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
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 precedes 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. 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." 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."

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.  

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."  

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." 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.  

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.  

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." 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." 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 practitioners. 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.

The fears of standardization are expressed by Wright: "Standardization is a form of dying of which to beware." He goes on to say standardization is merely an indispensable 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 unnecessary 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 prominence 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 juxtaposition 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 unhindered 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 known 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 sitting 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. 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. I reached the conclusion that we must counter-balance our externally oriented scientific research and technological speculation with inner-directed thought and practice.

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."

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." 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." 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." 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." 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" 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...the foundation of my design teaching was the general theory of contrasts." 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. Itten and Moholy-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. 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. 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. Moholy-Nagy claimed an objective reality for space and defined architecture as does Reyner Banham, as "the conscious manipulation of space." Therefore, Moholy-Nagy felt

the real architectonic conception, looking beyond the meeting of all purposive functions (is) that of space creation...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.

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, Moholy-Nagy based his belief in
biology; "the biological bases of space experience are everyone's endowment." 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." The spatial experience is said to be the experience of the relationship of objects, and it is "to be experienced most directly by movement."

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;" 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.
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 Guggenheim 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 be 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

Hierarchy 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 components 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." 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." 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."

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." He discusses how rhythm is an experience of wholeness:

Arrangement is an appreciable rhythm which reacts on every human being in the same way. 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.

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." 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)." 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."

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. 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."

Mood and Tone

Organic Architecture and its stress on site compatibility, 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," 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." 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." 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


3 Ibid., p. 70.


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.


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) Vitruvius 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. 1, 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.
21 Le Corbusier, p. 126.
22 Ibid., p. 103.
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 Lesnkowski decrives a similar attempt to categorize and formulationize 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.


34 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.


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.


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 Banham 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 Barzun, 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." Barzun, 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.\textsuperscript{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."\textsuperscript{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..."\textsuperscript{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 cubsists introduced a new system: organization of planes."\textsuperscript{53} Expressionism and abstract painting [explored the] psychophysical quality of color and space representation. Cezanne advancing and receding colors spatial illusion. Kandinsky warm and cool, nearness and distance, lightness and heaviness, centrifugal and centripetal...\textsuperscript{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.\textsuperscript{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.\textsuperscript{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).


48 Ibid., p. 188.

49 Ibid., p. 163.

50 Ibid, p. 178.

51 Ibid., p. 163.
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 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. xxxix 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.
58  Aalto, p.12.


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 Persiums
Institute, Helsinki
Alvar Aalto

5 Nested Rectangles
Kaufmann House
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6 Fan Arrangement
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7 Rhomboids
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8 Shell Form
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9 Finish Pavilion
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10 Design Research
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