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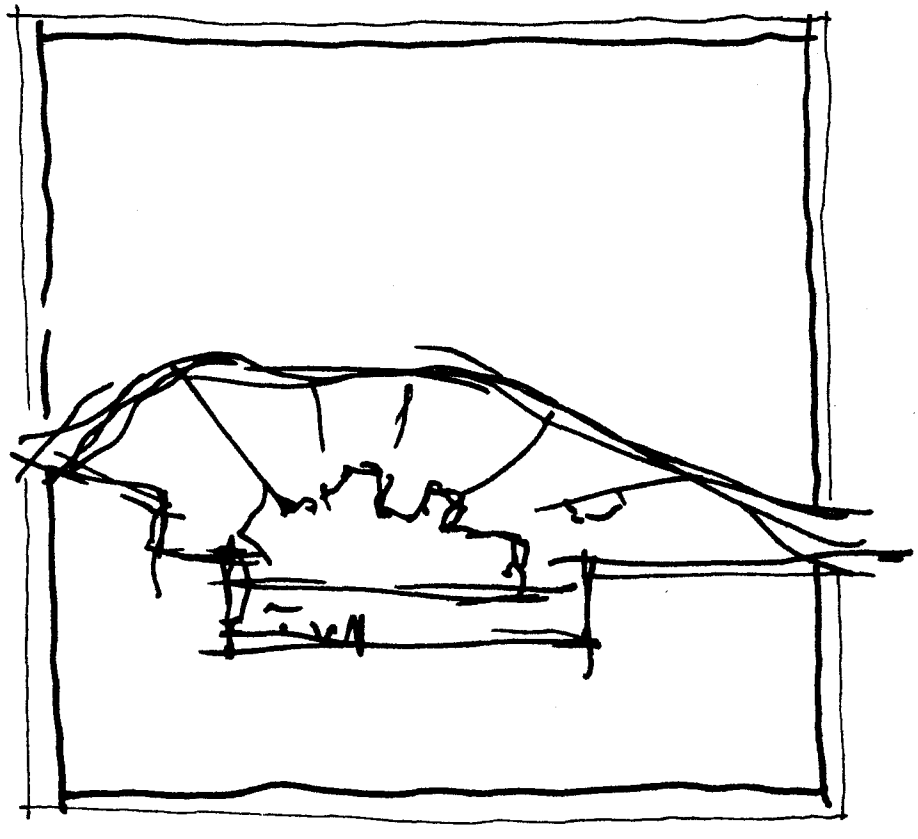
By

Frederick A. Jules



The School of Architecture & Urban Planning
The University of Wisconsin-Milwaukee

A COMPARISION OF THE APPLICATION TO ARCHITECTURE OF THE ECOLOGICAL AND GESTALT APPROACHES TO VISUAL PERCEPTION

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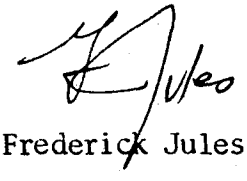

Frederick Jules

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INTRODUCTION

This research is a comparison of two psychological theories of visual perception, Gestalt Theory and an Ecological Theory developed by J. J. Gibson, with two theories of architectural composition, theories developed by the Ecole des Beaux-Arts and theories of the Modern Movement in architecture.

The objective of the research is to clarify the relation between the psychology of perception and building composition, and thereby to affect how architects are educated and practice. This is not the first time architectural theory has been evaluated and rethought based on advances in science. It will become clear, in the main body of the research, that each architectural theory analyzed here has relied, to some extent, on contemporary theories in science and other fields. However, the architectural theories of the Ecole des Beaux-Arts and of the Modern Movement, which dominate architectural practice and education, have not attempted to reconcile their outlooks with current advances in science. This research is to discover whether these theories of architectural composition are supported by current theories in visual perception, and if not, whether the theories of visual perception suggest a reordering of priorities in the design theories or a rejection of the theories.

These are relevant questions in architectural education and practice because compositional design theories have the objective of ordering built form to express an idea as well as to create a usable and meaningful environment. The psychology of perception is the science of how objects, ideas and situations are perceived. It would seem logical then, that any design theory committed to communication through formal manipulation would exhibit congruence with the capabilities of the receiving mechanism, in this case, the human observer. These capabilities are scientifically defined in the psychology of perception.

Since the way information is ordered by human observers is to some extent biologically determined, it would seem that any discrepancy between how information is received and the intended method of communication would be rectified by adjusting the transmission, or in this case, compositional theory. As will be seen later, this statement does not describe the only course of action. The human perceptual system has great flexibility in adapting to theoretical constructs, including compositional and spatial ones, regardless of their scientific validity.

Thus, while the prime objective of this research is clearly the comparison of theories to find compatabilities, the ramifications of the subtle interactions of the two perspectives are of equal interest.

The Context of Theory

Theories in Psychology and Architecture vary greatly in their implied or stated scope of applicability from absolute to varying degrees of predictability within a context. This makes them difficult to compare. It is important to this work to specify these ranges of applicability; a conflict will occur when one theory claims absolute applicability while a contrasting one suggests extreme relativity to a context.

The field of environment-behavior research has suggested a strong relation between culture and perception, that perception is highly influenced by cultural predilection. Thus the range of any theory of perception would be limited to a specific culture and its social belief systems. This stance seems the most relative one and suggests a high probability for conflict with architectural theories.

Psychology has a range of theories, from ones close to the environment-behavior concepts to ones more concerned with the structure of perception. These latter theories assume a consistency in the human perceptual system that is cross-cultural. Although there is a level of relativity in the arousal of the system, this is at a narrower range than cultural determinants. It is these theories that are more compatible with architectural theories.

Architectural theories have a tendency to assume that they are absolute and irrefutable. Theories of composition and symbology are considered to apply cross-culturally. The exception is the formation of a building program, generally assumed to be culture-bound and context-specific.

Architectural historians codify architectural theory. Juan Bonta has done an important analysis of some 20th century architectural historians and has shown conclusively that their analysis of buildings is internally consistent with their analysis of other buildings, but can contrast dramatically with other contemporary historians' interpretations.[1] He concludes that historical writing is relative to the individual's tastes which are part of his culture and training. This would suggest that there is no consistent interpretation of architectural form that is cross-culturally accepted.

For this work to be useful then, the assumption must be made that there is an underlying structure to vision and that to some extent this affects perception of architectural form. This does not deny the importance of culture in how perception occurs. It may be the case that both processes work simultaneously and that in any particular circumstance, perception has components of both interpretations.

In architectural education and practice, the issues of cultural relativity of form interpretation and the role of learning in this interpretation evoke profound questions. All theories maintain that culture is primarily transmitted through learning. The question is, at what point is it valid to assume a cultural norm as a basis of design and to forego the potential of continued education of the viewer. If it is appropriate to learn culture, is it not appropriate to let it evolve and help it where possible? The danger is, of course, that because architecture addresses so many people with varying cultural backgrounds and lasts longer than phases in a culture, it will always attract criticism and reinterpretation.[2] If these interpretations are out of the control of the architect because of the variety of viewers and the evolution of interpretation over time, is there a simpler layer of interpretation based on the structure of vision that is available for architectural manipulation, and is it important? The assumptions in this research are that such a structure exists and that it is important. Expressing the relative importance of this structure is an underlying objective of the work.

The Selection of Theories

The selection of the Gestalt and Ecological theories in the psychology of perception was based on several criteria. The primary criterion is that the theories are currently considered valid in their field. Although both theories have their detractors, they are generally supported by large sub-groups within psychology. They represent major competing conceptual frameworks in contemporary psychology. In addition, these two have been chosen from among other general theories because they emphasize the importance of visual perception and therefore seem most compatible with theories of architectural composition. The relation between Gestalt theory and architecture has been explored recently by Arnheim, Jules and Prak, and the impact of Ecological theory on design has been outlined by Lang.[3] A third criterion is that the theories state clear structures for vision that have implications for composition that are not entirely culture-specific.

The architectural theories of the Ecole des Beaux-Arts and the Modern Movement were selected for similar reasons. They contrast, and yet they are the primary theories in contemporary architectural education. In practice, the Modern Movement can not be considered dead, and Post-Modernism seems to begin with a classical compositional base which is then exaggerated in several dimensions for recognition and symbolic reasons. Although there are several other compositional theories, these two cover the broadest spectrum in education and practice, and underly or have been the genesis of a number of newer theories.

In both fields, theory is continually evolving. In psychology, this is generally an additive process that strengthens the initial conceptualizations. Divergent conceptualizations tend to produce new theories. In architecture, the evolution of a theory is more complex and less linear; in many instances, new conceptualizations modify parts of old theories while not entirely eclipsing them. Therefore, it is important, particularly in the architectural field, to define a theory at a particular phase of its evolution.

This analysis and comparison is not an attempt to trace meticulously the derivation of the theories presented. It is not to study the incubation of an idea but to examine it in some fuller form. Therefore, this work will concentrate on each theory in its developed form, when it had greatest influence on people in the field and its major challenges and/or evolutionary change had yet to take place.

With the exception of the Beaux-Arts, the theories at the selected time of evolution are championed by their principle innovators. The Modern Movement is represented by the ideas of Gropius at the Bauhaus and later in the United States, by LeCorbusier and Aalto in Europe and by Wright in the United States Gestalt theory is presented through the eyes of its initiators, Wertheimer, Koffka and Kohler, and the Ecological theory by J.J. Gibson in the present. The Beaux-Arts has been evolving since the age of Pericles. Since the Greek texts and monuments have been destroyed, Vitruvius has been the only direct interpreter of that world. Alberti then interpreted Vitruvius and Roman building, as did Palladio. The Beaux-Arts grew from all these basic texts and from what various theoreticians could observe from ruins remaining from antiquity. As a singular conceptual framework it last stood alone in France around 1850 just before Labrouse, Garnier, and Viollet-le-Duc brought major challenges to it. It is in this form that Beaux-Arts theory will be considered in this work.

The Relation Between the General Structure of Theories in Architecture and Psychology

Common to both types of theories are the assumptions that there is order in the environment and that humans perceive that order. However, the scope of theories in psychology are greater than theories in architecture; architectural theories generally are limited to the creation and perception of order in buildings or landscapes, while psychological theories are concerned with the entire range of environment and human behavior.

The basic difference between the psychological and the architectural theories concerns their goals. Architectural theory is prescriptive; it focuses on what should be done. Psychology, as a pure science, is descriptive of how and why

people behave; it can be useful in predicting behavior. In this light architectural theory strives for a utopian condition while psychology simply attempts to identify the reality of the present.

In any study relating two divergent fields to each other it is important to clarify the differences in approach to problem identification and solution. This identification pinpoints the conceptual differences between the fields which may underlie the primary conflicts found in more detailed analysis. For architecture and psychology the differences can be identified in a comparison of their definitions of what they observe, to what they attribute observed relationships, and how they verify their observations.

Psychology is the study of perception, thought and behavior in relation to physical, social and conceptual environments. Psychology observes people and the environment to identify relationships between the two. The correlations between a change in the environment or mind and changes in behavior or thought are the basis for theory. An ordering of these correlations and the explanation of the significance of this ordering is a theory.

In addition to correlations between the behavior of man and changes in the environment, this science requires a concept for the initiation of action or thought. The conceptual framework for this initiation is generally one of satisfaction or equilibrium. If a biological, social, conceptual need is strong enough, it provides the underlying motivation for action until it is satisfied. The satisfaction of a motivational force returns the organism to an equilibrium. Verification of observations and theories in psychology is done through the application of the scientific method. While the theories used in this research are commonly considered theories of visual perception, their originators feel that they are comprehensive theories that have been developed and tested furthest in the area of visual perception.

Architectural design is the determination of the function, form, orientation, strucute, space, material and construction of buildings. Design theory is a rationale for architectural design as well as a system for evaluating and interpreting architecture. A theory may or may not address all the issues of architectural design; most do not. Although architectural theorists observe the same things as psychologists, ie. both people and the environment, the framework is more specifically related to buildings and landscapes, and the behaviors or thought patterns are predominantly those of other theorists or architects. The reference system for architectural theorists includes architecture and architects, with minimal interaction with the society at large. Architectural theory assumes that a

change in the physical environment will cause a predictable response in behavior and thought.

As in psychology, architectural theory needs an underlying concept for satisfaction with an environment. Architectural theorists usually relate satisfaction with usability of an environment and beauty which is said to derive to some extent from perceived order and social symbolism. This type of satisfaction can be considered a subset of the psychological definition of satisfaction of motivational needs. The underlying assumption in architectural theory is that people need visual and symbolic order and that there is satisfaction in both creating order and perceiving it.

In some instances, architects verify their observations and interpretations scientifically, but the more common methods are through personal experience of environments and on precedents set in philosophy and architectural theory.

The Research Method

The research method is a literature search. The architectural compositional theories will be presented in four parts to facilitate comparison with each other and the psychological theories. These parts are Geometry, Development of Hierarchy within a composition, Mood or Tone of a composition, and explicit Symbol Systems.

Geometry refers to patterning of architectural plans, elevations, sections and solid form, which usually, but not always, follow regular geometric shapes. In this instance, geometry is not an abstract mathematical science of points, lines and planes, but instead deals with the selection and allocation of building elements in patterns that relate to each other. Hierarchy in architectural composition is the order in which the importance of various architectural forms are ranked and related in their context. Hierarchies are based on ideas of sequencing, proportionality and symbolism. Mood or Tone of a composition is difficult to define. It is intended to identify feelings that are not amenable to verbalization and are not verbalized in the process of experiencing them. It covers feelings of well-being that are perceived sensorially, such as the smell of a breeze on a spring day as one overlooks a familiar valley. Explicit Symbols are forms that are intended to represent a clear concept. For example, a bell tower of a church is an explicit symbol of church. The word explicit is utilized here because, from some psychological viewpoints everything has symbolic content including moods and tones, whereas others prefer to limit the meaning of symbols to a more infrequent mental activity. The choice of this separation is made to clarify differing architectural intentions and should not be considered an evaluation of psychological theories.

Geometry and Hierarchy within a geometric pattern have sometimes been called formal design principles, but they are simply coordinating systems in space. A formal system also includes both general and specific symbol systems, the latter two parts of this analysis format.

Footnotes

1 Juan Pablo Bonta, Architecture and its Interpretation, (New York: Rizzoli International Publications, Inc. 1979).

2 Good analysis of architecturel criticsm can be found in:

Wayne Attoe, Architecture and Critical Imagination, (Chichester and elsewhere: John Wiley, 1978) and in:

Juan Pablo Bonta, Architecture and its Interpretation.

3 Rudolf Arnheim, The Dynamics of Architectural Form, (Berkeley: University of California Press, 1977).

Frederick Jules, Form/Space and the Language of Architecture, (Milwaukee: Publications in Architecture and Urban Planning, Center for Architecture and Urban Planning Research, University of Wisconsin-Milwaukee, 1974).

Niels Prak, The Visual Perception of the Built Environment, (Delft: Delft University Press, 1977).

Jon Lang, "Theories of Perception and 'Formal' Design," in Designing for Human Behavior, ed. Jon Lang et al. (Stroudsburg, PA: Dowden, Hutchinson & Ross, 1974), pp. 98-110.

COMPOSITION AT THE ECOLE DES BEAUX-ARTS

The composition techniques of the Ecole des Beaux-Arts related below are a complex series of design processes that, as a group, were at their greatest influence around 1850. An abridged history of the evolution of the program at the Ecole des Beaux-Arts is relegated to Appendix A. The compositional concepts were derived from the Roman classical text of Vitruvius, Roman building, and the Renaissance writings and building of Alberti, Palladio and lesser well-known theorists, all of whom relied heavily on Vitruvius and Roman building as bases for their arguments. Design activities related to the program at the Ecole des Beaux-Arts were carried out in ateliers outside the school set up specifically to teach design. Each atelier had a master and he gave a particular emphasis to the methodology of design within the generally accepted conceptual framework that the Ecole des Beaux-Arts taught. Therefore, it is impossible to state with any clarity a single all-encompassing theory of composition which was applied to design in a rigid manner. What will be described here instead, will be a general methodology and set of techniques that had emerged by 1850 and was justified by the work of Vitruvius and other scholars.

The techniques are presented in the format that will be used to compare it to the Modern Movement in architectural theory and the Gestalt and Ecological theories in psychology. This format is one of describing first the physical ordering systems, by geometry and by the development of hierarchy within the geometry, and second, the symbolic systems of mood or tone and the application of explicit symbols.

Geometry

The geometries employed in the Beaux-Arts were circular and grid forms derived from Vitruvius's description in Book III Ch. 1[1] of the proportions of man fitting a circle inside a square, which so influenced the imagination of Renaissance Architects[2]. The grid was expanded to accommodate two principles. The first was the use of natural light in all primary spaces, and the second was roof drainage;[3] both can be traced to Vitruvius' discussions of the use of atriums in Book VI Ch. 3. Both principles are based essentially on practical concerns, but have obvious formal consequences.

The grid form was also allowed to expand into a limited set of proportional rectangles[4] in order to match the functional space requirements and as a means of developing hierarchy and unity in composition.(fig. 1). Elements were connected by symmetrical circulation patterns developed from nested

rectangular grid patterns of organization. The concept of separate circulation and the nested rectangular geometry as a method of achieving it were a unique contribution of the Beaux-Arts to composition. D. Van Zanten discusses Charles Percier's 1786 Grand Prix Design as one of the first competition winners to use this methodology.

> Percier's reduction of almost all the spaces to rectangles adhering to a continuously modular grid greatly increased the ease with which they might be combined and manipulated. Furthermore, the rectangle-within-rectangle figure produced a system of communication quite different from that of the Renaissance and Baroque enfilade.[5]

He goes on to state "The rectangle-within-rectangle figure and the overlapping of the outer rectangles introduced the possibility of the separation of functioning spaces and communications, which by the time of Guadet (1901) had become one of the cardinal rules of Beaux-Arts composition."[6]

Hierarchy

Hierarchical composition is the presentation of the relative importance of various elements of a building and their interrelationships. In Beaux Arts competitions, the elements of a building were assigned a scale in relation to their importance. L. Anderson writes that this determination of scale was the primary requirement for the student.

> The elements themselves--auditoria, exhibition galleries, libraries, lecture rooms, down to classrooms, offices, and smaller dependencies--were largely pawns in the game. Their forms were taken for granted. It was up to the student to rank them in order of actual size, need for easy access, and symbolic importance in his composition and to place them accordingly.[7]

Student responsibility was increased by the lack of specific program data. As Carlhian claims,

> It should also be remembered that no Ecole's program, beyond merely stating the maximum overall dimension of the project at hand and the scale at which it was to be presented, cared to even give exact desirable sizes pertaining to the functions of elements to be accommodated. The governing factors, in a plan arrangement exercise, was the determination of what relative importance was to be given to the programs' enumerated parts, and in elevation studies, to the overall proportions given to its various parts. Exact sizes were never a consideration.[8]

Hierarchy implies the bringing of things together into a meaningful whole as much as it means assigning relative importance to parts. This requirement for singular wholeness was a principal of Beaux-Arts composition as it was for some classical and most Renaissance design. It implied a unity of idea which was then given a unity of form. Anderson writes concerning the rules of composition during the early 20th century Beaux-Arts design that

> We must above all remember two truths: composition is necessary for all beauty, and the overall concern of composition is unity. The elements of any composition must subordinate themselves to one principal dominant element. The avoidance of equality is the basis for all orderly composition.[9]

The technique for developing hierarchy was the use of axes of symmetry. The underlying justification for this technique can be traced to Vitruvius, who based its importance as one of the fundamental principles of architecture on the symmetry, and therefore harmony, exhibited by man and nature.[10]

The process of composition then, was to identify within a given program the singularly most important element of the program and place it on the axis of symmetry. Secondary elements were identified and allocated symmetrically around the axis, with tertiary elements placed in a second level away from the main axis. David Van Zanten's description of the activity is simply that "the manner in which the students arranged these spaces and volumes was to group them along axes, symmetrically and pyramidally." In the educational setting these compositions tended to be limited to one level, or sometimes two, while in practice there was greater latitude; however, even there the concept of 'piano nobile' or prime floor flourished.

In the Beaux-Arts, the composition process moved from organization in plan to that of section, to that of elevation.[12] Being the singular key to the solution of the problem in section as well as elevation, the plan was developed in detail and "remained to the very end the horizontal expression of a load-bearing wall structure."[17] The scale of plan space had a corresponding scale in the cross section of the structural members so that its section and elevation could be read from the plan.

Decisions about the placement of the dominant element were first made in plan and were based on the number of axes of symmetry. This placement could be at the top of the page with the assumption that the approach to the building was from the bottom, or alternatively, the prime element could be placed in the center of the page at the intersection of two perpendicular axes. In this latter condition, the prime axis or approach was

still the vertical one but entry was developed symmetrically from the top and bottom.

While symmetry around two axes in a square plan order centered the major elements, the axes were usually not exactly replicas of each other and their difference usually implied an axes of approach from one or two ends of one of the axes, making that one slightly more significant. Palladio's villa rotunda was one of the few earlier models of purely symmetrical organization, and suggested as well the perfection strived for in all building.

D. Van Zanten states that

> The tension one sees in the Grand Prix projects between biaxially symmetrical planning and directional layouts is characteristic of a basic conflict in Beaux-Arts composition: that between the purity of the geometric pattern and circumstantial distortions required for the fulfillment of the given function and for the expression of that function.[14]

This conflict, it should be noted, never was great enough to disturb the basic system of symmetrical layout.

Despite which axial scheme was used, the dominant element remained the focus of the building. Anderson reports that on the approach axes on either the centering scheme or the linear one, the major element of the building was never to be masked by other elements.[15] The clear experience of the primary element as one approaches the building and travels through it is the 'marche' of the scheme. The 'marche' was not always possible to achieve in a purely biaxially symmetrical scheme because some elements might be blocking the approach view of the prime element. In these situations, a forecourt was often utilized to open the view to the major element, thus making the axis of entry dominant and directional. In linear progressions, a rising topography was usually employed to further emphasize the primary element at the highest level.

The sections were developed to reflect the plan hierarchy. "The section was essentially an exercise in asymmetrical organization...the western tradition of reading from left to right resulted in sections which usually feature their highest elevation towards the right."[16] Schemes where symmetry was developed around two perpendicular axes would in section cascade in scale from the middle.

Many Beaux-Arts schemes would be raised on plynths to ensure the purity of the composition. This reflected a concern of Alberti who felt that the most beautiful and important building was the church and that it should be separated and raised above

all other buildings.[17] Since great beauty was expected of Beaux-Arts composition it was only natural to separate their designs from any real context and to raise them on plynths.

The unity which is conceptually an intrinsic part of hierarchical composition was accomplished by the proportioning of all parts to each other, by the connection of elements by corridors, by the appropriate selection of orders, and by visual rhythm or pattern along axes, corridors, and in elevations. The Beaux-Arts, as did Vitruvius, considered the proportional relations of elements to the whole as one of the fundamental principles of architecture.[18]

> In (Beaux-Arts) architecture, relative proportions are always important--we look for them in details of the plan, in the balance of masses, or in the most refined moldings of a facade. Generally, neighboring elements need to differ dimensionally almost from single to double to completely avoid a sense of duality. For instances, at the cornice molding of the Ionic Order, large elements are always separated by small ones. The importance of contrast comes from a fear of duality.[19]

The modulation along corridors also followed this requirement for high contrast between sections of repeating rhythms.

Symmetry is maintained in the smallest detail or space. In the Beaux-arts drawing technique, scales were seldom utilized and instead proportional dividers were employed to layout elements in proportion to each other. The rules for proportioning were generally based on the writings of Alberti and Palladio who had very specific proportioning systems.[20] The concept of unity was applied to the most functional elements. For example, "It should be noted that in order to safeguard the precious precept of unity, all roofs on any one building were assigned identical pitches."[21]

The sectional and elevation proportions were developed from the plan proportions.

> With a well-ordered plan with its main features properly stacked in hierarchic order, its various elements correctly articulated in accordance with a working roof plan, a well-modulated poche figuratively expressive of the relative compressive forces generated by various spans or heights, the section was a cinch.[22]

In a similar fashion the proportions of the elevations were developed from the spaces behind the elevations and the proportions of the orders which were used to provide the appropriate decoration and reference to the interior scale.

Hierarchy then was generated by the assignment of an element's scale and location while unity was provided by proportioning all parts to the whole, all within the strict application of symmetrical ordering techniques. The current concept that a building requires a base, middle, and top which seems such an integral part of Beaux-Arts composition, Wittkower attributes to Palladio's dissemination, through his writings and work, of ideas present in the palace architecture of Bramante and Raphael.[23]

A major widening of the compositional methodologies occurred in the 1860's as a response to more specific programmatic and site specifications for the Grand Prix as well as to the theoretical expansion of Viollet-le-Duc, Charles Garnier, and their contemporaries. For a while, these infuences became a major direction in the Ecole, but their impact on the program weakened quickly.

Mood or Tone

Buildings have certain moods or tones which are attributes of light and shade, material choice, color, scale and proportional decisions and compositional methods. What will be recorded here are simply the stated methods of producing a mood or tone, though these can hardly be considered systematized. A. L. T. Vaudoyer, an atelier patron and secretary of the Ecole, sums up what the sensation of mood or tone is in his presentation to the Academie in 1832.

> And monumental architecture, architecture that is art, arrives at the same end; the material that comprises it is forgotten, when the architect who has produced it has deeply probed the human heart and sees how the human heart is affected by places under different circumstances; when he studies within himself the varying emotions he has experienced when seeing, caught by surprise or upon reflection, under a clear and luminous sky or a dark and sad horizon, the curious combinations of effects, of certain places, of this great universe. When this artist produces the same impression by means of imitation, we have what cannot be expressed in words, let alone be reduced to principle.[24]

Since the concepts of moods or tones were presented in ateliers outside the Ecole, there are few records of this important aspect of Ecole design. David Van Zanten describes this as an architecture of tableaux and

> this conception of architecture in terms of tableaux of building masses and interior spaces was an eighteenth century phenomonen, first stated by Leroy of the

> generation of Soufflot, and then by Boulle'e of the following generation. But it persisted through the Empire and the Restoration and down to the Romantic revolution around 1830.[25]

Van Zanten relates how Etienne-Louis Boullee, a prominent maitre d'atelier of the 1780's, rejected the importance of the orders and to some extent proportion. Boullee states "'In architecture, faults in proportion are sensible to any great degree only to connoisseurs. It is clear that proportion is not the first law....The first law of architecture...is regularity.'"[26]

Instead, he emphasized the importance of the mood or tone of a building which he felt could be based on the moods evoked by the four seasons: Summer, shimmering light on many objects with bright colors; Fall, contrast of light and shadow, dissimilar shapes, irregular quality of mixed and checkered colors; Winter, dark and sad, shapes hard and angular, bare walls, squat proportions and concealed in the earth.[27] While this list is undoubtedly not the only set, nor entirely complete in itself, it conveys a sense of the feelings that are meant to be evoked by architecture. Over time, these feelings became more concrete in specific components of a building and will be dealt with in the next section under explicit symbols.

Explicit Symbols

The Beaux-Arts developed the use of specific configurations of building elements (symbols) to a level of complexity unequalled in architectural education. The intent was to identify a series of proper responses to any stated architectural program. This intention evolved from Vitruvius' fifth principle in his Fundamental Principles of Architecture, Propriety.[28] For Vitruvius, Propriety came from the perfection of style and the appropriate application of it. The first set of appropriate symbols were the Orders. In Book IV, Vitruvius describes the origins and appropriate uses of the Orders, and in Ch. 1 of Book V, he explains the application of the Orders in public and commercial buildings.

Over the centuries, the range of building types designed by the Orders was expanded from public and commercial buildings to include residences and churches. Wittkower discusses Palladio's expansion of the uses of the Orders in the development of domestic architecture.

> Facades of ancient domestic buildings were unknown, but with the application of the temple front to the house, Palladio believed that he had re-created them in form and spirit; his reconstruction of the front of the ancient house in Babbaro's Vitruvius shows a large

eight-column portico.[2] (Pl. 23c). His conclusion was founded on two fallacies, an erroneous theory of the development of society, and an erroneous theory of the genesis of architecture...Therefore, he concludes, private houses were the nuclei of public buildings; in other words, temples reflect the appearance of the ancient house[3]....Thus to utilize the temple front for private buildings appeared to him a legitimate regression to an ancient custom...He was the first consistently to graft the temple front on to the wall of the house, and through him the type was most widely disseminated.[29]

Finally, with the neat trick of applying the Orders, which originally symbolized aspects of pagan religion, to church architecture, the Orders became the dominant decoration of all architectural building types. The choice of order and the scale at which it was applied was based on appropriateness to the building type, the building's intended tone and the intended hierarchy of the parts within the composition.

At this point in history, the subtlety of some of these decisions is totally opaque. D. Van Zanten relates that Quatremere, director of the Academy at its beginning (1816-39), taught that the Doric Order had the most character because it was supposed to be the most primitive and thus most vital.[30] However, this attitude did not permeate the work of the Beaux-Arts, as one can see from the numerous Grand-Prix drawings of record. Also, it must be clearly noted that much of the Beaux-Arts' architecture was formed by arches and vaults based on Roman precedent, and walls reinforced by engaged columns, all of which Quatremere disapproved.

The real intricacies of the Beaux-Arts education can be seen in the relation between design problem statements and the theory lectures in the Ecole. Students had to pass a series of design problems written by the Professor of Theory at the Ecole. The programs were a set of key words that related to appropriate design responses that could be learned only in the lectures.

J. P. Carlhian writes of the lectures that

> This is where one learned the difference between step, stoop, stair, staircase, stairway, stairwall, (marche, perron, gradin, escalier, emmanchement or the like) or between un peristyle, un hall, un vestibule, une entr'ee, un degagement, une galerie, une circulation. It was indeed extremely important to understand the professor's way of thinking, as one was called upon repeatedly to cope with the necessity of reading between the lines of the austere text of his programs.[31]

Historic precedent was, of course, an important part of this, and in many instances historic examples were referenced in the introductory paragraphs of programs.

The written comments about successful projects were equally cryptic and stylized, requiring the student to understand formal relationships that corresponded to specific words. Restated, the problem was to learn the appropriate form for a context; in a problem statement the underlying assumption was that specific form symbolizes a specific relationship that can be verbalized and justified. These form-word linkages covered everything from building type (such as the distinction between a country hotel and a major city one) to the detail of stairs and corridors. Every idea had an appropriate architectural response.

Since it took an education at the Ecole to understand and apply these symbols appropriately it must be assumed that the belief was that people would, when viewing a building, either be educated to appreciate these subtleties or respond to them instinctively. It is not necessary for this work to enumerate any particular Beaux-Arts theorist's word/form vocabulary. They, along with the appropriate application of the orders, have long since dropped from use in architectural education. The fact that they existed and were so succinct is what is of importance to this work.

Conclusion

Beaux-Arts composition was fairly strict. Its most obvious aspects were the complete application of symmetry, proportion, and the orders to every facet of a problem. The symbol systems utilized in design were quite intricate and explicit, but seemed to vary with the attitudes of the various teachers of theory at the Ecole. By 1850, the date at which this study is defining the Beaux-Arts compositional method, the Beaux-Arts began facing criticism from within which foreshadowed some of the attitudes of the Modern Movement.[32] These criticisms affected the Beaux-Arts for a short time, but were eventually rejected in favor of the system as it had existed earlier.

Footnotes & Illustrations

1 Pollo Vitruvius, The Ten Books on Architecture, trans. Morris Hicky Morgan (Cambridge: Harvard University Press, 1914).

2 Rudolf Wittkower, Architectural Principles in the Age of Humanism, (New York: W.W. Norton & Co. 1971).

Wittkower reports that "This simple picture seemed to reveal a deep and fundamental truth about man and the world, and its importance for Renaissance architects can hardly be overestimated. The image haunted their imagination." p14 He goes on to state: "But Palladio goes on to explain more fully what Alberti only adumbrates. For he states authoritatively which form is most worthy for the house of God. 'The most beautiful and most regular forms' he says 'and from which the others receive their measure are the round and quadrangular.'" p22. Wittkower shows that in the Renaissance mind the purity of these forms represented the purity of God and man's essential relation to that purity.

3 Jean Paul Carlhian, "The Ecole des Beaux-Arts: Modes and Manners," Journal of Architectural Education, Vol. XXXIII, No. 2 (November 1979):7-17.

Carlhian, in discussing the design process of Ecole students identified two basic pragmatic considerations: "the handling of natural light and provisions for the shedding of rain water.

Artificial light was never recognized as an acceptable solution justifying the assignment of windowless spaces to human use. It was deemed acceptable only for storage areas . . . never for people. . . . If and when permissible, top light had to be incorporated into a system of pitched roofs. . . . The resulting necessity of never allowing the disposition of more than three elements side by side thus becomes readily apparent." p12

4 Vitruvius, The Ten Books on Architecture.

Acceptable proportions for rooms varied with the theorist. Vitruvius in Book VI gives appropriate proportions to the variety of possible temples based on the orders and their proportioning. The dimensions given are outside proportions, so interior room dimensions seem not to have a direct proportional nature. In describing a forum in book V ch. 1, he relates the size of space to population. "The size of a forum should be proportionate to the number of inhabitants, so that it may not

be too small a space to be useful, nor look like a desert waste for lack of population. To determine its breadth, divide its length into three parts and assign two of them to the breadth." p132

and Wittkower, pp. 114+132.

Wittkower describes Alberti's very complex proportional system on page 114 of his book. He relates it to theories of mathematics and harmonics. In the same book on page 132 he describes Palladio's ratios for rooms and its musical scale interdependence. Both systems are reasonably complex and while the use of ratios and proportions for orders have transferred to the Beaux-Arts it seems that the rationale based on greek musical notation has disappeared in favor of a concept of mathematical unity.

5 David Van Zanten, "Architectural Composition at the Ecole des Beaux-Arts from Charles Percier to Charles Garnier," in The Architecture of the Ecole des Beaux-Arts, ed. Arthur Drexler (New York: The Museum of Modern Art, 1977), p. 129.

6 Ibid., p. 130.

7 Lawrence B. Anderson, "Rereading Gromort," Journal of Architectural Education, Vol. XXXIII, No. 2 (November 1979), p. 20.

Anderson's article is about the architectural theory of Georges Gromort who was the senior patron of the Atelier Gromort and served 1937-40 as Professor of Theory at the Ecole. While this then represents a time past the one considered in this work, the principles quoted are those of the earlier time as well.

8 Carlhian, p. 17.

9 Anderson, p. 19.

10 See Appendix B.

11 Van Zanten, p. 118.

12 Carlhian, p. 16.

13 Ibid., p. 13.

14 Van Zanten, P. 124.

15 Anderson, p. 20.

16 Carlhian, p. 13.

17 A detailed understanding of Alberti's philosophy which includes the centrally planned, white church separated from its context by placement on a plynth is well-documented in Wittkower, Architectural Principles in the Age of Humanism.

18 see appendix B.

19 Anderson, p. 19.

20 Wittkower, pp. 114 + 132.

21 Carlhian, p. 12.

22 Ibid., p. 13.

23 Wittkower, p. 77.

24 Van Zanten, p. 162.

25 Ibid., p. 160.

26 Ibid., p. 159.

27 Ibid., p. 159.

28 see Appendix B.

29 Wittkower, p. 74.

30 Van Zanten, p. 191.

31 Carlhian, p. 15.

32 Internal criticism of the Ecole des Beaux-Arts represented several changes in attitude toward composition. Viollet-le-Duc developed and promulgated a point of view that was distinctly geometric and abstract. "Violett-le-Duc's analogy of architecture and geology made one specific point, that his was, in a sense, a Copernican point of view. In the period from Boulle'e to Vaudoyer, a building had been conceived in terms of its marche--like the medieval universe, from the standpoint of the human occupant. In Viollet-le Duc's epoch, it was conceived abstractly, from everywhere and nowhere all at once--like the earth itself in Copernican astronomy, as an abstract diagram of natural forces."[33] His work also tried to integrate cast iron as a new structural material, which contrasted with predominantly wall bearing designs of the Ecole up to that point.

Charles Garnier's winning Paris Opera house project brought a different though no less significant challenge to the Beaux-Arts. He claimed through his principles of reason and

sincerity that the exterior volumes of a building should perfectly express the interior spaces.[34] And "'Regarding decoration as such, and regarding what ordering and style to adopt, there is no guide other than the inspiration and will of the one who is doing the building; the decorative art has such independence and freedom that it is impossible to submit it to fixed rules.'"[35] He cared quite a lot about the individual's experience of space and sequence and in this respect he humanized and expanded the meaning of the marche.

And finally, to use the words of D. Van Zanten, "That momentous event in architecture during the 1830's seems to have been the simultaneous discovery that architecture in itself was a physical, structural entity, not inhabited by any physical ideal, and that it had no eternal form, but evolved in form with the passage of time from place to place. This, of course, was the Romantic realization, and architecture's crisis during the 1830's paralleled that of literature and painting."[36]

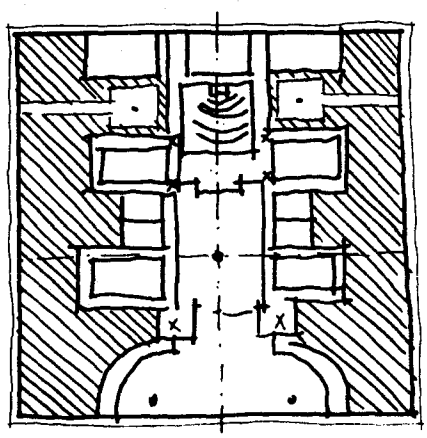
33 Van Zanten, p. 219.

34 Ibid., p. 278.

35 Ibid., p. 278.

36 Ibid., p. 231.

Illustrations



1 Beaux-Arts
Rectangular Geometry

THE MODERN MOVEMENT

The Modern Movement can be considered the recognition and exploration of several things: new materials; new structural and constructional opportunities; new problem definitions and building to site definitions; a concept of space; and a new reliance on a particular kind of architectural insight and analytical skills. With these go new compositional and expressive techniques as well as, for some, a reaffirmation of some time-honored principles of composition: unity and geometry.

This research will consider the Modern Movement after WWI till the mid 1960's, though its beginnings and major conceptual contributions were stated much before this. This time frame was selected because, by this time, the Modern Movement was at its greatest influence in schools and in practice. Its major intellectual leaders were alive and productive, and architectural practice, while not living up to the movement's ideals, was largely working within its conceptual framework. It was also a point at which the major theorists and practitioners had reevaluated their work in light of the flow of history and the actual application of their initial concepts, and the work had reemerged with a greater richness. At the same time, these reformulated concepts became an integral part of architectural education advocated by the Bauhaus and the theoreticians who proceeded it, Montessori and Froebel.[1]

The Modern Movement in architecture is not an educational system like the Beaux-Arts, and can not be neatly packaged as one. Although the Bauhaus, an educational system associated with the Modern Movement, has affected most schools of architecture, it is a system that has never been fully adopted among the major universities in the US. The concept of basic design and a particular attitude toward problem-solving and composition which were an integral part of the Bauhaus has become the introductory design curricula in most US schools of architecture. In general however, the curriculum structure of architectural education in the U.S. is a legacy of the Beaux-Arts educational system with a decidedly modern movement attitude toward problem solving.

As the Modern Movement in architecture is not an educational system, neither is it a compositional system. Again, the composition springs from a particular way of looking at problems and means for solving them. Modern buildings do take identifiable forms and these are derived from attitudes toward form that can be clearly stated. In the Modern Movement, there are two distinct directions for formal development, one evolving from an 'organic' outlook and the other from a belief in the

significance of primary forms. The origin of these outlooks will be discussed in this introduction while the specific forms will be described under the geometry category. While it is the intention of this work to look at composition and the experience of composition, there is no intention here to dismiss or diminish the complexity of thought that preceeds the selection of building elements and compositional techniques. In fact, the Modern Movement has expanded compositional options further than any other period in the history of architecture, and this breadth is what will be considered.

Collective Beliefs of the Modern Movement

The collective beliefs of the Modern Movement centered around the identification of new structural opportunities, new methods of construction, and the redefinition of architectural problems. There is less consistency among leaders of the Modern Movement about how form evolves in response to these new outlooks or how buildings are sited, but the outlooks themselves have strong form implications.

The first of the new beliefs recognizes the new structural opportunities of the concrete and steel frame. LeCorbusier and Pierre Jeanneret identified their five points of a new architecture in 1927 as: The Pilotis, the Roof Garden, The Free Plan, The Elongated Window, and The Free Facade.[2] The Pilotis refer to a concrete structural system so elegantly expressed in the diagram of the Domino Principle (fig 1.) of 1914. By separating walls and structure, this structural system allows the development of both the free plan and the free facade. Stanislaus von Moos states that LeCorbusier's and Pierre Jeanneret's "'five points of a new architecture,' are based on a structural argument. It suggests that the "new, universally applicable style is nothing but the passive result of a correct and efficient use of the concrete frame."[3] Ludwig Mies van der Rohe, writing in 1923, states approximately the same thing: "Reinforced concrete buildings are by nature skeletal buildings. . . . A construction of girders that carry the weight, and walls that carry no weight. That is to say, buildings consisting of skin and bones."[4]

Mies conceptualized the use of the steel frame in the same manner and used it in his major buildings in the U.S. Frank Lloyd Wright, writing for 'Architectural Record' in 1908, states similar views as the others:

> The old structural forms, which up to the present time have spelled 'architecture,' are decayed. Their life went from them long ago and new conditions industrially, steel and concrete and terra cotta in particular, are prophesying a more plastic art wherein as the flesh is to our bones so will the covering be to

> the structure; but more truly and beautifully expressed than ever.[5]

And again, writing for 'Architectural Record' Wright would express similar views as Mies and LeCorbusier: "In the steel and glass buildings I have designed, there are no walls, only wall screens. The method of cantilever in concrete and steel yields best to suspended screens or shells in place of outer walls, all may be shop fabricated."[6]

Alvar Aalto and Walter Gropius sum up the architectural changes brought about by the new structural systems, changes that would redirect some of the formal energies of architecture from the structure and also provide a flexibility of planning that enlarged compositional opportunity. Aalto states, "The skeleton of a modern building is often in its volume, but above all in its importance, certainly always a smaller part of the whole building than formerly."[7] And Gropius speaking at a much later date (1961) states,

> Beginning with the discovery of the Bessemer steel process and of Monier's reinforced concrete (which freed architecture of the supporting, solid wall and presented it with virtually limitless possibilities for flexible planning), there has been a steady movement toward a less rigid, less encumbered style of living and of building.[8]

Thus, advances in structural systems changed the nature of building and seemed to require new concepts for building.

New methods of construction had an equal influence on the Modern Movement and its leading theorists and practitioners. In the beginning of the Modern Movement, there was a romanticism associated with manufacturing and industrially produced building components. LeCorbusier looked at the great 20th century engineering feats of ship, plane, and car building and felt architecture could learn from them.

> The Engineer's Aesthetic, and Architecture, are two things that march together and follow one from the other: the one being now at its full height, the other in an unhappy state of retrogression. The Engineer, inspired by the law of economy and governed by mathematical calculation, puts us in accord with universal law. He achieves harmony.[9]

The car, plane, and great ocean liners were exciting advancements in technology. The greater mobility resulting from these advancements would require a restructuring of society; thus new building and city form would have to evolve to meet these opportunities. However, the masters of the Modern

Movement experienced the great destructive power of these machines in both world wars. While this did not lead them to the rejection of the application of mass production techniques, it certainly changed their totally optimistic view of technology's potential.

By the height of the Modern Movement, the industrially produced component had become an accepted fact requiring no eloquent rationalization for its use, nor a romanticization of its potential. Wright would foreshadow the qualification placed on architectural design through mechanization in his 1908 statement: "The present industrial condition is constantly studied in the practical application of these architectural ideals [his 'organic' method of design] and the treatment simplified and arranged to fit modern processes and to utilize to the best advantage the work of the machine."[10] In 1920, writing for 'Architectural Record' Wright predicts: "Perhaps the greatest eventual difference between ancient and modern buildings will eventually be due to our modern machine-made glass."[11] Many other Modern Movement theorists and practitioners also sensed the growth in industrialization of production and instead of denouncing it found in it a source of inspiration for design.

In spite of the acceptance of new technology, the dangers implicit in the standardization of components were acknowledged by some pracititioners. Aalto, in the "Influence of Construction and Material on Modern Architecture," summarized his aspirations for industrialization by stating:

> When the number of industrially prefabricated building materials, of standard parts, and of methods used increases, the number of various combinations will also increase, and with this the flexibility of all planning...the best standardization committee in the world was nature herself; but in nature standardization appears, above all and almost exclusively, only in the smallest units, the cells. This results in millions of elastic combinations in which there is no trace of formalism...architectural standardization must follow the same path.[12]

The fears of standardization are expressed by Wright: "Standardization is a form of dying of which to beware."[13] He goes on to say standardization is merely an indispensible tool, a means to an end.

The Modern Movement, in addition to changing structural opportunities and building production methods, identified a new definition of the architectural problem. Instead of the generally formal and symbolic issues of the Beaux-Arts, the Modern Movement became more interested in functionalism and its

expression. How space is used, how it can be molded to be most efficient in terms of functionality, use of materials and time in construction, and how buildings are sited for access, view and solar control, all became major issues. The new problem was to identify what people needed and to provide it expeditiously without unneccessary decoration or detail. The definition of acceptable architectural problems also expanded. No longer was the architect to work exclusively for the wealthy classes. The needs of industry and the working classes became acceptable architectural tasks. These new problems called for new solutions and typologies which became synonymous with Modern Movement design.

While the Modern Movement did not refer to Vitruvius, it certainly could have, for example, in the matters of siting and solar orientation.[14] This tendency to break with past theorists was a reaction to the dominance of the Beaux-Arts at the time the Modern Movement began to evolve. It was also the result of the Modern Movement's attitude towards the evolution of culture and architecture's role in that evolution. To keep pace with social and industrial change, the Modern Movement wanted to build a completely new foundation for architecture and set new objectives in accordance with the direction in which the culture was moving. As Gropius would say:

> I find that an architect who wants to help mold the evolutionary forces of his time . . . must distinguish between two sets of components which are apt to influence and direct his work. The first one consists of the human trends which gradually move a society toward new patterns of living; the second consists of the contemporary technical means and the individual choices of expression which help these trends to take shape.[15]

In addition to the advances in technology which provided structural and constructional opportunities, the Modern Movement recognized that changes in social patterns would require corresponding changes in architectural form and space. Functionalism was the basis of the Modern Movement's attempt to provide new architectural settings appropriate to the social and cultural changes it perceived.

Functionalism can be broadly or narrowly defined. The narrow definition focuses on efficiency, streamlining the process of a task. The machines in and the layout of a modern apartment kitchen is the most familiar example of this. However, a broad definition of the function of cooking could include the idea of a core family activity, the beauty of foods in preparation, and how to provide an appropriate setting for both. Aalto argued for the broader definition of functionalism.

> The development of the functional idea and its expression in structures are probably the most invigorating occurrences in architectural activity in our time, yet function in architecture--and also functionalism--are not so very easy to interpret precisely....The present phase of Modern architecture [1940] is doubtless a new one, with the special aim of solving problems in the humanitarian and psychological fields...[Architecture's] purpose is still to bring the material world into harmony with human life . . . To make architecture more human means better architecture, and it means a functionalism much larger than the merely technical one.[16]

The new problem definition was not easy. The program for some projects identified unique individuals and life styles while other projects were for a collective of people with differing purposes. The goals pulled in different directions, required different theoretical and compositional responses. Wright, for instance, felt a response to individual human aspirations was the democratic ideal and compatibility with a site a natural framework for life. He expressed an admiration for native building instinct, "Buildings growing in response to actual needs, fitted into environment by people who know no better than to fit them to it with native feeling..."[17] For Wright, the "ideal is democracy, the highest possible expression of the individual as a unit not inconsistent with a harmonious whole.[18] His work progressed from an expression of the individual and the particular to the Usonian House and Broad Acre City which gave the individual prominance within a cohesive and collective plan.

Le Corbusier exhibited a pull in both directions, towards functionalism and particularization of architecture based on the individual needs, and towards a disregard of functionalism in order to fulfill a higher, more abstract, architectural need. First, Jose Louis Sert could state emphatically:

> The great quality of Le Corbusier's buildings is that they are an expression of what happens in them, and consequently, they are alive...I know how carefully he studies and considers the life that will develop within a building....The ways it is going to be used and the movement of people inside govern his sequence of building spaces and their relationships, [and]...his novelty has roots in the changing human needs and the high aspirations of man.(19)

In a similar vein, Reyner Banham viewed one aspect of Le Corbusier's 'the house-a-machine to live in' as "a house that resembled a machine in being radically well-suited to the needs it had to serve, designed with

honest-even-inspired-rationalism, but without inherited prejudices." [20] However, Le Corbusier was also given to a search for absolute truths. He could say, "All men have the same organism, the same functions. All men have the same needs."[21] and

> Architecture has another meaning and other ends to pursue than showing construction and responding to needs (and by 'needs' I mean utility, comfort and practical arrangement). Architecture is the art above all others which achieves a state of platonic grandeur, mathematical order, speculation, the perception of the harmony which lies in emotional relationships.[22]

One of the strengths of Le Corbusier's work is his ability to blend both these attitudes and search for the appropriate solution for a given problem regardless of his polemical stance.

The nature and extent to which a building is formed by careful analysis of use is still an issue of debate. The fact that the question is considered at all is partly due to the effects of Modern Movement theorists posing it as part of the design problem.

The issue of siting was raised in relation to Wright's works, and Le Corbusier was also concerned with it. He generally set his buildings in contrast to the site as opposed to Wright's objective of blending in with a natural surrounding. In this respect, LeCorbusier seemed to like the purity of effect of the juxtoposition of man-made object to natural setting this generated. This effect could be traced to the siting of Greek religious buildings and theories leading up to and including the Beaux-Arts concerning siting. However, he did show a modern concern for orientation on the site for functional as well as aesthetic reasons. Quality and direction of light were issues in revealing form, and in a talk to students, he would discuss orientation as

> the key: the sun with its two paths, winter and summer, provides the mechanical possibilities to control it. As Socrates said one day, 'If you must build your house, put a portico in front of it, for the summer sun will not be bothersome and will cast a shadow beneath it, and in winter, the sun will penetrate the house.' These are fundamental elements.[23]

The concept of space and its flow from inside to outside seems a uniquely 20th century concept. In his book Reyner Banham states:

> The one thing that is undeniably new about modern architecture is the conscious manipulation of space....For an architect to think of himself as using or working in space is purely twentieth-century, and one of the things that mark the modern architect over and above any consideration of formal style.[24]

The flow from inside to outside is not so much a siting issue as it is a compositional technique, though it has been used to blend a building with its environment. Since it arises out of compositional concerns, it will be addressed in the section titled geometry.

The last two collective beliefs of the Modern Movement are especially interesting. The first is a reaffirmation of the objective of unity in a work of architecture. Unity has been the objective of design since the earliest theorists, and it has always been a purely compositional concept. Le Corbusier states that the business of architecture is to establish "the spirit of order, a unity of intention."[25] and Wright asserts that an individual must control a project to ensure "that unity [will] be secured which is the soul of the individual work of art."[26]

The second common belief of the Modern Movement is that development of style is not only irrelevant to design, but is, in fact, dangerous. Wright decries the idea of style. "A 'style' once accomplished soon becomes a yardstick for the blind; a crutch for the lame; the recourse or refuge of the impotent."[27] Gropius traces the decline of the Modern Movement to a shallow imitation of the masters. "In fact, the present disenchantment with the doubtful results obtained from simply imitating the highly personal design methods of this or that master, without adding to their substance, should give renewed emphasis to its principles."[28]

There is a curious inconsistency in the juxtaposition of the concept of unity, which requires calculated composition, with the belief in the futility of style. It can be partly explained by the fact that the Modern Movement considered style in a historic context and not in the present; style as an approach to design is inappropriate while a method of design that evolves a recognizable character is admissible.

The contradiction between unity and style has been exploited in recent years by practitioners and researchers who attempt to categorize the work of the masters of the Modern Movement into typologies of form.[29] This may be useful work, but it stands in stark contrast to the underlying premise of the Modern Movement of the appropriate approach to an architectural problem. This premise is one of free thought and inquiry into the true nature of a problem and the free exploration of

solutions unhampered by stylistic constraint. This attitude evolved in practice and education from two different directions in the US and Europe, and constitutes one of the Modern Movement's greatest contributions to architecture. The development of this approach will be traced in the next section.

The Bauhaus and Organic Architecture

The Bauhaus and what has become know as the organic approach to architecture both embody the Modern Movement's fundamentally new set of ways of viewing problems and synthesizing solutions to them. They do differ in form choice and basic siting relationships, but they share the attitudes of relying on the individual's sensitivity to problems and potential solutions by developing their ability to observe the nature of things (form, texture, light, motion, color, mass, etc.) and to observe nature. Abstract art had a great influence on the Bauhaus and some major practitioners while it had little impact on the organic approach to design. This represented a tendency of abstracting essences in the European approach to problems, whereas in the US solutions were expected to evolve in an organic way from the activity of design.

Gropius formed the Bauhaus in 1919 in order to unite the arts and educate people in the new philosophy of design. In 1961, he reflected on his early intentions stating,

> We tried to put him [the student] on a solid foundation by giving him objective principles of universal validity, derived from the laws of nature and the psychology of man....From this basis he was expected to develop his own individual design approach, independent of the personal approach of his teacher....The Bauhaus was not concerned with the formulation of time-bound, stylistic concepts; and its technical methods were not ends in themselves.[30]

Johannes Itten, the first teacher of the foundation course at the Bauhaus, and Laszlo Maholy-Nagy, who brought the New Bauhaus to the US, together represent the ideals of the educational program. Maholy-Nagy gave credit to Maria Montessori for the theoretical framework for education.[31] There are amazing similarities between the Bauhaus basic course and what Montessori did with children in the first decade of the 20th century. Montessori based some of her work on Friedrich Froebel's work with children published in 1883.[32] Frank Lloyd Wright was influenced to some extent by Froebel's theory since he played with Froebel blocks as a child, if his mother followed Froebel's strict method of introducing the materials, the influence might be very great.

The Bauhaus program itself is best shown by the original diagram (fig. 2) which shows a series of courses culminating in building design. The initial course set the tone and method for all other courses and of all the Bauhaus courses has had the greatest influence on architectural education in the US. The basic course developed the individual's sensitivity. Itten saw this as the key:

> The teacher's most difficult problem is the liberation and deepening of the inner spiritual sense of perception.[33]....To realize creative ideas through the expressive means of art takes sound physical, sensual, spiritual and intellectual powers and qualities. This insight determined the goal and methods of my teaching.[34] I reached the conclusion that we must counter-balance our externally oriented scientific research and technological speculation with inner-directed thought and practice.[35]

Thus he started his classes with relaxing exercises and tried to develop the student's native ability to perceive. "First I tried to evoke a vivid feeling for the theme through visual experience; next followed the intellectual explaining and comprehending, and only then the execution of the task. Common exercises in drawing always introduced the theme of the day."[36]

Maholy-Nagy reiterated these sentiments for the New Bauhaus in America; "Their training this first year is directed toward sensory experiences, enrichment of emotional values, and the development of thought."[37] He felt that everyone has talent that must be drawn out; he wanted to keep a "child's sincerity of emotion, his truth of observation, his fantasy and his creativeness. That is why the Bauhaus does not employ a rigid teaching system."[38] He wanted to develop this sensitivity because, "It is the practical exercise and the pleasure in sensory experiences which lead him (the student) to a security of feeling and later to the creation of objects which will satisfy human needs which are spiritual as well as utilitarian."[39] Maholy-Nagy described the design problem; "In all fields of creation, workers are striving today to find purely functional solutions of a technical-biological link; that is, to build up each piece of work solely from elements which are required for its function."[40] His description of function includes utilitarian, psychological, social, and economic criteria. But for the project or part of a project that goes beyond any known scientific method or knowledge, he felt "an instinctive sureness of perception is required"[41] and this sensitivity is instilled in the student in the beginning course. This attitude of sureness and relying on the individual's observational and synthetic powers is unique in architectural education. There is no longer a reliance on past solutions but a sense of arriving at the appropriate solution to

a problem through the direct application of scientific principles and human insight.

In the Bauhaus, the process by which sensitivity was developed was a series of hands-on exercises exploring contrasts of material, form and color. The exercises Itten and Moholy-Nagy devised in order to develop perception, sensitivity and synthesis were similar in intent to those of Montessori and Froebel, but developed to more complex levels. Since Itten held that "All artistic effects are based on the creation of contrast.[42]...the foundation of my design teaching was the general theory of contrasts."[43] Students, therefore, studied every conceivable type of form, color and texture contrast. They looked at extremes and gradations.

Montessori and Froebel both stressed the primacy of Platonic solids in a child's development of an understanding of form.[44] Itten and Maholy-Nagy agreed with the significance placed on such forms, but their emphasis derived from theories evolving in the sciences and art of the time, as well as from the work of Montessori and Froebel.[45] They developed basic exercises to study the implications of primary forms and their systematic deformations. Influenced by these theories in education, art and similar emphasis in the history of building composition (prior to this point), some practitioners, in particular LeCorbusier, also championed the importance of platonic solids in design.[46] This stand is in curious contrast to the Modern Movement's more general attitude which stressed an unrestricted search for appropriate form. However, the importance attributed to the platonic solids has greatly affected composition in the Modern Movement.

Besides the emphasis on primary forms and the study of contrasts in composition, the Bauhaus gave a decidedly major emphasis to the concept of space. Maholy-Nagy claimed an objective reality for space and defined architecture as does Reyner Banhan, as "the conscious manipulation of space." Therefore, Maholy-Nagy felt

> the real architectonic conception, looking beyond the meeting of all purposive functions (is) that of space creation"[47]....Building material is only an auxiliary, in so far as it can be used as carrier of space-creating and space-dividing relationships. The principal means of creation is always the space alone, from whose laws the treatment has to proceed in all respects.[48]

He characterizes past architectural form as static, and hierarchial in comparison to new concepts of fluid, dynamic, but balanced composition. Thus space was studied as if it were an object. As with form, however, Maholy-Nagy based his belief in

biology; "the biological bases of space experience are everyone's endowment."[49] The experience of architecture, as is its creation, is the experience of space. Thus, "the road toward experience of architecture thus proceeds first of all over a functional capacity of grasping space which is biologically determined."[50] The spatial experience is said to be the experience of the relationship of objects, and it is "to be experienced most directly by movement."[51]

As all the references suggest, the Bauhaus was also concerned with nature and natural growth. Montessori and Froebel felt that a child should garden and be in nature at least one day a week, and Itten and Maholy-Nagy believed their work stemmed from biological realities that they discovered by observing and drawing natural form. They all felt that there was an underlying natural geometry that must be recognized, and through this recognition man could understand the world and a path to design in harmony with it. Maholy-Nagy uses the word organic for this design process, and it is an obvious reference to Wright's earlier work and concept of organic architecture. There is however, a difference in emphasis between the two concepts. Maholy-Nagy is greatly influenced by the abstract art movement in Europe and the earlier Bauhaus work in Germany which attempted to abstract principles of form, space, and motion, beginning with basic characteristics of form, color, texture, and their interrelationships. The purity with which these issues were dealt seem significantly more abstract than Wright's approach.

While Wright had experienced some of Froebel's toys, he seemed to look directly to nature, not necessarily deriving basic cubes, spheres, etc., or concepts of space and motion. He felt "a sense of the organic is indispensable to an architect;"[52] this was achieved by observation of nature.

> Let us learn to see within, at least far enough to grasp essential pattern in all created things. And method in creation will come freely to him who learns to see in the abstract. Study the geometry that is the idea of every form: a quail, a snail, a shell, a fish....find the essential geometry of pattern that gives character to each....Get patiently to the point where you naturally see this element of pattern in everything.....This essential pattern mastered in the abstract, now try to connect it as form with what function you may discover by search it may fit.....Things begin of themselves to proceed from generals to particulars; to build, to develop, to emerge and take inevitable form, forcing nothing, imposing not at all.[53]

This approach seems to be similar to the Bauhaus courses which required one to experience natural form until it is second nature and begins to affect one's design process subconsciously. However, the abstraction Wright discusses is different from the European abstract art movements in that it is less theoretical and more experiential. Pattern was not a goal in itself to be studied abstractly, but was to be wed to a function and site, and was to support relationships between the two. Natural colors were favored over a wider range of colors, including primaries, utilized by artists and architects in Europe.

Wright did not like his approach called picturesque.

> The schemes are conceived in three dimensions as organic entities, let the picturesque perspective fall how it will. While a sense of the incidental perspectives the design will develop is always present, I have great faith that if the thing is rightly put together in the true organic sense with proportions actually right, the picturesque will take care of itself.[54]

Vincent Scully traces most of Wright's attitudes back to Andrew Jackson Downing's writings of the 1840's and '50's.[55] However, what makes Wright's approach modern is his ability to match these attitudes with the new opportunities evolving in concrete and steel and newly evolving patterns of living. What makes Wright great, of course, is his building.

In concluding this description of the Modern Movement, its essential flexibility must be stressed. The next section will order the compositional methods of the Modern Movement so that they can be compared to concepts in psychology, but it must be remembered that these categories are for comparison. They are not rigid formula for design. As Wright says, "architecture is a scientific art, and the thinking basis will ever be for the architect his surety, the final court in which his imagination shifts his feelings."[56] Gropius elegantly expresses the underlying belief of every educator, "There are, of course, many technical and formal approaches to the same task, and any one of them may be successful, if it is well-suited to the purpose of the building and to the temperament of the architect; if it is used with discrimination in its given environment."[57] And Aalto comments on practice:

> In order to meet its responsibility of helping towards a solution of the extensive humanistic sociological, and psychological problems, architecture must be allowed as much inner and formal flexibility as possible. Every external, formal pressure--whether it be a deep-rooted tradition of style, or a superficial

> homogeneity born out of a misunderstanding of modern architecture--hinders architecture from playing a really active part in human development and thus lessens its importance and its intensity.[58]

In discussing the Geometry, Hierarchy, Mood or Tone, and Symbols of the Modern Movement, one has to speak of a range of available alternatives from which various practitioners choose. Their choices reflected their view of the problem they were facing and their general attitudes toward form. Lesnikowski expresses this range in comparing Aalto and Le Corbusier. "Aalto composed his works in response to nature; unlike Le Corbusier's powerful intellectual works based on the conflicts between the artificial and the natural, Aalto's work is responsive, contextual, and naturalistic in manner."[59] This range is accepted under the label Modern Movement architecture, and while the particular compositional methods are available, most practitioners did not take advantage of them all. They center around either concepts of abstract purity or organic growth forms. Therefore, the following descriptions will cover both areas.

Geometry

The Modern Movement exploration of geometry followed both technical processes (structural and constructional), and formal processes of Abstract Art and Bauhaus exercises. The new structural concept of column supporting planes which freed functional planning and facade from structure was an underlying principle. Abstract art, particularly de Stijl, emphasized the use of planes, usually rectangles; this was adopted in the early part of the Modern Movement as a way of clearly expressing the difference between space enclosure and structure. Mies' houses are primary examples of this. As Reyner Banham says of Mies' Farnsworth house, "The dominant visual function of those verticals (columns) is to establish the regular rhythm that measures, controls, the pieces of infinite space that has been marked off to form the house."[60] Grids were utilized for spatial modulation and structural layout. They were usually rectangular grids, but in some instances triangular or other plane geometric forms were used. Grids were also overlaid and symmetrically rotated in relation to each other. Wright's work frequently explored these opportunities. (fig. 3).

Three dimensional form followed similar Bauhaus explorations, the basic elements being nested rectangles (fig. 4 and fig. 5). However, as stated earlier, Platonic solids still intrigued some architects, such as Le Corbusier who said that "Architecture is nothing but ordered arrangement, noble prisms, seen in light.[61] More complex forms were generated by fan arrangements (fig. 6), abstract shapes that can be associated with an individual's style, for example, Le Corbusier's

rhomboids (fig. 7), or the abstraction of natural forms such as Wright's synthesis of a shell form for the Gugenheim Museum. (fig. 8). Free form was also a possibility, but it was utilized very infrequently. Perhaps its use was precluded by the strong sense of the need to standardize design to material manufacturing processes which were generally producing rectilinear form.

Space, considered objectively real, also had form characteristics. It flowed around volumes and planes. Its geometries were controlled by those of the defining elements, except for the fact that space was considered fluid and linked so that it rarely took on a simple form. Aalto's major entry spaces express the extreme fluidity that could as associated with space. (fig. 9) Interior to exterior relationships were related through a continuity of space flowing from inside to outside and defined by both interior and exterior form. This could be accomplished, while retaining some environmental control, by large glass walls with little or no trim visually separating the inside from the outside. (fig. 10). In general, space was thought to have shape that could be modulated in relation to other space and solid forms to hold sequences of places together.

Hierarchy

Hierachy within a composition expresses both continuity and unity as well as differences. Modern Movement composition developed hierarchies to express function in terms of use and function in terms of the structural or constructional tasks of building elements. The separation and expression of every element was an extreme; the traditional process of selecting the primary function and making it dominant was still paramount. A specific piece of architecture had first to express a dominant idea and then support it with appropriate articulation. Dominant ideas were given dominant forms, location and scale. In contrast to the Beaux-Arts, the forms were usually the less rectangular ones (if the composition had any); the location of the forms were not necessarily centered in the composition; their scale, while matching prestated programmatic requirements, was made to seem larger than other building compoments either by the fact that they really were or by breaking the other components down to smaller sets of elements.

A concept could be symbolized by dominant form, and Wright did this in his residential work by articulating a central core mass and terminal masses. The core of most Wright houses was the hearth which symbolized the family, and these cores were given grand scale on the interior and exterior. Wright would say of terminal masses: "Terminal masses are most important as to form....Take good care of the terminals and the rest will

take care of itself."[62] These masses originate in a concept of composition in which all axes require a termination.

There were no locational rules for primary forms as there were in the Beaux-Arts. The important issue was that the prime function or concept be expressed by the form and that the entire composition be balanced. Balanced composition is a visual concept that assumes that the scale of an element is equal to its mass and that from any viewpoint there would be a balance point within the composition, usually somewhere within the center half of the view. Prime functions could be found at centers of compositions, at ends, raised or lowered, but the flow of vision would be toward them as a focus. Terminal masses were utilized to terminate axes, if there were any, and to balance compositions.

LeCorbusier's techniques for hierarchial composition are more typical of the Modern Movement than Wright's. He reiterates some of the concepts behind Beaux-Arts composition, but he adds less rigid ways of expressing them in form. LeCorbusier finds axes as primary to composition as the Beaux-Arts, but uses balance and rhythms as new ways of defining them. He says: "An axis is perhaps the first human manifestation; it is the means of every human act....Architecture is based on axes....Arrangement is the grading of axes, and so it is the grading of aims, the classification of intentions"[63] However, his compositional response to this issue can be found in his statement, "Rhythm is a state of equilibrium which proceeds either from symmetries, simple or complex, or from delicate balancing."[64]

This leads to his key methods of unifying composition, rhythm, regulating lines, and modulation. He cites the Acropolis as an example, "The different masses of the buildings, being asymmetrically arranged, create an intense rhythm. The whole composition is massive, elastic, living, terribly sharp and keen and dominating."[65] He discusses how rhythm is an experience of wholeness:

> Arrangement is an appreciable rhythm which reacts on every human being in the same way.[66]...If the relationship of mass to space is in just proportion, the eye transmits to the brain co-ordinated sensations and the mind derives from these satisfactions of a high order; this is architecture.[67]

Le Corbusier also utilizes regulating lines for a sense of unity. He says, "The regulating line is a satisfaction of a spiritual order which leads to the pursuit of ingenious and harmonious relations. It confers on the work the quality of rhythm."[68] And in discussing the problem of unifying openings of different sizes and shapes that are present in a mass to

reflect a function behind, he also utilizes regulating lines; "Surfaces, pitted by holes in accordance with the necessities of their destined use, should borrow the generating and accusing lines of these simple forms (the building Masses)"[69] The horizontal window, one of Le Corbusier's five points towards a new architecture, is in effect a regulating line. In much of Le Corbusier, Sert, and Aalto's work, these windows have vertical mullions in a rhythmic pattern to strengthen the horizontality by making a flowing composition of these mullions. Wright utilizes a similar rhythm of horizontal regulating lines for residential work from which he then develops contrasting verticals for emphasis, "The horizontal line is the line of domesticity....The inches in height gain tremendous force compared with any practicable spread upon the ground.[70]

Modularity is the final unifying methodology and, as in other compositional areas, Le Corbusier is closest to Classical and Beaux-Arts methodology. His modular system evolved from an initial six foot human figure and grew from the double square and the golden section.[71] Other Modern Movement figures would base modulation on requirements of manufacturing and coordinating building components. Aalto, in a reference to attempts to coordinate and modularize all building processes rejects this concept of modularity, "the seeing of a module which should cover all the world. This represents at the same time the dictatorship which finishes the revolution, the slavery of human beings to technical futilities which in themselves do not contain any piece of real humanity."[72]

Mood and Tone

Organic Architecture and its stress on site compatability, use of natural materials and the evolution of form in response to function, site, and materials has an obvious tone. The "optimistic tones of earth and autumn leaves,"[73] is Wright's description of brick, wood, and stained plaster. Aalto's work is more complex. For him, "Form is a mystery which defies definition, but it gives man a good feeling, quite different from an act of social rescue as such."[74] He also praises wood for its tone, "It is wood, the natural material, which is closest to man, both biologically and also as the environment of original forms of culture."[75] His compositions have been compared to the natural structure of Finland and carry its tone.

The Central Europeans, on the other hand, wanted to express an enthusiasm of the machine age. They wanted their work to be viewed as architectural machines that benefited mankind by matching their every need. Their buildings mimicked the expressionism of machines. After the world wars, this sense of enthusiasm diminished and the Bauhaus sense of revealing and juxtaposing textures and colors emerged. Le Corbusier, in contrast to earlier quotes, raised his intentions for

architecture to an emotional level. "The business of Architecture is to establish emotional relationships by means of raw materials."[76] And he looks away from decoration, and in some of his work away from color too, to an abstract concept of harmony. "Decoration is a sensorial and elementary order, as is color, and is suited to simple races, peasants and savages. Harmony and proportion incite the intellectual faculties and arrest the man of culture."[77] He was later to disregard this in much of his work.

Explicit Symbols

The Modern Movement eschewed the use of symbols. A thing was to express itself (how it was made and its use) and not resemble something else. Form was not to be reminiscent of past eras and it certainly was not. Much criticism of the Modern Movement is for its barrenness and lack of reference to anything the viewer experiences as positive. In a sense, it has, over time, come to symbolize a sense of inhumanity and alienation totally unexpected or desired by its authors. These sensations are not explicit symbols, however, and therefore they are simply conveying a mood. Many of the great works of the Modern Movement have avoided these empty connotations and have a real presence about them that gives them a lasting personality.

Footnotes & Illustrations

1 Maria Montessori, The Montessori Method, trans. (The House of Childhood, Inc. 1912); and Friedrich Froebel, Froebel's Chief Writings on Education, trans. S.S.F. Fletcher & J. Welton (London: Edward Arnold & Co. 1912, original in 1883).

2 Stanislaus von Moos, Le Corbusier: Elements of Synthesis, (Cambridge, MA. The MIT Press, 1979) p. 70.

3 Ibid., p. 70.

4 Ludwig Mies van der Rohe, "Working theses," trans. Michael Bullock, in Programs and Manifestoes on 20th-century Architecture, ed. Ulrich Conrads (Cambridge, MA the MIT Press, 1970), p. 75.

5 Frank Lloyd Wright, Frank Lloyd Wright on Architecture, ed. Frederick Gutheim, (New York: The Universal Library, Grosset & Dunlap, 1941) p. 43.

6 Ibid., p. 107.

7 Alvar Aalto, Alvar Aalto Synopsis, ETH Papers of the Institute of History and Theory of Architecture at the Swiss Federal Institute of Technology, Zurich. Vol. 12 (Zurich, 1970) p. 12.

8 Walter Gropius, "Unity in Diversity," in Four Great Makers of Modern Architecture, (New York: Columbia University, 1961) p. 219.

9 Le Corbusier, Towards a New Architecture, trans. Frederick Etchells (London: The Architectural Press, 1927) p. 7.

10 Wright, p. 42.

11 Ibid., p. 122.

12 Aalto, p. 13.

13 Wright, p. 110.

14 Pollo Vitruvius, The Ten Books on Architecture, trans. Morris H. Morgan, (Cambridge, MA: Harvard University Press, 1914) Vitrivius has described the appropriate siting of buildings in Book IV, Ch. V and Book VI, Ch. II, and the importance of solar orientation in housing and public baths in Book VI, Ch. I, Book VI, Ch. IV and Book V, Ch. X.

15 Gropius, p. 218.

16 Aalto, p. 15.

17 Wright, p. 63.

18 Ibid., p. 36.

19 Jose Luis Sert, "Le Corbusier and the Image of Man," in Four Great Makers of Modern Architecture, (New York: Columbia University, 1961) p. 174 & 175.

20 Reyner Banham, Age of the Masters, (London: The Architectural Press, Ltd., 1962) p. 19.

21 Le Corbusier, p. 126.

22 Ibid., p. 103.

23 Le Corbusier, "A Talk to Students," trans. Charles Rieger, in Four Great Makers of Modern Architecture, (New York: Columbia University, 1961) p. 169.

24 Banham, p. 50.

25 Le Corbusier, p. 140.

26 Wright, p. 45.

27 Wright, p. 111.

28 Gropius, p. 224.

29 This activity has been quite extensive. Stanislaus von Moos has analyzed Le Corbusier's style in Le Corbusier: Elements of Synthesis, and Richard Meyer and the White group from New York have rejuvenated the 'style' of the 20's in their work. Wojciech Lesnikowski decries a similar attempt to categorize and formularize the work of Alvar Aalto by Demetri Porphyrios in his work (in the fourth issue of Architectural Monographs).

Lionel March and Philip Steadman in The Geometry of Environment (Cambridge, MA, The MIT Press, 1971) have analyzed Le Corbusier's, Wright's, and Mies' work in terms of symmetries and topologies, however, their objective was not to codify their design method, but simply to describe some of their applications of geometry.

30 Gropius, p. 224.

31 Laszlo Maholy-Nagy, The New Vision, Fundamentals of Design Painting Sculpture Architecture, (New York: W. W. Norton & Co., 1938) p. 17.

32 Frederick Froebel, Froebel's Chief Writings on Education, translated by S.S. F. Fletcher and J. Welton, (London: Edward Arnold & Co., 1912 original in 1883).

33 Johannes Itten, "The Foundation Course at the Bauhaus," in Education of Vision, ed. G. Kepes, (New York: George Braziller, 1965) p. 115.

34 Ibid., p. 105.

35 Ibid., p. 105.

36 Johannes Itten, Design & Form, ( ) p. 12.

37 Laszlo Maholy-Nagy, p. 18.

38 Ibid., forward.

39 Ibid., forward.

40 Ibid., p. 61.

41 Ibid., p. 62.

42 Itten, "The Foundation Course at the Bauhaus," p. 105.

43 Itten, Design & Form, p. 12.

44 Maria Montessori, The Montessori Method, (The House of Childhood, Inc., 1912) Montessori introduces the concept of self-reliance through the development of a child's perception. Henry W. Homes summarizes her attitude in the forward to the English translation of her work. "She seems to hold, too, that sense perception forms the sole basis for the mental and hence for the moral life; that 'sense training will prepare the ordered foundation upon which the child may build up a clear and strong mentality,' including, apparently, his moral ideals; and that the cultivation of purpose and of the imaginative and creative capacities of children is far less important than the development of the power to learn from the environment by means of the senses." Montessori, P. xxix. She discusses substituting the traditional teacher for learning materials: "For this teacher we have substituted the didactic material, which contains within itself the control of errors and which makes auto-education possible to each child." Montessori, p. 371. She chooses exercises where, "the child working by himself, learns to differentiate objects according to thickness,

according to height, and according to size." Montessori, p. 192. Cylinders and prisms are used for this work. There are also basic matching and grading of primary forms, textures, and colors. The tactile sense is considered equally important to vision in these exercises. She warns "to observe a geometric form is not to analyze it, and in the analysis geometry begins." Montessori, p. 236. Her method to strengthen a child's ability to analyze is to help children learn the characteristics of basic geometric figures first as planes (because so much of the environment is made of them) and then as volumes. And in a story about looking over Rome with a child, she comments on seeing simple geometric figures and laments: "Such uniformity in such an expanse of buildings seemed to prove the limitation of human intelligence, while in an adjoining garden plot the shrubs and flowers spoke eloquently of the infinite variety of forms in nature. Montessori, p. 239.

Frederick Froebel, Froebel's Chief Writings on Education, translated by S. S. F. Fletcher and J. Welton, (London: Edward Arnold & Co., 1912 original in 1883).

Froebel's work influenced Montessori, and while he sets a similar tone for self-education, he is much more architectural in his discussions of form education. He states, "The fundamental principle of education, instruction, and teaching, should be passive and protective, not directive and interfering." (Froebel, p. 22) His educational system for the study of form begins with a ball and then moves to a globe and next to a cube. He attributes characteristics of movement to these forms "While the globe can be regarded as the physical expression of pure movement, the cube expresses pure rest,"(p. 183) as well as the more usual analysis of a cube as having "sides, edges, corners, surfaces, lines, points" in various relations to each other. (Froebel, p. 184). He also deals with magnitude and stresses the importance of being able to develop a "comprehension of the real nature of form, which involves magnitude and number as well as shape, it's most important for life." (Froebel, p. 184). He relates form to mathematics, "Mathematics expresses the nature of space, and so sets forth its properties and relations." (Froebel, p. 121). He stresses the importance of building. "Building comes first with the child as with the race. The first experience the boy gathers in representing by building what he sees around him is the importance of the vertical, the horizontal, and the rectangular. The ideas of equilibrium and symmetry come next. (156) After spheres and cubes are introduced he begins to introduce cylinders which he says join with spheres and cubes to form a "united trinity;" this points to "a trinity in architecture - the column with its cubical pedestal, its cylindrical shaft, and its globular capitol. (Froebel, p. 190) His fourth plaything is the division of a cube into eight bricks through which "the child gains an idea of a fixed measure which

may be applied to temporary as well as to permanent forms," (Froebel, p. 201) Eventually he introduces diagonals through a block. Collectively these exercises instill a sense of primary form, points, lines, and planes, motion, and modular gradation; these were key Bauhaus experiences as well. Froebel also presented the idea of the unity between man, nature, and mathematics. "Man can find no more secure and unifying center, no surer guide, in the search for the unity of nature...than mathematics." (Froebel, p. 121). Again, this is a theme reiterated by the Modern Movement.

Reyner Bahnam traces this influence in this book Age of the Masters, (London: The Architectural Press Ltd., 1962). He contends three movements in abstract art influenced the form selection of the European architects in the Modern Movement. These art movements were Futurism, which "look for inspiration in the technology," (Banham, p. 31) de Stijl, which developed a planar vocabulary, and Cubism. "From Cubism's wandering emphasis on the regular geometrical solids (canonized by Cezanne as the cylinder, sphere and cone and thus belonging to a tradition that goes back to Plato) come a group of forms, mostly cubic and rectangular, but including also cylinders and half-cylinders (handy for staircases). These forms were realized, where humanly possible, in absolute Platonic purity; cornices, cappings, sills, dripstones were rigorously suppressed, . . . " Banham, p. 34

Jacques Barzum, in his address to a symposium at Columbia University in 1963, titled 'the Architect and the Aspirations of His Day,' published under the title for the entire series of lectures, Four Great Makers of Modern Architecture, (New York, Columbia University, 1962), makes an argument that architecture and art of the time were also responding to the visual sense of accelerated speed brought about by new forms of transportation and to the anonymity of groups. "The violent changes I mentioned in the perception of time and space, coupled with the spiritual effect of anonymity, induced in the sensitive artist a relentless tendency toward abstraction. I mean by this, the urge to bring out the geometry of things, the love of fleshlessness characteristic of all twentieth-century arts. One may wonder how airplane speed, or motion pictures, or anonymous crowds lead the sensuous artist to such a mental ideal as abstraction. The connection is quite simple. Abstraction is the natural result of distance and motion." Borzum, p. 11 He uses Marcel Duchamp's "Nude Descending the Staircase" as a prime example of motion and abstraction.

45 Itten stressed the study of plane geometric figures. "We therefore worked on the problems of elementary geometric form-characteristics. We studied circles, squares, triangles and their derivatives, as well as lines, planes, objects and stress points, directions in space, and

proportions. All studies designed to improve constructive thinking were also subject to test by perception."[50] Itten also studied Platonic solids and his students would make "models of plastic forms, spheres, cubes, pyramids, and cylinders so that they could perceive and experience elementary plastic geometrical forms."[51] In the analysis of student work he said that "essential in all these studies are not the objects, but the scale character of the tone-value relations..."[52] which means the relationships between the characteristics of elements in a composition. These relations were meant to be felt as well as understood.

Moholy-Nagy would relate similar exercises back to the work of and experience of abstract art. "The cubists introduced a new system: organization of planes."[53] Expressionism and abstract painting [explored the] psychophysical quality of color and space representation. Cezanne advancing and receding colors spatial illusion. Kandinsky warmth and cool, nearness and distance, lightness and heaviness, centrifugal and centripetal..."[54] Thus a similar quest for expression by submerging or lightening the material is to be found: in sculpture: from mass to motion, in painting: from colored pigment to light, and in architecture: from restricted closed spaces to free fluctuations of forces."[55] He too studied the Platonic solids, but referred back to the work of a contemporary biologist. "The biologist Raoul France' has distinguished seven biotechnical constructional elements: crystal, sphere, cone, plate, strip, rod, and spiral, and says that these are the basic technical elements of the whole world."[56] Presumably they were also the basic elements of the man-made world and Maholy-Nagy felt they should be studied because of their basic nature.

46 Le Corbusier, in Towards a New Architecture, championed Platonic solids; he believed "primary forms are beautiful forms because they can be clearly appreciated." Le Corbusier, p. 8 He even contended that "Egyptian, Greek or Roman architecture is an architecture of prisms, cubes and cylinders, pyramids or spheres," which can only be appreciated, if at all, as an abstraction of that architecture. (Le Corbusier, p. 31).

47 Maholy-Nagy, p. 180.

48 Ibid., p. 188.

49 Ibid., p. 163.

50 Ibid, p. 178.

51 Ibid., p. 163.

52 Wright, p. 31.

53 Ibid., pp 129 & 130.

54 Ibid., p. 39.

55 Vincent J. Scully, Jr. in the introduction to his book The Shingle Style, (New Haven, Conn: Yale University Press revised edition 1971) traces the roots of some of Wright's beliefs to Andrew Jackson Downing and the "picturesque revolution which had been going on in England since the middle of the eighteenth century." Scully, p. xxxiv Scully states "the freedom of the shingle style and the discipline of a truly classic moment are consequently both present in Wright's design. Scully, p. 160 Behind the whole development of free design ran the insistent belief that man must live as a free human being, in close contact with nature, in order to realize his own potentialities. Wright, of course, has always completely accepted the premise that the industrialized city is evil and that human beings can live fully only in rural surroundings. (Wright's) 'Broadacre City' of the 1930's represents hi his work a culmination of these Jeffersonian, agrarian enthusiasms." Scully, p. 162.

Scully gives credit to Downing, "Downing is important to us because he decisively established the principles of asymmetrical, picturesque design in America and thereby laid the foundation for a whole new sequence of experiments in planning and spatial organization." Scully, p. xxix Scully quotes Downing in describing his approach to cottage design. These quotes foreshadow many of Wright's attitudes. Downing on appropriate building: "Fitness being the beauty of utility; Expression of Purpose, the beauty of propriety; and Expression of Style, the beauty of form and sentiment, which is the highest in the scale." Scully, p. xxxi. "Beauty grows out of the enrichment of some useful or elegant features of the house, as the windows or verandas," Scully, p. xxxv. Colors should be "a mellow softened shade of color, in exquisite keeping with the surrounding objects." Scully, p. xxxiii. Downing champions truthfulness and simplicity in cottage design and attacks unnecessary ornament. He defines two types of beauty. "Absolute beauty is beauty of form governed by the universal and 'abstract ideas' of 'Proportion, Symmetry, Variety, Harmony, and Unity.' Relative beauty 'expresses peculiar moral, social or intellectual ideas, and is usually termed 'beauty of expression.'" Scully, p. xlii.

56 Wright, p. 43.

57 Gropius, p. 219.

58 Aalto, p.12.

59 Wojciech G. Lesnikowski, Rationalism and Romanticism in Architecture, (New York: McGraw-Hill Book Company, 1982) p. 227.

60 Banham, p. 56.

61 Le Corbusier, p. 151.

62 Wright, p. 107.

63 Le Corbusier, p. 173.

64 Ibid., p.___.

65 Ibid., p. 43. Symmetry is a difficult word because it means both mirror imagery around an axis as well as a balanced relationship. Vitruvius discusses symmetry as if it were some sort of balance because he uses as his example the relation of the fingers and thumb to the hand. See appendix A. Other theorists seem to use the word in its other sense of exact mirror imagery about an axis.

66 Le Corbusier, p. 47.

67 Ibid., p. 45.

68 Ibid., p. 71.

69 Ibid., p. 41.

70 Wright, p. 74.

71 Le Corbusier's complete work on his modular system can be found in Modular I and II (Cambridge, MA: Harvard University press, 1980). An illustration on page 53 of Modular II shows the Vitruvian figure in a circle and square which is an obvious reminder of its relation to classical proportioning systems.

72 Aalto, p. 21.

73 Wright, p. 34.

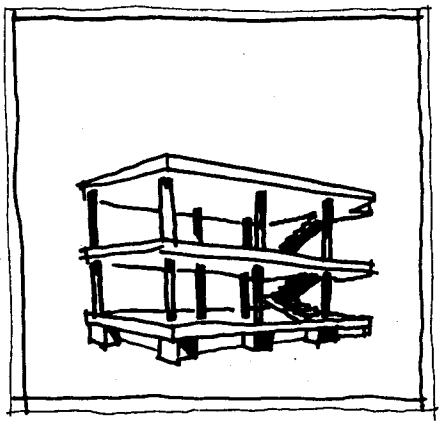
74 Aalto, p. 20.

75 Ibid., p. 25.

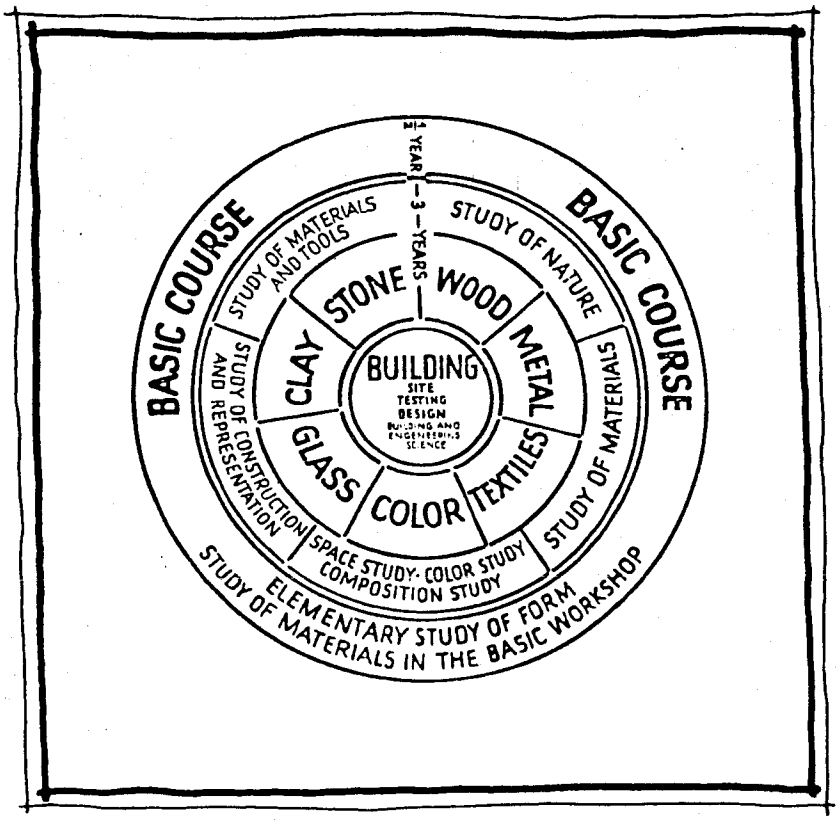
76 Le Corbusier, p. 140.

77 Ibid., p. 133.

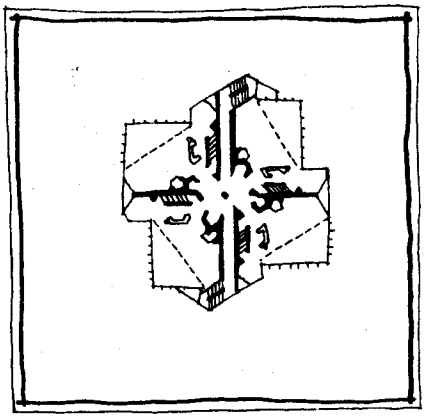
Illustrations



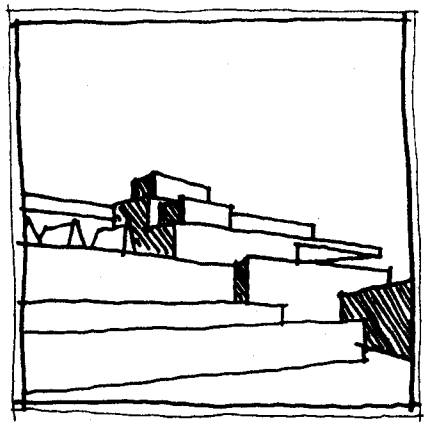
1 Domino Principle
Le Corbusier



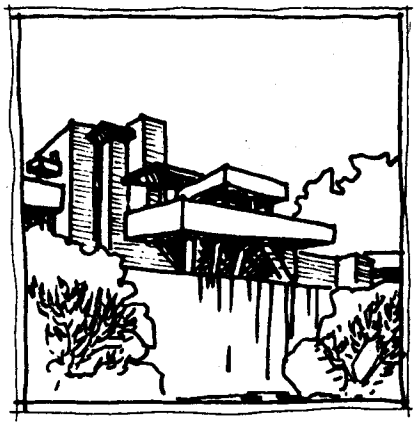
2 Bauhaus Program



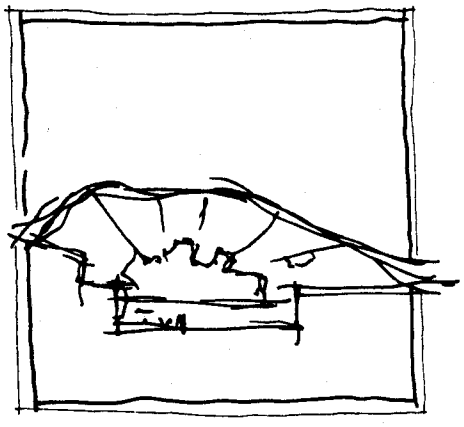
3 Rotated Grid
F.L. Wright



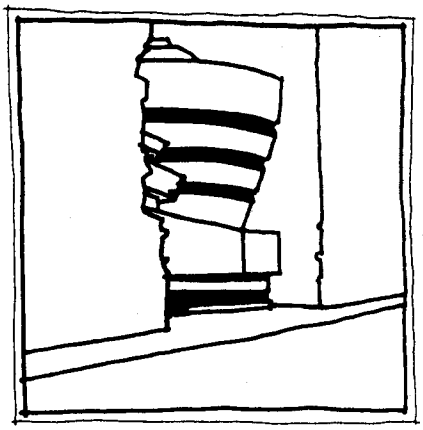
4 Nested Rectangles
Finish Public Persiuns
Institute, Helsinki
Alvar Aalto



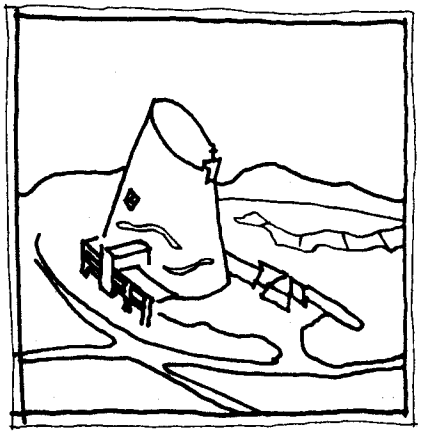
5 Nested Rectangles
Kaufmann House
F.L. Wright



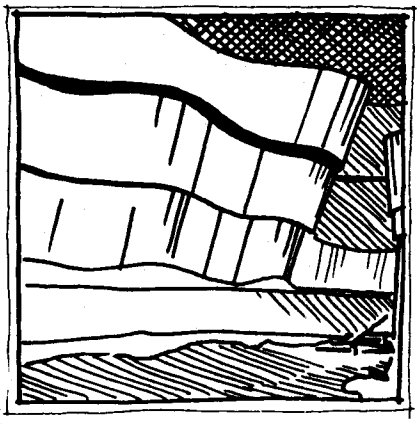
6 Fan Arrangement
Neve Vahr Apts.
Bremen
Alvar Aalto



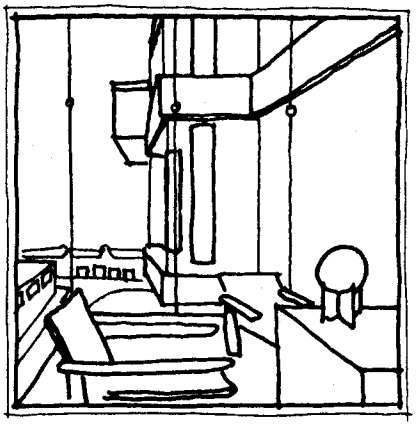
7 Rhomboids
Church at Firminy, France
Le Corbusier



8 Shell Form
Guggenheim Museum
F.L. Wright



9 Finish Pavilion
New York World's Fair 1939
A. Aalto



10 Design Research
Ben Thompson

GESTALT THEORY

Gestalt psychology is the study of the behavior of animals in their environment. The environment is both physical and social; behavior is physical, emotional and social. Architecture is part of the physical environment, but from the gestalt point of view, it evokes physical, social, and emotional responses. Gestalt psychology covers the behavior of all animals; however, in this work any quote or reference to animal behavior refers to human behavior.

There are three primary figures in the field of gestalt psychology: Max Wertheimer, Wolfgang Kohler, and Kurt Koffka. They tend to quote each other's works and experiments, though Kurt Koffka also substantiates many of his hypotheses with a wide variety of experiments by lesser-known gestalt psychologists. Both Koffka and Kohler credit Wertheimer for identifying the principles of grouping and formulating the concept of isomorphism. Wertheimer's principle works are in German; therefore the descriptions of these concepts will be from Kohler's and Koffka's works in English.

Basic Design and Graphic Design have tended to emphasize the gestalt laws as two dimensional phenomena, and this has affected architectural thinking. However, the environment is three dimensional, and gestalt psychologists are primarily interested in explaining behavior in terms of this environment. The confusion between the design applications and experiments is reasonable because most gestalt experiments have utilized two dimensional presentatons to isolate a phenomena even though it is, in the final analysis, assumed to be a part of a larger framework in which its value is relative to the framework and other events within it. As Koffka states, "our hypothesis claims that three-dimensional shapes are matters of organization in the same way as two-dimensional ones, depending on the same kind of laws."[1]

There are, in gestalt psychology, several primary hypotheses that relate to the perception of three-dimensional environments. They are hypotheses concerning the relation between what is real and what is perceived, the nature of gestalts, the behavior of gestalts formulated into the Law of Pragnanz, the principles of grouping, the reality of the Ego, processes of learning, including the concept that meaning is an overlay of form perception, and finally, hypotheses concerning the formation and cohesion in and among societies.

The first conceptual problem gestalt psychologists address is whether what we see is real or subjective. Kohler identifies our initial reaction to things when he says, "our naive

experience consists first of all of objects, their properties and changes, which appear to exist and to happen quite independently of us."[2] We experience an ordered environment that responds to physical and social laws and relationships. Is this environment real or subjective?

> The simple truth is that some of the experiences which depend upon processes in any organism have the character of objectivity, whereas others which depend upon different processes in the same organism have the character of being subjective. This contrast has nothing to do with the generic subjectivity of both types of experience, i.e., with the fact that both depend upon events within the organism.[3]

To account for this subjectivity, the Gestaltists hypothesize a relationship between the geographical environment the real environment, and what Koffka calls our behavioral environment or that which we perceive. Wertheimer's solution is the theory of isomorphism. This theory postulates that the real and behavioral worlds are similar; however, order is a property of perception, the behavioral environment, and not necessarily the real environment. Gestaltists contend that for us to function there has to be a high correlation between the real and the behavioral environment. The differences between the two are of great significance, although theoretically we can never know the magnitude of these differences or if in fact they actually exist. A simple example to demonstrate the hypothesis of isomorphism would be two people looking at a bowl of oranges. It is believed that both the people and oranges exist and both people's perceptual systems see oranges. There is an isomorphic relation between the real world bowl of oranges and the image of oranges on which their perceptual system operates. What proof one can have of isopomorphism is that the people can reach for the oranges and expect to be able to grasp them. However, one of the people viewing the bowl might feel the oranges make a pleasurable stillife that is well-composed in its context. This experience is not so much an aspect of the geographical environment, but is primarily part of the behavioral environment. The pleasant experience might not be shared by both people and, in a more critical example, it could be detrimental to assume that both viewers are experiencing the same thing. Koffka says that, "the results of the animal's behavior depends not only on his behavioural but also on his geographical environment," and that we as animals, "can explore directly only our behavioural environment, and indirectly merely, through the behavioural, the geographical one."[4] He goes on to say we can be attracted to or repelled from things in our environment, but that these forces of attraction or repulsion only occur in the behavioral environment, not in the geographic one.

Visual perception depends on light which gestaltists say stimulates the retina and, "as far as retinal stimulation is concerned, there is no organization, no segregation of specific units of groups."[5] We do see order; "thus in countless instances sensory organization means a reconstruction of such aspects of physical situations as are lost in the wave messages which impinge upon the retina."[6] In other words, the order in the environment that is lost in the transmission by light to our retina needs to be reconstructed to be interpreted. The reconstruction is the behavioral environment, not a one-to-one map of the order in the view.

This reconstruction and organization of information is into gestalts. A gestalt is a form, a shape, an ordered whole which may refer in Gestalt psychology to ideas learned, emotions, needs, attitudes, social structure, as well as physical organizations. Gestalts are attributes of our behavioral environment. Gestalts have varying degrees of internal cohesion and strength of relation to other gestalts and to their background.

The basic gestalt experience is that of a figure and its background. The minimal visual stimulation is an undifferentiated, unfocusable fog. Koffka says that, "we must further conclude that homogeneous tri-dimensionality, the fog, is a simple effect, the simplest of which our sense of sight is capable."[7] Gestalts are formations of order in this fog and they possess forces in the behavioral environment. "To see a surface is...the effect of a higher degree of organization, presupposing special forces."[8] These forces are said to hold the figure in equilibrium by balancing the forces of the field which impinge upon it. These forces are thought to be similar to physical forces, but have never been clearly defined and documented.[9]

From this base, the first Gestalt Law of Figure/Ground derives. Koffka called this the Law of Unit Formation and Segregation and said "the equality of stimulation produces forces of cohesion, inequality of stimulation forces of segregation, provided that the inequality entails an abrupt change."[10] The Figure/Ground relationship exhibits two tendencies; one representing movement toward the minimum organizaton (ground) and one toward the maximum organizaton (figure formation). The forces attributed to figure formation and other gestalts such as emotions are thought to be similar to physical forces. The best example given is that of a drop of water on a smooth surface such as a car hood; the surface tension of the water causes a rounded form, taking its shape from a balance of internal and external forces. In a similar fashion, figural objects are said to have internal forces of cohesion and are restrained by forces of the ground, all tending toward equilibrium. Koffka says,

> In our psychophysical case, then, we have two kinds of forces, those which exist within the process in distribution itself and which will tend to impress on this distribution the simplest possible shape, and those between the distribution and the stimulus pattern, which constrain this stress towards simplification.[11]

The concept of balance and equilibrium of forces gave rise to the most general principle of gestalt, the Law of Pragnanz, which was formulated by Wertheimer. As Koffka describes the Law of Pragnanz, "psychological organizaton will always be as 'good' as the prevailing conditions allow,"[12] "Good" generally refers to regularity, symmetry, simplicity, an equilibrium among things. This end state of equilibrium and simplicity is approached from the balance of inward and outward forces. Since these forces are considered to be part of one's own internal ordering of events, they are dynamic and their function is to clarify a visual field or social event or both.

This concept of forces of attraction and repulsion is also fundamental to the principles of grouping. When several objects are perceived, they are grouped on the basis of several relationships that they exhibit in the behavioral environment. These relationships are said to represent forces similar to those that provide cohesion to a figure, and they act in three-dimensions as well as in the experimental world of two-dimensions. Kohler writes that, "Werhteimer was the first to recognize the fundamental importance of spontaneous grouping in sensory fields. He showed by many examples what principles the grouping followed."[13]

The principles he identified were grouping by proximity, similarity, good continuation, closure, and familiarity. Grouping by proximity is self-explanatory, but it is interesting to note that the closer two objects come to each other, the stronger the relationship between the two becomes. Grouping by similarity can be in terms of any or all attributes of an object, such as size, shape, color, texture, location in a subset, or emotional value to the individual. Although good continuation usually refers to lines, in architecture it refers to alignment; objects are said to group by alignment. This idea is intimately tied to grouping by proximity as well. Grouping by alignment is reinforced by proximity; the grouping of the sills of two windows, if close, is stronger than the same alignment at a greater distance. Flowing curves are said to exhibit directional force in line with the flow, and continuity can be developed in alignment of interrupted flow as well as straight lines. Grouping by closure is usually represented by a drawn circle with a segment missing; the force of good continuation would seem to close the figure. In three-dimensional space, such as a medieval urban space, the

force of closure blends the small spaces between the surrounding buildings to give the space a sense of the interior of a container. In essence, it would be tending toward a simpler form. The last grouping, grouping by familiarity, is also self-explanatory; similar familiar objects simply group, for instance oranges.

All these aspects of forms have relative relationships to each other. Things can be more or less similar to each other, closer or further away from each other. Recognizable groups of objects are held in a balanced state by the forces in the behavioral environment that provide the order we see. Koffka points out that on "the problem of perceived form we must conclude that the shape of our ink blot or of any other figure is the result of forces which do not only segregate the figure from the rest of the field, but hold it in equilibrium with the field."[14]

Hierarchies among the gestalt characteristics of a group of objects can be identified, but the evaluation is relative to the situation observed. There is no basic hierarchy of gestalts; each situation depends on the intensity of particular characteristics and their relative strength in relation to other gestalt characteristics. Hierarchies in the strength of gestalt relationships are important in composition and comprehension because they define what is seen and in what order. Think of a small fishing village. The houses are generally similar in size, shape, color and texture. They tend to group visually and to be read collectively from a distance. The church, however, might separate itself by being larger and more formally composed. Because of its stronger internal gestalts and greater scale contrast with its context, it is seen first and it dominates the composition and visual organization of the entire village. While there is an internal hierarchy in the view, the entire village is considered to be visually balanced by counteracting forces in the behavioral environment (visual/mental apparatus), which are not present in the geographic environment. Because of the varying strengths of the gestalts in this view it is assumed that the composition will only be seen in this one way. The church, strongly organized and of greater contrast to its context than an individual house, will always dominate. (fig. 1)

This example also illustrates the contention that there can be nesting gestalts. The church facade has an internal cohesion based on symmetry and similarity of forms which forms a composition within the larger composition of the village view. It exhibits more and stronger gestalt relationships than the average house and is therefore quickly recognizable and more stable compositionally.

The relativity of visual order can be illustrated by comparing two villages, one with a church in the center painted the same color as the houses and one with a church on a hill some distance from the village, the church painted in a contrasting color to the village. The first village seems to order around the church because it is within the village and is similar in color while only contrasting in scale. The other village and church exhibit two organizations with few interrelationships between the church and houses, but many within the church composition itself and within the village composition itself. The first village will seem more integrated than the second because of the relative strength of the gestalt relationships between the church and housing. The Law of Pragnanz suggests that it is simpler to see the first example as one composition while the second, because of the strength of the internal gestalt relationships in the church and town, and the weak relation of simple proximity between the two, would be seen as two separate compositions.

Gestalt characteristics tend to relate objects together, but they can also be used for differentiation. Kohler's example is the sense of grouping in ornaments, such as Sullivan's terracotta work, a homogeneous material. "In countless cases organization is a sensory fact when there is no corresponding physical unit."[15] In this example, light and shadow and linework produce patterns that exhibit strong gestalts within one object.

Since the gestalt relationships enumerated so far deal primarily with physical relationships, it should be clear that architectural composition can be manipulated to express desired relationships and sublimate undesirable ones, and that this expression can exhibit relative levels of clarity which can provide emphasis to parts of a composition.

> The strength of the gestalt character is defined by Kohler by the degree of interdependence of the parts. The stronger the gestalt, the more will each of its parts depend on all the others, and the more will this dependence affect every aspect of the parts.[16]

Things and situations will appear as simple, balanced, and ordered as possible; if there is an inbalance, it stimulates action to bring greater order and stability to a situation. In discussing form, Koffka says,

> Good continuation and good shape were powerful organizing factors, and both were in the true sense 'understandable:' a line carries its own law within itself, and so does a shaped area or volume. Violations of this law due to external forces are felt as violations; they conflict with our feeling of the fit, hurt our sense of beauty.[17]

Thus far, this description of gestalt psychology has dealt with forces within the behavioral environment that provide order to the visual stimuli. However, it became clear to the Gestalt psychologists that order is not simply an aspect of the physical relationships of things, but is also affected by attitudes, and attitudes require a place to reside. Therefore, the Gestaltists hypothesize the existence of a Freudian ego. Koffka states:

> In the first place, we find the field organization under certain circumstances dependent upon attitudes, i.e., forces which have their origins not in the surrounding field at all, but in the Ego of the observer, a new indication that our task of investigating the surrounding field alone is somewhat artificial, and that we shall understand its organization completely only when we study the total field which includes the Ego within its environment.[18]

The Ego is the self and is said to behave like any other segregated object in the field except that, as a rule, it is more or less in the center of the behavioral environment. Koffka states,

> For in all changes of the behavioural field the Ego remains as a segregated part. The segregation will not proceed along the same boundary lines all the time, it will not invariably be of the same strength, and the relative importance of the Ego in the field will change. Still the Ego within the total field seems comparable to the physical organism in its geographical environment. Both are strongly organized stable sub-systems within a larger system, and just as in all changes the organism maintains its identify and thereby produces its growth and development, so will the Ego grow and develop by maintaining itself in the flux of the behavioural environment, or more generally of the psychophysical field. And the study of action as conduct is just the study of the continuous process of balancing the Ego sub-system in the total field.[19]

In this description, the Ego is a stable entity that can expand or contract and exerts force on the interpretation of objects and events in the behavioral environment. An Ego can expand outside the physical self, as in the case of one's home or children, as a projection, to some degree, of the person. Koffka says, "forces originating in the Ego can exert an influence on the behavioural environment of the Ego by influencing its organization."[20] These forces are considered to originate in the needs or quasi-needs of the Ego, and are reflected in attitudes toward things and situations.

Another aspect of the relation of people to their environment is the concept of a framework of reference for the Ego. This concept says that objects are seen in relation to more stable frameworks. In describing real and imagined motion, Koffka writes,

> We fall back on our distinction of things and framework and our knowledge that the framework is more stable than the things within it. If we apply this to the case of motion we must deduce the following proposition: if one of the two field objects has the function of framework for the other, then it will be seen at rest and the other as moving no matter which of the two moves in reality.[21]

At this point, the description of Gestalt Psychology has covered the organization of the visual field, the concept of framework or reference system, and the supposition of the Ego. The next issues to address are how and why people learn and the relation of emotions to things. But before this, it is important to note that the gestaltists believe that organized wholes are perceived first, and then acquire meaning. Kohler states,

> Gestalt Psychology holds, sensory units have acquired names, have become richly symbolic, and are now known to have certain practical uses, while nevertheless they have existed as units before any of these further facts were added. Gestalt Psychology claims that it is precisely the original segregation of circumscribed wholes which makes it possible for the sensory world to appear so utterly imbued with meaning to the adult; for, in its gradual entrance into the sensory field, meaning follows the lines drawn by natural organization; it usually enters into segregated wholes.[22]

Imagine, for a moment, an infant's behavioral world held stable by a balance of forces of the ego and objects that look organized. This represents a field of forces in the brain, presumably chemical and electrical, that define the behavioral environment. This field can be imagined as a layered or three-dimensional field with cohesive parts that segregate themselves from, as well as relate to, other segregated parts of the field. The segregations can be strong or weak depending on what they represent and how they have been reinforced through learning into forming stronger gestalts. Learning is the interaction between objects and the ego that changes and strengthens the gestalt of the object or ego or both. The learning process is a process of permanent change of the gestalt of an object or situation toward a more balanced meaningful whole. The infant grows by interacting with the environment and

learning. The infant's brain field organizes into stronger and stronger gestalts. Gestalts can be nested hierarchically or cluster to form larger whole organizations, all dependent on the Ego interacting with the environment.

The meaning of objects changes through use. Koffka states, "the use of an object means it has undergone a permanent change of organization, by virtue of which it is no longer an Ego-independent thing, . . . but a thing with a permanent relation to the Ego.[23] For example, a tool such as a computer has vague implications to an individual who does not use one. Upon repeated use its abilities and limitations become clear and it can no longer be thought of again in a vague way. It is the same object with a new understanding of it, but the understanding and object are inseparable. The designer of the machine has an even greater knowledge of it which is again different from that of the user and is not interchangeable with the user's knowledge. To each individual the object is perceived slight differently, while in the geographic environment it is the same object.

Activity or Ego interaction with the environment leaves what are called traces in the mental field. These traces form gestalts or segregated organizations in the field. "Learning, as the modification of an accomplishment in a certain direction, consists in creating trace systems (in the field) of a particular kind, in consolidating them, and in making them more and more available both in repeated and in new situations."[24] Memory is simply the trace left in the field of a strong gestalt; the stronger the gestalt the more easily it is remembered and related to its next larger whole. The field becomes articulated and "articulate organization has two aspects. In the first place the individual trace may be more or less articulate, in the second the trace may be more or less articulate and significant part in one of several larger trace systems."[25]

To return to the computer example, a strong gestalt of the computer at hand is developed through use, while at the same time, it is part of one or more larger conceptual organizations which are gestalts in themselves. For example, the computer could be part of the definition of one's job or it may be part of a classification of many computers with differing capabilities.

The idea that Ego interaction with the behavioral environment changes the meaning of things has interesting architectural implications. First, Koffka contends that emotions are states of the Ego system, and a "feeling of happy satisfacton corresponds to a psychophysical field at a lower level of tension and of greater stability."[26] This implies a strong visual order; i.e. stable configurations will produce a

satisfying experience. Secondly, since meaning is learned and part of an ego-environment interaction which changes the meaning of the environment, an environment can be said to embody emotional meanings, such as sadness or happiness, depending on the gestalt a particular social and physical environment formed in the memory of an individual. It should be remembered that Gestalt Psychology hypothesized the behavioral environment as distinct from the geographic environment but related the two through the concept of isopomorphism. Emotions relate to the behavioral environment and not the geographical environment, but they are definitely real to the individual. They are formed by the interaction of the Ego with the environment and can be biased by attention to particular details. A simple example is that of having a car accident at a particular location. The accident produces a trauma which becomes part of memory and the location takes on all the meanings associated with the accident. The place and experience are inseparable.

Social structures are said to exert similar forces on the individual that must be brought into equilibrium with the ego. Educational systems bring culturally organized systems to the individual to learn and accept. Koffka suggests that some social structures act as barriers for ego development and expression. He says: "In ordinary life customs, manners, and morals will often constitute such external barriers."[27]

These barriers are gestalts which can be accepted, thus minimizing tension, or balanced and changed by the will of the Ego. Architecture, as all other fields, is influenced by the attitudes and methods of both the larger society and the professional sub-group, including its educators and educational institutions. From the Gestalt point of view, change in the order and meaning of architecture would be difficult to accomplish because it requires a change in collective beliefs and institutions, as well as in the individual. These changes require a great deal of energy. As Koffka says, "articulations of a highly complex kind can be produced only under special conditions, when the organism, through its 'attitude,' supplies part of the effective forces and an ample store of energy."[28]

In conclusion, if gestalt theories are accepted by architects, they require an understanding of gestalt relationships that include physical order as well as both individual and societal conceptual orders that have great influence on the interpretation of the environment. Gestalt psychology contends that these aspects of interpretation can be quite clear and unambiguous within a context, at least in formal terms and probably in societal and individual terms as well. This then provides the framework for clear communication between an architect and the public through building form.

1 Kurt Koffka, Principles of Gestalt Psychology, (New York: Harcourt, Brace and Company, 1935) p. 161.

2 Wolfgang Kohler, Gestalt Psychology, (New York: Liveright Publishing Corporation, 1947) p. 5.

3 Ibid., p. 24.

4 Koffka, p. 4.

5 Kohler, p. 162.

6 Ibid., p. 163.

7 Koffka, p. 116.

8 Ibid., p. 117.

9 It is not the intention of this work to criticize the theories presented, but it should be noted that the Law of Pragnanz and the general idea of force have been identified as the least well-documented aspects of Gestalt theory. Such criticisms can be found in:

W.C.H. Prentice, "The Systematic Psychology of Wolfgang Kohler," in Psychology: A Study of a Science, ed. Sigmund Koch (New York: McGraw Hill, 1959).

and

Benjamin Wolman, Contemporary Theories and Systems in Psychology, (New York: Plenum Press, 1981), p. 456.

10 Koffka, p. 126.

11 Ibid., p. 138.

12 Ibid., p. 110.

13 Kohler, p. 144.

14 Koffka, p. 132.

15 Kohler, p. 157.

16 Koffka, p. 650.

17 Ibid., p. 175.

18 Ibid., p. 149.

19 Ibid., p. 331.

20 Ibid., p. 398.

21 Ibid., p. 282.

22 Kohler, p. 139.

23 Koffka, p. 393.

24 Ibid., p. 544.

25 Ibid., p. 544.

26 Ibid., p. 402.

27 Ibid., p. 424.

28 Ibid., p. 508.

Illustrations

1 Church Form
Dominating Village

ECOLOGICAL THEORY

J. J. Gibson's Ecological approach to visual perception is radically different than the theories of his predecessors.[1] He does note that he owes a "debt to the Gestalt psychologists, especially to Kurt Koffka. I have extended many of his ideas, [and] I owe a great deal to the functionalists in American psychology."[2] But this does not mean that Gibson accepts the basic premises of these theories. In fact, he does not, and he takes pains to explain the differences.

Gibson argues that other psychological theories of perception deal with irrelevant situations. He contends, "The vast quantity of experimental research in the textbooks and handbooks is concerned with snapshop vision, fixed-eye vision, or aperture vision, and it is not relevant."[3] Gibson holds that our experience is actually continuous and recorded over time.

He singles out the concept of figure/ground as a prime example of irrelevant research:

> The figure-ground phenomenon does not apply to the world in general. The notion of a closed contour, an outline, comes from the art of drawing an object, and the phenomenon comes from the experiment of presenting an observer with a drawing to find out what she perceives.[4]

According to Gibson, the real environment has edges, not outlines, and an edge is perceived differently than an outline. In Ecological theory, visual perception is paying attention to the flow of the light array impinging on the retina. Every material and form is specified by characteristics of the light array's change, and learning is the process of distinguishing these characteristics. Reflected light specifying outlines behaves differently than light specifying objects, and these differences are learned. Gibson contends that people first learn about the real environment of objects because it is imperative that they do, and that understanding two-dimensional figures comes later as it is needed. Therefore studying two-dimensional phenomena to understand three-dimensional phenomena is inappropriate.

Another difference between Gestalt research and reality is the perception of an object in perspective. Gibson points out that "the progressive foreshortening of the face of an object is perceived as the turning of the object,...and is never perceived as a change of form."[5] This leads Gibson away from studying the figure/ground phenomena of two-dimensional design to the

study of flowing light arrays in the environment; these light arrays have predictable behavior which defines form.

Although other sources of the following information have been reviewed, including Gibson's earlier work, the primary source for this exposition is Gibson's The Ecological Approach to Visual Perception, 1979. This latest book of Gibson's represents a lifetime's work and the evolution of several ideas, as well as the rejection of some earlier constructs. He presents his theories as several hypotheses with varying degrees of specificity and actual experimental corroborating data. He feels he has defined an area that can now be elaborated upon by others, including, interestingly enough, teachers of drawing and basic design, and architects. The following explanation of Gibson's theory emphasizes the human perception of the world and highlights what Gibson conceives as the attributes of environments that are manipulatable and subject to human composition.

The Ecological approach to visual perception refers to the fact that there is an integral relationship between people and their environment to the extent that people cannot be defined as separate from their environment, that there is a general scale to the environment that we live in, and that the perceptual system of the species is an integration of the senses, the brain, and the body, and is functionally inseparable. Perception itself is said to be paying attention to attributes of the flowing energy arrays in the environment that are registered by the perceptual system. Visual perception is attending to the registration of the flowing light arrays on the retinas of the eyes.

Living things and their environments evolved together over millions of years. The evolution of sense organs is directly related to particular aspects of the energy flowing in the environment that can be sensed. Gibson notes, "the fact is worth remembering because it is often neglected that the words animal and environment make an inseparable pair. Each term implies the other."[6] Only recently, in evolutionary terms, have people become particularly successful in adapting the environment to the species. Gibson's point is that our general evolution has been the other way around, and all of our organs have evolved to take advantage of what our environment affords us.

Therefore, he starts his inquiry into the nature of perception by looking at our environment. The environment he sees is complex, but the behavior of objects and other attributes of the environment is consistent in certain ways, which has allowed Gibson to categorize their behavior and evolve a theory of perception. He notes, "The fact of an environment that is mainly rigid but partly nonrigid, mainly motionless but

partly movable, a world that is both changeless in many respects and changeable in others but is neither dead at one extreme or chaotic at the other, is of great importance for our inquiry."[7] His analysis of the environment and what the perceptual system registers and can perceive is related to the character and rate of change of various attributes of the environment. Gibson contends this character and rate of change provides the information necessary for perception. All one needs to do is pay attention to it. The perceptual system registers an environment that surrounds the individual and is not simply a scheme in front of him.

This suggests that perception requires exploration over time so that the nature of closure and surround can be understood. In most respects, perception is part of a sequential process in the continuing flow of events; it is dynamic instead of fixed. It centers on the individual's relation to his environment and not simply his environment. This all implies new ways of thinking about architecture and architectural eduction which are fundamentally different from what is suggested by the two-dimensional world of plans, sections and elevations.

Gibson notes that the human environment has a particular scale and order. The scale of the environment with which humans generally deal is in a fairly close definable range which is neither the largest nor smallest we can measure, but somewhere in between. Gibson's description of this range is that,

> at the level of kilometers, the earth is shaped by mountains and hills. At the level of meters, it is formed by boulders and cliffs and canyons, and also by trees. It is still more finely structured at the level of millimeters. Blades of grass are more or less similar to one another, and so are clumps of grass and bushes. These natural units are not, of course, perfectly uniform like the man-made tiles of a pavement. . . . It is stochastically regular . . . regular in a probabilistic way. . . . They tend to be evenly spaced; and if they are scattered, they tend to be evenly scattered.[8]

He contrasts this to the geometric and mathematical order found at the microscopic and vast scales of the universe; the environment inhabited by humans should not be confused with these two scales and the order they exhibit. We are adapted to a scale of environment that is not mathematically or geometrically pure.

Gibson describes our ecological environment, its scale tendencies and the basic reference system it affords us by breaking it into two categories, object surfaces and mediums. There are two basic mediums, air and water, and we can move

through both. The mediums provide sustenance and orientation. "The medium is separated from the substances of the environment by surfaces,"[9]

The first aspect of a medium is orientation. Within the medium air, Gibson says we can perceive the basis for an orientation system based on gravitational force that provides "an absolute axis of reference, the vertical axis." Further orientation is provided by the compass points for "even the two horizontal axes of reference are not wholly arbitrary, for they depend on sunrise and sunset."[10] A second aspect of a medium to sustain animals and provide greater orientation within the environment is that it allows light, sound and smells to move through it in an orderly manner. It is the order in this distribution of energy that is perceived, and without order, Gibson contends, there could be no perception. The medium is filled with light, sound and smells; any point within this medium is a potential location for monitoring the environment and orienting to the energy flow within it. Space and objects do not provide this wide capacity for orientation or locomotion.

The persisting part of the environment are the solids and they have a base. "The literal basis of the terrestrial environment is the ground, the underlying surface of support that tends to be on the average flat--that is to say, a plane--and also level, or perpendicular to gravity."[11] The persisting surfaces are those that do not change appreciably over time spans such as days, weeks or years. Buildings are examples of persisting surfaces. However, this must not be confused with the idea of an exact configuration. People, for instance, tend to persist for 80 years or so, but are not static in form. Persisting simply means that the surface does not vanish when not within view, but continues to exist and to behave in certain discernable ways. Gibson concludes the earth and "the persisting surfaces of the environment are what provide the framework of reality."[12]

The perceptual system, from Gibson's standpoint, is an integrated system. He maintains that "natural vision depends on the eyes in the head on a body supported by the ground, the brain being only the central organ of a complete visual system."[13] The complete perceptual system includes taste, smell, hearing, and touch, all similarly integrated with the body and brain. This system registers the environment as well as the individual's relation to it. Gibson says, "The optical information to specify the self, including the head, body, arms, and hands, accompanies the optical information to specify the environment. The two sources of information coexist. The one could not exist without the other."[14] Gibson argues that the purpose of vision, "is to be aware of the surroundings, the ambient environment, not merely of the field in front of the

eyes...visual perception is panoramic and, over time, the panorama is registered."[15] Perception as a function of motion through an environment is one of the most striking differences between Gibson's description of perception and other theories. It requires a totally new definition of what and how we see.

Perception is not part of a stimulus response system; it is an activity of the entire perceptual system. Gibson's point is,

> perception is not a response to a stimulus but an act of information pickup. Perception may or may not occur in the presence of information. Perceptual awareness, unlike sensory awareness, does not have any discoverable stimulus threshhold. It depends on the age of the perceiver, how well he has learned to perceive, and how strongly he is motivated to perceive.[16]

Man can see, Gibson claims, because reflected and direct light has structure and the structure at any location is different than the structure at another location; this provides the information required to perceive one's location. Light comes from either a direct source such as the sun or is reflected from surfaces in the environment. Reflected and direct light fills the medium and is called ambient light. The ambient light is structured in certain ways by its source and this structure defines the source. Gibson's theory is that ambient light converges to all points within the medium and that the structure of light is different at every point within the medium. A point can be occupied by an observer. Gibson notes, "When the position becomes occupied, something very interesting happens to the ambient array: it contains information about the body of the observer."[17] This information is conveyed by light reflected off of parts of the body such as hands, as well as from the sense of light converging on the observer. Body movements or locomotion register the environment in relation to a center, the perceptual system.

Ambient light is registered by the perceptual system and the registered pattern is called the optical array. The optical array is usually flowing because of eye, head and body movement. This flowing array has all the information necessary for perceiving: light and dark, color, form and location. This information is structured in that it changes in a systemmatic fashion and perception is said to be paying attention to this structure. The light reflected by any object such as a brick or water has a defining set of structures that Gibson calls invariants. He says, "The eye-head-brain-body system registers the invariants in the structure of ambient light."[18] "The main invariants of the terrestrial environment, its persisting features, are the layout of its surfaces and the reflectances of these surfaces."[19] Gibson lists several structural aspects of

the array that could be perceived, but he contends that further study is necessary to generate a complete list. An example, one that Gibson does not use, is the simple motion of flow of the array specifying a cube as one walks past it. The outline form of the array is difficult to describe, but one can imagine that there is a specific structure to the way the array flows that represents a set of flat surfaces connected at edges that cover and uncover its other surfaces and the surface on which it rests in an orderly manner. The array deforms rather radically at overlapping surfaces which specify outline or object while the surface itself is represented by a flow that changes smoothly while maintaining color and light/shadow consistency of the object. In short, the light reaching the moving eye has all the information necessary for specifying the environment.

The key aspect of our environment is that it persists. Objects that flow out of our visual array can and will return and things covered will become uncovered; Gibson calls this the principle of reversible occlusion.

> The moving observer and the moving sun are conditions under which terrestrial vision has evolved for millions of years. But the invariant principle of reversible occlusion holds for the moving observer, and a similar principle of reversible illumination holds for the moving sun. Whatever goes out of sight will come into sight, and whatever is lighted will be shaded.[20]

Perception is said to be direct; no thought or analysis of the array is necessary for perception. Gibson states

> information [about our present environment] does not have to be stored in memory because it is always available. The increasing capacity of a perceptual system to pick up information, however, does not in itself constitute information. The ability to perceive does not imply, necessarily, the having of an idea of what can be perceived. The having of ideas is a fact, but it is not a prerequisite of perceiving. Perhaps it is a kind of extended perceiving.[21]

This is a very difficult concept to understand. Gibson tries to clarify it by contrasting it to cue theories. Cue theory suggests there are cues to interpreting the environment. Cue theories suggest, for instance, that the visual perception of depth is sensed indirectly as a function of visual cues such as overlapping surfaces, texture/density gradiations, and others. Gibson says of such theories:

> It seems to me that all such arguments come down to this; we can perceive the world only if we already know what there is to be perceived. And that, of course, is circular....

> The alternative is to assume that sensations triggered by light, sound, pressure, and chemicals are merely incidental, that information is available to a perceptual system, and that the qualities of the world in relation to the needs of the observer are experienced directly.
>
> In the case of a special sense [such as vision in a cue theory], the process of attention occurs at centers within the nervous system, whereas in the case of a perceptual system attention pervades the whole input-output loop. In the first case attention is consciousness that can be focused; in the second case it is a skill that can be educated....
>
> We are tempted to think of attention as strictly a narrowing-down and holding-still, but actually this is rare. The invariants of structure in an optic array that constitute information are more likely to be gradients than small details, and they are scanned over wide angles.[22]
>
> According to the theory being proposed, perceiving is a registering of certain definite dimensions of invariance in the stimulus flux together with definite parameters of disturbance. The invariants are invariants of structure, and the disturbances are disturbances of structure. The structure, for vision, is that of the ambient optic array. The invariants specify the persistence of the environment and of oneself.[23]

The integral nature of the perceptual system and the environment is still further enhanced by Gibson's theory of what we perceive. He contends that we perceive "affordances" and "events" in the environment as integrally as we perceive the structure of the light array. An example of an affordance of an object may be that it can be walked upon, such as a set of steps. Gibson argues that, "The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill."[24] He makes the point that an affordance is unique for a species, for example water affords breathing for fish, but not for man. Therefore, an affordance is not an abstract physical property, but a relationship between an environment and a species. Gibson goes on to state that:

> The basic affordances of the environment are perceivable and are usually perceivable directly, without an excessive amount of learning.[25]
>
> Perhaps the composition and layout of surfaces constitute what they afford. If so, to perceive them is to perceive

what they afford. This is a radical hypothesis, for it implies that the 'values' and 'meanings' of things in the environment can be directly perceived. Moreover, it would explain the sense in which values and meanings are external to the perceiver.[26]

The value and meaning of objects are their affordances and can be considered external to the individual in that they apply to the species' relationship to its environment and not simply the individuals. For example, the concave form of a material that fits the hand affords ladling and drinking of liquids. It is a cup to all people. While Gibson contends that this type of affordance is usually perceived directly, there are affordances that are culturally specific and must be learned. A culturally specific affordance might be a complex machine like a computer which has an affordance only to those who know its function. In this instance, the form does not suggest its use. At a basic level, buildings afford shelter and at another level they may represent their cultural or personal use to those familiar with them.

Affordances are attributes of objects, while events describe changes in form which could mean a change in affordance. Gibson lists three varieties of events registered by the perceptual system: "Change in the layout of surfaces, change in the color and texture of surfaces, and change in the existence of surfaces."[27] Any of these events could specify a change in the affordance of some part of the environment. In relation to the optic array, "The beginning and end of the disturbance in the light corresponds to the beginning and end of the event in the world, but that is about as far as the correspondence goes."[28] For example, one might be viewing a doorway when the door closes. The event is the disturbance of the optical array that is registering the light reflected from an opening which one can go through to a surface that must be manipulated before it affords passing through. The same event might also be thought to afford a change from exposure to privacy depending on the social context of the event. Thus, the disturbance of the light array simply suggests that an affordance might have changed, but it doesn't define what the change might be.

The key points so far are that the perceptual system is integrated, that man and environment are intimately related, that perception is the recognition of affordances in the environment, and that this recognition normally occurs by paying attention to a moving optical array.

There are three other aspects of Gibson's theory that are of importance to architects and architectural educators. The first is a concept of nested images, implying a kind of hierarchy; the second concerns the nature of place and its attributes; the third concerns learning.

Imagine for a moment a sphere in space. Gibson contends that its outline projected back to the eye is a solid angle, in this case a cone. As one moves closer to the sphere the solid angle increases, and this affords you a knowledge of its distance. But the object is a sphere with a surface which has a texture and is illuminated. This all behaves, Gibson suggests, as a dense pack of angles similar to the outline angle; therefore the entire environment is registered in the optic array as disturbances of the array that correspond to this dense pack of angles.

The visual array is a flowing mosaic; objects, surfaces, and events are nested within each other. Perception is paying attention to different levels of disturbance of the array. One can perceive a forest, tree or leaf, but not all at once. The information necessary to perceive all three is present in the optic array, but is nested one within the other. The boundry between them is vague. One pays attention to what one wants and this is a function of motivation and affordance. As Gisbon says,

> Things are components of other things. They would constitute a hierarchy except that this hierarchy is not categorical but full of transitions and overlaps. There are no atomic units of the world considered as an environment. Instead, there are subordinate and superordinate units. The unit you choose for describing the environment depends on the level of the environment you choose to describe.[29]

The nesting of the optic array is scalar, smaller attributes within larger ones. This hierarchy must not be confused with a hierarchy of value or meaning which is based on what the environment affords an individual and to some extent on what her needs are at the moment.

Events are similarly nested, but they exhibit the attribute of being sequential. They do not repeat exactly; the flow of events is in one direction. Distinguishing between one event and another is a relative issue because of this nesting, and Gibson says that "what we take to be a unitary episode is therefore a matter of choice and depends on the beginning and the end that are appropriate, not on the units of measurement."[30]

Place recognition is of equal importance to survival as event or object recognition and the phenomena has characterstics that are distinctly its own. Place recognition has great significance because it is a basic form of orientation (along with gravitational and solar axes) and is a precondition to all human behavior. Gibson goes as far as to say, "The habitat of an animal is made up of places"[31] The principle of reversible

occlusion (i.e., that which goes out of sight is still there and can be brought back) is an attribute of place. The other basic attribute of places is that they are at fixed locations and that they differ from each other in ways that can be perceived. Places are nested, and as Gibson puts it:

> Note that the perception of places and the perception of detached objects are quite different. Places cannot be displaced, whereas objects can be, and animate objects displace themselves. Places merge into adjacent places, whereas objects have boundaries.[32]

Places are affordances of the environment as much as objects and events. An entire environment made out of nested places is comprehended through exploration. Gibson points out,

> that in a terrestrial environment of semienclosed places each vista is unique, unlike the featureless passageways of a maze. Each vista is thus its own 'landmark' inasmuch as the habitat never duplicates itself. When the vistas have been put in order by exploratory locomotion, the invariant structure of the house, the town, or the whole habitat will be apprehended.[33]

The principles for the control of locomotion from place to place within an environment involve what Gibson calls the edge of danger, the gradient of danger and symmetrizing the rate of flow of the optical array.

Danger is an affordance of the environment. For humans, it is perceived as a looming up on the optical array, a dropping away precipitously or several other obvious experiences, all of which produce an alarming visceral response. A looming object quickly expands in the visual array and suggests physical contact is eminent if no diffensive action is taken. A door swinging into one unexpectedly has the prerequisite rapid looming characteristic. A steep hill exemplifies the other condition where either the rate at which the texture of the surface changes is alarming or an abrupt dropoff is specified by a considerable difference of texture on either side of the edge. These are all dangerous conditions that are controlled by moving away from them or at least by insuring that they pass by at a safe distance. Thus, part of the act of locomotion is avoiding danger.

The other part is the pursuit of goals which Gibson hypothesizes occurs by visually locating a goal and symmetrizing the rate of flow of the visual array around the goal in question. Symmetrizing the rate of flow of the visual array simply means that the rate of flow of visual information passing is even on all sides as the goal is approached. The activity of

approaching a goal is more complex than this because we also scan the environment as we move, and motion is judged in relation to a framework, but nonetheless the general concept still applies. This particular concept introduces an interesting aspect of symmetry that has had little investigation in architectural terms.

Another architecturally interesting aspect of Gibson's theory is its emphasis on the integral nature of things and the inherent inability to describe objects and events without abstracting them. The abstracting process is different from perception, which is flowing and nested. What we describe is what we can most easily separate; this depends on our motivation and how well we have learned to discriminate. But no matter how well we discriminate, we can not reproduce what we perceive in words or lines. We perceive much more than we can relate. For example, it is impossible to exactly represent what is perceived through all of the senses when sitting in a forest. And if this is not difficult enough, it must be remembered that the event is simply one in a non-reproducible, continuous flow of events.

This point is being made forcefully because architecture tends to rely on the measurable aspects of things, while it is quite clear that the immeasurable sense of things is equally important. Architects and architectural educators can not avoid using the measurable, but they should not suppose that it is all that is perceived. Gibson addresses this point in the following quotations concerning the relative value of color and how perception begins:

> From an ecological point of view, the color of a surface is relative to the colors of adjacent surfaces; it is not an absolute color. Its reflectance ratio is specified only in relation to other reflectance ratios of the layout. For the natural environment is an aggregate of substances. Even a surface is sometimes a conglomerate of substances...the colors are not seen separately, as stimuli, but together, as an arrangement. And this range of colors provides an invariant structure that underlies both the changing shadow structure with a moving sun and the changing perspective structure with a moving observer.[34]

> The animal or child who begins to perceive substances, therefore, does so in a different way than one who begins to perceive places, attached objects, and detached objects. Substances are formless and cannot be counted. The number of substances, natural compositions, or mixtures is not fixed. . . . We discriminate among surface colors and textures, but we cannot group them as we do detached objects and we cannot order them as we do places.[35]

Knowledge, thought and learning are also significant issues to architectural educators; of course, they are the basic realities of education. Gibson's theories provide a unique outlook toward these issues that is worthy of further study. Gibson is wary of the idea that knowledge or learning is a higher, supposedly more intellectual, process than perceiving. Perception from his viewpoint includes, to some extent, memory, experience, and knowledge:

> Knowledge of the environment, surely, develops as perception develops, extends as the observers travel, gets finer as they learn to scrutinize, gets longer as they apprehend more events, gets fuller as they see more objects, and gets richer as they notice more affordances. Knowledge of this sort does not "come from" anywhere; it is got by looking, along with listening, feeling, smelling, and tasting. The child also, of course, begins to acquire knowledge that comes from parents, teachers, pictures, and books. But this is a different kind of knowledge.[36]

Knowing and learning are extensions of perceiving. Creative thinking is a further extension of the perceptual system where the system begins to work without exterior stimulation. Gibson hypothesizes that,

> a perceptual system that has become sensitized to certain invariants and can extract them from the stimulus flux can also operate without the constraints of the stimulus flux. Information becomes further detached from stimulation.[37]

> To expect, anticipate, plan, or imagine creatively is to be aware of surfaces that do not exist or events that do not occur but that could arise or be fabricated within what we call the limits of possibility.[38]

A very different type of knowledge is developed through education. Things are abstracted and ordered as tools for gaining knowledge, but they are not knowledge themselves. Knowledge is the individual's relating these orders back to his experiences and finding consistency with it. Gibson discusses how extremely abstract our modes of communication are and how far from an ecological reality they get.

He points out fundamental confusions we have between our abstract systems of communication and the reality we perceive. The use of mathematic constructs to describe the environment is one. Gibson contends, "the faces of the world are not made of some amorphous, colorless, ghostly substance, as geometry would lead us to believe, but are made of mud or sand, wood or metal, fur or feathers, skin or fabric."[39]

We talk of planes, lines, and points in architectural education and basic design. Gibson contends that while they are reasonable parts of a mathematical theory, they are not parts of the environment, nor should they be used exclusively in developing theories of design. He states these differences between abstract geometry and what he calls surface geometry.

> A surface is substantial; a plane is not. A surface is textured; a plane is not. A surface is never perfectly transparent; a plane is. A surface can be seen; a plane can only be visualized. Moreover, a surface has only one side; a plane has two....a surface has the property of facing a source of illumination or a point of observation; a plane does not have this property.[40] [and]...surface color is inseparably connected with surface texture.[41]

He suggests that new terms for surface geometry are needed in "ecology, architecture, design, the biology of behavior, and the social sciences instead of the planes, forms, lines, and points of geometry."[42] Two-dimensional representations (drawings), as has been stated earlier, are abstractions. Perception is principally of the three-dimensional world and the understanding of two-dimensional layouts is a special case which Gibson feels requires study as an exception instead of the norm. He acknowledges, "perceiving, knowing, recalling, expecting, and imagining can all be induced by pictures, perhaps even more readily than by words.[43] However, he warns that there is no comprehensive theory of how drawing communicates and that this lack makes the teaching of drawing less precise and communicative than it could be.

In summary, perception is an awareness of a wholeness, not in the gestalt terms, but in terms of the integrity of what things mean (affordance), their form, color, texture and relation to context (place and event). The image is much too complex to describe, and yet, the intent of architectural education is, in some aspects, an attempt to simulate the experience of perceiving a real environment. At this point, Gibson would contend, we have not yet defined our tools nor attempted to address the less quantifiable aspects of design.

Footnotes

1 Gibson's theories have been compared to other theories of visual perception in:

William Epstein, "In the Eye of the Beholder: Competing Theoretical Formulations of Visual Perception," Psychological Studies, V. 24 No. 2 (July 1979):82-97.

Ralph N. Haber, "Visual Perception," Annual Review of Psychology, 29 (1978): 31-59.

Harry Heft, "An Examination of Constructivist and Gibsonian Approaches to Environmental Psychology," Population and Environment, Vol. 4(4) (Winter 1981): 227-245.

Jon Lang relates Gibson's theories and Gestalt Psychology to 'Formal' design in: Jon Lang, "Theories of Perception and 'Formal' Design," in Designing for Human Behavior, ed. Jon Lang, et al., (Stroudsburg, PA: Dowden, Hutchinson & Ross, 1974) pp. 98-110.

2 James J. Gibson, The Ecological Approach to Visual Perception, (Boston: Houghton Mifflin Company, 1979) p. xiii

3 Ibid., p. 3.

4 Ibid., p. 66.

5 Ibid., p. 84.

6 Ibid., p. 8.

7 Ibid., p. 14.

8 Ibid., p. 10.

9 Ibid., p. 22.

10 Ibid., p. 18.

11 Ibid., p. 10.

12 Ibid., p. 100.

13 Ibid., p. 1.

14 Ibid., p. 116.

15 Ibid., p. 114.

16 Ibid., p. 57.

17 Ibid., p. 66.

18 Ibid., p. 61.

19 Ibid., p. 87.

20 Ibid., p. 92.

21 Ibid., p. 250.

22 Ibid., p. 246.

23 Ibid., p. 249.

24 Ibid., p. 127.

25 Ibid., p. 143.

26 Ibid., p. 127.

27 Ibid., p. 94.

28 Ibid., p. 103.

29 Ibid., p. 9.

30 Ibid., p. 101.

31 Ibid., p. 34.

32 Ibid., p. 199.

33 Ibid., p. 198.

34 Ibid., p. 91.

35 Ibid., p. 242.

36 Ibid., p. 253.

37 Ibid., p. 256.

38 Ibid., p. 255.

39 Ibid., p. 87.

40 Ibid., p. 35.

41 Ibid., p. 31.

42 Ibid., p. 44.

43 Ibid., p. 262.

COMPARISON OF THEORIES AND THEIR ARCHITECTURAL EDUCATIONAL IMPLICATIONS

The comparison of the design theories with the theories in the psychology of perception is complex and revealing. The complexity arises from differences in methodology and intention between architectural theory and psychology. It is also due to the fact that neither architectural theory or the psychology of perception is singular and monolithic. Within each field there are major differences which will be brought out to reveal the surprising breadth of interpretation these differences make possible.

At a fundamental level, architectural theory and psychology differ in what constitutes a rational justification and test of a concept. In psychology, a plausable hypothesis is formulated and its validity is tested through the scientific method; architectural theory justifies its concepts by relying heavily on historic precedent and bits and pieces of philosophy and science. In the two design theories examined in this work, scientific experimentation was never utilized to substantiate a concept.

The second fundamental difference between the fields is that of intent. The psychology of perception tries to explain how people perceive their general environment while underlying most design theories is the artistic intention of perfect expression. Artistic appreciation is usually handled, if at all, in psychology is a special condition and experience and not as the norm. The two psychological theories under discussion say very little about interpreting art.

Neither of these fundamental differences can be said to be unimportant. However, the intent of this research has not been to validate the methodologies of either field or to accept one over the other. It is simply to suggest that some parts of architectural theories can be supported by one or both of the psychological theories and that this might have some effect on the training of architects.

The issues become even more complex when, as has been done in this case, the design theories are carefully analyzed. Not only are there major differences between the design theories of the Beaux-Art and the Modern Movement, but the Modern Movement itself has three distinct conceptual forms. There is a formal strain to some of the theories of the Modern Movement, particularly those of LeCorbusier, that are, in many ways, quite similar to formal concepts of the Beaux-Arts. There is a diametrically opposed strain which is represented by the ideas of Organic Architecture championed by such greats as Wright and

Aalto. And finally, there is a philosophy of problem solving instigated at the Bauhaus under Gropius which has interesting components of both attitudes and yet has distinct characteristics of its own. These differences are delineated in detail in the preceeding sections. The reader need not let these distinctions be confusing. In general, the comparison will state which of these attitudes within the Modern Movement are being discussed.

The last complication introduced in this work is that the psychological theories also differ fundamentally with each other. They have differing rationales for the process of perception and therefore they support differing interpretations of the significance of components of the design theories. These differences are most apparent in the influence of symbols on perception, to be elaborated upon in the comparison. The most surprising commonality is that both support the concept of 'man as the measure,' though for very different reasons. This will be elaborated upon in the section on heirarchy.

All this complexity has the positive objective and value of providing greater insight into the relation between design theory and the psychology of perception. It is not necessary or recommended for the reader to try to come away with a clear prescriptive method for selecting an appropriate design theory. Instead, this work supports the idea that there are many appropriate design strategies, any of which might be valid in a particular context.

To deal with this complexity, the comparison has seven primary sections and several sub-headings. The first four sections follow the structure used to organize the architectural theories of both the Modern Movement and the Ecole' des Beaux-Arts, the categories of geometry, hierarchy, mood or tone, and explicit symbol. The fifth section is an evaluation of the psychological theories, and the sixth formulates the implications of this comparison for architectural education. The final section is a summary.

Geometry

Geometry refers to patterning of architectural plans, elevations, sections and solid form, which usually, but not always, follow regular geometric shapes. Geometry, in this instance, should not be considered as an abstract mathematical science of points, lines and planes, but instead as dealing with the selection and allocation of building elements in patterns that relate to each other.

Platonic Form

The idea that there is a truth greater than a mathematical clarity in simple geometry is an architectural concept. The Vitruvian image of a man within a circle and square has represented the idealized relationship between human proportion and basic geometries for centuries and has been the genesis of many elegant designs. The idealized truth embedded in this drawing is that the clarity and simplicity in geometry is within human form and proportioning. It begins to define human beauty and compositional beauty as resting on the idea that a geometric truth is somehow a key to the laws of an inherently beautiful nature.

Gestalt theory would support Beaux-Arts and Modern Movement formalists in their assertion that primary forms are visually dominant. However, the Gestalt contention that form tends to be interpreted as being as 'good' (symmetric, simple, balanced) as the situation allows, is not the same as the value judgement the design theories place on the significance of primary forms. Good is a description of clarity and ease of recognition in Gestalt psychology; the design theories have interpreted primary forms as having elementary significance to the viewer. In some instances the rationale has been that primary forms symbolize a mathematical truth, a religious unity, and a natural law which can be intellectually appreciated as well as felt.

The Ecological approach would dismiss these ideas. They are not conceivable within a reality that perceives form from a flowing visual array of changing, not static, patterns nor do they take into account the exceptional performance capability of the perceptual system exhibited even in the most mundane human activities. From this view, simple configurations may be easily understood but are not therefore 'better' than complex configurations. The latter have the capability to sustain layers of significance. Nor is it clear that complex configurations are at all more difficult to perceive in an operational sense. There are, of course, levels of clarity in the environment, but the Ecological theory would suggest that it is not, for example, more difficult to perceive a place in a public park than the pure geometry of a racquetball court.

The other argument against a special significance of primary forms from the Ecological view is that most objects are not seen in a pure projection, but from an oblique angle, accompanied by motion and perspective distortion. This would make the view of platonic solids as complex as the view of many other objects and therefore difficult to distinguish, as shapes, from other relatively simple forms. In contrast, Gestalt theory is that through mental processes objects are geometrically rectified to a frontal view as part of recognition, and therefore it is quite possible to recognize pure geometries from other forms. If this

is the case, which the Ecological theory specifically contends is not, then platonic solids are easily recognized for their strong gestalt and can dominate a view.

Bauhaus Exercises

Basic Design exercises of the Bauhaus and later dealing with geometric shapes and platonic solids were based on contemporaneous theories in science, art, and education which contended that form was built from these elemental pieces and could be broken down into them for study. This idea is not supported by either psychological theory. Gestalt theory simply contends that if there are two ways of interpreting a composition, the simpler, in terms of gestalt groupings, will be utilized. This does not suggest that everything is built from smaller, clearer gestalts. Ecological theory is based on an entirely different view. Every material thing has its own behavior in the visual field, and these are learned. Objects are not decomposed and recomposed, but their consistency is registered from movement in the visual array. The consistency of things is not primarily geometric, though the built environment tends toward it. In Ecological terms, perceived consistency can be an attribute of texture, color, form or meaningful use of a thing.

Grids, Romboids and Free-form Objects and Organizations

The Beaux-Arts' use of nested and overlapping rectilinear grids and nested circular forms created extremely regular and repetitive rhythms. These patterns are visually strong gestalts in plan and elevation. They utilize all the Gestalt attributes of grouping (proximity, similarity, scale, etc.) very distinctly and could exemplify Gestalt theory as it might be applied in Architecture.

The transformation of form exercises of the Bauhaus and the more complex compositions of the Modern Movement test the strength of Gestalt forces in composition through experimentation. Both architectural theories stress the importance of unity in composition; the Modern Movement has simplyattempted to find the limits to which composition can be expanded while still retaining a sense of unity. The test for whether unity is achieved in these more complex compositions seems to rest on Gestalt grouping techniques, and on concepts of balance, other than symmetrical, which are also gestalt-based. The Bauhaus test for success was less formularized than the Beaux-Arts methodology and relied to some extent on the creator's subjective judgement. Nonetheless, the underlying principles of composition in both theories are supported by Gestalt theory.

It is interesting to note that in some Modern Movement theory, notably that of Gropius, composition is de-emphasized in favor of a functonalist attitude toward planning and use of materials. To the extent this philosophy is applied in design it can find support in the Ecological theory of percepton which places great emphasis on the fundamental understanding of things through use. In general, Ecological theory would not emphasize one geometry over another, but would suggest geometry affects use. Expressing a clear use then, would be of greater importance than the selection and application of simple or complex compositional geometries.

Hierarchy

Hierarchy in architectural composition is the order in which the importance of various architectural forms are ranked and related in their context. These rankings and relationships are based on several conceptual issues that can be analyzed in relation to theories in the psychology of perception. The first, and most commonly considered, deals with consistencies and dominance within a composition developed by relationships in properties of materials and proportioning, geometry and rhythm in composition. This leads to a second issue dealing with the general concept of unity. Object recognition is the third issue which is followed by place and closure recognition. Finally, the issue of whether man has a scalar relation to form that affects his sense of hierarchy in composition can be addressed.

Consistency and Dominance

Implied in the architectural concept of hierarchy is the idea of a consistency that must be part of a composition so that things of various levels of importance can be juxtaposed to it. This consistency provides some of the sense of unity which a composition might exhibit. An element of a composition has many characteristics such as texture, color, location, form and proportion, that may be utilized to provide either the consistency or hierarchy in a composition. Consistency is developed by similarities between characteristics of elements while hierarchy is developed by contrast between other characteristics of the elements. It is not uncommon for all elements in a composition to exhibit both relationships. For example, a stone building may utilize the same stone and proportioning everywhere to provide consistency, but change its texture, scale, or location to develop hierarchies. Consistency then is as important as contrast in the analysis of hierarchy in composition.

The following is an analysis of hierarchial compositional techniques of the Beaux-Arts and the Modern Movement from the Gestalt and Ecological psychological perspectives. The Ecological perspective pushes this analysis beyond the strictly

formal issues in hierarchial composition to issues dealing with the use of things. This deviation is unavoidable because Ecological theory refuses to separate issues of form and use.

The Beaux-Arts relied heaviliy on dominances of centers of symmetry and scale relationships, large scale being more important than smaller. Consistency was developed by similarities of any of the gestalt attributes of visual organization, but also relied heavily on rules of proportioning. Rhythms in Beaux-Arts composition exhibited nested symmetries and not overly complex sets of modulation. All these techniques can be supported by Gestalt Theory.

The Modern Movement favored similar techniques but was less exacting in their application. Symmetries are downplayed in favor of scale relationships and consistencies are developed through alignment and similarities in simpler form, color and textures. Modularity and proportioning is evident to some extent in modern buildings, but is not as pervasive as it is in Beaux-Arts work. Rhythms in modern buildings are developed as in the Beaux-Arts but are also developed from a new and more fluid methodology. An example is the mullion modulation of the Carpenter Center for Visual Arts at Harvard University by LeCorbusier. (fig. 1) In this building, alignment holds the elements together while the spacing has a wave motion with no clear points of focus. Therefore, the Modern Movement techniques, while exhibiting a slightly different emphasis than the Beaux-arts, can quite easily be evaluated in Gestalt terms. The Gestalt concept of varying strengths in gestalt relationships is also clearly evident in the design theories; the buildings considered the best architecture exhibits the clearest, though possibly not the simplest, Gestalt ordering.

The Ecological interpretation of these methodologies is similar to the Gestalt but in a total interpretation of form the Gestalt aspects would be downplayed in favor of decisions in choice of material and the use-related aspects of form. The Beaux-Arts generally felt that the only true and noble building material was stone. The Modern Movement utilized all materials and in general, tried to express the true nature of the material, its potentials and limitations. The Beaux-Arts gave less emphasis to use-related form and greater emphasis to symbolic and hierarchical form. Modern Movement reversed this and the maxim of "form follows function" appeared.

Ecological theory would support the Modern Movement interpretation of both material selection and use-related form. Ecological theory claims that basic to understanding the world is understanding of the affordances of materials and that this understanding does not separate the form from the material or use. Together, they form a whole interpretation of an environment. From this perspective, form cannot be discussed

without reference to use and material which is similar to the beliefs of the Modern Movement. Thus, while formal relationships can be distinguished and discussed as a separate aspect of an object, the usual interpretation is a totality which includes intrinsically what the viewer knows about the material and function of the object.

Unity

Some level of consistency in a composition implies the concept of unity, but since it is such a significant issue in architecture it requires further exploration.

Unity is an underlying concept of all design theory. It also has two distinct aspects. The first is simply the development of consistency within a composition which was referred to earlier and relies on the same principles as the methodology for developing hierarchy.

The second concerns itself with conceptual intention and its execution in building. Most architectural theory, whether Beaux-Arts or Modern Movement, has espoused the idea that a building required a single concept that all aspects of a building must serve. The test of a good building then, is that nothing can be added or removed without ruining the composition. The Beaux-Arts further limited composition to a single primary focus to which all other elements were hierarchially ordered. Duality was abhorred. The Modern Movement allowed greater flexibility, but in general, still required this singular conceptual unity.

Psychological theory does not directly address this formal issue, but there is no indication of support for it. Ecological theory in particular suggests that the discrimination of the relationships of things is relative to the viewers' intentions and needs and is not clearcut and unambiguous. The edges between places and events are fluid, and can expand and contract at the will of the viewer. One can be in a meeting and switch from a discussion with an individual to an appreciation of the entire group. One is not able to concentrate evenly on both at the same time; concentration on one or the other controls the sense of scale of the relationship. This is true of relationships in the inanimate environment as well. Thus the use of a singular idea that must dominate an architectural composition, this pervasive unity, has little relation to ecological concepts of environmental understanding.

Gestalt theory does not suggest there is a particular value in a singular unity in architectural composition any more than Ecological theory does. However, architectural unity corresponds to the strength of a gestalt; a strong gestalt does not permit ambiguity in its perception as an object.

Object Recognition

The concept of a visual unity based on a conceptual unity requires the ability to recognize objects. Both of the psychological theories find object recognition fundamental to perception, but they describe the process differently. Gestalt theory hypothesizes the figure/ground relationship; the force in visual organization forms the figural experience. The Ecological approach states that as the textural array of reflected light crosses the retina the discontinuities in the flow of the array can be noticed and that these discontinuities specify attributes of objects, not the least of which is the outline or volume or object itself. Ecological theory contends people learn to recognize most objects early in life and maturation is a process of redefining our knowledge of things based on greater experience and learning.

The Renaissance technique that Wittkower notes of putting buildings, particulary churches, on plynths or bases would seem to be effective from both a Gestalt and Ecological perspective. The technique clearly separates the object from its context. Having the buildings literally separated, standing alone, instead of, for example, being one of a wall of buildings, is equally successful, because its objectness can be perceived through movement over time.

Man is the Measure

All formal proportioning systems, in contrast to proportioning based on technical integration of elements, has contended that measure begins with human scale and proportion. Vitruvius' image of a man in a circle and square links human proportion to pure geometry and LeCorbusier's Modular attempts to provide a similar link between mathematical progressions and human form. Since humans come in varying sizes and shapes, these were of course attempts to define ideal relationships. The apparent conclusion would be that these ideas would have no basis in psychology, but this is not the case. Although from very different directions, both Gestalt theory and Ecological theory support the idea that people measure the environment in relation to their scale and location within the environment. The Gestalt concept of an ego as a central element in composition which exerts a force on the way environments are perceived would make the individual central to compositions. The force of the ego fixes the location of the individaul and measures the environment in relation to that individual. The Ecological view is that everything is measured and scaled from the location of the eyes. Use-related scales, such as the height of a seat, are of particular interest to humans because they identify an affordance of the environment, in this case a place to sit. Thus, while these theories do not necessarily speak directly to the architectural methodologies for

proportioning related to human form, they do indicate a measured relationshp of man to form that could be applied in design.

Place Recognition and Closure

The psychological theories consider place recognition to be as fundamental to perception as object recognition. It is also a major issue in architectural and urban design composition. From the Gestalt view, a sense of recognizable place can be achieved by highly integrated compositions of pure forms, and gestalt interrelations of parts, such as alignment, symmetrical ordering, and proportioning the parts to the whole. Separations from place to place require contrasts between the collective gestalts of one place and another. The higher the contrast the clearer the separation. These are attributes of Beaux-Arts composition to a greater extent than the Modern Movement. Design theories dealing with concepts of contextualism suggest that places need to be integrated with their contexts, as, for example, a facade needs to be composed. This would require an approach of providing some similarities with the context and some contrast. The exact balance between the two is the historic problem of contextural design.

Ecological theory would support the recognition of similarities and symmetries, but consider them less significant in perception. Perception in ecological terms is a process of discrimination, and this discrimination is based on a desire to know something or to find one's way. While complex environments such as Greek fishing villages seem difficult to understand because of their lack of formal order, Gibson would contend that most people living in them do not find them difficult to navigate in; it simply takes time and repetition to learn to discriminate one place from another. There is a slight suggestion in Gibson's description of places that greater contrast from place to place makes them more distinct, but limited compositional sets, such as the Beaux Arts, would not necessarily meet this objective. The Ecological theory suggests that there is a fundamental difference between places and objects; that is, they are geographically separate from each other and can not be moved. Therefore, place is recognized, in part, as an aspect of a progression and not simply from form contrast. Obviously, this interpretation of place recognition places a major emphasis on a concept outside the control of design theory. And finally, both psychological theories would find the excessive repetition of some housing developments a factor in both confusion in wayfinding and sense of individual place, and in contributing to boredom.

In design theory, one important aspect of place recognition is the sense of closure. Although one Gestalt characteristic is closure of form, perceived closure is more significant to place definition in the Ecological approach than in the Gestalt.

Ecological theory suggests that there are basic perceptions of form organizations such as convexity that are primary to our overall organization of space. The sense of enclosure is powerful in this theory and has the potential of taking on meaning from use and relation to human scale. The concept does not suggest clear geometries as being more significant than other forms of closure, but that contrast in closure can signify sequence and change of sense and use of place.

This matches well with both Beaux-Arts and some Modern Movement design methodologies. In the Beaux-Arts, the 'marche' or entry progression in a scheme usually was through a forecourt that provided a strong sense of closure and place. Courtyards were also utilized to separate elements and allow light to rooms. So, in siting and general arrangement, strongly configured surrounded space was the norm. Interior space also had a strong sense of closure in that designs were formed with distinct rooms where openings were made by puncturing the surface while the key to a sense of closure, the edges, were maintained.

Most Modern Movement buildings exhibit less closure than Beaux-Arts buildings. Siting and progression is usally not through articulated forecourts nor are edges of rooms always maintained. However, there are still many significant examples of well closed rooms and even exterior spaces which suggest that this type of spatial definition was not entirely forsaken.

Mood or Tone

Mood or Tone of a composition is difficult to define because it is intended to cover feelings that are not amenable to verbalization and are not verbalized in the process of experiencing them. It covers feelings of well-being that are perceived sensorially, such as the smell of a breeze on a Spring day as one overlooks a familiar valley. Moods and tones are interesting psychological issues.

The Gestaltist view suggests moods are learned gestalts based on a combination of the ego, characteristics of place, the social setting and learning. A Gestalt, or organized whole, can be a concept of the season, fall, which is an aggregate of related characteristics of an event such as a temperature change accompanied with leaf color change and shortened days. There is a collective tone developed from these experiences which can be associated with a mood of a festive season or of the passing of summer. The Beaux-Arts concept of tableaux was an attempt to capture the mood of seasons through the application of tonal characteristics of materials that imitate nature at a particular season. This can be described as applying the Gestalt concept of grouping by similarity; similar color and texture selections relate a season to a room. Organic architecture of the Modern

Movement is conceptually similar. Aalto and Wright's work that develops major relationships between natural and designed environments through similar geometries and tones work, from the Gestalt perspective, by evoking a mood through similarity.

The Ecological interpretation of these examples would be similar to the Gestalt interpretation. From this perspective, these color/texture issues would, in an overall sense, be a more significant part of perception than the formal ordering of geometries. Because the Ecological view holds that these basic, inseparable characteristics of things must be learned by everyone before they can function effectively in the environment, they become base conditions on which further understanding is built. They are a prerequisite to perception, and an integral part of everyday behavior.

Thus, the idea of tableaux and Organic Architecture as defined by Wright does have psychological justification from both Gestalt and Ecological perspectives.

Education in the Development of Mood and Tone

In the educational context, there were two methods of studying the ability of material and form to evoke a mood or tone. First, the Beaux-Arts lectured on the concept of tableaux, and their application must have been discussed in the ateliers of the various masters. The lectures were probably fairly specific in the methodologies of forming tableaux; later in the evolution of the Beaux-Arts, Garnier would attack this position by reclaiming the individual's right to select and invent decoration in design. Garnier's claim is one step towards an increased freedom in personal expression.

The Bauhaus took this freedom to an elemental level. They abstracted tonal experiences by exercises that developed the student's understanding of the nature of materials and color. The underlying assumption of these exercises was that personal experience is a prerequisite to formal education. The exercises dealt with gradations and classifications of colors and textures and with the nature of materials and their connections. The overriding objective was to sensitize a student to potentials of materials and give them a sense of sureness in their decisions.

Ecological theory would stress the value of this method of education. Again, the value would lie in the understanding of the basic qualities of things, their color and texture, the way materials can be formed to make objects. Since much of the Bauhaus education was sensitizing instead of intellectualizing, the Ecological theory has a particular perspective on reality that would support this approach. The Ecological view is that there is a great deal of perception and attention that can never be verbalized, but is none the less a primary aspect of

experience. A description of an event or object is always an abstraction and simplification of a perceived reality. Great poets have difficulty capturing the essence of a tree, but trees are easily seen and experienced. They are part of a pervasive reality that can be experienced in great detail emotionally but not necessarily intellectually. Since most daily experience is at this level, so therefore is understanding of the environment. The introductory course at the Bauhaus, and most basic design courses, are attempts at expanding the individual's ability to see and feel things about materials and their organization in a non-verbal way. Although some of these exercises, usually two dimensional, abstract compositions, also deal with Gestalt concepts of visual mass and balance, the sensing of order is stressed over the conceptual explanation of the feelings the compositions evoke. Wright's Taliessen building projects were, in an educational sense, his method of sensitizing students to the reality of materials. However, this technique has never really caught on in formal educational settings. All these teaching methods have a particular affinity to the Ecological conceptualizations of perception, based on direct experience and not intellectualization or symbol formation.

The Mood and Tone of Place

The sense of place is often partly a mood or tone based on a link between a particulary physical setting and social grouping. Examples of social orders are families, communities, countries, churches, etc. They become linked to a place through repetitive use by individuals. Over time the links become exceedingly strong; the sense of a heritage related to a country is only one obvious example. These relationships, from the Gestalt perspective, are gestalts of a higher order which links a physical gestalt to a social one and to a sense of being. The parallel between Ecological Theory and Gestalt Theory is strongest here. Similar nested orders of events and feelings are hypothesized in Ecological theory but their boundaries are vague and shifting. Even from the Gestalt view, the overall gestalt of place can have varying degrees of strength for different persons. Since many of these associations and aggregations are as idiosyncratic as personalities are in general, they are difficult to collect into a statement of design intent. They nonetheless require recognition because of their great ability to elicit feelings of well-being and belonging. The Beaux-Arts' attempt at defining a typology for every building type could be on the one hand an effort to capture the essence of place, and on the other to standardize it.

The Modern Movement, with the exception of Organic Architecture, did not formulate a methodology for place formation that linked people's past experience with new designs. Organic Architecture, by utilizing similar tones and

forms as the surrounding natural setting suggested, began to develop a general methodology for the mood and tone of a place. The general idea of contextual design has a similar intent where social and physical structures that represent a particular physical and historical place are preserved and strengthened.

In summary, the issues of mood and tone of place are difficult to formulate into exact design methodlologies because they require some inate sensitivity to a context, and the design process needed to achieve a sense of place need not be simply mimicking the past. Psychological theory would support the prominent role a sense of place has in human experience, and it is gratifying to note that the design theories studied here do attempt to address the definition of a place.

Explicit Symbols

Explicit Symbols are forms that an architect employs in design that are intended to symbolize a clear, verbalizable concept. The word explicit is utilized here because from some specific psychological viewpoints everything has symbolic content, including moods and tones, whereas others prefer to limit the meaning of symbols to a more infrequent mental activity. This is a prime difference between the Gestalt and Ecological views, and this difference might suggest divergent directions in design.

The Gestalt theory of isomorphism between a geographic environment (reality) and a behavioral environment (what we perceive and imbue with meaning) suggests that everything experienced is a symbol or set of nested symbols representing a larger concept. A gestalt is a symbol in the behavioral environment that represents a combination of the geographic environment and social and personal interpretations of it. An extremely strong gestalt is an explicit symbol. Most of the explicit symbols on which people operate would be reasonably similar within a specific culture because they are developed and reinforced by formal education. The Beaux-Arts education into the meaning and appropriate application of the orders and other specific configurations for building types and elements is such an education. If appropriately applied, the form symbolizes a specific social relationship believed to be culturally accepted. However, there is a circular logic to this educational concept. If the Ecole des Beaux-Arts theory lectures are the only place within the culture that these form meanings are explicitly identified, then how can it be assumed to affect a population who has not benefitted from the education? There are two answers to this question. The first is that architectural education and formal relations are developed solely for the educated classes of people. The second is that if all buildings are built with the appropriate formal orders, then there would develop a consistency in buildings that

could be sensed, though not explicitly learned. Probably some of both answers were used to justify this approach.

The Ecological view is that symbols play a much less important role in perception. Its core concept is direct perception, and assumes an inseparable relationship between the physical qualities of things and their use. In this theory, perception is of use and form; use is not a symbol or gestalt applied to form. This theory would not support the intricate applications of specific forms prescribed in Beaux-Arts education. Instead, it would concentrate on places and scales appropriate for human use. Acquired meanings are simply developed from attending to using things and from formal education, and Gibson contends that this activity permanently changes the perception of the environment. These changes are not abstract characteristics of an object, but are the object. The function and the object are inseparable. Gibson does not disregard the use of symbols in science and writing, but contends that they are not that significant in our daily behavior. From this perspective, one needs to be taught symbols and how to look for them as well as how to think about them. Symbolic interpretation of architecture, such as recognizing a style as representative of a theory of design is not precluded, but is recognized as an abstract thought process not normally associated with behavior in an environment. This attitude of the diminished role of symbolism would support the Modern Movement concept that form should support function. However, as Aalto points out, function requires a broad definition which includes emotional values as well as the more usual use-related functionality.

It is tempting to think that these divergent views represent the difference between architecture as art and architecture as a purely functional object. Architecture as organized figurative symbols is simply one interpretation of the art of architecture. The other attitude is that visual perception is a set of experiences that cannot be replicated verbally and conceptually, and that a portion of the art in architecture takes place in this realm. It seems that the masters of architecture and architectural education, whether Beaux-Arts or Modern, have combined the two possibilities in their work, and this is what has made them great.

Evaluation of the Psychological Theories

Since the analysis in this work has been of architectural composition from two psychological viewpoints, it seems appropriate to comment generally on the strengths and weaknesses of these two perspectives.

The strength of Gestalt theory is that it classified certain recognizable relationships such as figure/ground, and

grouping by similarity, proximity, etc. However, the assumption that these relationships are formed by forces in the behavioral environment that are similar to physical forces, but can represent formal relationships as well as emotions, has not been proved. It is known that mental activity is chemical and electrical, but its exact methodology is yet to be discovered by neurological research. Gibson is also highly critical of some of the research methodology utilized to verify Gestalt concepts because he contends that they do not represent human behavior in a three-dimensional world. It is also difficult to imagine that, as the Gestalt perspective suggests, all experience is symbolic. It is much simpler to assume that only particular forms and situations are symbolic in the sense that they stand for a meaningful concept. This is of course, the Ecological perspective.

The Ecological theory's strength is its inherent three-dimensionality and its reliance on a flowing visual array. It seems conceivable. Its weakness is that it has just begun to develop substantiating scientific evidence for its concepts. The theory still has several underdeveloped areas that need articulation and verification. In terms of this inquiry, the area requiring the most development is the nature of artistic perception, which was mentioned as a particular problem but never received elaboration. Gestalt theorists would criticize Gibson for not describing exactly how the perceptual system works. He simply avoids the Gestaltists' need for hypothesizing a behavioral environment that is at least physically isomorphic to the geographic one by saying that the issue is irrelevant. He maintains the concept of direct perception, which remains inexact. However, since exact brain activity is at a neurological level as yet undeciferable, his lack of a clear hypothesis in this area may be reasonable. Both theories seem plausable and neurological research may find one more reasonable than the other. However, there is also the possibility that, to some extent, they are both correct, for the brain's ability to multi-process information should not be underestimated.

Educational Implications

The implications of these psychological theories for architectural education are somewhat divergent. Gestalt theory emphasizes the development of stronger and stronger gestalts built on the interrelationships of individual gestalt characteristics and symbols. The Ecological approach would strengthen the importance of texture and contrast in composition. Symbolism would be less important, and use-related place formation more important. Gestalt compositon is a formal compositional technique, whereas the Ecological approach would give equal validity to abstract and intuitive composition. Both the Beaux-Arts and Modern Movement compositional theories have

aspects that would be supported by one or the other psychological theory, as the previous discussion describes.

Architectural education has a difficult role in that the best possible thinking on the subject of composition is inconclusive. There are experiences that are inherently visual and can only be judged visually, and there are other ideas amenable to language and teaching. One can not be allowed to dominate the other in a broad design education.

Concepts, which seem to be inherently language formations, are proving to be as relative to context and individual interpretation as purely visual presentations. Juan Pablo Bonta in his book Architecture and its Interpretation analyzes this relationship as it is expressed in architectural history. He concludes that:

> The goal of architectural interpretation is not permanent knowledge. Architectural interpretations are subject to the general trends of the history of ideas. Interpretations are cumulative to a certain extent: each critic can build upon what has been said before. But, just as in the process of accumulation of scientific knowledge (Kine, 1962), the cumulative processes in architectural interpretation are interrupted from time to time by 'revolutions' in which everything is re-examined, and old paradigms no longer relevant to present problems are abandoned. We interpret buildings in certain ways because, in doing so, we can throw light upon aspects of the world in which we live. Interpretations are discarded--like forms--not so much because we get bored with them, but because they cease to fulfil the initial, cultural role, and new interpretations more closely in line with contemporary interests are bound to arise in substitution of the old ones. [1]

He further contends that an idea has an initial phase of growth, a maturing, and then a slow decay. Bonta says "Ideas often become impoverished and degraded as they become entrenched in self-perpetuating verbal traditions."[2] Ideas become irrelevant to current situations or so obscured by interpretation that their original clarity and relationship to a social context are totally lost. It is particularly important to stress the relativity of ideas in architectural education because the proof of whether people respond to composition in ways suggested by theory is still far from proven. Therefore, architectural education should develop a student's respect for the theories of the Beaux-Arts and Modern Movement composition as well as other forms of composition, but they should be presented in context. Their methodologies have produced inspiring architecture; yet for them to remain vital they must

be seen in their orginal and re-examined in light of current understanding in the psychology of perception.

Summary

The Ecological theory of Gibson demands an understanding of form from the flow of light impinging on the optic array. Architectural form is something to be in, move around and through. Experience is registered over time and is highly directed by individual motivation. The appreciation of the aesthetic of a place can be done at many levels of nested relationships, from detail to panorama, and from a variety of viewing points. This makes architecture an essentially different art form than painting and even sculpture. It suggests that design might have levels of interest from detail to room configuration to overall organization. More normal behavior in the environment, Gibson contends, is at the use-related level. Doors suggest passage, chairs sitting. An environment can be formed that is useful and provides a variety of options for use supporting flexible behavior. From the Ecological view, use is scale related to a species, and therefore something like a sill height of a window needs to be in some relation to human viewing heights to be useful. At the most primitive level of experience, the basic natures of materials are the essential experience. This need to understand material could conceivably place a renewed emphasis on the qualities of materials selected for building finishes and details.

From the Ecological perspective, the role of symbolism is the most difficult and illusive issue to understand. Amos Rapoport, in discussing some of Gibson's ideas, has suggested that in present western culture it may be possible to identify a consensus on the meaning of use-related objects, but that higher levels of meaning have become far more personal than in other historic periods and thus are unpredictable. He reinforces Juan Bonta's idea that symbolism is relative and that

> Today it is far more difficult, if not impossible, to design in the associational world since symbols are neither fixed nor shared. . . .The solution may then lie in openendedness--not just of function, but of meaning, so that people can take possession by personalizing, since, as we have seen, man takes possession of the world through symbolic means.[3]

Gibson seems to limit symbolism to formal languages that are learned. Use and feeling related to objects are evolving personal definitions of the object and not symbolic layers applied to the object. To Gibson, environments can be extremely meaningful without being symbolic. In fact, symbolism takes mental effort; for example the identification and classification

of a building as "gothic" requires the understanding of what it means, beyond a formal vocabulary, to be gothic. Gibson contends that the large majority of people do not perceive in this way, but that environments are nonetheless very meaningful. The meaning is related to personal experience of place and social situation. In form terms, it simply requires a recognizable place and form that is somehow able to grow meaningful to the individual. This may require, as Rapoport suggests, multiple options and variety so that through varying interactions with the environment the individual develops a rich and varied interest in it.

Design theories have historically searched for a singular ideal world; the idea of the perfect sacred space, the hierarchically ordered urban form supporting a fixed social structure. Building in the modern world does not, in general, start with a search for the ideal, the sacred or the ritualized. Nor can it. In the first place, most building is a commercial venture that does not, on the face, have a utopian base, and second, there are real function and site constraints that make problems complex and multi-faceted. This type of environment is more easily understood in Gibson's Ecological terms. It is an environment of relative values and meanings to various individuals, but it can be given distinct visual form capable of growing in meaning. This requires contrast from place to place and a level of detail and complexity capable of sustaining interest. Form may follow formal ordering systems, but may also be produced intuitively. Neither, from the Ecological perspective, is intrinsically more capable of evolving in meaning.

Gestalt theory essentially supports the most formal compositional and symbolic systems. Prak, Arnheim, Lang, and Jules have shown how the theory can be applied to the interpretation of architectural form.[4] Gestalt theory can be utilized in developing a measurable value scale for hierarchical interpretation of form. All gestalts, in theory, are symbols; they stand for something in the real world, but they are themselves in an individual's behavioral world. By implication then, symbols can have hierarchical values. In general, this supports a purely Beaux-Arts method of design and in ordering technique, this would probably be the case. But, in light of the previous discussion of designing in the modern world, the method would not be limited to singular centering hierarchies of the Beaux-Arts. Gestalt relationships can be employed to order complex, multi-focused problems. In Gestalt terms, better design has stronger gestalt interrelationships of component parts because they are most easily recognized. This, too, is measurable in a comparative sense, and, as in the Ecological view, can be layered at a variety of scales.

In conclusion, the psychological perspectives can provide theoretical underpinnings to aspects of compositional theory which have lost credibility from worn out rhetoric and archaic rationales. The two compositional methodologies of the Modern Movement and Beaux-Arts are not simple, single concept theories, but rather have great richness and variety addressing many aspects of architecture. They span both psychological theories forming a fascinating and complex mosaic.

Footnotes & Illustrations

1 Juan Pablo Bonta, Architecture and its Interpretation, (New York: Rizzoli International Publications, Inc., 1979), p. 202.

2 Ibid., p. 180.

3 Amos Rapoport, "Symbolism and Environmental Design," International Journal of Symbology, Vol. 1, No. 3, April 1970.

4 Rudolf Arnheim, The Dynamics of Architectural Form, (Berkeley: University of California Press, 1977).

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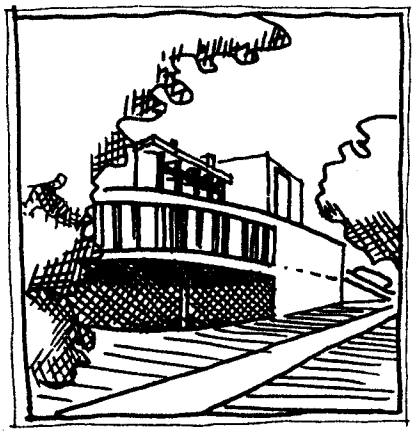
Illustrations



1 Mullion modulation
Carpenter Center for the
Visual Arts,
Harvard University
Le Corbusier

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APPENDIX A

The Ecole des Beaux-Arts
General Evolution

The Ecole des Beaux-Arts' (1819-1968) conceptual base evolved from the Academie Royal d'Architecture which began in 1671. The "academic doctrine was, in twentieth-century terminology, rationalist; it was characterized by a complete trust in, to use a more eighteenth-century word, reason; and at least at first the Academy's trust was so complete as to make reason a seventeenth-century absolute. The Academy sought to evolve universal principles of architecture. . . . The touchstones of these principles were what had long been regraded as the best examples: for proportion, the five Orders; in general, the greatest buildings and texts of Roman antiquity and the Italian Renaissance." (1) By 1717, its basic lectures had become a two year course of study delivered by an appointed Professor of theory. The lectures covered the issues dealt with by Vitruvius, Alberti, Palladio and others, namely architectural theory, composition, arithmetic, geometry, mechanics, military architecture, fortifications, construcion and perspective. In addition to the lecture series, the education included work on competition projects in ateliers outside the school and study in Rome.

Two primary lecturers on theory influenced the form of the program greatly. The first was the program director and first Professor of theory, Francois Blondel (1617-86). He believed in immutable rules of composition and taught them following the Roman and Renaissance texts and examples. A distnt relative of his, Jacques-Francois Blondel, (1705-75) was later appointed Professor of theory and his lectures were recorded in L'Architecture francaise and Cours d' Architecture. J-F "Blondel acknoledged that bauty is changing, not absolute, but he also believed beauty to be derived from long-appreciated predecessors, while maintaining a belief in the validity of the classical examples. This educational system lasted a little over a century and was dismantled immediately after the French revolution and the fall of the Bastille (1789) and reinstituted in a slightly modified form as the Section d'Architecture of the Ecole des Beaux-Arts in 1819 fter the monarchy of Louis the XVIII was restored. "The king gave to the administration and curriculum of the school a shape that remained substantially unchanged, except for a few years aftrer the reform of November 1863, formore than one and a half centureis." (3)

The structure of the curriculum was similar to its predecessor, the Academie Royal d'Architecture. It comprised lectures on archiectural theory, mathematics, geometry, construction, history of architecture, perspective. In addition a series of competitions and levels of achievement culminated in the Grand

Prix de Rome. The competitions were worked on outside the formal school in ateliers of architects and theorists. They criticized students' work and gave varying emphases to the basic rules of composition and design. The general Ecole des Beaux-Arts program in architecture required a potential student to first be accepted into an atelier by the master. After this, the student could enroll in the Ecole des Beaux-Arts and prepare for the entrance exam which tested mathematics, geometry, history, drawingand architectural design. To prepare, a student could hire a tutor, work in their atelier, and listen to the lectures at the school. "From the early 1820's on, there were lectures in theory of architecture, history of architecture, construction, perspective, and mathematics; by 1900 there were more than twice as many courses, including physics and chemistry, descriptive geometry, building law, general history, and French architecture." (4) After passing the entrance exam a student was admitted to the second class and allowed to submit to competitions and continue to listen to lectures. The competition programs and instructions were written by the Professor of theory and judged by the faculty of the academy. The only exams were at the end of lectures on scientific subjects and a student could take the exam without listening to the lectures.

There were two types of competitions; esquisses (sketches) and projects. The competitions tested composition, construction and drawing. For a student to be promoted into the first class he had to receive credit for a specific number of sketches, projects and exams on all subjects. Projects and exams would be given points for good work and a student also needed a minimum amount of points to advance to the first level. A particularly interesting aspect of developing a project was the use of time limits on the development of an initial idea. Students were given twelve hours to develop a sketch for a project. After this point they could take tracings of it back to their atelier and develop it. At the final judging of the project it was first compared to the original drawing; if it did not reflect the same idea, it was rejected. This method of evaluation would certainly have an erffect on design; it would tend to require conservative approaches relying on known prototypes and rigid compositional rules. And this was in fact the case.

The first class was similar to the second but with greater emphasis placed on the competitions which had greater program complxity. The Grand Prix de Rome was the culmination of the program and it was open to anyone, though it was usually won by someone in the first class. Winners, one a year, were sent to the French Academy in Rome for four to five years at government expense. Many people competed more than once for this honor and mny never won. Students in the first class had no discrete termination to their education if they did not win the rome prize, so they left whenever they felt ready to go. A diploma

was instituted in 1867, but was of little importance for quite awhile. The ateliers were not architects' offices, they were places for teaching. Each atelier had one master who set the tone of the work and emphasized particular approaches to design within the gnerally accepted Beaux-Arts traditions.

Footnotes

1 Richard Chafee, "The Teaching of Architecture at the Ecole des Beaux-Arts," in The Archtiecture of the Ecole des Beaux-Arts, ed. Arthur Drexler (New York: The Museum of Modern Art, 1977), p. 62.

2 Ibid., p. 63.

3 Ibid., p. 79.

4 Ibid., p. 82.

APPENDIX B

Since Rudolf Wittkower, in his book Architectural Principles in the Age of Humanism, (New York: W.W. Norton & Co. 1971) shows the significance of Vitruvius' The Ten Books on Architecture, to all Renaissance architectural thinkers, and since these thinkers and Vitruvius' works were the foundation for the Beaux-Arts, this work will simply refer to the Vitruvian text. The following excerpt is such a fundamental basis for architectural theory it is deemed appropriate to quote it instead of paraphrasing its intentions. It will be referred to more than once. It is from the Morris Hicky Morgan (Cambridge: Harvard Unviersity Press, 1914) translation.

Greek words appearing in this translation have been omitted while their parentheses remain.

BOOK I

CHAPTER II

The Fundamental Principles of Architecture

1. ARCHITECTURE depends on Order (in Greek), Arrangement (in Greek), Eurythmy, Symmetry, Propriety, and Economy (in Greek).

2. Order gives due measure to the members of a work considered separately, and symmetrical agreement to the proportions of the whole. It is an adjustment according to quantity (in Greek .....). By this I mean the selection of modules from the members of the work itself and, starting from these individual parts of members, constructing the wole work to correspond. Arrangement includes the putting of things in their proper places and the elegance of effect which is due to adjustments appropriate to the character of the work. Its forms of expression (in Greek) are these: groundplan, elevatioin, and perspective. A groundplan is made by the proper successive use of compasses and rule, through which we get outlines for the plane surfaces of buildings. An elevation is a picture of th front of a building, set upright and properly drawn in the proportions of the contemplated work. Perspective is the method of sketching a front with the sides withdrawing into the background, the lines all meeting in the centre of a circle. All three come of reflexion and invention. Reflexion is careful and laborious thought, and watchful attention directed to the agreeable effect of one's plan. Invention, on the other hand, is the solving of intricate problems and the discovery of new principles by means of brilliancy and

versatility. These are the departments belonging under Arrangement.

3. Eurythmy is beauty and fitness in the adjustments of the members. This is found when the members of a work are of a height suited to their breadth, of a breadth suited to their length, and, in a word, when they all correspond symmetrically.

4. Symmetry is a proper agreement between the members of the work itself, and relation between the different parts and the whole general scheme, in accordance with a certain part selected as standard. Thus in the human body there is a kind of symmetrical harmony between forearm, foot, palm, finger, and other small parts; and so it is with perfect buildings. In the case of temples, symmetry may be calculated from the thickness of a column, from a triglyph, or even from a module; in the ballista, from the hole or from what the Greeks call the ; in a ship, from the space between the tholepins ( ); and in other things, from various members.

5. Propriety is that perfection of style which comes when a work is authoritatively constructed on approved principles. It arises from prescription (Greek), from usage, or from nature. From prescription, in the case of hypaethral edifices, open to the sky, in honour of Jupiter Lightning, the Heaven, the Sun, or the Moon: for these are gods whose semblances and manifestations we behold before our very eyes in the sky when it is cloudless and bright. The temples of Minerva, Mars, and Hercules, will be Doric, since the virile strength of these gods makes daintiness entirely inappropriate to their houses. In temples to Venus, Flora, Prosperpine, Spring-Water, and the Nymphs, the Corinthian order will be found to have peculiar significance, because these are delicate divinites and so its rather slender outlines, its flowers, leaves, and ornamental volutes will lend propriety where it is due. The construction of temples of the Ionic order to Juno, Diana, Father Bacchus, and the other gods of that kind, will be in kekeping with the middle position which they hold; for the building of such will be an appropriate combination of the severity of the Doric and the delicacy of the Corinthian.

6. Propriety arises from usage when buildings having magnificent interiors are provided with elegant entrance-courts to correrspond; for there will be no propriety in the spectacle of an elegant interior approached by a low, mean entrance. Or, if dentils be carved in the cornice of the Doric entablature or triglyphs represented in the Ionic entablature over the cushion-shaped capitals of the columns, the effect will be spoilt by the transfer of the peculiarities of the one order of building to the other, the usage in each class having been fixed long ago.

7. Finally the propriety will be due to natural causes if, for example, in the case of all sacred precincts we select very healthy neighbourhoods with suitable springs of water in the places where the fanes are to be built, particularly in the case of those to Aesculapius and to Health, gods by whose healing powers great numbers of the sick are apparently cured. For when their diseased bodies are transferred from an unhealthy to a healthy spot, and treated with waters from health-giving springs, they will the more speedily grow well. The result will be that the divinity will stand in higher esteem and find his dignity increased, all owing to the nature of his site. There will also be natural propriety in using an eastern light for bedrooms and libraries, a western light in winter for baths and winter apartments, and a northern light for picture galleries and other places in which a steady light is needed; for that quarter of the sky grows neither light nor dark with the course of the sun, but remains steady and unshifting all day long.

8. Ecnomy denotes the proper management of materials and of site, as well as a thrifty balancing of cost and common sense in the construction of works. This will be observed if, in the first place, the architect does not demand things which cannot be found or made ready without great expense. For example: it is not everywhere that there is plenty of pitsand, rubble, fir, clear fir, and marble, since they are produced in different places and to assemble them is difficult and costly. Where there is not pitsand, we must use the kinds washed up by rivers or by the sea; the lack of fir and clear fir may be evaded by using cypress, poplar, elm, or pine; and other problems we must solve in similar ways.

9. A second stage in Economy is reached when we have to plan the different kinds of dwellings suitable for ordinary householders, for great wealth, or for the high position of the statesman. A house in town obviously calls for one form of constructon; that into which stream the products of country estates requires another; this will not be the same in the case of money-lenders and still different for the opulent and luxurious; for the powers under whose deliberations the commonwealth is guided dwellings are to be provided according to their special needs: and, in a word, the proper form of economy must be observed in building houses for each and every class.