior be more legible than the exterior? The author believes that the interior would be more legible than the exterior because of the way the respondent reacts to the interior features as compared to the exterior. For example, sitting in a lounge or walking to the teller area would result in greater interior feature legibility than would just looking at the exterior of a building. This study explores the relationship between exterior and interior building legibility.

4. Subjects with high scores of field-independence will also have high scores on legibility.

   Rationale. The Embedded Figures Test was used in this study to assess whether a person's legible building image is a result of the building's physical characteristics, familiarity, the respondents compentence at perceptual disembedding, or a combination of the three. This was determined by administering the Embedded Figures Test. The subject's task on each trail (total number of twelve trails) is to locate a previously seen simple figure within a larger complex figure which has been organized to obasure the sought after simple figure. Likewise, when the subject draws an interior map or sketch of the building this also tests his compentence at perceptual disembedding. For example, the better the respondent is at picking out exterior building elements such as the doors, automatic teller machine and the windows, and being able to draw the building to show the relationship between these building elements, the greater his legibility. Therefore, a subject who is poor at perceptual disembedding would have lower legibility, and would have trouble picking out the building elements and drawing the building structure. He would be field-dependent on the Embedded Figures Test. However, familiarity also influences perceptual disembedding

and legibility. In the literature reviewed, nothing was found to deal with the relationship between perceptual disembedding and legibility, or how familiarity influences perceptual disembedding.

CHAPTER II

RESEARCH DESIGN

Methods of Procedure

Sampling of Respondents

To test the influences of familiarity group differences, 41 subjects were studied. Respondents were selected by a quota system to ensure sufficient numbers in each familiarity type and sex. The subjects were separated into three familiarity groups: workers, users and passersby. Thirteen subjects were categorized and identified in the worker group, and fourteen each participated in the user and passerby groups. An equal number of males and females participated in each familiarity group, with the exception of the worker group, which contained seven females and six males. All respondents were residents of Manhattan, Kansas.

The recruitment of subjects was performed by approaching the manager of the building under study and asking permission to use the building for the study. Consent was also obtained for the participation of employees and users in the study. Each subject's willingness to participate in the experiment was then determined. The passerby group consisted of people living in town. After willingness to participate was established, each subject was contacted to arrange a time for an interview which took place in the respondent's home.

Although randomization was not used in the selection of subjects' an effort was made to use a building frequented by people with diverse types of personal characteristics

Setting

The Union National Bank was the building selected for this study. The bank is located in Manhattan, Kansas, a town with a population of approximately 40,000. The building was chosen because it was assumed it was one of the larger and better-known

edifices in Manhattan. It was believed that this building would would provide a well-rounded test of the hypotheses of the study.

The Instrument

A questionnaire was designed to measure cognitive judgments of the overall building as well as the preferences, past experience, emotional feelings and personal characteristics of the individual subjects. The experimental procedure's goal was to provide information on the importance assigned to building characteristics as they relate to legibility. The questionnaire was pretested on twelve college students at Kansas State University and adjustments were then made. The corrected version of the questionnaire appears in the appendix of this thesis.

The first part of the questionnaire was designed to measure the respondent's past experience with similiar building types. This was followed by a request for a series of sketches and verbal responses to questions dealing with the physical characteristics of the building. This part of the questionnaire dealt with the relationship between building elements and structure and the person's feelings about the building. The next part of the interview dealt with the internal structure of the building. The Embedded Figures Test was also given. Finally, each respondent was asked about preferences and personal characteristics. It took approximately 45 minutes to administer the questionnaire of the passerby group one hour to administer it to the other two groups.

CHAPTER III

RESEARCH FINDINGS

To Examine the Cognitive Maps

The content analysis of the sketch and verbal preference questions dealing with the physical characteristics of buildings was achieved by reviewing the sequence in which the elements were drawn. The Index of Legibility was arrived at by using omission, mislocation and distortion scores. The formula used is as follows:

Legibility = Omission + Total Mislocation + Total Distortion

The most accurate sketch and map were chosen as the standard by which to score omission, mislocation and distortion.

The omission score consisted of the number of elements overlooked by the subjects. See the appendix for a complete list of the outside (Table 1) and inside (Table 5) building elements. For example, Figure 2 shows several sketches done by the different familiarity groups. A workers sketch was the most accurate, even though it omitted the elevator shaft. The passerby group omitted the carport, which extends out over the parking lot, as well as the automatic teller. Both the user and the passerby group omitted the balcony.

Mislocation utilized a four-point scale. It ranged from the element not being mislocated (1) to the element not being on the sketch (4). Two examples of mislocation are shown on the users' sketch. The first floor windows are out of place or too high, and the carport does not extend across the front of the entire building.

Finally, distortion was arrived at by measuring the total area of the map or sketch drawn in square feet and the elements within that area, and converting it to a percentage of the building. For example, the total percentage of the first floor

(absolute distortion) is $\frac{18,687 \text{ sq. ft.}}{18,687 \text{ sq. ft.}} \times 100 = 100\%$. On a workers map the teller area took up $\frac{1,200 \text{ sq. ft. teller area}}{9,225 \text{ sq. ft. total first floor}} \times 100 = 13.0\%$. Whereas, the actual teller area (absolute distortion took up $\frac{796 \text{ sq. ft. teller area}}{18,687 \text{ sq. ft. first floor}} \times 100 = 4.25\%$. This made it possible to make comparisions between the different scales of the drawings.

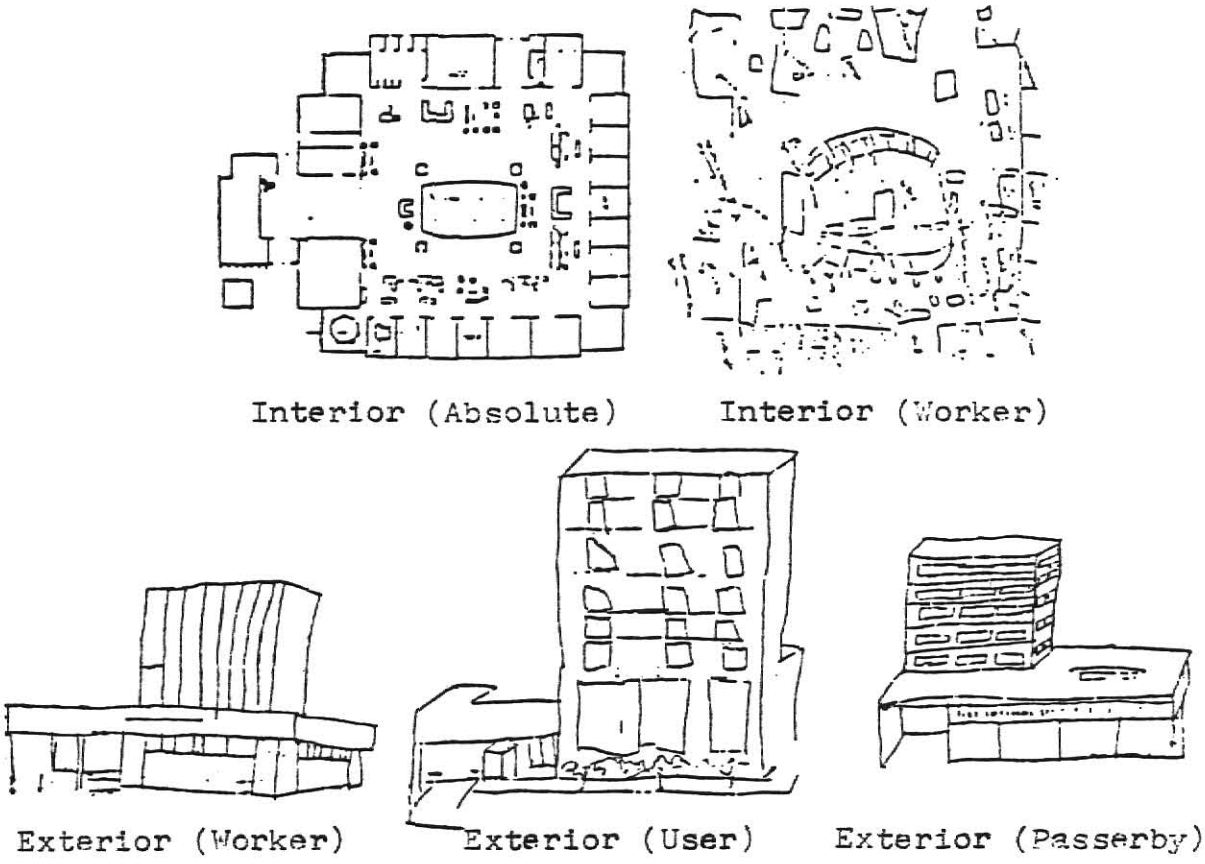

Figure 2: Examples of drawings by familiarity type.

The content analysis of the Index of Legibility was performed by computing frequencies for the building elements omitted (See Table 1 and 5 in appendix), mislocated and distorted. The elements were rank ordered.

The intercorrelations among the indicies of exterior legibility (Table 1) suggest that the indicies are related to each other and are tapping related dimensions. The correlations between omission and mislocation (r=.985), distortion (r=.355)

and legibility (r=.565) imply that these indices are moderately related. This was predictable since those three indices were scored using the same building elements. However, these elements were scored in different ways which does not guarantee high correlations. In addition, the correlation between distortion and mislocation (r=.420) and legibility (r=.625) imply that these dimensions of legibility are moderately related.

Table 1

Pearson Product-Moment Correlations Among Indices of Exterior Building Legibility

	Omission	Mislocation	Distortion	Legibility
Omission				
Mislocation	.985***			
Distortion	.355*	.420**		
Legibility	.565***	.625***	.970***	

*p<.05, **p<.01, ***p<.001

General Characteristics of the Sample

Sex and familiarity formed the basis for the selection of the sample, with fourteen people each in the user and passerby groups, and thirteen in the worker group. As Table 2 illustrates, 95.12 percent of the subjects were white and 2.44 percent were black or Hispanic. Most of the respondents were Protestants (68.85 percent). No one came from a rural area or small town (having less than 2,500 inhabitants), and only two respondents (4.88 percent) came from metropolitan areas. Given the lack of variation in race, religion and urban/rural backgrounds, the decision was made not to investigate these differences further. Personal characteristics are important in cognition, but this lack of variation in the personal characteristics is a result of the correlation design used. This type of research did not manipulate the personal characteristics of the subjects as they were not selected at random.

The subjects ranged in age from 21 to 47 years old. The selection resulted in an average respondent age of 28.97 years old. The subjects in the passerby group were slightly younger (mean: 25.35 years old) than those of the worker (31.69) or user groups (30.7). The majority of the respondents were married (60.89 percent).

The income breakdown pattern demonstrated a similiar diversity. The respondents' total household income ranged from $1,000 to over $35,000 a year. The mean household income for 1980 before taxes was between $10,000 and $19,999. A large number of working couples (58.54 percent) accounted for this diversity. The worker group had the highest average income of the three groups, while the passerby group had the lowest average income, owing to the inclusion of college students in the study. The high average income of the worker group was the result of the participation in the study of older, well-to-do bank executives.

The respondents had a very high level of education. On the average, they had completed three years of college study.

Half the population of the sample had lived in Manhattan for five years or more and were of a predominantly medium-sized town background (less than 50,000 inhabitants). The remainder came from backgrounds of mixed town size. Those of the more educated or upper income groups tended to be from cities with a population of over 50,000.

The predominant occupational groups in the sample were educators (i.e., teachers and counselors), people in the field of recreation and secretaries. These were followed numerically by bookkeepers and those involved in various banking activities and functions. Occupations were then assigned prestige values (Hodge, Siegel and Rossi, 1964). Occupational prestige ranged from an occupation having the highest prestige such as an administrator (1) to an occupation having the lowest prestige such as a waiter (13). Other occupations that fall between these two prestige values were people in banking, education, accountants, nurses, farmers, and bookkeepers. The majority of the respondents fell in this middle range.

Table 2

Percent Distribution of Demographic Characteristics for 3 Familiarity Types: Workers, Users and Passersby

Variable	Total N=41	Type Familiarity: Worker N=13	User N=14	Passerby N=14
Sex				
Male	48.78	46.1	50.0	50.0
Female	51.22	53.9	50.0	50.0
Age				
Mean	28.97	31.69	30.70	25.35
S.D.	(7.45)	(9.24)	(6.41)	(5.28)
Race				
White	95.12	100.0	92.85	92.85
Black	2.44	0.0	0.00	7.15
Hispanic	2.44	0.0	7.15	0.00
Religion				
Protestant	65.85	92.31	42.85	64.29
Catholic	12.20	7.69	14.28	14.28
Jewish	2.44	0.00	0.00	7.15
Nothing	19.51	0.00	42.85	14.28
Income				
$1,000	2.44	0.00	0.00	7.15
$1,000-4,999	24.39	0.00	28.59	57.14
$5,000-9,999	12.20	7.69	14.28	14.28
$10,000-19,999	26.83	38.48	14.28	14.28
$20,000-24,999	9.76	15.38	14.28	0.00
$25,000-29,999	4.88	7.69	0.00	7.15
$30,000-34,999	9.76	7.69	21.42	0.00
$35,000+	9.76	23.07	7.15	0.00
Education				
1 year college	4.88	7.69	0.00	7.15
2 years college	7.32	15.38	7.15	0.00
3 years college	9.76	23.07	0.00	7.15
4 years college	12.20	7.69	0.00	28.57
5 years college	41.46	38.48	71.43	21.42
5 years college+	21.95	7.69	21.42	35.71
Marital Status				
Married	60.98	92.31	64.29	28.57
Single	39.02	7.69	35.71	71.43
Years Live in Manhattan				
Mean	3.58	3.38	4.07	2.07
S.D.	(2.15)	(1.75)	(1.87)	(1.93)

Table 2 (Continued)

Percent Distribution of Demographic Characteristics for 3 Familiarity Types: Workers, Users and Passersby

Variable	Total N=41	Type Familiarity: Worker N=13	User N=14	Passerby N=14
Urban/Rural Background				
Small/Medium Town	36.59	23.10	35.71	57.16
Small/Medium Town/ City	4.88	7.69	7.15	0.00
Medium Town/City/ Metropolitan Area	4.88	15.38	0.00	0.00
Medium Town	29.27	15.38	49.99	14.28
City/Metropolitan Area	9.76	7.69	7.15	14.28
Medium Town/City	9.76	15.38	0.00	14.28
Metropolitan Area	4.88	15.38	0.00	0.00
Occupational Prestige[a]				
Administration (1)	4.88	7.69	7.15	0.00
Social Services (2)	2.44	0.00	7.15	0.00
Banker (3)	14.64	46.17	0.00	0.00
Therapy (4)	2.44	0.00	0.00	7.15
Education (5)	21.95	7.69	28.57	7.15
Accountant (6)	4.88	7.69	0.00	7.15
Nurse (7)	2.44	0.00	7.15	0.00
Farming (8)	7.32	0.00	7.15	14.28
Bookkeeping (9)	9.76	15.38	14.28	0.00
Recreation (10)	12.20	0.00	28.57	7.15
Secretary (11)	12.20	15.38	0.00	21.42
Cook (12)	2.44	0.00	0.00	7.15
Waiter (13)	2.44	0.00	0.00	7.15

[a]Number in parentheses indicates the occupational prestige rank. Occupational prestige ranged from an occupation having the highest prestige such as an administrator (1) to an occupation having the lowest prestige such as a waiter (13).

Report of Research Findings

The remainder of this chapter is a concise report of the research findings of this study, presented in response to the four hypotheses stated. To facilitate reader comprehension, each hypothesis is restated and immediately followed by those research results relating to it. A detailed examination and interpretation of the research findings is recorded in the next chapter.

Hypothesis 1

> Exterior and interior building legibility scores will differ among the three familiarity groups, with those most familiar with the building (workers) possessing significantly higher legibility scores than those least familiar with it (passersby).

To test the first hypothesis that respondents more familiar with the building will have greater legibility, analysis of variance on exterior legibility was performed among the familiarity groups and within groups to determine if differences existed. A t-test was performed among the familiarity groups for interior legibility. Pearson product-moment coefficient of correlation was used to see if workers and users who have spent more time in the building also have greater legibility. Finally, frequencies were also computed to determine which building elements were most frequently recalled.

The Sketch

This section examines the effects of setting familiarity on building perception. The research focused on two issues: 1) building elements recalled as a result of use and 2) changes in legibility resulting from increased familiarity. This research on building cognition examined the implications of frequency of setting contact.

Whether preferred or disliked, people recognize and remember certain physical characteristics of a building. The building elements most frequently recalled by all familiarity groups were size, shape, windows, entrances and plants. Other building elements were mentioned less frequently such as window sizes, columns, style of design and building setbacks (see Table 1 in the appendix). The most frequently mentioned building elements of the first floor were the entrance, office windows, automatic teller machine. This may be due to the way a person approaches the building, such as either by driving or walking. A person walking by may notice more building elements than one driving rapidly past.

The data in Table 3 shows that there are differences between

external building legibility on familiarity types. Table 4 supports the hypothesis that people working in the building produce maps with fewer omissions, mislocations, and distortions; that is with greater legibility, than do respondents in the other familiarity groups. In other words, the worker group not only omitted fewer elements (Table 2 in appendix) than the other groups, but the elements were also least often mislocated (Table 3 in appendix) and distorted (see Table 4 in appendix). The user group also mentioned more elements and had a lower rate of mislocation and distortion than did the passerby group. Increased familiarity or use resulted in less omission, mislocation and distortion.

A significant difference existed between the worker group and user group (t=-3.25, df=36, $p<.002$) and the passerby group (t=3.26, df=36, $p<.002$). However, there was no significant difference between the user group and the passerby group (t=-.88, df=36, $p<.353$). Greater legibility among the worker group is the result not only of long-term use but also the attitude of the employees. Workers feel differently about their surroundings than do users or passersby. They work in the building and are involved in its activities. This is the result of the sense of identity or belonging a worker feels in connection with the building. A user simply patronizes the building and feels no intrinsic concern for it.

Table 3

Analysis of Variance for Exterior Building Legibility by Familiarity Type

Source of Variance	df	Mean Square	F	P
Between Groups	2	5613.74	5.56	.008
Within Groups	34	1010.45		
Total	36			

Table 4

T-Test for Exterior Building Legibility Scores by Familiarity Type

Type Familiarity	Mean	S.D.	Compared To	T-Score	P Value
Worker	122.60	9.58	User	-3.25	.029
User	152.82	9.17	Passerby	- .88	.353
Passerby	164.59	8.49	Worker	3.26	.002

When the worker group was broken down into years of employment in the building, it was found that increased tenure resulted in increased image legibility ($r=.340$, $p<.033$).

In the case of the worker, user and the passerby, it was found that increased use results in greater exterior building legibility ($r=.340$, $p<.035$). This is reflected in the fact that when a pearson product-moment correlation was performed, greater use resulted in higher legibility. Therefore, as legibility increased, familiarity with the building increases as well. In other words, the more familiar the subject is with the building (worker) the greater his or her legibility.

It was also found that increased viewing of the building is associated with greater legibility ($r=.415$, $p<.010$). A person who sees the building several times a week does have a more legible image than someone who sees it a few times a year. These data support hypothesis 1. The individual's mental image contained more elements when the building was more familiar. It was also less fraught with omission, mislocation and distortion. Therefore, increased use or familiarity did result in greater legibility.

Familiarity becomes complicated by such other factors as previous experience, expectations and curiosity. The ability to structure the building also depends on the individual's mode of travel. For example, an individual who walks by the building may later draw some elements more accurately than someone who drives by.

Interior Map

The data support the hypothesis that increased familiarity results in greater legibility. The worker group had greater interior legibility than the user group (t=-3.67, df=24, $p<.001$). The length of contact with or use of the interior was related to the legibility of the individual's map. The long-term users and workers had the most legible images. Also, as a respondents use of the building increased so did legibility ($r=.50$, $p<.01$). The results show the relation of recognition memory of the features of a setting to actual experience. For example, the main entrance was more frequently mentioned and more often distorted than the south entrance (see Table 5 in appendix). Therefore, the extent of the actual setting experience determined the individual's image legibility. In the case of the main entrance, the results showed that 16 respondents usually entered this way. Low omission and mislocation was another result stemming from the regular use of that particular feature. However, the worker group omitted fewer features than the user group (t=6.59, df=24, $p<.001$), distorted fewer features (t=2.05, df=24, $p<.05$), and the features were also least often mislocated (t=-5.89, df=24, $p<.0001$).

When the worker group was broken down into years of employment it was found that the longer employees worked in the building, increased building familiarity resulted in increased interior map legibility ($r=.50$, $p<.01$).

Features frequently mentioned by workers were the teller area, the reception desk, open offices, conference rooms, the main entrance and lobby, plants, offices in the lobby and vaults. The worker's immediate areas of operation were drawn first and mentioned first. Physical features were drawn in afterwords.

Hypothesis 2

> Regardless of familiarity type, subjects with higher legibility scores will also have higher building preference scores. This implies that as familiarity increases so does the respondents legibility as well as their preference.

Analysis of variance was used to test hypothesis 2 to

determine if respondents with greater building legibility had higher building preference. Pearson product-moment coefficient of correlation was used to see if increased legibility due to familiarity resulted in increased preference for the building.

Positive and negative evaluations of the building revealed many interesting findings which are shown in Table 10 and 11. Half the respondents thought the building somewhat attractive (3) when ranked on the attractiveness dimension. The attractiveness dimension utilized a five point scale which ranged from the building being very attractive (1) to being very unattractive (5). Table 10 shows there is a difference on exterior building attractiveness among the three familiarity types. Table 11 shows that the workers who are more familiar or use the building also rate the building as more attractive than those less familiar with the building.

Table 5

Analysis of Variance for Exterior Building Attractiveness by Familiarity Type

Source of Variance	df	Mean Square	F	P
Between Groups	2	4.29	5.56	.0004
Within Groups	38	.44		
Total	40			

Table 6

T-Test for Exterior Building Attractiveness by Familiarity Type

Type Familiarity	Mean	S.D.	Compared To	T-Score	P Value
Worker	1.46	.18	User	-3.12	.005
User	2.21	.17	Passerby	1.56	.166
Passerby	2.57	.17	Worker	-4.62	.0001

Significant relationships existed between legibility and building preference. The data supporting hypothesis 2, those who thought the building unattractive had the lowest legibility

and also used the building the least. For all subjects, it was found that increased legibility resulted in increased preference for the building ($r=.386$, $p<.018$). Respondents with greater familiarity and legibility gave building attractiveness a higher rating.

Hypothesis 3

Regardless of familiarity type, subjects' scores on interior legibility will be greater than scores on exterior legibility.

Analysis of variance was used to test hypothesis 3, to determine if subjects' scores on interior legibility would be greater than their scores on exterior legibility.

It was expected that the interior would be more legible than the exterior owing to the comparative frequency of interaction with interior features. For example, sitting in a lounge or walking to the teller area would result in greater interior feature legibility. This interior legibility due to familiarity differs slightly from the legibility resulting from exterior familiarity. The respondent could not interact with the exterior of the building beyond just looking at it. However, the data in Table 7 show that there is a difference between exterior and interior building legibility. Table 8 shows that the exterior of the building was more legible than the interior.

Table 7

Analysis of Variance for Inside/Outside Building Legibility by Familiarity Type

Source of Variance	df	Mean Square	F	P
Between Groups	4	20971.52	17.15	.0001
Within Groups	57	1222.80		
Total	61			

Table 8

T-Test for Inside/Outside Building Legibility by Familiarity Type

Type Familiarity	Mean	S.D.	Compared To	T-Score	P Value
Worker/Outside	122.60	10.54	User/Inside	-7.85	.0002
Worker/Inside	179.63	9.76	Worker/Outside	3.97	.0001
User/Outside	152.82	10.09	Worker/Inside	-1.91	.05
User/Inside	237.25	10.09	User/Outside	5.92	.0001

Hypothesis 4

Subjects with high scores of field-independence will also have high scores on legibility.

Personal differences in legibility were assessed by pearson product-moment coefficient correlations (e.g., age, income, occupational prestige) and t-tests (e.g., sex, marital status). A pearson product-moment correlation was used to test hypothesis 4, which asserted that subjects with high scores on the Embedded Figures Test (field-independent) would also have high scores on legibility.

More field-dependent subjects are expected to have low legibility because such an individual would have trouble drawing the building structure since the elements are experienced as fused. A field-dependent's perception is dominated by the building structure. He would have more trouble picking out the building elements than a person whose style of perceptual disembedding is field-independent. In contrast, a field-independent person was expected to have greater legibility because his style of perceptual disembedding makes it easy for him to pick out building elements and combine them to form the building structure. The style of perceptual disembedding a person brings to the building (either field-dependent or field-independent) is utilized when a person looks at a building.

The data in Table 9 do not support the hypothesis that subjects with high scores of field-independence will also have high scores of legibility. Field-dependent respondents did not differ from their field-independent counterparts in their ability

to draw or recall building elements as a function of perceptual disembedding. Therefore, building image illegibility is not the result of compentence at perceptual disembedding. Nor, for that matter, is building image legibility.

Also, no significant relationships were found between outside building legibility and any of the personal characteristics tested. Males and married couples did not have greater legibility than females (t=-.075, df=36, $p<.939$) and single respondents (t=1.06, df=36, $p<.298$). Nor did legibility increase with age. In this study the personal characteristics of style of perceptual disembedding, sex, age, and occupational prestige played no role in building perception as it relates to legibility in this study.

Table 9

Pearson Product-Moment Correlations between Exterior Building Legibility and Personal Characteristics of the Individual

Personal Characteristics	Legibility	Significance
Embedded Figures Test	.113	.504
Years Live in Manhattan	-.028	.867
Occupational Prestige	-.144	.392
Education	.144	.392
Income	.192	.330
Age	.012	.940

CHAPTER IV

CONCLUSION

Discussion

By concentrating on people's perception of buildings, manifest in their preferences and legibility, this study has revealed useful insights into building cognition and perception.

How do people form impressions of buildings? Can this process be understood well enough for designers to predict the psychological effects of their work? This thesis has addressed these questions by determining how an individual's cognitive representation of a building is related to his patterns of looking, and how these patterns in turn are related to the form of a building.

Significant agreement was expected among subjects in their selection of building elements. The physical characteristics of the Union National Bank most frequently recalled by all respondents were shape, size, glass, first floor elements, and landscaping. Infrequently mentioned building elements included the building material, the columns, and the style of design.

These results are similiar to those of Appleyard (1976) and Lynch (1960), who found that the elements people recalled most were the contour (the sharpness of the boundary which defines a building from its background), the size and the shape of buildings. However, the landscaping was frequently mentioned in the present study, while Appleyard considered it but a subtle design feature. A possible explanation is an increase in the societal emphasis placed on nature and ecology at the present time (Kaplan, 1978; Steintz, 1968). S. Kaplan conducted several studies to determine whether pictures of everyday natural and built environments were differentially perceived. He found that people vastly preferred the natural environment with its grassy areas and trees. In fact,

in one study, the only urban slide enjoyed as much as the nature scenes was one depicting a few trees in a downtown part surrounded by tall buildings. These studies by S. Kaplan demonstrated that nature or landscaping is an important characteristic of preferred scenes in pictures.

Features frequently mentioned by workers were the teller area, the reception desk, open offices, conference rooms, the main entrance and lobby, plants, offices in the lobby and vaults. These results are indirectly related to many other studies done on the city scale. City landmarks which were distinctive in size, color or form were frequently used and more easily remembered. Arcedolo (1975) found that landmarks in interior spaces also help orient people. Furthermore, those building designs are more easily remembered which have visual differentiation among the various interior parts (Weisman, 1979). For example, the teller area and the reception desk were frequently mentioned owing to their everyday use. They may also serve as landmarks.

The data supports hypothesis 1 that subjects more familiar with the building would have higher legibility. However, familiarity with the building did not change which building elements were recalled. For example, all respondents recalled exactly the same physical characteristics such as the size of the building and windows, and the landscaping. However, sketches by users and passersby were less detailed and more illegible than those done by workers. The user and passerby groups omitted, mislocated, and distorted more exterior building elements and their drawings were less legible than the workers. This may be due to unpleasant experiences occasioned by confrontation with totally unfamiliar building elements. The ability to identify or categorize a building structure and its elements should enhance its preference value. This may be why the building was less clear and more illegible to those respondents who used it less. Legibility not only plays an important role in orienting the individual to the built environment; it also affects his emotions and preferences.

Familiarity with the building resulted in greater preference.

Respondents more familiar with the building tended to spend more time there. These respondents had feelings of attachment to the building or simply liked it more. Acking and Sorte (1973) and Herzog, et al.(1976) found that familiarity enhanced preferences for scenes in both the built and natural environments. This was a result of the affection people had for the familiar environment. Acking and Sorte defined affection as the feeling of the old and genuine. It would be interesting to determine if a customer's attachment to the building would keep him from changing banks.

Several flaws occurred in the analysis because of the way familiarity was measured. The relationship between legibility and the amount of setting exploration must also be examined. Familiarity is not fully explained by the person's length of use of the building. For example, behavioral mapping could have been used to determine the person's actual use of the buildings interior. From this more inferences could have been drawn concerning legibility. A number of questions could have been answered, such as: Does greater legibility result from a person's increased use of a building's interior? Why is one area of the interior or exterior more legible than another? Why does a person explore one area of a building and ignore others?

The data also support Hypothesis 2 that subjects with higher legibility will have higher preference ratings for the building. The respondents' experience of personal satisfaction and security in the building may have borne out this hypothesis. But, again, preference was only measured as how attractive the respondent thought the building was. Preference should have been more broadly defined in an effort to examine its component parts beyond mere attractiveness.

The data do not support Hypothesis 3. Contary to what was predicted, the exterior of the building was more legible than the interior. Several possible explanations exist to account for these results. For instance, a comparision of the building's exterior design simplicity and its interior complexity could explain this apparent anomaly. Complexity is defined as the

number and variety of interior features and outside building elements. The furniture of the interior was scattered all about the floor area, and was of several different shapes. The vaults were the same size as the open offices, and were quite difficult to find. Contrast this with the outside, where the basic shape was a rectangle on a square with glass windows. Simply stated, the interior had more features, and was more intricate than the exterior. A second possibility is that the measurement technique used for this experiment contributed to greater exterior legibility. Because the interior was more complex, it simply contained many more features to recall and sketch than did the building's exterior. For instance, the most accurate exterior map contained 22 building elements. The interior had actually contained almost twice that amount (39). The greater number of interior features resulted in a higher legibility score (i.e., worse legibility). The greater the number of elements, the greater the margin of error. The author concludes that comparisions between inside and outside building legibility cannot be made with any degree of confidence using this technique.

Finally, exterior legibility may be greater because the building is so distinct from other buildings in town. Past experiences with other banks may have also resulted in a more accurate image of this bank.

However, an informal recording of observations made while the respondent drew his sketch revealed an interesting phenomenon. Many respondents drew and described exterior building elements by relating them to some interior feature or activity. For example, while drawing the sketch, many respondents mentioned elements by their function--conference room windows, office windows, the penthouse with the old lady living there, etc. Therefore, it may be assumed that way-finding behavior and the learning of building elements may be enhanced by designing the building's exterior to give hints of internal structure and function. This might also be a way for an architect to create a more legible building.

The appearance of the bank's physical building characteristics

combined with the respondent's personal characteristics produces the bank's building image, which in turn affects future behavior and images in similiar buildings. Personal characteristics influence how the individual interprets what he sees in the bank and this eventually becomes part of his image of that building. Those characteristics which represent an individual's activities, participation or involvement in a building have the greatest influence on the development of building images. In other words, the individual's perception of and actions in a building are influenced by past experiences in similiar buildings. In this experiment several characteristics demonstrating this influence were tested, such as urban/rural background and familiarity.

Building images contain many elements, the meaning of which are defined by function, past experience or way-finding relevance. No relationship was established between any personal characteristics and legibility in this study. As an example, field-independent respondents did not have higher legibility scores than field-dependent subjects. However, the personal characteristics domain was not adequately represented by using a correlational design. This type of research did not manipulate the personal characteristics of the subjects as the subjects were not selected at random.

A common practice in architectural psychology today is to downgrade the importance of physical planning and the physical environment. This is a reaction of social scientists against the environmental determinism characteristic in the past of the planning and design professions. Studies such as this thesis are not intended to undermine the work of the designer, but to demonstrate the effects of the built environment on human behavior. This should encourage the architect to be more sociably accountable. The object of this and other studies is to make the architect aware of his assumptions about human behavior when he constructs a building. A vital key to this accountability is to increase the architect's power to predict the social, political and economic consequences of his building.

The techniques used in this thesis can not be used only to

find out what people want in a building, but also what they expect from it, or for what they are willing to accept. Cognitive mapping in this study provides a pratical technique for capturing visual cognitive constructs on how people use information. For example, the data in this study was acquired by asking the subject to draw a map of the building being studied, and to question the respondent about the various details of the map. However, the author believes that the cognitive map turned out to be an auxiliary rather than a central measure in the study. The most useful information was obtained from what was asked about the maps rather than from the maps themselves. For example, interpreting area maps has shown that people with limited movement-often poor people-have detailed knowledge of their immediate neighborhood, but an ill-formed image of the city they live in as a whole (Orleans, 1973). For designers this means if they want to control the behavioral side effects of places they design they must understand the different ways that various groups see them. For instance, in a hospital, workers estimated a path outside the building to be twice as long as a path inside the building, although the two were measurably the same distance (Downs and Stea, 1973). If designers know how people see and use their environment, they can make better design decisions. In the hospital example mentioned above, if the designer knew that outside paths are seen as longer than inside ones, he might have made different decisions about enclosing them in order to provide alternative ways to get around.

The information gained by using cognitive mapping may serve as a foundation upon which to build educated, informed solutions to design problems. It will give the designer a sound empirical basis for design decisions.

This is a tangential implication of this research, but one of importance. The real power of this study lies in its potential to provide a body of knowledge for understanding of relationships between human behavior and the built environment.

Limitations

This study was limited in several ways. To begin with, the sample was very small. Only 41 people were interviewed. The sample size resulted from the method of inquiry, which required lengthy interviews and extensive analysis. Also, since a random sample was not used in this study, the author does not know whether these findings apply to other populations. Clearly, a retest involving a larger sample is needed. This would, however, require more rapid and precise methods. It is impossible to generate a representative public image of the Union National Bank from such a small sample.

Researchers depend on individual, hand-drawn sketch maps to indicate the cognitive processes involved in the perception of the built environment. However, a fundamental question remains: Are hand-drawn sketches, models and photographs valid representations of an existing building. To determine if the exterior sketch or interior map was a valid representation of the existing building, the most legible sketch and map were compared to absolute legibility (the Index of Legibility for the existing building). This was accomplished by using the existing building as the most correct sketch and map and determining the accuracy of the respondents' images by comparing them to the building itself.

Relative legibility was determined by choosing the most accurate sketch or map submitted by the 41 subjects and using it as the standard by which to score omission, mislocation and distortion. A few features were omitted on even the most accurate person's interior map--the tile floor, the glass office windows in the lobby and in the doors, and a sign on the floor in front of the interior bank entrance. Typewriters and sculptures were also excluded. Only the furniture was included. There were also a few elements missing in the most accurate sketch--canopy top and fake windows, for example. Absolute legibility was defined as the existing building elements themselves. A t-test was computed between relative and absolute building legibility for the interior (t=.494, df=4, $p<.10$) and the exterior (t=.760, df=4, $p<.10$). No significant differences were found. The author

concludes that people draw and maintain mental maps which are very close in their representations to existing building elements. Other researchers have reached similiar conclusions. For example, Howard, Chase and Rothman (1973) and Rothwell (1976) found good reliability and validity in hand-drawn maps of small spaces. Dirks and Neisser (1977) compared the memory of adults and children and found no differences between photographs and models. Results show, then, that the technique of cognitive mapping used in this research is reliable. This study also supports Appleyard's suggestion that graphic ability in adults may not be as great a problem as once was assumed by researchers.

Stephen and Rachel Kaplan's technique for studying environmental preference is preferable to cognitive mapping. The Kaplans collected a large number of photographs and classify the scenes depicted according to two sources of information: legibility (i.e., coherence, texture, identifiability and spaciousness) and information (i.e., complexity and mystery). Using this method, they identified elements in each scene which can be classified in these two categories. This is not only quicker than cognitive mapping, but more information can be obtained from each setting than was possible with the method used in this study. The information derived is also more helpful to architects and planners. Future research may yet reveal that photographs are more reliable and valid than hand-drawn maps.

A final limitation concerned the way legibility was operationally defined in this experiment. A legible building is one in which building elements can be recognized and organized into a coherent pattern. This definition should be broadened to include the setting attributes which comprise legibility--complexity, coherence, mystery, etc. Questions need to be addressed concerning the combination of attributes resulting in a legible image. Which attributes comprise a building style? Does less complexity result in greater legibility? In this study, legibility was defined in functional terms, ignoring aesthetics or the buidling appearance. Everyone wants the emotional satisfaction which comes from making sense out of a building.

However, Kaplan asserts that the appearance of a building is also very important.

Perhaps this study's most significant finding is that this research further demonstrates that an individual's perceptual and cognitive behavior can be predicted by techniques readily available to designers and planners.

Implications for Future Research and Action

Frequent assessments of buildings should be conducted by architects to determine improvements in design. Whether such assessments focus on urban neighborhoods, residential design, building cognition or orientation behavior they should provide useful information to architects and to those involved in public policy decisions. The key is to design buildings with human beings in mind. Decisions are made every day concerning these problems without benefit of information on man-environment interactions. The quality of these decisions could be improved by supplying better information dealing with how people perceive and react to their environment. The study's methods may be used to evaluate existing buildings or to design new ones. However, as with most planning projects, many more facts were needed than could be obtained in one interview. This study devoted more attention to perception than to attitudes and use patterns. Future research should specifically concentrate on three aspects of building behavior--perceptions, attitudes, and use patterns. These should be surveyed and interrelated in a systematic way.

Clearly, benefit would be derived from a better understanding of peoples' attitudes toward buildings, particularly with regard to complexity, legibility, building style (i.e., colonial, victorian or modern). Although more difficult to measure, vital comprehension must also be reached concerning the individual's need for stability, security, and environmental adaptation.

A final issue requiring further investigation deals with how a person translates experience in other buildings to the imaging of a building new to him. For example, when a person visits a

new shopping mall, he has preconceived expectations concerning what will occur and how the building will look. How does the researcher seperate past experience from present anticipations in such a case (see Appleyard, 1970). It is a question worthy of research

APPENDIX

DATA

TABLE 1

Percent Distribution of Omitted Exterior Building Elements by Familiarity Type

Element	Familiarity Type: Worker N=11	%	User N=13	%	Passerby N=14	%	Total N=38	%
Parking	5	13.16	10	26.32	8	21.05	23	60.53
Sidewalk	6	15.79	8	21.05	13	34.21	27	71.05
Planter	10	26.32	13	34.21	14	36.84	37	97.37
Landscaping	1	2.63	7	18.42	9	23.68	17	44.74
First Floor	0	0.00	4	10.53	4	10.53	8	21.05
Conference Windows	1	2.63	7	18.42	7	18.42	15	39.47
Office Windows	3	7.89	6	15.71	5	13.16	14	36.48
Steps	1	2.63	9	23.68	14	36.84	24	63.16
Main Entrance	2	5.26	3	7.89	7	18.42	12	31.58
Night Deposit	11	28.95	11	28.95	14	36.48	36	94.97
Automatic Teller	0	0.00	5	13.16	13	34.21	18	47.37
Doors	4	10.53	10	26.32	8	21.05	22	57.80
Sign	4	10.53	12	31.58	10	26.32	26	68.42
Canopy Columns	5	13.16	9	23.68	12	31.58	26	68.42
Canopy	0	0.00	4	10.53	7	18.42	11	28.95
Tower	0	0.00	2	5.26	2	5.26	4	10.53
Tower Windows	1	2.63	3	7.89	0	0.00	4	10.53
Tower Window Frames	8	21.05	12	31.58	13	34.21	33	86.84
Balcony	2	5.26	7	18.42	10	26.32	19	50.00
Balcony Plants	10	26.32	12	31.58	14	36.84	36	94.97
Balcony Rail	10	26.32	13	34.21	14	36.84	37	97.37
Elevator Shaft	10	26.32	13	34.21	13	34.21	36	94.74
Building Material	11	28.95	9	23.68	13	34.21	33	86.84
White Color	11	28.95	12	31.58	10	26.32	33	86.84

Table 2

T-Test for Exterior Building Omission Scores by Familiarity Type

Type Familiarity	Mean	S.D.	Compared To	T-Score	P Value
Worker	4.69	.69	User	3.66	.05
User	8.50	.79	Passerby	-1.45	.197
Passerby	9.85	.50	Worker	6.14	.0001

Table 3

T-Test for Exterior Building Mislocation Scores by Familiarity Type

Type Familiarity	Mean	S.D.	Compared To	T-Score	P Value
Worker	32.54	1.31	User	6.59	.0001
User	44.23	1.21	Passerby	- .80	.431
Passerby	45.57	1.16	Worker	7.48	.0001

Table 4

T-Test for Exterior Building Distortion Scores by Familiarity Type

Type Familiarity	Mean	S.D.	Compared To	T-Score	P Value
Worker	84.50	8.98	User	-1.27	.212
User	100.32	8.59	Passerby	- .75	.455
Passerby	109.16	7.96	Worker	2.05	.047

Table 5

Percent Distribution of Omitted Interior Building Elements by Familiarity Type

Element	Familiarity Type: Worker N=13	%	User N=14	%	Total N=27	%
Entrance	7	25.93	9	33.33	16	59.26
Doors	6	22.22	5	18.52	11	40.74
Lobby	4	14.81	6	22.22	10	33.33
Presidents Office	0	0.00	11	40.74	11	40.74
Conference Rooms	1	3.70	8	29.63	9	33.33
Open Offices	0	0.00	1	3.70	1	3.70
Real Estate Vault	3	11.11	13	40.15	16	59.26
Safety Deposit Vault	4	14.81	10	37.04	14	51.85
Counter Safety Deposit Vault	3	11.11	11	40.74	14	51.85
Booths Safety Deposit Vault	9	33.33	14	51.81	23	85.19
Loan Vault	1	3.70	8	29.63	9	33.33
Counter Loan Vault	8	29.63	12	44.44	20	74.07
Teller Area	0	0.00	1	3.70	1	3.70
Stand Up Tellers	6	22.22	11	40.74	17	62.96
Sit Down Tellers	1	3.70	9	33.33	10	37.04
Teller Area Doors	7	25.93	14	51.85	21	77.78
Teller Area Wall	9	33.33	14	51.85	23	85.19
Teller Area Storage	9	33.33	14	51.85	23	85.19
Teller Area Stairs	6	22.22	13	48.15	19	70.37
Teller Area Elevator	8	29.63	14	51.85	22	81.48
Plants	5	18.52	9	33.33	14	51.85
Receptionist	1	3.70	1	3.70	2	7.41
Stock Office	6	22.22	8	29.63	14	51.85
Real Estate Office	4	14.81	8	29.63	12	44.44
Elevators in Lobby	6	22.22	5	18.59	11	40.74
South Entrance	6	22.22	9	33.33	15	55.56
Secretaries	2	7.41	4	14.81	6	22.22
Presidents Bathroom	12	44.44	14	51.85	26	96.30
Office Bathroom	11	40.74	14	51.85	25	92.59
Janitors Storage	11	40.74	14	51.85	25	92.59
Sliding Bank Doors	9	33.33	11	40.74	20	74.07
Carpet	12	44.44	13	48.15	25	92.59
Conference Furniture	12	44.44	14	51.85	26	96.30
South Stairs	7	25.93	13	48.15	20	74.07
Information Booth	12	44.44	11	40.74	23	85.19
Column-Counters	10	37.04	9	33.33	19	70.37
Radiators	12	44.44	14	51.85	26	96.30
Drinking Fountains	11	40.74	13	48.15	24	88.98
Lounge	2	7.41	8	29.63	10	37.04

Table 5 (Continued)

Percent Distribution of Omitted Interior Building Elements by Familiarity Type

Element	Familiarity Type: Worker N=13	%	User N=14	%	Total N=27	%
Outline of Entire Building	7	25.93	5	18.52	12	44.44
South Doors	9	33.33	13	48.15	22	81.48
Automatic Teller	12	44.44	12	44.44	24	88.89
Directory on Wall	12	44.44	14	51.85	26	96.30
Walnut Bank Walls	11	40.74	14	51.85	25	92.59
Pictures in Bank	13	48.15	12	44.44	25	92.59

QUESTIONNAIRE

A. FRAME OF REFERENCE

INTERVIEW CHECK POINT After consent form is signed record interview number, date and time of interview.

A1) Interview Number_____

A2) Date of Interview_____

A3) Time of Interview_____(Time of Day) Ended_____
am/pm

INTERVIEW CHECK POINT Record time of day that interview begins and when interview is completed.

A4) (Skip for workers go to B1) Considering all the main office banks your familiar with; how would you describe these main office banks by the way they look outside such as their shape, height, what are the windows like, etc? (Anything else)

_____

_____

_____

B. SKETCH

B1) (Hand respondent paper for sketch overlay 1 and turn tape recorder on) In a moment you will be asked to draw a picture of the main bank office of Union National Bank. But first place a dot on the paper where you are standing looking at the bank.

Close your eyes for a moment and stand at this point in your mind; and visualize the physical features of the building or what the outside of the building looks like such as its walls, its color, how high it is, its shape or what it is made of, etc. Now think of where the windows are placed, and how all these physical features are put together in the building. Remember this will set the balance for the entire building. You can open your eyes now.

Now I would like you to draw a sketch of the outside of the building you were just thinking of. Please talk outloud about what you are drawing. (Interviewer takes notes on the sequence the sketch is drawn and the physical features mentioned. If having trouble ask person what are you drawing now or repeat please talk outloud about what you are drawing. Ask anything else)

B2) (Overlay 2) Now look at the sketch you have just drawn which is your first impression. Do you have anything you would like to add or any parts of the sketch you would redue? For example, you may have omitted something, the door may be out of proportion or the building might have two or more stories, etc. (Anything else, end tape)

B3) Could you describe the physical features you have just drawn in more detail? (Interviewer ask respondent about his or her physical features drawn earlier. Anything else)

B4) Not only do people have mental pictures of the outside of a building, but they have feelings about the building as a whole and those physical features you have talked about. For example, the building may be good overall but the paint is ugly. Tell me about your feelings. (Interviewer ask respondent about his or her physical features drawn earlier. Anything else)

B5) (Overlay 2) Is there anything you have just drawn that you are uncertain about? (Interviewer puts question marks and notes on the overlay. Anything else)

B6) The physical features of the outside of the building you have drawn may be large or small, but tell me those which you think standout? (Anything else)

_____

_____

B7) What physical features do you like most about the building? (Anything else)

_____

_____

B8) What physical features do you like least about the building? (Anything else)

_____

_____

B9) If you had to describe the main office of Union National Bank to someone what physical features would you name so that someone can recognize it? (Give example of physical features such as the building may have a strange shape if needed. Anything else)

_____

_____

C. FAMILIARITY

C1) (Skip for workers go to C3) Have you ever been in this building?

☐ Yes ☐ No

If so about how often do you use it?

- [ ] Almost every day
- [ ] A few times a week
- [ ] Once a week
- [ ] A few times a month
- [ ] Once a month
- [ ] A few times a year

C2) About how often do you pass it or see it?

- [ ] Almost every day
- [ ] A few times a week
- [ ] Once a week
- [ ] A few times a month
- [ ] Once a month
- [ ] A few times a year

C3) (Skip for users and passersby go to D1) How long have you worked in this building?_____Years

D. INTERNAL STRUCTURE

D1) Could you tell me what kinds of activities go on inside this building on a regular basis? (Anything else)

D2) (Skip for passerby group go to E1. Hand respondent paper and start tape) I'd like you to draw a map of the inside of the first floor of the bank on the paper I have just handed you. Please talk outloud about what you are drawing. (Interviewer takes notes on the sequence the sketch is drawn and the physical features mentioned. Anything else)

Could you describe what you have just drawn in more detail. (Interviewer ask respondent about his or her features drawn. Turn tape recorder off)

How certain are you?

- [ ] Very certain
- [ ] Certain
- [ ] Neutral
- [ ] Uncertain
- [ ] Very uncertain

At what point do you enter the building? Put an arrow in that place on the map.

Do you have any particular emotional feelings about the map? (Anything else)

_____

_____

On the map you have just drawn, tell me those features that you think standout? (Anything else)

Would you draw on the floor plan the direction of north?

E. PREFERENCES

E1) (Skip for workers go to E3) Does the way the main office of Union National Bank look outside have anything to do with your decision to use it?

☐ Yes ☐ No

What is it about its appearance?

_____

_____

E2) How would you rate the attractiveness of the outside of the building?

☐ Very attractive
☐ Attractive
☐ Neutral
☐ Unattractive
☐ Very unattractive

E3) (Skip for passersby go to F1) Considering everything outside and inside of the building, how much do you like the building?

☐ Very much
☐ Somewhat
☐ Neutral
☐ A little
☐ Not much at all

F. NAVIGATIONAL EXPERIENCE/EMBEDDED FIGURES TEST

F1) I am going to show you a series of colored designs. Each time I show you one, I want you to describe it in any way you wish. I will then show you a simple form which is contained in the larger design. You will then be given the larger design again, and your job will be to locate the simple form in it. Let us go through a practice trail to show you how it is done. (Give the practice run)

This is how we will proceed on all trails. In every case the simple form will be present in the larger design. It will always be in the upright position, so don't turn the card around. There may be several of the simple forms in the same design, but you are to find and trace only one. Work as quickly as you possibly can, since I will be timing you, but be sure that the form you find is exactly the same as the orginal simple form in shape, size and proportions. As soon as you have found the form, tell me at once and then start to trace it. If you ever forget what the simple form looks like, you may ask to see it again, and you may do so as often as you like. Are there any questions. (Present the first complex figure (1-A) and proceed)

RESPONSE RECORD

Form administered: A(Items 1-12)

Practice item: Solution time_____

Item	Comments	Time data	Solution time (In seconds)
1-A			
2-B			
3-C			
4-D			
5-E			
6-A			
7-F			
8-E			
9-C			
10-G			
11-A			
12-H			

Total time (In seconds)_____

G. DEMOGRAPHY

I would like to ask you a few background questions about yourself if you don't mind.

G1) Sex: ☐ Male ☐ Female

G2) Race: ☐ White ☐ Black ☐ Other_____
Specify

G3) How old are you?_____Years

When were you born_____
Month Day Year

G4) What religion are you?

☐ Protestant ☐ Catholic ☐ Jewish ☐ Other_____
Specify

G5) Could you check the box that shows your total household family income for 1980 before taxes?

☐ Less than $1,000
☐ $1,000-4,999
☐ $5,000-9,999
☐ $10,000-19,999
☐ $20,000-24,999
☐ $25,000-29,999
☐ $30,000-34,999
☐ $35,000+

G6) What was the highest grade of school completed?

00	1	2	3	4	5	6	7	8	9	10	11	12

Grades of School

13	14	15	16	17+

College

G7) What kind of work have you done most of your life?

_____
Occupation title or duties

G8) Did you ever attend any business or trade school?

☐ Yes ☐ No (If no go to G10)

G9) What kind of business or trade school? _____
Title or duties

G10) Have you ever been married? ☐ Yes ☐ No

Are you presently:
- ☐ Married
- ☐ Widowed
- ☐ Separated
- ☐ Divorced
- ☐ Other _____
  Specify

G11) Where have you lived:

a) When you were growing up (1-18 years old)
b) Young adulthood (19-25 years old)
c) Adulthood (26-35 years old)
d) Middle adulthood (36-48 years old)
e) Late adulthood (49+)

a	b	c	d	e	
☐	☐	☐	☐	☐	Small town (Less than 2,500)
☐	☐	☐	☐	☐	Medium sized town Less than 50,000)
☐	☐	☐	☐	☐	City (Less than 500,000)
☐	☐	☐	☐	☐	Large Metropolitan area (500,000+)

G12) How many years have you lived in Manhattan?

G13) Where did you live before you moved to Manhattan? _____
City/State

G14) How many years did you live at this place?

This concludes the interview. I would now be happy to answer any questions you may have concerning the interview or the project.

INTERVIEW CHECK POINT Record time at the end of interview and enter this value in the appropriate box in question A3.

REFERENCES

Acking, C. A. and Sorte, G. J. How do we verbalize what we see. Landscape Architecture, 1973, 64, 470-475.

Acredolo, L. P., Pick, H. L. and Olsen, M. Environmental differentiation and familiarity as determinants of children's memory for spatial location. Developmental Psychology, 1975, 11, 495-501.

Appleyard, D. A. Planning a pluralistic city. Cambridge, Mass: MIT Press, 1976.

Appleyard, D. A. Styles and methods of structuring a city. Environment and Behavior, 1969, 2, 100-116.

Appleyard, D. A. Why buildings are known. Environment and Behavior, 1969, 1, 131-156.

Anderson, J. and Tindal, M. The concept of home range: New data for the study of territorial behavior. Unpublished paper, Department of Geography, Clark University, 1970.

Banerjee, T. K. Urban experience and the development of city image: A study in environmental perception and learning. Unpublished doctoral dissertation, MIT, 1971.

Beck, R. J. and Wood, D. Cognitive transformation of information from urban geographic fields to mental maps. Environment and Behavior, 1976, 8, 199-238.

Blaut, J. M. and Stea, D. Mapping at the age of three. Journal of Geography, 1974, 73, 5-9.

Bruner, J. Perceptual readiness. Psychological Review, 1957, 64, 123-152.

Canter, D. Attitudes and perception in architecture. Architectural Association Quarterly, 1961, 1, 24-31.

Carr, S. The city of the mind. In W. R. Ewald, Jr.(Ed.). Environment and man: The next fifty years. Bloomington, In.: Indiana University Press, 1967.

Carr, S. and Schissler, D. The city as a trip: Perceptual selection and memory in the view from the road. Environment and Behavior, 1969, 1, 7-36.

Collins, J. B. Perceptual dimensions of architectural space validated against behavioral criteria. Unpublished doctoral dissertation, University of Utah, 1969.

DeJonge, D. Images of urban areas: Their structure and psychological foundations. Journal of the American Institute of Planners, 1962, 28, 266-276.

Downs, R. M. and Stea, D. Image and Environment: Cognitive mapping and spatial behavior. Chicago: Aldine Publishing Company, 1973.

Dirks, J. and Neisser, U. Memory for objects in real scenes: The development of recognition and recall. Journal of Experimental Child Psychology, 1977, 23, 315-328.

Evans, G. W. Environmental cognition. Psychological Bulletin, 1980, 88, 259-287.

Everitt, J. and Cadwallader, M. The home area concept in urban analysis. In W. J. Mitchell (Ed.), Proceedings of the Third Annual Environmental Design Research Association Conference. Los Angles: University of California, 1972.

Francescato, D. and Mebane, W. How citizens view two great cities: Milan and Rome. In R. M. Downs and D. Stea (Eds.), Image and Environment: Cognitive mapping and spatial behavior. Chicago: Aldine Publishing Company, 1973.

Gittins, J. S. Forming impressions of an unfamiliar city: A comparative study of aesthetic and scientific knowing. Unpublished M.A. thesis, Clark University, 1969.

Golledge, R. G. Methods and methodological issues in environmental cognition research. In G. Moore and Golledge (Eds.), Environmental knowing. Stroudsburg, Pa.: Dowden, Hutchinson and Ross, 1970.

Golledge, R. G. and Zannars, G. The perception of urban structures: An experimental approach. In J. Archea and C. Eastman (Eds.), Proceedings of the Second Annual Environmental Design Research Association Conference. Stroudsburg, Pa.: Dowden, Hutchinson and Ross, 1970.

Goodchild, B. Class differences in environmental perception. Urban Studies, 1974, 11, 59-79.

Gould, P. R. On mental maps (Discussion Paper No. 9). Michigan Inter-University Community of Mathematical Geographers, Ann Arbor Michigan, 1966.

Harrison, J. and Howard, W. The role of meaning in the urban image. Environment and Behavior, 1972, 4, 389-411.

Hart, R. A. and Moore, G. T. The development of spatial cognition: A review. In R. M. Downs and D. Stea (Eds.), Image and environment: Cognitive mapping and spatial behavior. Chicago: Aldine Publishing Company, 1973.

Heft, H. The role of environmental features in route learning: Two exploratory studies of way-finding. Environmental Psychology and Nonverbal Behavior, 1979, 3, 172-185.

Herzog, T. R., Kaplan, S. and Kaplan, R. The prediction of preference for familiar urban places. Environment and Behavior, 1976, 8, 627-645.

Hodge, R. W., Siegel, P. M. and Rossi, P. H. Occupational prestige in the United States 1925-1962. Journal of Sociology, 1964, 70, 290-292.

Holahan, C. J. Environment and behavior. New York: Plenum Press, 1978.

Howard, R. B., Chase, S. D. and Rothman, M. An analysis of four measures of cognitive maps. In W. Preiser (Ed.), Environmental Design Research (Vol. 1). Stroudsburg, Pa.: Dowden, Hutchinson and Ross, 1973.

Howell, R. W. A study of informal learning (Project 8-13-125). Washington, D. C., U.S. Department of Health, Education and Welfare, 1969.

Ittelson, W. H. Environmental perception and the urban experience. Environment and Behavior, 1978, 10, 193-213.

Ittelson, W. H. Environment and cognition. New York: Seminar Press, 1973.

Kaplan, R. The green experience. In R. and S. Kaplan (Eds.), Humanscape: Environments for people. Duxbury Press, 1978.

Kaplan, S. Adaptation, structure and knowledge. In G. T. Moore and R. G. Gooledge (Eds.), Environmental knowing. Stroudsburg, Pa.: Dowden, Hutchinson and Ross, 1976.

Kaplan, S. An informal model for the prediction of preference. In E. H. Zube, R. Brush and J. Fabos (Eds.), Landscape Assessment: Values, perceptions and resources. Stroudsburg, Pa.: Dowden, Hutchinson and Ross, 1975.

Kaplan, S. Cognitive maps in perception and thought. In R. M. Downs and D. Stea (Eds.), Image and Environment: Cognitive mapping and spatial behavior. Chicago: Aldine Press, 1973.

Kosslyn, S. M. and Pomerants, J. P. Imagery, propositions, and the form of internal representations. Cognitive Psychology, 1977, 9, 52-76.

Ladd, F. Black youths view their environment: Neighborhood maps. Journal of the American Institute of Planners, 1969, 35, 195-199.

Lansing, J. B. and Marans, R. W. Evaluation of neighborhoods. Journal of the American Institute of Planners, 1969, 35, 195-199.

Los Angeles Department of City Planning, The visual environment of Los Angeles. Los Angeles: Department of City Planning, 1971.

Lozano, E. E. Visual needs in the urban environment. Town Planning Review, 1974, 45, 351-374.

Lynch, K. The image of the city. Cambridge, Mass: MIT Press, 1960.

Maurer, R. and Baxter, J. C. Image of the neighborhood and city among Black, Anglo and Mexican-American children. Environment and Behavior, 1972, 4, 351-388.

Michelson, W. Most people don't want what architects want. Transaction. 1968, 5, 37-43.

Michelson, W. An empirical analysis of urban environmental preferences. Journal of the American Institute of Planners, 1966, 24, 355-360.

Milgram, S., Greenwald, J., Kessler, S., McKenna, W. and Walters, J. A psychological map of New York City. American Scientist, 1972, 60, 194-200.

Milgram, S. and Jodelet, D. Psychological maps of Paris. In H. M. Proshansky, W. Ittelson and L. Rivlin (Eds.), Environmental psychology (2nd Ed.). New York: Holt, Rinehart and Winston, 1976.

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

Norman and Rumelhart, D. Explorations in cognition. San Francisco: Freeman, 1976.

Orleans, P. Differential cognition of urban residents: Effects of social scale on mapping. In R. Downs and D. Stea (Eds.), Image and environment: cognitive mapping and spatial behavior. Chicago: Aldine Press, 1973.

Pezdek, K. and Evans, G. W. Cognitive mapping: Knowledge of real-world distance and location information. Journal of Experimental Psychology: Human Learning and Memory, 1980, 6 13-14.

Saarinen, T. F. Image of the Chicago Loop. Unpublished manuscript, 1964.

Sims, B. Perceptual readiness: The effects of environmental experience on ability to image unfamiliar settings. Man-Environment Systems, 1979, 9, 293-299.

Steinitz, C. Meaning and the congruence of urban form and activity. Journal of the American Institute of Planners, 1968, 34, 233-244.

Rapport, A. and Hawkes, R. The perception of urban complexity. Journal of the American Institute of Planners, 1970, 36, 106-111.

Rothwell, D. Cognitive mapping of the home environment. Doctoral dissertation, University of British Columbia, Canada, 1974.

Weisman, J. Way-finding in the built environment: A study of architectural legibility. Doctoral dissertation, University of Michigan, 1979.

Winkel, G. H., Malek, R. and Thiel, P. The role of personality differences in judgments of roadside quality. Environment and Behavior, 1969, 1, 199-223.

Witkin, H. A., Oltman, P. K., Raskin, E. and Karp, S. A. Manual for the embedded figures test. Consulting Psychologists Press, Inc.: Palo Alto, California, 1971.

Zajonc, R. B. Attitudinal effects of mere exposure. Journal of Personality and Social Psychology Monograph, 1968, 9 (2, Pt. 2).

Zannars, G. An analysis of cognitive and objective characteristics of the city center. Unpublished doctoral dissertation, Ohio State University, 1973.

DEVELOPMENT OF A BUILDING IMAGE: A STUDY IN BUILDING PERCEPTION AND LEGIBILITY

BY

GARY FRIEDMAN

B.S. Pennsylvania State University, 1979

AN ABSTRACT OF A MASTER'S THESIS

Submitted in partial fulfillment of the

requirements of the degree

MASTER OF ARCHITECTURE

Department of Architecture

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1981

ABSTRACT

This thesis examines the relationship between a building's physical characteristics and the mental images formed of those characteristics.

In the past decade, the study of mental images has been an area of active interest in urban perception. Studies have shown that people form mental maps of their physical surroundings based on personal background and experience. These studies have been limited to examinations of the physical structure of cities and the perception of that structure by inhabitants. This leaves questions unanswered concerning the perception of an individual building's physical characteristics.

A questionnaire was developed to measure cognitive judgments of the building in general, as well as the preferences, past experience, emotional feelings and the personal characteristics of the study's subjects. The survey design tested the relationship between physical building characteristics and such things as familiarity, personal characteristics (such as perceptual style) and legibility. The relationships among these variable domains were then examined. To test the influence of group differences, 41 subjects were selected. Respondents were chosen by a quota system to ensure sufficient numbers in each familiarity group and sex. Although randomization was not used in the selection of subjects, an effort was made to use a building whose employees, patrons and passersby represented a combination of personal characteristics.

It was found that the building's physical characteristics most frequently recalled by all respondents were shape, size, windows, first floor elements and landscaping. Increased use resulted in less omission, mislocation and distortion of building elements, and greater legibility. It was also found that increased legibility of the interior and exterior images resulted in increased use of and greater preference for the building.

Finally, field-independent subjects did not have greater legibility than their field-dependent counterparts on the Embedded Figures Test. No significant relationships were discovered between any personal characteristics and legibility.

Directions for future research were discussed, as were the potential applications of environmental cognition work to architecture.