THE ARCHITECTURAL LEARNING/THINKING/DESIGNING MODEL AND RADARSCOPE

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Bachelor of Architecture

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1971

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF ARCHITECTURE
May, 1973

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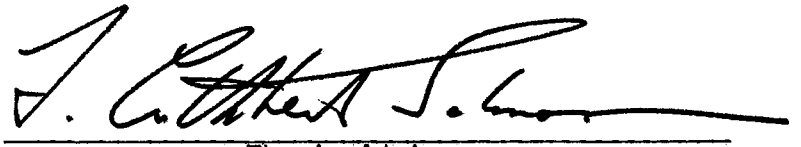
MODEL AND RADARSCOPE

Thesis Approved:



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PREFACE

This study is basically a continuation of my previous experiments and investigations in the field of architecture. I feel that I have the obligation to reveal some of my past efforts and experiences and hope that will explain my new approach for this thesis.

In 1970, during my fifth year in architecture, I engaged in a study on the investigation of the best conditions and situations which would facilitate my design process and quality. It was a series of self-administered experiments on the design process with respect to the variation of time, space, environment, and materials at the various levels of my physical, psychological and emotional conditions. The whole presentation was handled in a subjective, humorous approach parodied to the conventional scientific experiments report format.

In 1971, I did a fifth year undergraduate thesis on perceptions. All kinds of human perceptions were being investigated. The major literary reference materials included anthropology, biology, physiology, psychology, sociology, humanities, philosophy, ecology, and architecture. It was a perspective study of nature, man, and environment. An understanding of such relations hopefully would lead to our awareness and environmental perceptions. Through perceptions, one could discover perceptual creativity within and without. Using this as an orientation, one could project his knowledge and skills in architecture and other environmental endeavours. In the thesis, a number of questions related

to architecture were being presented and discussed, thus it intrigued me to continue onto further studies. The thesis was composed in a philosophical and poetic style.

The present thesis is a metamorphosis of my past works, and it will be written in an objective, academic, and humanistic way.

I wish to extend my appreciation first to my thesis adviser, Professor F. Cuthbert Salmon, for his guidance and assistance in preparing this thesis. Appreciation is also expressed to my other thesis committee members, Professor William George Chamberlain, of Architecture, and Dr. Larry Hochhaus, of Psychology, for their invaluable advices on this thesis.

Deep gratitude and love of mine are expressed to my parents, who have made everything possible for me.

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CHAPTER I

INTRODUCTION: THE ARCHITECTURAL DESIGN PROCESS

Architectural activity is initiated by the introduction of a particular problem by a client to an architect. Together client and architect explore and define the nature of the problem and establish in the light of needs and cost limitations the character and extent of the activities to be housed. Against the background of the social and technological setting, the architect assembles relevant data. He also establishes the nature of the sub-problems embedded in the architectural problem--both human and technological.

From his awareness of the building context in which the building work is to be carried out (materials, skills, knowledge, organization), he determines in principle the character of his materials and the assembly process he will use. He establishes the physical performance to be expected of his building fabric, and the standard of protection to be offered to human beings and goods within. He relates all of his thoughts and proposals to the dictates of the particular site where the work is to be carried out.

He establishes the nature of the place that is required in the light of the specified human and equipment needs; its plan, circulation requirements, volume, provision for further expansion. He ascertains that the requirements can be met within the cost limits proposed by

the client. He gauges, to the extent of the present knowledge, the psychological reactions that may be expected to the spaces he makes and amends their character as may be necessary to create a desired impression. He seeks to ensure that socially the building makes its purpose plain, and that in its formal arrangements the building is neither too anonymous nor too forceful for its location in social and physical space. If the building is to attempt to play a symbolic role in cultural space, then the architect works to ensure that symbol presented is worthy of the idea symbolized; being neither incoherent, nor too subdued, nor hysterical nor merely fashionable.

In order to solve this interlace of problems of building design and the design of spaces for human activities, the architect selects, or devises, an organizing principle around which the solution to the problem as a whole can grow. This organizing principle becomes the armature around which the structural skeleton and building fabric are developed and the expressive role of the work shaped. The size of the building and the effect of that size upon the observer is judged by the architect, and his assessment helps shape the detail and complexity of the formal resolution.

In testing the validity of his design proposals, the architect draws upon available knowledge of how people experience buildings. He analyzes the proposals for the building fabrics to ensure that they relate to the method of production and erection selected and to a wise and economical use of material. He assesses how successful he has been in so resolving all of the sub-problems of structure and building services so that they contribute to the total principle of the design. He seeks to establish that every design decision, however small,

reinforces the main design intentions. He makes a critical appraisal of the totality of his work as "an object" to be placed in the landscape. He is also concerned with the reactions from the public. Two main strands of information are brought together by the architect in his problem-solving--that of human needs and that of technology and its economic use. Once intentions and objectives are clarified, he has to determine how to approach design work; what pattern of thinking he has to adopt if he is to think and design architecturally.

Therefore, central to the study of architecture is the study of the process of architectural design, of design objectives, and of the whole structure of design thought.

CHAPTER II

THE BASIC CONSTITUENTS OF ARCHITECTURE

Architecture Theories

Architects are not all agreed as to what constitutes the design process in architecture. Nor are there any very widely accepted theories of architectural intention. On the other hand, there are some existing understandings of purpose in design works; and research, still in progress, has given insight into the elements necessary in design methods. Quite often, architects and designers do develop their own theories and philosophies of architecture and of work methods in order to proceed with their design works. Frank Lloyd Wright's "Organic Architecture," Le Corbusier's "The Modulor," and Mies van der Rohe's "Less is More" are just a few examples of the well known architectural theories.

It is important to stress that any theory of architectural design work is a semantic theory. Such a theory has to do with experienced order and meaning; direction and purpose; assessment and evaluation--all in non-scientific terms. Such a theory cannot satisfy those who seek an architectural theory framed along scientific lines, but then those who do so are bent upon a futile task. Thus, architecture has as much to do with science as with anything else, yet it is not a

truly scientific activity.

Many problems of architectural theory stem from a search for meaning and intention in design over and above the meeting of immediate human shelter needs. Architects as a group are thus prone to philosophize on the nature of man in society, on man's relationship to his built environment, and on the nature of his perception of the world in which he lives. Probably they are forced by the nature of their task to do this in the attempt to match social needs with an approprite personal vision in order to make a design. The aforementioned theories of Wright, Corbusier, and Mies are just some of the numerous examples.

Terminology is a diffulty quite as much as the lack of agreed theory. The function of architecture as seen by the architecture designer, architectural critic, architectural historian, and the architect himself is unlikely to coincide. Words such as "function" only acquire meaning from the context in which they are found and by reference to the professional outlook of the person using such vocabulary.

The structure and linking roles of the ideas encountered in architectural discussion may be more important than the ideas themselves. New connections have constantly to be made as new knowledge appears: new ideas are required to embrace new ranges of facts. But the premature synthesis of the now discarded theory will often provide the basis for the new. Old and new theories together work to erect the scaffolding of a structure for architectural ideas and ensure that all of the necessary points of connection stay in the mind even if the connections made between them may snap. An architect's commitment is to the total process of architecture: to ends and not irrevocably to means. A structure of ideas is necessary. Method is necessary. Both

will be subjected to constant amendments to keep up with the change of our current needs.

The practice of architecture is almost as old as recorded civilization, but architecture as an organized area of study is relatively new and its compass and bounds are still to be determined. Whatever theories one has are not very deep and are based upon not very profound generalization of surface aspects. Nevertheless, one has to start somewhere if only to establish a point of departure.

Architectural Attitudes

The fact that the architect has two distinctive attention centers sets up a tension in his thinking. The focus of "space as human environment" sets into one stream of ideas; the focus of "the building fabric" as a definer of that space, yet another. When both of these streams of thinking are run together, they give rise to the architectural approach to problem solving--to an architectural attitude.

An architectural attitude stems from thinking in an architectural way. It is personal to the individual who develops it. Where a number of architects and designers see architecture in the same light, then their attitudes become shared, identified, but they still remain personal. Whatever the attitude itself, one may expect in his time to find three basic strands in an individual's pattern of architectural thought. These may be identified as rational, humanistic, and poetic.

One can identify the rational with the clear statement of design problems, the clarification of design intentions, the establishment of the framework of design solutions, the drawing upon the body of

scientific and technological knowledge in problem stating and design making, clear thinking, work method, and with the development of a self-critical faculty.

One can identify the humanistic with having a concern for the nobility of man, for man as an individual, as a social being, and as universal man; with the concept of all men having an equivalent value, with the social good and social order, and with a desire to form a living cultural unity out of the evolving components of the urban-industrial world.

One can identify the poetic with having a concern for light, color, shape, material and form; for spatial and plastic organization, for symbols that speak to man's mind and heart, and for the soul of man and for its uplifting and delight.

These threefold patterns of architectural attitudes involve patterns of value judgements and of aesthetic judgements which distinguish themselves on the one hand from that of engineers and builders, and on the other, from economists and community developers.

Architectural Intentions

The architect, in common with other artists and poets, tries in his work not only to satisfy immediately felt needs, but also to humanize his experiences and give meaning to life. Works of architecture form one of man's most intimate expressions of his conception of his environment and, conversely, provide one of the prime explanations of his environment.

The architect struggles for ways of identifying himself with all

of the forces of nature and to establish a meaningful relationship with his immediate environment. He tries to establish a universe that makes sense. He has a longing to absorb the surrounding world within himself and make it his own. He seeks to make himself sociable. He seeks to make his own individual experience a shared experience.

An environment takes on meaning only through reference to what is environed. The environment of human beings is multi-dimensional. Some of the immediately experienced physical environment is raw nature, but increasingly it is man-ordered and man-made. Man lives and is environed by a society, an economy, a civilization, and a culture. A humanizing architecture will, of necessity, be devised by reference to all of these dimensions of human environment. Following this line of thought, then architecture as an activity is seen to be the art of bringing order to our spatial environment, to enhance human activities, and to bring meaning to life.

The continuing debate as to whether architecture is an art or a science is a symptom of the lack of agreement upon what constitutes architectural purpose. The disagreement on method of approach stems basically from differences of emphasis in architectural intentions.

Those who identify human living space as being primarily physical space, see the function of architecture as being that of providing protection and shelter for human beings and their activities. This, they go on to suggest, is a problem of a kind that can be stated simply and rationally and solved through the application of scientific knowledge and applied technology. A science of human environment and a process of technological production are thus postulated as being the determinants of architectural activity.

There are others, who while not disputing the correctness of this viewpoint as far as it goes, maintain that it does not go far enough. They hold to the view that of equal significance to the design of building fabric is the creation of a space that is not only directly functional in the immediate sense, but which also helps to shape social, economic, and cultural space in a comprehensible way.

The resolving of the tension that lies between these two intentional roles is architecture; the practical and functional on one side, and the social and cultural on the other, can be achieved only through a synthesis of the present knowledge, through which one can gain a better understanding and establishes a new outlook for the architecture of our time. Such action is a necessity if human environment is to satisfy intellect and emotion as well as physical needs. And architects or designers cannot ignore their responsibility at this level.

Man experiences his environment along two channels--through the immediate sense reactions of his body, and through the spectacles of his society. Architecture condenses both experiences into one totality. In this, it is a more total activity than either the pure sciences or fine arts. The coherence of a work of architecture stems not from the objective organization of clear description, as does the work of science, nor solely from the effect of presentation and symbolization as do the fine arts, but from the simultaneous organization and revelation of the character of an enclosed and structured place in physical, social, and cultural space. In a work of architecture, man/time/place/activity/materials/technology/science/beliefs are resolved and dissolved into one plastic organization, form and image.

Architectural Design

Architecture is to be differentiated from nearly all other design activities in that the architecture designer starts off not by studying how to achieve his result, nor by concerning himself with what result shall be his aim, but by trying to decide what the principle objectives of his design shall be. What kind of spaces are to be defined and what, if anything, is his design to express? And how?

The design end is never in sight as design work is commenced and is never fully so until the design is completed. The architect commits himself deeper and deeper into the "unknown" as he works, for unlike painters and sculptors, he does not see his work being realized physically before him as he decides and shapes. As design work proceeds toward its "unknown" objective, some associated and some subsidiary design problems may emerge. These include the relationship of the evolving architectural scheme with the immediate environment of the site, the character of the building fabric and its relationship to the architectural schema, the detail requirments of building components, and the problems of building technology.

The word "design" is quite elusive in definition. This is, in part, because of the confusion that exists between design seen as an outcome, as a work, and design seen as an activity. In speaking of design as an outcome, one speaks of "a design." This implies the existence of some problem to which this is offered as a solution. When thinking of design as an activity, one speaks of organizing, planning, shaping conceptually, shaping in terms of plastic form and of image or symbol making. One thinks of the realization of an intention. It

would therefore appear that if one is to fully comprehend what is meant by design, one has to embrace problem stating, intentions, design activity itself, design objectives, and design outcomes (Pye, 1964).

The shift in focus that is required in design work, as one problem arises and then another, each having quite different frames of reference, makes comprehension of the total architectural process and a systematic description of it very difficult. Each designer has to resolve the conflicts and contradictions that arise within himself in his own personal way and in the light of his overall architectural intentions.

CHAPTER III

AN APPROACH TO ARCHITECTURAL DESIGN

A discussion of the thought processes that take place during architectural design will necessarily have to be based upon the acceptance by both the author and the readers of a particular mode of operation as a reference point and guide.

Once having grasped the constituent elements and issues, those readers whose minds require that these be stated in other terms and faced through the use of other concepts and images can restate the design discipline for themselves. What follows, therefore, is to be seen as being an approach to design and not as the approach.

As one has seen, even scientific method is well established, but individual scientists do not rigidly determine their thought processes by the dictates of their method. They use their method to check their thinkings and theories and also to ensure that they present their discoveries in a logical form.

If the architecture designer is to evolve a discipline that will serve him in much the same way as scientific method has done scientists, then he must have some understanding of the present state of knowledge of how the mind works. Such discipline is essentially a thought-guiding process.

In thinking, there is some kind of representation of objects,

possibilities and events which are not immediately present to the senses of the thinker. In general terms, one can say that the vehicles of thought are visual images, words and numbers, symbols other than words or numbers, non-verbal and non-visual constructions: an example of this last being the mathematical postulates of the intellect which cannot be imagined, such as the Theory of Relativity.

Not all of us make use of these various aids to thinking in the same way or to the same extent. Some people incline toward non-visual abstract imagery, others are visualizers, yet others are able to call upon either mode according to need. According to Grey (1961), these latter naturally prove more adaptable thinkers than the other two groups.

Then, extreme personality types may well adopt quite distinct and irreconcilable differences of approach to problem-solving. Things may well reach the point where two people tackling a problem together will so disagree in methodology that neither will credit the other with clarity of thought, consistency, or even good taste.

CHAPTER IV

TERMINOLOGY AND CULTURAL INFLUENCE

Concept

Concepts are the organizing ideas through which one interprets his own experience. A set is the reflection of concept constancy. For example, one thinks of "the rural home" and "the urban dwelling." Around each concept, one can organize further concepts, groups of ideas and factual information. New concepts may serve the designer in two ways. They draw his attention to certain happenings, to classes of phenomena which without their aid, he may not recognize to exist. Secondly, concepts serve as a useful shorthand description of the phenomena involved and so help him in further analysis of the questions raised by their existence, and this helps him to extend his knowledge. For example, the study of undulating ground and of sloping building sites is facilitated by use of the concept "contour." Once this concept is grasped, then much more information can be marshalled and absorbed than would have been possible without its aid.

"Man" is a concept which one will meet often in architectural theorizing. Sometimes this will refer to man as an individual; sometimes to man-in-society, and sometimes to universal man--man in the face of nature, the universe, and destiny. All such concepts are

open to question and misuse. "Man" is an abstraction representing all men, which is in itself an abstraction. The "individual" is an abstraction, also. Neither "man" nor the typical "individual" can be instantly identified, but the concepts are nevertheless useful. They assist the designer to organize his thinking in certain respects so that when he has to act in the world of real men, he is enabled to do so more efficiently. Therefore, one does not ask whether a concept is right or wrong, but whether or not it is useful in context. Concepts useful in analysis may sometimes mistakenly be carried over into synthesis without further examination. Concepts with similar names such as "neighborhood" and "neighborhood unit" may, if used loosely, result in muddled thinking.

Concepts are shaped by the events they link, but also by the language (visual, mathematical, words and grammar) by which they are described. Each concept offers a model of some aspect of the natural or human reality, which may or may not accurately represent that aspect.

From this, it is obvious that concepts and theories are double-edged. One needs them in order to be able to think, but at the same time, they also pattern his thoughts and so may distort the world as it really is to fit his way of knowing and describing. Nevertheless, models, theories, concepts, and past experience all save thinking time. One has to ensure that they do not stop him from thinking. Thoughts are tools just as are pencils and saws; all need constant sharpening if they are to be useful.

Schema

Normally, a design is developed around a schema that has evolved through time or is the result of theory. A design schema may be said to represent a principle or a collection of principles that are already known.

The "schema" is the name one gives to an organizing concept that lies behind a particular piece of design work. It may be loosely interpreted to mean "essential form." In architecture, a schema may take the form of a spatial idea, a structural idea, a social idea, a growth concept, an organization of building masses, or the realization in plastic form of a symbol. Whatever basis the schema takes, it will offer the armature of the work one experiences and so the clue to its comprehension.

Concepts and Percepts

Concepts and percepts in psychologists' usage are the products of retained and organized effects of past experience. Concepts always represent some degree of generalization and abstraction. For example, the concept "window." There is a great variety of windows, yet the word has meaning. Concepts unite objects and events through stressing their similarity, ignoring or playing down differences. Not all people will use a named concept to cover the same range. Some people who have never moved far away from a particular area cannot raise the concept of "window" to the level whereby it includes those not seen in their particular neighborhood. Windows seen elsewhere, or in drawings or

pictures, are not the "meaningful" windows for them. As compared with concepts, percepts are more stimulus-bound. Perception being tied in with sensory experience, can be influenced by concepts already held. If a window does not resemble one's conception of a window, then no window is perceived, for what one notices depends very much on what one is expecting to see (Gombrich, 1961). What one expects to see is the result of attitudes, concepts, meanings, and experiences. The combined effect of these influences is that the individual perceives of his world as his past experience has indicated it to be, rather than by direct response to the stimulation of actual situations encountered. Some people in late age (and sometimes not so late) become so set in their ways that they are impervious to further experience.

Cultural Difference

Philosophers also make use of the term "concept." They use it to describe the basic premises upon which a culture is built. Psychologists may be described as attempting to erect concepts one upon another until they meet the philosophical concepts of the prevailing culture. One is fortunate when both his sets of concepts merge into one total coherent world view. But whether or not both sets of concepts form a coherent pattern in themselves, they enable him to organize elements in his experience which otherwise he would be at a loss to interpret.

One may say that today all people of the earth live in "one world" but it is also the case that not all people share the same philosophical concepts. Since differing people so disagree about the basic premises upon which social and cultural life is built, they cannot be

said to inhabit in one conceptual world. And this has an effect upon communication between cultures even where the medium of a common language is used. Signs, symbols, and architectural ideas can all cross cultural frontiers, but their meaning may be transformed as they do so. This may lead to confusion and disagreement between cross-cultural architectural colleagues, who may not be able to see that their architectural differences are not in themselves very deeply seated, but reflect differing social cultural viewpoints which are so deep-seated that neither party is aware of them in their conscious minds.

A consideration of the idea of function may serve to illustrate this. Many contemporary designs are centered around the concept of function, one aspect of which being that a spatial volume in a building shall reflect and serve the function that is to take place in it. Hidden in this concept is the notion that activities do take place in specific spaces. One eats in the dining room, cooks in the kitchen, plays in the yard or den, and sleeps in the bedroom. However, suppose people who have grown up in a home where these activities take place more or less just where one happens to be at the time, can comprehend only with difficulty the idea of a plan reflecting human activities. What one does, and where one does it, for him it springs out of a situation and not the formal arrangement of rooms, and such situations will vary according to the occasion. An extreme example will be the dormitory room where a student practically lives his daily college life in an all-activities-in-one habitat. The concept of function as an ordering idea in plan-making can cross cultural boundaries, but the planning elements that resulted from its application in one cultural

tradition are unlikely to be appropriate in another culture. If transferred, one can expect them also to change in meaning. New functional principles and new elements in plans will need to be devised along with the evolution of the culture into which the concept of functional planning is imported. Architectural thinking remains creative when rooted in principles but stultifies when based upon elements whose shapes and forms are rearranged with no comprehension of the underlying concepts.

CHAPTER V

REASONING - INDUCTION AND DEDUCTION

As noted that emotion and reason form an interplay during the thought sequence that leads to the realization of an architectural design. While reason itself is not quite sufficient for the creation of an architectural work, it forms an essential constituent of architectural thinking.

Reasoning moves along two main paths known as induction and deduction. It is for convenience in understanding that these are separated and put into opposition; the one to the other. In practice, while either one may dominate a pattern of thought, both will be found necessary in the following through of any piece of thinking (Harre, 1960). The arrangement and classification of things perceived by the senses, the noting of relationships between events--one event causing another, and of similarities is known as induction. The application of general rules to specific instances--the reverse process--is called deduction. These thinking techniques underlie the discussion on concepts and theories.

Induction proceeds by way of generalization, classifying and grouping; it is concerned with cause and effect and makes use of analogy in explanation. Analogy is frequently resorted to in architectural thinking and work processes. For example, at the level of higher

theory bearing upon man and his environment, and the form of his city, a biological analogy can be used and the city is referred to as being an organism. At other levels, physical analogies are made with the real world through the use of cardboard design models, structural models made for testing, and through the use of accelerated weathering tests.

Deduction proceeds along the premises that if an argument is to be considered sound, then it should have a recognizable form. The most common form of deductive reasoning is the syllogism. This takes the form of the presentation of a major premise, a minor premise, and a conclusion. For example, architecture reciprocates its time: today one lives in an age of technology. Conclusion--today's architecture will be an architecture of technology. The deduction is sound, since the form of the argument is sound. It will be noted, though, that the validity of the premises is another matter.

Therefore, the deductive method, in common with other forms of logic, has no comment to make upon the validity of the premises used. Induction and deduction are merely methods and are empty of value in themselves. The premises upon which they build have to be publicly verified if the conclusions reached by their application are to be widely accepted.

All evidence, premises, forms of argument used, one must consider them dispassionately on their merits. This is more difficult to achieve than to state for most people find ridding their minds of irrelevant attitudes and opinions very difficult. What may start off as being a clear line of thinking all too easily becomes muddled by old prejudices; the use of inappropriate sets and stereotypes; the

use of emotional and loaded words; rationalizations, in which one tries to excuse, or justifies an opinion by making it conform with reason; by vagueness and the loose use of terms; through laziness and the lack of follow-up of implications. Furthermore, a whole line of thinking may become distorted by being subjected to propaganda or other personal commitments (Moonman, 1965).

The achievement of clear thinking is dependent upon the balance and level of the thinker's total approach, his correct identifying of context, cultural or otherwise, in which ideas are being handled; his insight into the working of his own mind, his receptiveness and willingness to change worn-out mental sets for new ones when the occasion demands; his ability to be critical of his own ideas and also those of other people in a reasonable, objective manner.

CHAPTER VI

ARCHITECTURAL THINKING

Not all thinking is reasoning. Grey (1961) interprets that the word itself is used to describe the general activity of the mind which may be engaged in recall, reverie, imaginative thinking of conceptual thoughts. To recall is to bring to the surface of thought something already learned and to describe it from memory. A person engaged in reverie or day-dreaming dwells for a time in a thought world of fantasy in which the mind flits about from one half-formed thought to another. Imaginative thought lies somewhere between the uncontrolled flow of day-dream and the attempt to deliberate recall. It is different from day-dreaming in that it is brought about through encounter with external situations--people, things, and architectural problems. Schema and images of what is possible or feasible form an essential element in the solving of problems. Imaginative thinking is thus closely allied to reasoning (Thompson, 1961).

To speak of the concept of thinking is to take thinking in its sense of meaning, reasoning, reflecting, and pondering. Thinking in this sense involves:

(i) A moderate degree of motivation. Too little and the mind is not motivated and so nothing happens; too much and the mind may become emotionally clouded and so no longer

capable of reason.

(ii) The ability to state and analyze a problem.

(iii) The use of mental sets.

Mental sets are conceptual pictures and schemas through which the buzzing confusion of daily experience of the senses are interpreted. Mental sets used in problem-solving constitute in some degree ready-made outline solutions to frequently encountered situations. A builder will typically have a mental set in relation to a brick wall that leaks in the rainstorms--waterproofing and moisture protection. Such mental sets are useful, providing that all of the factors that lead to their formation remain constant. When new circumstances are met, when new materials are used for new types of walls, then old sets tend to establish mental blockages and make it difficult for an old established practitioner to perceive and conceive in the new way necessary. Quite often, an old specification-writer will unintentionally prefer copper flashing to aluminum flashing on concrete buildings, even though the latter costs less.

Wrong sets are encountered at many levels in architectural thinking. A fairly common example is the attempt to design small family homes for the mass of the population as if they were big houses reduced in scale and size. With this inappropriate set, designers of mass housing never get within sight of solving the problem even after years of design experience. The efficient selection of schemas or sets is developed from the ability to recognize the category of problem one faces. One of the important functions of a design discipline will be to point the designer toward identifying appropriate sets and mental maps for specific phases of the design process. Some people identify

this discipline as the control strategy or search strategy, whichever is applicable for the different situations.

CHAPTER VII

ARCHITECTURAL PROBLEM SOLVING

Stating and Solving a Problem

The thinking of architectural design centers around problem stating and problem solving. Seen from this standpoint, design work will consist of a problem to be solved. A problem context is to be established, an idea or principle around which the design solution will be organized, a method of work, a method of realization, and the criteria for assessing the success of the design. Success in architectural thinking stems from the ability to state and analyze, the ability to select and devise schemas appropriate to specific problem categories, and in the efficient use of mental sets.

Probably there will not be very much disagreement over the need to state a problem clearly if a correct answer is to be expected. However, one can expect there to be rather less agreement as to when a problem has been adequately or correctly defined. To take housing as an example: a designer who poses to himself the problem of producing hundreds or thousands of house units as economically as possible, produces a somewhat different housing design solution to the designer who poses the problem as being the design of human environment, personal, family, communal, and cultural, for a hundred thousand families. In

one case, the emphasis of the design will be upon the ease and economy of production, and in the other, on satisfaction in use at many levels. These two approaches are not always found in complete opposition by any means, but so contrasted it is readily seen that both offer inadequate statements of the housing problem. A complete problem statement demands orientation to means as well as to design objectives stated in human terms. Balance is required in problem stating if it is to be achieved in problem solving.

A problem has to be both defined and solved within a specific context. The low income family housing in New York is not the same problem as the low income family housing in Hong Kong. This is obvious. One has to be just as sure that he recognizes all of the subtly different housing problem situations that lie between these two extremes and ensure that they, too, are correctly defined within their context.

An architectural design is determined in some essential aspects by the particular nature of the problem itself. This is the justification for stressing the need to state a problem clearly. Important as this is, the manner of organizing a solution is not necessarily to be found in the problem situation; nor are the expressive qualities of the final work. Intentions, ideas, principles, and schemas are brought by the designer to the problem and are selected and tested for size and fit. In assessing the suitability of his design, some of the criteria used stem out of the problem situation and its necessities, but others relate to organizing and synthesizing ideas.

Ideas Organization

Organizing ideas stems from a living culture and its philosophical premises. They are the result of new theorizing. They are borrowed from the past, or where patterns of life have been maintained over long periods of time. They are part of a living tradition. For example, a man designing an elementary school anywhere in the world can draw upon the conceptual idea of such a school as it exists in his culture or in any other. He can, in association with educationalists and child psychologists, theorize upon the nature of elementary education and "what it needs to be" and then frame a design around their newly evolved principles. Less analytically, he may borrow what are thought to be the best organizing ideas from internationally known examples of elementary schools and interpret them in the light of his localized problem. Alternatively, he may continue a tradition that is alive in his area and work within this vernacular. He may, of course, do none of these things, but merely take a few magazines home and scan through them until he finds a design illustrated that appears to offer a solution and just transfer it onto his design drawings.

The Role of the Architecture Designer

Architecture seen as an activity has its roots in social and cultural life; grows within the framework of natural and physical laws; and flowers in social, cultural, and economic space. The architecture designer is thus a person who seeks to synthesize knowledge and to find connections between distantly related phenomena. The dimensions of the

structure of architectural thought include the serving of human needs; the problems raised in the human reality and in design by new patterns of daily life and evolving patterns of settlement; the necessity of framing new concepts to aid understanding of these patterns and the fostering of the development of local building industries and labor skills. The swirling ferment of ideas and hopes, problems, and transformations are at once a challenge and a great opportunity for the architecture designer at work. Harnessed to the energy of the development process, he becomes involved, implicated, then committed, and thus becomes free to design. The ability to make use of the energy of one's times--to draw upon the latent power, is a matter of organization, personal organization for action.

CHAPTER VIII

ARCHITECTURAL IDEAS

An architectural thought is built upon ideas taken from many disciplines, but there are some central ideas that can be described as being architectural and these revolve around the themes of the coherent organization of space for human activity and the meaning of that space and its enclosing forms for its uses and for society as a whole. Such ideas that are current in the time tend to belong to one or other of the three strands that makes up the warp of architectural attitudes--the rational, the humanistic, and the poetic.

The idea that man is living in an age of technology has been handled in the field of architectural ideas within all of these three strands. In strand one, clear but rather plain solutions reflect the particular logic of industrialized production. Dimensional coordination and repetition of components and elements are not only accepted, but made articulate. The "Age of Machine Technology" as handled by Mies van der Rohe, is underlined by drawing attention to the logic and simplicity of mechanized, machined parts. The overall handling of the solutions brings out the underlying nobility of technological order and, so, the symbolicity of the aspects of the time. In strand two, mechanistic technological order is expressed as an idea through the conventionally constructed the Unité at Marseille by Le Corbusier in which

the human modulor is being integrated into the building. The dramatic use of concrete form-boards to create a variety of interesting textures and patterns which in turn enhance the form of the building. In strand three, Antonio Gaudi's Church of the Sagrada Familia, at Barcelona, is an excellent example of using masonry building materials poetically and romantically. The concrete is inlaid with color glazed tiles to give a pleasant, attractive visual effect. The form and spatial quality are excitingly impressive. It is indeed a fresh and imaginative exploitation of technology of his time. Le Corbusier once said, "Gaudi is the constructor of 1900, the professional builder in stone, iron, or brick" (Prats, 1958).

From the foregoing, it will have been realized that it is possible to draw a distinction between making use of modern technology in building and using it expressively as an architectural organizing idea.

CHAPTER IX

CULTURAL PURPOSE AND AESTHETIC INTENTION

The body of ideas through which man relates himself to his external world and his internal domain not only varies between cultures but changes, if slowly, during the lifetime of a particular culture. A cultural system is generally related to:

(i) An idea of reality--an understanding--of the nature of the physical world, of universe, and of man's relationship to both.

(ii) The nature of individual, social, and religious needs and of the ends to be satisfied.

(iii) The extent to which the needs and ends are satisfied.

(iv) The methods and techniques of meeting needs.

Sorokin (1952) from his study of a wide range of cultures by statistical methods, has drawn attention to three types of super-cultures within whose overall context, national cultures rise and fall. His systems are God-centered, material-centered, and man-centered. He calls them ideational, sensate, and idealistic.

An ideational culture is perhaps best understood in terms of being an "age of faith." Examples are the Hindu culture of India. Daily life is sanctified, and human needs are seen as being satisfied at an abstract and high level.

A sensate culture is a material-oriented culture, an age of the common man, an age of technology and science. Reality for the sensate culture tends to be actuality. It is a process, a becoming. Human needs are conceived as being satisfied at the physical level. Progress is conceived as being achieved, not through the modification of the character of human beings (as that in the ideational culture), but by modifying and exploiting the physical environment. A sensate culture exploits technology.

The idealistic or median type of culture is typified by the emphasis that is given to the creativity of the human mind. This cultural outlook makes the attempt to synthesize the other two. Harmony is not envisaged as being a balance of the spiritual and the physical, but as being sustained by a predominantly spiritual/humanistic momentum. Idealistic cultures do not regard the physical world available to the senses as being an illusion, but endeavour to make use of the physical world to the greater glory of the human spirit.

If these cultural concepts are applied at the level of generality as intended by Sorokin (1952), they offer an insight into why architecture (a product of thinking and designing) differs so radically in overall intention from one culture to another, or from one indivicual to another. The three super-cultural systems differ greatly in the major premises underlying their mentality; in the view that their people take of what constitutes reality and so of what constitutes truth and beauty; in the kind of evidence they will accept and in the means and character of ends they pursue. Their aesthetic intentions will reflect the differing cultural outlooks; or in Jung's (1968) terminology--the difference in their "collective unconsciousness."

Pure examples of Sorokin's (1952) super-cultural systems may be hard to find, but their value lies in their providing the poles, in relation to which cultures and aesthetics of emotion may be more easily comprehended. One may not necessarily expect them to have a predictive power for the aesthetics of a cultural emotion appropriate to our time. However, they do offer us a classification system which may be useful when referring to the already mentioned architectural attitudes: the rational, humanistic, and poetic.

CHAPTER X

ARCHITECTURAL SPACE

Ideas about space as experienced human environment, of its organization, of its boundaries concrete and implied and of its structure in psychological terms are unique to architecture, while the pictorial space depicted in a painting and the space generated by sculpture generally co-exist but do not fuse with architectural space.

So important is the concept of architectural space to the organization of an architectural work that some would make it synonymous with the activity of architecture--architecture as the art of the organization of space (Zevi, 1957).

A more comprehensive definition has been given: "Architecture is a dynamic of relationships which involve space, give objective reality to structural form, and within the form is content and meaning" (Burchard, 1960). With this description, more agreement will be reached for a further discussion of architectural ideas, and each attribute therein listed will be considered in turn.

Form is tangible. The objects presenting it can be seen, although the experience of form demands a degree of abstraction for which some clues and past experience are required. Form is not too hard a concept to grasp. It is otherwise with space. The word "space" is put to

use in a variety of disciplines and even in the ordinary everyday life, has a variety of meanings according to context. It is used to refer to the unimaginable postulate of universal space. It is used in the conceptually constructed world of physics as a co-ordinate in mathematical functions. Then there is the space of visual perception which enables one to position himself in his everyday life. At another level, there is the engineered space inside factories and aircraft hangars which can appear to have little or no reference to the scale of human beings. There is the space of area: large and small in the experience of which a value judgement enters. There is consciously designed humanized space inside buildings and within urban environments. There is the space of architectural conception which is constructed intellectually through a fusion of reason and emotion to be experienced by each individual through his interpretation of his space of visual perception.

Architectural space has a multi-dimensional quality. Followed in one dimension, space is experienced as interval, as linear space. Explored two-dimensionally, space is area--the space of plans. When registered in three dimensions, space is volume--volumetric space. Registered in four dimensions, space is experience--it is traversed space (Engel, 1964). A spatial organization may stress any one of these dimensions. Linear space, planametric space, and volumetric space exist even when all human beings have left a building, but the traversed space of experience exists only as a dynamic between human beings and building. Buildings have always had to be entered and moved through for their space to be realized in the space of human perception and experience. This is similar to Gideon's (1962) concept of space/time continuum in architecture.

CHAPTER XI

INTERPRETATIONS OF ARCHITECTURE

Critics serve the body of architectural thinking by adopting a standpoint. One may question the validity of a standpoint and should always be prepared to do so, yet there is also value to be gained in accepting the standpoint of a critic, for something useful will be revealed when a body of knowledge is penetrated in depth. Even a wrong schema may enable one to see. The man without a schema at all sees nothing but chaos. The standpoints adopted by critics have been various, and most have served the designer reasonably well in that they have revealed attributes of architecture which otherwise he may not have clearly understood. In the nature of things, no critical approach has revealed the essence of architecture. The critical method adopted makes this possible, since it depends upon bias. Furthermore, if it is possible to reveal the essence of architecture as activity and to present it through another medium (that of words), then there will be no further need for the architectural activities. The ultimate justification of poetry is that in the last resort what it has to convey can be conveyed by no other means. Poetry and architecture both establish unique links with aspects of the human reality. One needs such links if he is to make a totality of our experience and of our theoretical knowledge.

Zevi (1957) points out that the principal interpretations of architecture have been related to that of content--the carrying of meaning beyond any that the building itself may convey; physiological and psychological interpretations; formalistic or visually poetic interpretations; functional interpretations applied to building fabric and to building use; and interpretations based on architecture seen as the art of space.

Critical approaches tend to become dogmas unless carefully and objectively kept under review by their users. The architecture designer therefore must always look to his source for living architecture--to people/time/place/activity, and technological situation and aesthetic considerations.

CHAPTER XII

ARCHITECTURAL EXPRESSION

Architectural expression is a very complex subject to write about, since an architectural form is more or less dependent on the intention and attitudes of the designer, and cannot be successfully abstracted from the architectural totality. In order to facilitate understanding, one can relate architectural expression to the expression of structure, articulation of structure, and the presentation of materials. A simple rule to abide is that a building must not pretend to be other than it is.

Architectural works do not stand alone in the built and natural environment. It had to be envisioned as a component in the organic life process of our total environment. The architectural work may be related to this life of a people and to the evolving structure of their environment by reference to Esherick's (1963) seven principles which are a basis for an architectural expression appropriate for the current time.

(i) There shall be a continuous analysis of the human society, its ways and mores, its potential and pattern of change in which continuity and discontinuity, tradition and innovation each have a part to play. The creation of works of architecture is itself part of the analytical process of understanding a society.

(ii) The recognition that "the built world rests in the landscape of the natural world" and that it is necessary to establish a harmony with this world. This harmony will be reciprocated in architectural form.

(iii) There shall be a continuous synthesis: the built world is a world in change; architecture renews, serves today and prepares for tomorrow. A work of architecture must serve immediate needs but also function as a component in the city and reveal its structure in space and time. The city structure will itself be partly moulded by architectural activity, resulting from the execution of plans of action rather than master plans. The future is not for man to control. He prepares for it, does not determine it.

(iv) Architectural works shall be simple, clear in organization, non-arbitrary, and economical. What the eye sees shall be confirmed in use. The form shall make legible the relationships between parts and whole and the whole (as a component) to the environment in the realization that form is constructed in the mind of the observer as he interprets frames of reference. Works, while clear, must be able to sustain change (a system of spine, routes, links and containers for activities).

(v) Architecture will precipitate prototypes and eventually archetypes which, if repeated as serial designs, will enhance one another and aid in making comprehensible the pattern of the whole.

(vi) There is the realization that technology is a means and not

an end. One is committed to the solution of human problems, not to the expression of the potential of today's technology which, if devoted to human ends, will speak for itself but deferentially, as the good servant.

(vii) Adherence to principle is seen as being a necessary condition of achieving a relevant architecture. At the same time, it is realized that mere adherence to principles does not guarantee success. It is not sufficient that all principles be followed: it is how they are followed that determines a work of architecture; the reflection of the inner life and capabilities of the individual designer, within which the rational, humanistic concerns and visual poetry have to blend as one, before they unify within a work.

CHAPTER XIII

THE STRUCTURE OF THE INTELLECT

In architectural design, the philosophy of the design process stems from three other philosophies: that of the role and purpose of architecture, that of the nature of mental process and that of how one experiences architecture, and that of the individual designer toward his work.

To design is to activate the mental process in a distinctive way and to put to use the intellectual factors such as memory, judgement, insight, foresight, hindsight, ability in creative thinking, and ability in problem solving.

Guilford (1959) hypothesizes "the structure of the intellect" which can help a designer to identify the distinguished features of these abilities and so enable him to name their components. Three broad abilities are recognized that in combination can be said to structure an intellect. These abilities surround the themes of content, product, and operation. These terms can be interpreted as follows: A difference that is registered by the mind between visual forms, numbers, and meaningful objects is said to be a difference in "content." A difference registered between relations and classes as a difference in "product." Differences between processes, such as understanding or memorizing, are called differences in "operation."

Studies and intelligence tests, operated on the basis of this

model, led to the recognition of four kinds of content: figural, symbolic, semantic, and behavioral; six kinds of product: units, classes, relations, systems, transformations, and implications; five kinds of operation: cognition, memory, divergent thinking, convergent thinking, and evaluation.

Combination of particular contents, products and operations will yield one hundred and twenty unique outcomes, each considered to be a potential intellectual ability distinct from other abilities.

For the present purpose, the author will expand the ideas of "operation" of this particular intellect model. In regard to the architectural aspects of "content" and "product," since they are quite complex if not abstract, it is rather beyond the scope of this paper.

The five categories of mental operations are cognition (verbal comprehension), memory (recall), divergent thinking (induction), convergent thinking (deduction), and evaluation (judgement and assessment).

An example of cognition can be illustrated by the word "home." The symbolic meaning of the word "home" is one ability. The ability to recognize the word "home" when seen in a sentence is yet another. This latter gives rise only to verbal comprehension; the former to symbolic understanding. The ability to recognize behavorial differences gives rise to a social intelligence: the cognition of the perceptions, thoughts, feelings, and actions of other people--to the recognition of tension and strain. As an illustration of the memory at work, one can mention the ability for concept recall; for example, if presented with a list such as brick, earth, gypsum, concrete, one will recognize that (in the context met) they all offer alternative

walling materials and that other materials, also useful in wall construction, need to be added to the list if a well-informed decision is to be reached as to which will be used. The concept recalled is the "load-bearing wall." The phrase "divergent thinking" used to describe a mental operation, refers to the ability to generate diverse ideas about information given. Convergent thinking is the reversed mental process in which the mind moves toward the one correct answer in the light of the information given. Evaluation is a critical ability; the ability to evaluate a situation or a decision offers a distinctive operation relating to the "goodness" of the information available, or the decision taken. Usually, before such mental operations can take place, a criteria for judgement is needed--a frame of philosophy, concepts and principles from which are derived standards and limits.

Thus, it will now seem that the potential of a mind to be creative is very much determined by what it knows; the form in which it knows it; and to developed skill in handling what is known and what can quickly be found out through speedy reference. A creative person will certainly be an informed person, but perhaps more significantly, he will be one who has his knowledge organized freely, has shed preconceptions, rigid classifications, and all pre-formed solutions to half-understood problems.

CHAPTER XIV

CREATIVITY

Creativity seems not to be distinguishable from reasoning but is to be seen as an extension of the same activity. Everyone is potentially creative to some degree. Creativity, like thinking in general, is a process or the outcome of a process. A problem of definition appears to be that of distinguishing between originality and creativity. Many original solutions to problems, including architectural problems, are not useful. An original idea need not necessarily be a useful one. Perhaps creativity has to meet the criteria of both originality and usefulness. An individual may be highly intelligent, original in his thinking, but not creative. Creativity is dependent not only on originality, but on society's reaction to his originality. Creativity must have value. Creativity is thus a more all-inclusive concept than originality, but exercising originality is the basis of creativity. It has been suggested that originality plus fluency plus flexibility leads to creativity (Sawrey, 1964).

A significant factor in creativity is, therefore, the clear stating of problems to which the mind is to be applied; perhaps even more so the original restatement of typical problem structures. A further factor is the permitting of the mind to be original--setting loose, allowing ideas to grow and flower quite uncritically until they are

large and firm enough to handle and test. A mind that is not fed regularly with new and varied material is not likely to be creative, since it is not able to form new linkages.

The difficulty in talking about the moment of creative design lies partly in the general belief that thought patterns are arranged in logical progressions--similar to the way of scientific description. To quote Poincaré (1952), "It is by logic that we prove but by intuition that we discover." Here the author will like to introduce a new concept to the learning/thinking/designing theory. It appears that a creative mind, having been fed with a problem and relevant information, will work away at a number of levels progressively and simultaneously.

One can imagine the learning/thinking/designing structure as two opposing, symmetrical cones (symbolizing a bi-polar universe) rotating along a common axis (the worldly discipline of values). Thought-elements are radiating (in succession or not) from a source within the structure and begin to revolve inside the domain of the cones. Further, it is assumed that the thought-elements are flowing randomly following the loci of the logarithmic spirals when a potential organizing principle begins to crystalize around which the other structures or partial solutions will appear naturally to arrange themselves. Then this thought-crystal will continue to adjust its pathway to the logarithmic spiral, bringing enlightment to other possible sources until at a certain stage (time/space) it is spinned out from its domain (mind) or rests itself down to dormancy.

Thus, this learning/thinking/designing process is a self-spontaneous structure which grows (or diminishes) in continuity and simultaneity. The growth of the domain is to expand the unknown. The

opposing, symmetrical cones symbolize the "yin/yang," "negative/positive," "bad/good," and so on, aspects and values of various philosophies. The point where the two cones meet is a state of harmony (or balance), and from which a multi-dimensional concept can further be postulated. (Note: This postulation tends to be more philosophical than architectural, therefore it will not be presented here.)

Following this trend of thinking, one may speak of the architecture designer creating the phenomenon of architecture through the organization of a balance of pluralities and polarities, all of which find a place to function according to their own laws of activity as well as working for the collective balance--each organizing structure, system, and part retarding or accelerating, limiting, or expanding the grand rhythm of the whole to make an universal order.

CHAPTER XV

THE ORGANIC THEORY OF LIVING, LEARNING, THINKING AND DESIGNING

The Age of Flux

There have always been three basic forces within a society: technological, sociological, and biological. These general forces have constantly undergone change and growth, sometimes at imperceptible rates and usually at differing rates within themselves and with respect to others. Nevertheless, they have undergone change, and a change within any one of these forces affects changes in the other two. Presently, each of these societal forces is undergoing drastic changes simultaneoulsly both in breadth and in magnitude.

Schon (1967) has stated that two different philosophical positions with regard to stability and change have been dominant throughout the history of human thought. The first view is that stability is the only reality. Western society has wanted to see all human action as occurring against a background of stability--stable institutions, stable laws, stable values.

The second position Schon (1967) identifies as the one most realistic today. In this case, change is the only reality, and stability is an illusion. Technological innovation, especially as it has become institutionalized through such bodies as universities, think tanks, and

research and development corporations, has made change a permanent part of today's society. But it is doubtful that the full impact has yet been truly felt. Social change has accompanied technological innovations. It has resulted from it and now, in some instances, even causes it. It is most obvious that these changes will and must influence architecture. In this respect, architecture must be considered as a dynamic phenomenon.

The Growing Architecture Designer

An old proverb states that "the fruit reciprocates the seed." A seed is sown to germinate; an architecture designer has to prepare his mind so that it may grow within. Natural resources have to be absorbed. Fertilizing ideas have to be added from time to time. Only then will the tree of architectural knowledge flourish, and from which the designer constructs his own web of architectural thoughts. Therefore, the desgner himself is a living organism. His mind grows continuously and simultaneously with his body. Learning, knowledge and experience will guide his thoughts and intentions. His actions and reactions will determine his immediate environment which, in turn, will affect his physical and mental processes. Thus, if trying to isolate a single function or a single process out of this complex chain-cycle of growing, living, learning, thinking, and designing, it will seem rather out of context if not meaningless. Man is living in a dynamic world with a constant supply of stiumulations, whether he is aware of it or not. In a sense, when one perceives, one picks up information and stores it in his memory for immediate or later retrievals. Therefore, so long as

there is life, there is growth. If there is growth, there will be learning. Through learning, one acquires knowledge and experience. With knowledge and experience, one organizes them into concepts, schemas and theories. With these thoughts in his mind, he will establish his attitudes and intentions. Thus, the processes of identification, analysis, selection, synthesis, evaluation, decision, action, and reaction will briefly make up the thinking and designing routine. Creativity can be achieved through refined thinking and designing, but depending on the degree of originality and practicality. For each intermediate stage of this chain-cycle, it is appropriate to see it as a metamorphosis because it is part of a biological growth phenomenon. The author will name this "an organic learning/thinking/designing process"--a spontaneous process that grows within and without. The fruit of the architectural tree are the buildings (or the environmental outcomes) which, in turn, seed other architectural trees of thought.

CHAPTER XVI

THE LEARNING/THINKING/DESIGNING MODEL

Identification

Deep down within a person, there is his background, his knowledge, experience, attitude, intention, culture, and his current physical and mental conditions. Under all of these influences, he has to identify the problem among other problems. He has to set himself a goal, so that he will know in which direction he will proceed, because blind searching does not help to initiate any design process at all.

Analysis

One can identify and break down the human needs and human requirements in relation to the particular activity to be investigated. Each item is to be labelled, classified, and related. The activity to be served is not to be assumed as being obviously self-evident. Considerable investigation is generally required to establish exactly what it is. For example, one can use bubble-diagrams to indicate the different relationships of the various elements to be considered. Arrows and curve lines can be designated as traffic patterns or environmental forces. Different color schemes can be utilized for simple

classifications. Then, all of the main groups of variables will be organized under activities, purposes, and intentions to converge to a statement of the problem.

Synthesis

The object of synthesis is to recompose and fuse the pattern of activities, aims, service systems, and so on, that are recognized and classified in the analysis stage (Alexander, 1964). The overall objective is to reciprocate the problem structure with a solution structure that satisfies not only problem requirements, but one's own external criteria which he brings to the problem-solving activity. His concern now is not with designing a building to obey relationships and achieve stated objectives, but discovering what relationships are obeyed and what objectives achieved in an existing design. Then the methodical approach continues with the identification and selection of design strategies.

The synthesis is made as the activity structure, service structure, the concept governing growth and change, the structural concept, and the aesthetic structure are all brought together into one controlling schema. Within this schema, the design is realized. If it cannot be, then the schema has to be modified or even rejected. It will probably be necessary to return to the analysis to see if something has been left out that is making synthesis difficult to achieve.

Once a schema is devised and passes its testing period, then design work takes on a new character. From now on, one works not so much to solve, but to prove. Every further design decision is taken

in such a way that the overall design intention is reinforced. The synthesis of critical approaches will, as applied by the designer in particular cases, contain two levels. The first is the design absolutes, the second, standards of personal value. The absolutes one needs is in reality a definition of the purpose and function of architecture today. The criteria one applies when assessing a particular work will stem from this as compared to the local context and which as a result will be judged to fit or not. Fitness is perhaps the prime test of all--fitness to man and his needs, society, culture, activity, material and structure and means of making and erecting a building.

As the synthesis is shaped into completeness, the character of the problem situation will be even more brilliantly illuminated. And as solution and problem structure are brought together, they will complement each other and make a perfect fit. Jones (1962) has pointed out that during these stages of preliminary design synthesis, problems can be allowed to lie in the subconscious while other duties are attended to. Quite purposeful work can be done on design problems by the "unconscious," providing the mind has set the problems clearly and then given time to mull over implications and possibilities.

Evaluation

A critical faculty is compounded of values and judgements that together go to make up a coherent outlook. Some values stem from the desire to achieve something. Other criteria are bound up with the desire to realize an ideal. Other values which one must learn to be on his guard against may distort his ability to appraise the success of

his own work. Arbitrary values may creep into one's judgement, set up a false criteria. The key is perhaps to learn to recognize the different values for what they are, and for what purpose they are meaningful.

The Learning/Thinking/Designing Flow Diagram

The author wishes to take this opportunity to present his learning /thinking/designing model (see Appendix). The structure of this model is a concise representation of the different stages involved in an architectural design process.

The model can be grouped progressively into three regions:

(i) The environmental influences, the mechanism of the intellect, and the physical and mental conditions of the designer himself.

(ii) The actual design procedure.

(iii) The outcome of a solution which either remains within the designer's intellect, or affects the environmental systems.

There are two categories of feedback (or feedforward) loops--the "internal" and the "external" (only for the sake of differentiation).

The "internal" feedback loops are invisible mental activities. Sometimes they are rather inert, but nevertheless take up an important role in the thinking process especially decision-making. The "external" feedback loops are arranged in their hierarchial order of appearance--from the unconscious level to the conscious level. Although the process is invisible, yet the outcome when at a certain level is quite detectable by psychological means, such as sensations and perceptions. At other levels, like learning, application, or experience, the

immediate results are rather obvious to be observed. Thus, with these characteristics, a design problem can be spliced into "separate elements" which can be solved either in series or in parallel.

The author theorizes that there is no demarkation to separate each element from another in this structure of the model; rather, they are fused together in a state of flux. The author also thinks that the process of thinking/designing always has its roots in learning. No matter which procedure one is going to adopt, he learns. Whether he is aware of it or not, he learns either through perception, association, insight, or according to any other theories in psychology.

To sum it up, the learning/thinking/designing process is an active and self-spontaneous process. It requires the participation of the designer himself. Of course, his own background and the immediate environmental systems will have a tremendous influence on him; he will be the one to utilize all of these factors and carry out the responsibility of his learning, thinking, and designing.

Furthermore, it is the intention of the author to incorporate this model into the aforementioned concept of the opposing, symmetrical cones. As represented two-dimensionally, the flow diagram can be visualized as a cross-section of a cone revolving along its axis. Therefore, at any moment and at any particular stage of the process, the thought-elements can be traced along the imaginary locus of any logarithmic spiral, thus having infinite chances of inter-reaction with any reference point within the structure of this model [flow diagram]. Since spontaneity, continuity, and simultaneity are all taken into account in this model, its validity can be extended to accommodate a great variety of other concepts and theories, too.

CHAPTER XVII

A METHOD OF ARCHITECTURAL APPRAISEMENT

Experiencing Architecture

Man experiences architecture through physical contact as well as through active perception. He also experiences architecture indirectly through the particular interpretations he gives to the reactions of the senses--according to personal character traits and cultural conditioning. Personal character traits offer a great variable--too great to take it as a point of reference, but one must consider the channel of direct sensation--perception as modified by knowledge, cultural expectancy, and cultural intentions.

To a degree, all of these responses are available to all observers but they will take on a different weighting in the minds of architecture designers, architectural critics, architectural historians, informed laymen, to people having a particular experience of the building type, and the ordinary man in the street. All will compound a different balance according to the nature of their spatial perceptions, special knowledge (or lack of any relevant knowledge) cultural outlook, and frame of judgement. All of these are quite apart from personal preferences, sensitivity to visual images, and experiences.

These people are also concerned with the building forms in

relation to their physical performances, human experience of their performance, and the reaction of meaning given to that experience. Again, they are concerned not only with the actual measured size of a building and its elements, but also with its scale and with the meaning that is attached to that scale.

The Building-User System

A building-user system can be roughly identified to have four main parts. First, the building system which includes the constructional, services, and contents sub-systems. Second, the environmental, spatial, and physical sub-systems which are generated by the building system and the activities of the occupants. Third, the activity and behavior of the occupants which are affected by and affect the environment. Fourth, the objectives of the occupants themselves.

Appraisal Activities

This is an exploratory study of the way in which measurement and appraisal can become part of a design method. It shows their relevance both as generative techniques of use during the design stages, and as evaluative techniques of use during later, retrospective stages.

The aim of this appraisal model is to make available to architecture designers techniques for obtaining an increased amount of reliable performance data to aid design decision-making. It is postulated that the resulting improvement in design activity will result in better buildings.

Measurement and appraisal of performance in an evaluative activity consisting of the application of various evaluative yardsticks to design solutions. These evaluations enable alternative solutions to be ranked and, possibly, to be placed in relationship to the best solution arrived at by analytical means. It is widely believed that the chief role of these techniques is in the appraisal of buildings-in-use, and that obtaining data from this source is useful but peripheral and not central to design.

Appraisal is central to design for two reasons. First, because data from buildings-in-use are the means whereby what would remain a series of isolated and closed design projects becomes a single linked design activity in which the connecting elements are a series of performance appraisals. Data can be used in subsequent designs only if they are produced in a form which fits the pattern of subsequent design activity. Second, because the complete building-in-use is only one of the many embodiments of a design concept which is quite detailed and precise. Models generated at earlier stages in the design have sufficient detail for many of the performance appraisal techniques to be applicable. Thus, while appraisal presupposes earlier design activities of a generative kind which have produced testable solutions, it itself is part of the generative process.

Therefore, each building is a potential piece of apparatus capable of testing any hypothesis the appraiser wishes to set up.

The appraisals of buildings deal, at least theoretically, with objects with finite characteristics, but appraisals are infinite since any objectives can be applied as evaluative yardsticks. The appraiser may be a designer or acting in a judicial capacity on another designer's

designs. He may use: the designer's explicit objectives (his own if his appraisal is part of his design process); implicit, underlying objectives (if they can be discovered); objectives which may have been formulated by the designer but which he has ignored or rejected; objectives which have become established through subsequent research; objectives formulated on the basis of projected future needs. The appraiser, therefore, needs to state the objectives he is seeking and to set up criteria, limits, values, constraints, priorities, and so on, before he starts on the actual appraisement.

When designing a model for the appraisement of a building, emphasis is placed on objectivity. The elimination of some independent variables because they seem unimportant, or cannot be measured, or in order to simplify the model, can involve some real losses (also as being the result of value judgements). Nevertheless, an appraisal model is a tool for visualization, as well as an aid for design considerations. Though it may seem to be a little far from being perfect, it is better than no tool or without aid.

Appraisal Model

This appraisal model is designed mainly for research in buildings-in-use; as a framework for designers to make relationship decisions; for evaluation and classification of existing research; for identifying gaps for further research.

Therefore, all of the criteria, objectives, and values are rather subjective and will vary for different building types or at various sites and climatic conditions. The following examples are to illustrate

the technique of using this model for the appraisement of a building--in this case, an imaginary single family house. The first example is suggested to the reader as a guideline. However, the reader can follow the procedures of the second example (alternative) and set up his own criteria, objectives and values and compare it with the first example to derive a mean value for the "intended" model. Or he can gather more people; each one of them sets up his own criteria, objectives and values, and derives a norm value among these models, making it a "standard" model. Thus, the infinite possibility of usages of this model speaks for its validity as a design aid.

The appraisal considerations for an imaginary single family house is indicated as follows:

Activity:

Need - What kind of building for the client? Age, sex, usage, and living habit considerations.

Function - Does space meet the requirements and performance standard?

Interaction - To what degree is the social and psychological interaction enhancing the activities and living?

Flexibility - The interchangeability of space and the possibility for future expansion.

Spatial:

Living Space - The living-, bed-, family-, dining-, and restrooms, kitchen, den, porch, and so on.

Storage Space - The quantity of closets, shelves, cabinets, and garage.

Open Space - The garden, front, and/or back yards.

Connecting Space - The driveways, entrance, hall, corridor, and so on.

Quantity - Is space adequate? Or is it abundant?

Quality - Is spatial design interesting, inviting, efficient, and livable?

Acoustic Privacy - The relations of noisy and quiet areas?

Visual Privacy - The views, sight lines, fenestrations, daylighting adjustment, and so on.

Accessibility:

Circulation - The household circulation and capacity.

Service - Meter box and breaker box locations, garbage pickup, mail delivery, and so on.

Maintenance - Water heater, thermostat, junction box, switch, water and gas valves.

Safety - The floor finish or covering, stairs, rails, steps, ramps, treacherous corners, garbage disposer, and so on.

Security - Gates, locks, peephole magnifier, chain, alarm systems, fire extinguisher, or emergency route.

Mechanical:

Heating and Ventilating - Air conditioning, humidifier, stove, oven, fan, vent, and so on.

Plumbing - Sink, water heater, tub, shower, water closet, gas lines, conduit, and so on.

Lighting - Electrical lighting, daylighting, the locations of electrical switches and outlets.

Communication Systems - Telephone outlets, television antenna outlet, intercom system.

Utility Systems - Water, gas, electricity, telephone, or cable television.

Appearance:

Form - What type of house in respect to the site, climate, and function?

Identity - What kind of people live in it? Does the house imply any meaning or prestige?

Visual Quality - Daylighting control and artificial lighting adjustment.

Color - Color scheme and harmony.

Pattern - Shape and form of space and furnishings.

Texture - Varieties of materials and surfaces.

Finishes - Wall, floor, ceiling, furnishing, door, window, and so on.

Environmental:

Site - Is design sympathetic to site?

Landscaping - Is it related to site and enhancing the building?

Context - Is the overall form of the building in harmony with the context?

Social Effects - Is social interaction possible?

Traffic - Vehicular and pedestrian traffic considerations.

Ecological Consideration - Is building upsetting or in harmony with the ecological balance?

Performance - The overall efficiency and livability, the aesthetic evaluation, and the quality of space.

The RADARSCOPE (Pilot-Chart)

The author wishes to name this appraisement model RADARSCOPE.

"RADAR" stands for "Revolving Architecutral Design Axial Rating," which has its reference embedded in the "axial rotating, symmetrical cones" philosophy. "SCOPE" means the field or domain. It can also mean an instrument like that of a telescope or microscope. Also, the word "RADAR" implies the functions of detection, guarding, and guiding. This is exactly what this model will do for the designer who uses it. He can readily visualize the relationships and tensions of his objectives. He can get a clear graphic representation of the values of each item under consideration. He can use the RADARSCOPE to test his own hypothesis and get an instant feedback. To say the least, this RADARSCOPE is the pilot-chart for the designer. When put in use, it will become both a generative and evaluative instrument.

Technique and Theory

Example one is the author's own interpretation of proportion rating.

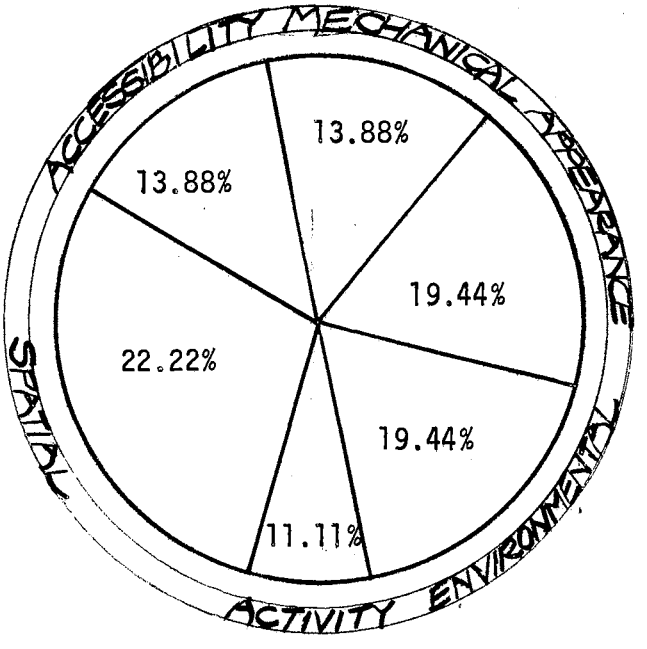

Figure 1. Proportion Rating of Example One

Calculations:

Activity	$\frac{4}{36}$ x 100% = 11.11%
Spatial	$\frac{8}{36}$ x 100% = 22.22%
Accessibility	$\frac{5}{36}$ x 100% = 13.88%
Mechanical	$\frac{5}{36}$ x 100% = 13.88%
Appearance	$\frac{7}{36}$ x 100% = 19.44%
Environmental	$\frac{7}{36}$ x 100% - 19.44%

Technique and Theory

Example two is a reader's interpretation of proportion rating.

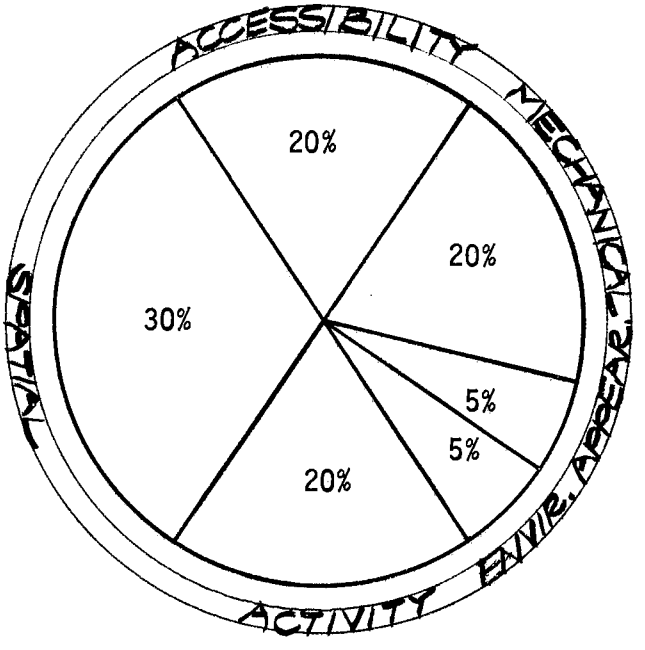

Figure 2. Proportion Rating of Example Two

Derivation of an "intended" proportion rating:

$$\frac{\text{Author's proportion rating + reader's own proportion rating}}{2}$$

= Mean value of the "intended proportion rating

Calculations to obtain the mean value:

Activity	$\frac{11.11\% + 20\%}{2} = 15.55\%$
Spatial	$\frac{22.22\% + 30\%}{2} = 26.11\%$
Accessibility	$\frac{13.88\% + 20\%}{2} = 16.94\%$
Mechanical	$\frac{13.88\% + 20\%}{2} = 16.94\%$
Appearance	$\frac{19.44\% + 5\%}{2} = 12.22\%$
Environmental	$\frac{19.44\% + 5\%}{2} = 12.22\%$

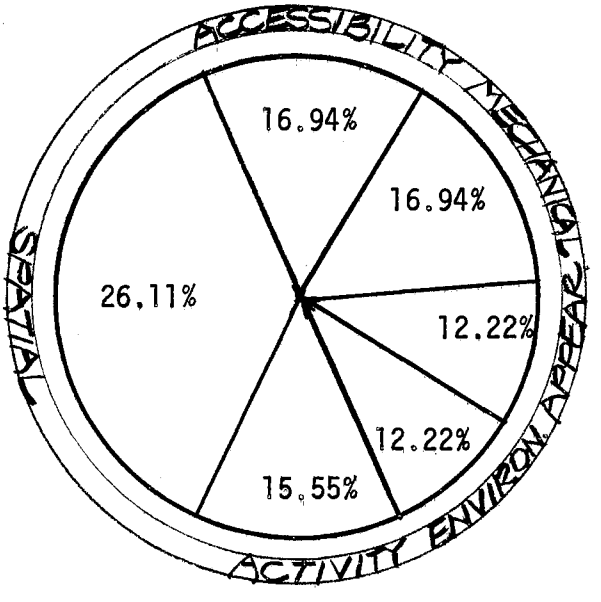

Figure 3. The "Intended" Proportion Rating

Note: The author has no intention to impose any value or judgement upon the readers. All numerical values shown in the above examples are merely for the purpose of illustration. The reader should assess his own value and judgement.

The Rating Scale

A seven-point rating is established as a scale for reference. Its function is similar to the scales used on a thermometer, the scale value is for comparison rather than representing an absolute value.

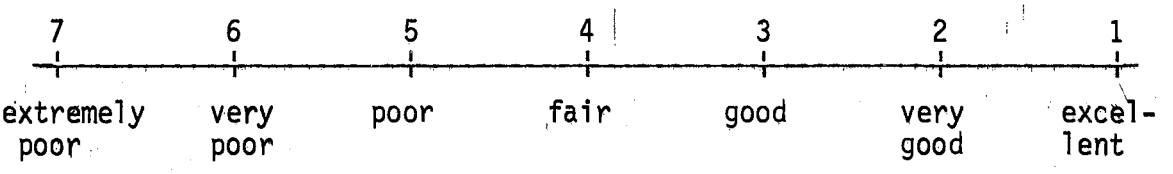

Figure 4. A Rating Scale

Functions

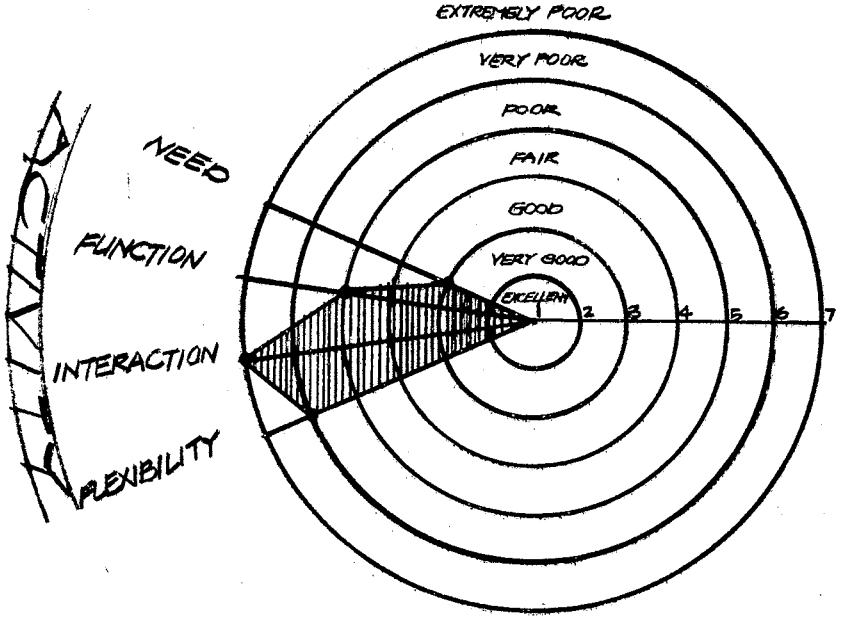

Figure 5. The Functions and Values of RADARSCOPE

Explanation

Each concentric circle corresponds to one level of rating on the seven-point rating scale, with the exception of the center, which falls on the excellent rating. Each radius represents one item under consideration. All of the items will group under their general heading which occupies one sector of the big circle. Due to the wider space occupied at the outer ranges, there will be more amplification of weakness (deficiency) shown on the RADARSCOPE; thus it is much easier for detection and identification. The more related items are grouped under headings next to one another, thus any weakness (deficiency) shown on the RADARSCOPE will draw immediate attention to that particular area.

Application

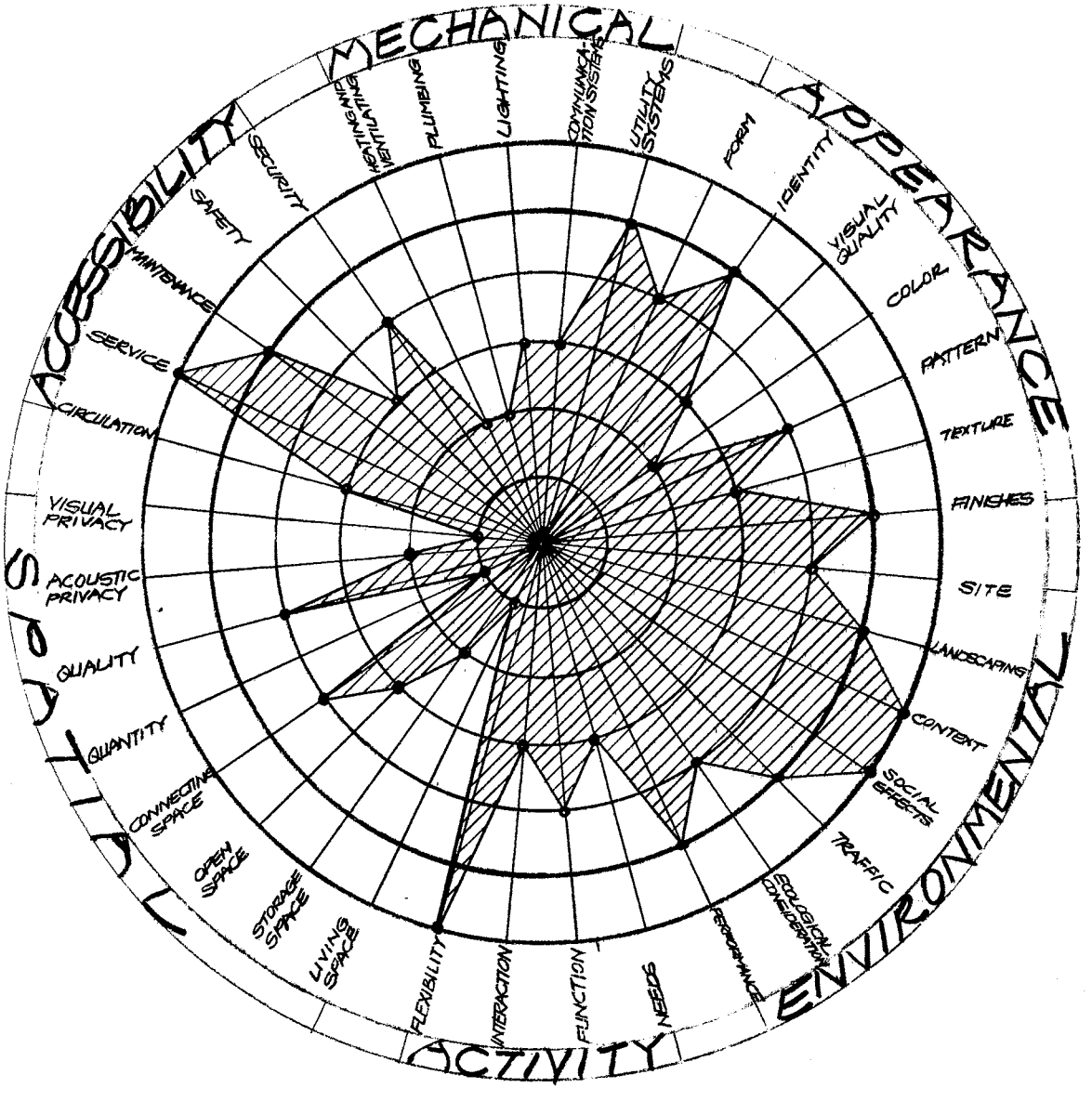

Figure 6. The RADARSCOPE

The "areas" of design weakness (deficiency) are indicated by the RADARSCOPE as shown. The "proportion" of weakness in "relation" to the overall project is determined by the designer's intended proportion rating. The "degree" of deficiency of each item is indicated on the radius crossing the seven-point rating scale.

Overall Rating

The value of the overall rating is derived from the following equation:

$$\text{Rating score} = \frac{\text{Number of items receiving fair or above ratings} \times 100\%}{36}$$

TABLE I

SCALE OF OVERALL RATING

Rating Score	Design Performance Rating
50% to 60%	Marginal
60% to 70%	Adequate
70% to 80%	Average
80% to 90%	Good
90% to 100%	Outstanding

Evaluation

TABLE II

EQUIVALENT SCALE OF PERFORMANCE

Flow Chart Guide	Overall Rating	Verbal Rating	Items Rating	Remarks
Sensation	50% to 60%	Marginal	26 Poor	Increment of 4, 1/9 of 36 items
Perception Conception	60% to 70%	Adequate	22 Fair	Increment of 4, 1/9 of 36 items
Learning Assumption Knowledge	70% to 80%	Average	18 Good	1/2 of 36 items
Evaluation Application	80% to 90%	Good	14 Very good	Deduction of 4, 1/9 of 36 items
Experience Reality	90% to 100%	Outstanding	10 Excellent	Deduction of 4, 1/9 of 36 items

SUMMARY AND CONCLUSIONS

A comprehensive study of the factors affecting architectural design is being presented in this paper. The author has proposed an organic theory of living, learning, thinking, and designing, and regards this chain-cycle process a biological metamorphosis rather than a number of isolated framental phenomena. A study model is being constructed to explain the spontaneity, continuity, and simultaneity of the learning/thinking/designing process. All of these concepts have their origins rooted in the author's own philosophical schema. The author also presents the RADARSCOPE, an implementary design aid used for architectural appraisement. The author, however, would like to emphasize one point: all of these theories and methods in this paper are recommended to be guidelines only; there is no intention to make them as rules. One should design in any way one can feel most at ease, then use the relevant knowledge and techniques to evaluate their validity. The selection of any method must be based on its success as revealed by an evaluation of the designs produced. Normally, the process itself will determine which techniques may seem suitable.

On reflection, architecture is a multi-discipline activity. An architecture designer must learn to assess the wide range of knowledge and experience in the light of situations, current practices, available resources, anticipated future developments, and the social, cultural, economic, technological, and physical matrices in which he is at work. Therefore, architecture is more than merely a problem-design-solution activity.

To conclude this paper, a quotation from MacKinnon (1962) seems

most appropriate for such occasion:

> "Architecture, as a field of creative endeavour, requires that the successful practioner be both artist and scientist --artist in that his designs must fulfill the demands of 'Delight' and scientist in that he must meet the demands of 'Firmness' and 'Commodity.' But surely, one can hardly think that the requirements of effective architecture are limited to these three demands. The successful and effective architect must, with the skill of a juggler, combine, reconcile, and exercise the diverse skills of businessman, lawyer, artist, engineer, and advertising man, as well as those of author and journalist, psychiatrist, educator, and psychologist."

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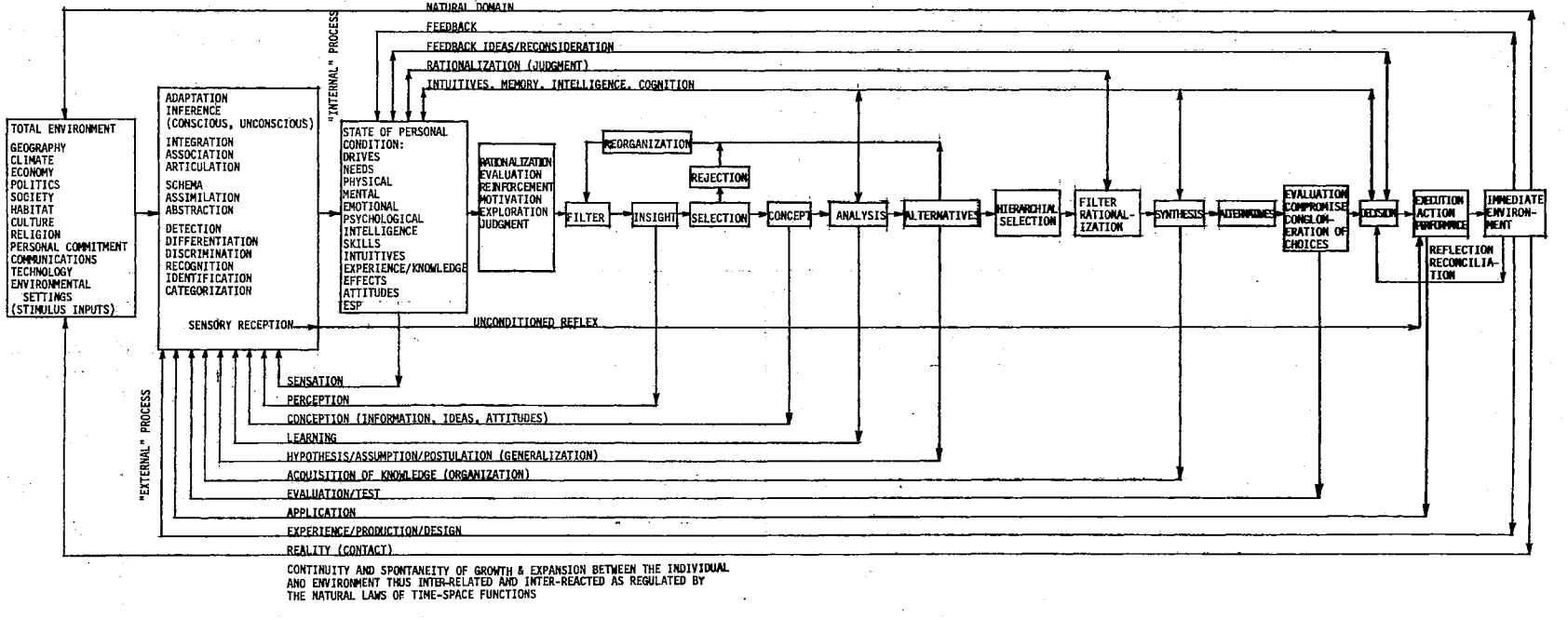
APPENDIX



THE LEARNING/THINKING/DESIGN FLOW DIAGRAM

VITA

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