EVOLUTION OF FORMS IN ARCHITECTURE

by

JOSE AVELINO REY PASTOR

B. Arch., University of Buenos Aires,
Argentina, 1953

A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARCHITECTURE

Department of Architecture

KANSAS STATE UNIVERSITY
OF AGRICULTURE AND APPLIED SCIENCE

1961

TABLE OF CONTENTS

INTRODUCTION

Architecture has gone, during the two past decades, through an interesting enrichment of some of its forms, and in consequence of its spatial conception. From the wide-spanned halls of our day a new attitude towards space was proclaimed which has no parallel in the past. Aesthetic and structural knowledge derived up till now from the classical proportions of post and beam in the Greek temple, or from the vaulted structures of the Middle Ages, was no longer enough to cope with the facts of the modern requirements for large coverings. Since the end of the XIXth. century there had arisen with new forms a completely new relationship between the size of the area spanned and the necessary strength of the structure. But unfortunately, this change occurred only in the forms and construction of large halls and, despite its invigorating renewal, architecture in general has fallen in the last few years into a dangerous formalism of the basic language of forms enounced by the Modern Movement.

However mysterious the reasons for this architectural stagnation may seem, the strong technological advance achieved in our time and the cultural unbalances recurrently created by social and economical adjustments, that architecture does not absorb with the same rhythm, may give in part an answer to the cultural disintegration where architecture is being left behind, while the resultant lack of an architectural philosophy pointing towards the future, derived in turn from a total absence of an

historical position, may be the backbone to the problem.

Fortunately, at the present time, the reawakening of a dynamic sense of history is proving there is no possible cultural isolation and, in the field of architectural historiography, this means to admit the continuous existence of precedents in form that, tied to a constant evolution, are in the dialogue between architecture and history, the direct answer to a given cultural moment.

In the hope that the lesson of the past, with its striking coincidences and contrasts, may furnish the required knowledge for the architecture of a needed new philosophy, it is that the purpose of this work is to clarify, within its limits, some aspects of the intimate and reciprocal architecture-history relationship.

Special attention is to be given to modern architecture as the present final stage of the form-evolution line, where the causes and effects of the contemporary classicizing trend in America, leading country of today's architecture, are going to be subject to analysis. But leading to that goal, a previous definition of the concept of form, matter and substance of architecture, and a survey of its evolution continuously decanted in the grammar of styles, shall show the existence of the two opposite attitudes in the realm of man's thought that, acting as constant modulators of his acts, are object of so much controversy in the field of architectural criticism.

FORMS, SPACE AND ARCHITECTURE

In the field of architecture, the Modern Movement concentrated its attention on the organization of spaces, of architectural spaces that, accomplishing specific functions, were to be determined by pure forms. Through these two "narrow gates of fitness for purpose and rejection of historical styles",[1] modern architecture rediscovered the realm of space because, if its attitude was indeed the result of a careful reevaluation of what in essence architecture is, the language was not new.

Historians and critics, studying later the entire evolution of architecture, have proved the constancy of this spatial language through the ages. In fact, N. Pevsner, in the "Introduction" to his European Architecture, analyzing the qualities that make out of a building a work of architecture states that, while

> . . . nearly everything that encloses space on a scale sufficient for a human being to move in, is a building; the term architecture applies only to buildings designed with a view to aesthetic appeal. Now, aesthetic sensations may be caused by a building in three different ways. First, they may be produced by the treatment of walls, proportions of windows, the relation of wall-space to window-space, of one story to another, of ornamentation such as the tracery of a XIVth. century window, or the leaf and fruit garlands of a Wren porch. Secondly, the treatment of the exterior of a building as a whole is aesthetically significant, its contrasts of block against block, the effect of a pitched or a flat roof or a dome, the rhythm of projections and recessions. Thirdly, there is the effect on our senses of the treatment of the interior, the sequence of rooms, the widening out of a nave at the crossing, the stately movement of a Baroque staircase. The first of these three ways is two-dimensional; it is the painter's way. The second is three-dimensional, and as it treats the building as volume,

---

1. Siegfried Giedion, Space, Time and Architecture, p. 26.

> as a plastic unit, it is the sculptor's way. The third is three-dimensional too, but it concerns space; it is the architect's own way more than the others. What distinguishes architecture from painting and sculpture is its spatial quality. In this, and only in this, no other artist can emulate the architect.
>
> But architecture, though primarily spatial, is not exclusively spatial. In every building, besides enclosing space, the architect models volume and plans surface, i. e. designs an exterior and sets out individual walls. That means that the good architect requires the sculptor's and the painter's modes of vision in addition to his own spatial imagination.[1]

Thus, in the evolution of architecture, styles become only variable problems of syntax, ruled by the regional grammars of place and time, while space remains as the constant and main protagonist of architecture. But it will not do to say simply that a piece of architecture is situated or exists in space: it treats space according to its own needs, it defines space and even creates such space as may be necessary to it.

In this sense, forms in architecture

> . . . are subjected in the strictest, most passive way to spatial data that cannot change. This must be so, for, in essence and by destination, the art of architecture exerts itself in a "true" space, one in which we walk and which the activities of our bodies occupies.
>
> The three dimensions are not simply the locus of architecture; they are also, like weight and equilibrium, its very material. The relationship which unites them in a building is never casual, nor is it predetermined. The order of proportions comes into play in their treatment, confers originality upon the forms, and models the space according to calculated properties.[2]

---

1. Nikolaus Pevsner, An Outline of European Architecture, p. XIX.
2. Henri Focillon, The Life of Forms in Art, p. 20.

> But if one gives the matter thought, it will be observed that the greatest marvel of all is the way in which architecture has conceived and created an inversion of space. . . constructing an interior world that measures space and light according to the laws of a geometrical, mechanical, and optical theory which is necessarily implicit in the natural order, but to which nature itself contributes nothing.[1]

Accepting then that "the root of architecture lies in the mastery of the problem of space",[2] as an organization of spaces by means of forms that are set into life "under the tools and the hands of men, assuming substance in a given material",[3] it is through this concentric limitation, departing from the infinite forms available in space, that the architectural goal is reached. On the proper selection of forms and their adequate spatial treatment - as a result of the previous analytical study of the social, economical, cultural, technical and aesthetic premises involved with a specific problem - lies the difference between a work of architecture and a building.

EVOLUTION AND DEVOLUTION OF FORMS

Form, as translation of the Greek words Eidos, Schema and Morphe, and the Latin word Forma, means no less then

> . . . the qualities which make any thing what it is. If we accept this meaning, all philosophy, art and science can be regarded as the endeavor to study the forms of things and to discover the underlying formative principle

---

1. Ibid., p. 22.
2. Laszlo Moholy-Nagy, The New Vision and Abstract of an Artist, p. 60.
3. Focillon, Op. Cit., p. 15.

which brings all things into existence and makes them what they are.[1]

Every historical period and every school of thought has had its own idea on this subject. Following a development that started with the myths of process and transformation of the earliest cultures, these ideas have reached at the present time the concept of "structure", as the underlying pattern of form, a total organization being more important than its particular components which lack individuality.

Deductively, this general attitude or principle is also valid for the specific field of architecture. Strictly analyzed, the few individual forms used to define architectural spaces, from Stonehenge to our own time, could be reduced to the narrow selection of the basic geometric forms, while their possible "structural" combinations in the organization of total spaces cover an infinite scale of values, and this dichotomy leads straight to the problem of evaluation of architectural forms.

This is a difficult task for two reasons which are really one, depending on the attitude of the observer: if he thinks "analytically" in terms of decomposing the architectural complex into the simplest unitary forms he can find, or if he things "formally" (in the sense of being concerned with spatial form) in terms of the whole formal organization he is studying.

Since the time of the ancient Greeks, thinkers have shown a tendency to fall into one of two camps that may be called the

---

1. Lancelot Law Whyte, Accent on Form, p. 14.

Atomistic School and the Holistic School. The first doctrine "asserts that the universe is made up of ultimate particles, simple, indivisible and permanent",[1] while the second one considers the universe "as an organism in which every part is harmoniously related to the processes characterizing the system as a whole".[2] Difficult to overcome, this habit has led in architecture to the extreme disintegrating but real subdivision between "Rationalism" as opposed to "Organicism".

These two tendencies have spent much energy challenging one another, expressing two contrasted types of human temperament each of which cannot help disliking the other. On one side we hear from Le Corbusier that

> . . . architecture is the intelligent, correct and magnificent play of volumes grouped under the light. . ., that the cubes, the cones, the spheres, the cylinders or the pyramides are the great primary forms that the light reveals so well; .. and this is why they are beautiful forms, the most beautiful forms,[3]

or that

> . . . the Ehyptian, Greek or Roman architecture is an architecture of prisms, cubes, cylinders, trihedrons or spheres. . ., while the Gothic architecture is not based on spheres, cones or cylinders. Only the nave expresses a simple order and this is why a cathedral is not very beautiful,[4]

suggesting later as an architectural methodology

> . . . to classify, to typify, to fix the cellule and its elements. Economy. Efficiency. Architecture i always when the problem is clear,[5]

---

1. Ibid., p. 53.
2. Loc. Cit.
3. Bruno Zevi, Storia dell Architettura Moderna, p. 120.
4. Ibid., p. 120-121.
5. Loc. Cit.

while according to the other temperament,

> . . . reason can dissect, but cannot originate; she can adopt, but cannot create; she can modify, but cannot find,[1]

or that

> . . . in seeking a clear, definite and full comprehension of the word "organic", we should at the beginning keep in mind the correlated words, organ, organize, organization, organism and what is still more important what these words signify, because all these words imply the existence of a vital force and of a structure or mechanism whereby the force is made operative and manifest.[2]

Although apparently irreconcilable, both attitudes are complementary and in perpetual interaction and their significance changes as architecture advances following the evolution of

> . . . plastic forms, because forms are subjected to the principle of metamorphoses, by which they are perpetually renewed, as well as to the principle of styles by which their relationship is, although by no means with any regularity of recurrence, first tested, then made fast, and finally disrupted,[3]

and if this change of significance, shifting from one side to the other, implies different evaluations that may consider evolution what a later tendency might tend to despise as devolution, the time has come when the traditional form of this equivocal conflict is disappearing as the Ronchamp Chapel or the Chandigarh's architecture of Le Corbusier and the last works of Louis Kahn in this country prove.

---

1. Horatio Greenough, Form and Function, p. 52.
2. Louis Henri Sullivan, Kindergarten Chats and Other Writings.
3. Focillon, Op. Cit., p. 6.

FORM AND STYLE

When the architecture of a certain period shows a number of striking similarities of form that distinguish it from the architecture of other times, we label it a "style" and although we may dislike the term, "simply because it brings to our minds unpleasant memories, we cannot keep on pretending that we solve our problems without a precedent in form".[1]

New purposes, new materials, new social and economical conditions may make new forms possible and even call for new forms, but architecture is not only the product of these factors but also of the changing spirit of ages. "A style in art belongs to the world of mind, not to the world of matter",[2] and as a matter of mind the development of a new language of form is an all embracing intellectual process, in which creative forces in the most varied fields fashion the elements of the coming style, often independent of one another.

Now, it is true that sometimes forms may become formula, crystallyzing into normative types but, as primarily they are mobile life in a changing world only ordered and coordinated by the principle of style, the danger of a stylish stabilization that could make canons out of them, shall endure only a short time, sufficiently large as to accumulate enough power and strength for a new evolution.

---

1. Matthew Mowicki, "Origins and Trends in Modern Architecture", Magazine of Art., Nov. 1951, p. 274.
2. Pevsner, Op. Cit., p. XX.

The term style has two meanings: as an absolute, and as a variable. As an absolute, in its generic sense, it indicates the idea of supreme quality, while as a variable it is a development, a grouping of forms in a fit reciprocal relationship whose harmony is constantly testing, building and destroying itself.

Blending both meanings into a single concept, it can be said that in architecture a style is constituted by a repertory of formal elements which, having a certain index value, are structured into coherent groupings that with a given syntax possess that superior absolute quality that makes out of a building a work of architecture. If the first meaning was a consequence of the analytical, the atomistic, the rational concept and the second, of the formal, the holistic, and organic concept leading to the present structural trend of evaluation, both are also complementary and in intimate interaction. Now, this self activity of a style, developing and growing from the particular to the general and vice verse,

> . . . defining itself and then escaping from its own definition, is generally known as an "evolution". Biological science checked and modulated the concept of evolution with care; archaeology on the other hand, took it simply as a convenient frame, a method of classification.[1]

Keeping this in mind, any interpretation of the movement of styles must consider some essential facts: (1) that several styles may coexist even within the same field because (2) their successive states, more or less intense, more or less durable,

---

1. Focillon, Op. Cit., p. 8.

depending on the style itself, often overlap the fresh experimental age of the coming style on the charming decadence of the baroque age of the dying style.

Committing what Zevi[1] calls, not explaining why, the evolutionistic mistake - when he considers the necessity for a complete renewal of the historical analysis of architecture - and recalling David Hume's statement that "the same motives always produce the same reactions; the same events follow from the same causes", the history of forms and in consequence of styles cannot be indicated by a single ascending line. As one style comes to an end and another to life, overlapping sinusoidal ascending curves would express much better their transitional fluctuations as well as their three states or ages.

As for a clarification of these three different stages of each style, that "present the same formal characteristics at every epoch and in every environment",[2] "the experimental state is the one in which style is seeking to define itself",[3] (archaism); the classic age becomes the "brief but perfectly balanced instant of complete possession of forms and not a slow monotonous application of rules, but a pure, quick delight",[4] (classicism); and the baroque age "the freest and the most emancipated"[5] moment, (barochism).

---

1. Zevi, Op. Cit., p. 533.
2. Focillon, Op. Cit., p. 10.
3. Ibid., p. 11.
4. Loc. Cit.
5. Loc. Cit.

> We must never think of forms, in their different states, as simply suspended in some remote, abstract zone, above earth and above man. They mingle with life, whence they come; they translate into space certain movements of the mind. But a definite style is not merely a state in the life of forms, nor is it that life itself: it is a homogeneous, coherent, formal environment in the midst of which man acts and breathes.[1]

HISTORICAL SEQUENCE IN THE EVOLUTION OF ARCHITECTURAL FORMS

Background

The sense of form by which each age expresses its state of awareness is reflected in the arts, philosophy and science of the period, and architecture, as the visual art Summa of social, economic, physical and aesthetic pressures, becomes one of the keynotes for all historical evaluation.

Departing from the Greek civilization - although the Egyptian flat geometrical spatial frame linking symmetry with stability and permanence, should not be left aside - it can be said that the Western evolution of form started its development with the Greek sense of balance, proportion and symmetry, only made possible by the Pythagorean School in which religious mysticism and social idealism were intellectually brought together by means of the concept of Number. This self intoxicating Greek perfection reached its summit with Plato's Eternal Forms crystallized in the discovery of the five Platonic regular solids and Euclid's quanti-

---

1. Focillon, Op. Cit., p. 14.

tative relations of space, while Aristotle, as an exception, started to develop an awareness of organic forms, interpreted not only as visually perceived shapes, but as an internal principle of being, an attitude which had been lacking in the Pythagorean School.

The Greek morphology, contaminated later in its purism by the Roman interpretation, was succeeded by the new Christian aspiration to reach, as the Greeks aimed, a Universal Form, but imbued now with a religious desire to pay reverence to something more lasting than man. Thus, in the Middle Ages, form was regarded as the essential quality of individual things that hierarchically ordered, structured the world, and this mediaeval concept of form, rounded later as the arrangement of spatial parts that configurate up a whole, was the point of departure for its present meaning. At the present time thanks to the achievements reached towards 1920 by the Gestaltists that, concerned with the problems of perception, emphasized the importance of system characteristics and of properties of the whole rather than of the parts, form means besides spatial shape, the comprehensive idea of structure, of organization, of patterns of relationship.

Now, surveying the entire evolution in this search for form, as Eliel Saarinen pointed out, we see that

> . . . the Egyptian, the Greek and the Mediaeval - were the only three truly creative epochs in the evolution of the Western civilization. In considering each one of these epochs one can speak about genuine form-evolution, originated from its primary germ and carried on the basis of the

fundamental forms of the respective times,[1]

and concerning the Renaissance, the Baroque and Eclecticism,

> . . . in their respective cases no particular form-evolution took place. . . This was so much the more true during the times of reason and romanticism with their "revivals" and "rebirths". And emphatically indeed, this was true when the age of materialism took the conduct of things into its hands. From there on, we could not speak of evolution, but rather of devolution.
>
> Say, "la devolution imitatrice".
>
> Again, as for the post-nineteen hundred era, the time so far has been much too short to speak about evolution. . . For - as we know - the natural evolutionary line had been broken and therefore an intense search for its logical continuance has become imperative.
>
> We are still very much in the process of this search.[2]

Remembering the analyzed characteristics of both schools of thought, while the Greek forms, and in consequence the architecture they defined, were essentially rational in character, the Gothic architecture, as a result of the mediaeval structural concept of form, falls into the organic field. The isolated pure form of the Greek temple, raised on a platform that detached the architecture from the ground, in opposition to the Gothic cathedral, tied to the urban pattern of the town, with its complex structural organization and articulation of spaces, prove this evaluation.

But the evolution of architectural forms from Greece up to our days, as analyzed before, is not a straight line that now suddenly, by the XIIIth. century, shifts from the rational to the

---

1. Eliel Saarinen, Search For Form, p. 171.
2. Ibid., p. 172.

organic tendency, where it remains up to the present time. The three different ages of styles described - the experimental age or archaism, the classic age or classicism and the baroque age, as the Pre-Hellenic, the Hellenic or Greek classicism of the Vth. century B.C. and the Hellenistic period - constitute also different tendencies contained in the domain of a single style, so the suggested undulated line, introducing now a strong curvature towards Organicism at the beginning of the Middle Ages, would be the most adequate graphic expression of this evolution. (Plate I).

Similar to the ascending helicoid proposed by Zevi,[1] this sinusoid would express on one side all the styles achieved by means of a more rational and analytical approach, while the other side would show all the other styles built on a more organic and emotional basis.

By the way, does not the modern Functionalism share with the Hellenic, Roman, Early Christian, Romanesque, Renaissance and the XIXth. century Neoclassicism, some main common features: the same spatial fragmentation into separate spatial units containing different functions, achieving a total composition by means of grouping different forms; the same preference for the isolated pure forms; the modulation of plans; the careful use of proportions; the grid pattern in city planning; the divorce between architecture and its allied arts; contributing, all of them, to the static character of all these styles? And is not the spatial

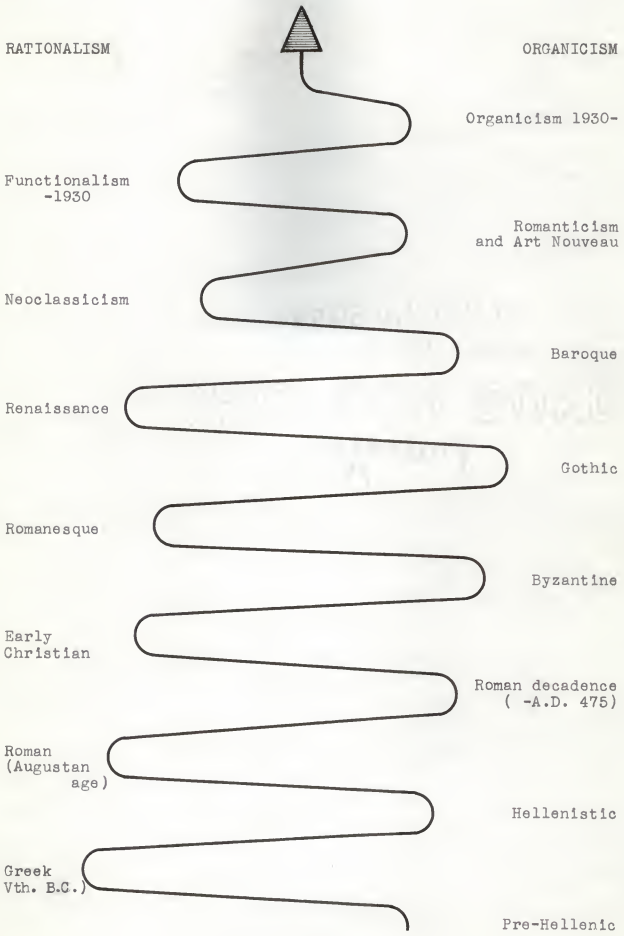
---

1. Zevi, Op. Cit., p. 552.

EXPLANATION OF PLATE I

Graphic expression of the form-evolution line of architectural styles.

PLATE I


RATIONALISM
ORGANICISM
Organicism 1930-
Functionalism -1930
Romanticism and Art Nouveau
Neoclassicism
Baroque
Renaissance
Gothic
Romanesque
Byzantine
Early Christian
Roman decadence (-A.D. 475)
Roman (Augustan age)
Hellenistic
Greek Vth. B.C.)
Pre-Hellenic

integration with no discriminated functions, resultant in an organization of forms tied together as a total continuous structure; with the same preference for the undulated forms; the force-line suggested in structures; the anecdotic elements sometimes misinterpreted as picturesque; the organic pattern in city planning; and the marriage between arts and architecture, some common denominators that make of modern Organicism, Romanticism and Art Nouveau, together with the Baroque, Gothic, Byzantine, decadent Roman, Hellenistic and Pre-Hellenic, dynamic architectural movements?

It is true that this dichotomy is dangerous, as some historians and critics suggest, when it is partially taken into consideration and a style is dissected for analysis from the main architectural trunk. But the striking similarities in each of both tendencies, backed by the two prevailing opposite attitudes of thought analyzed, as a chain of continuous reactions, cannot be denied. As a guide to the historical analysis of the endless metamorphoses of architecture it can be useful and only in this sense it is proposed as such.

Comparative Analysis

Considering modern architecture as the aim of this analysis, which have been the contributions of both tendencies that, by atavism, are reflected in it?

The lesson of Greece and Rome, according to Zevi,[1] reached the Modern Movement by means of several different ways. One was through the wrong track of the dogmatic and archaeological XIXth. century Neoclassicism by which, as a reaction, the few pioneer creative artists of the period fell into the opposite Neomediaevalism that made the "Arts and Crafts" movement possible. An indirect road was the discovery made in the twenties of the true essence of the Renaissance. A romantic Neoclassic interpretation came by way of the early works of Asplund that contributed in this manner to the maturity of the Scandinavian Rationalism, shown in its best at the Stockholm Exhibition designed by him in 1930, but the most important influence came through Le Corbusier who, after traveling through Greece and Italy in 1907, spread his passionate admiration for the classic intellectualism.

The Neoclassic influence fortunately died soon, and Asplund's brief romantic interpretation did not extend beyond its Nordic limits, but the modern interpretation of the architecture of the Renaissance, as well as the hellenism distilled by Le Corbusier's works and writings, gave to the modern Rationalism the precedent of form it needed.

In fact, from the analysis of the Renaissance came the rational tendency towards simplification and selection of forms; the intellectual control that leads to a scientific ideology; the awareness for the geometric planimetry and stereometry of

---

1. Bruno Zevi, Architettura e Storiografia, p. 87.

architecture; the spatial decomposition into different functions.

Does not the careful prismatic selection of Gropius in his early Fagus factory (1911), or of Mies van der Rohe in his Kroller house design (1911), or of Le Corbusier for his Domino Houses (1914-1915), or even the earlier protorationalism of Sullivan's Wainwright Building (1890-1891), recall the powerful prismatism of Brunelleschi's St. Spirito in Florence (1435) and the verticalism of the protorenaissance St. Gimignano towers (XIIIth. century)?

Is not there an astonishing similarity of circumstance between the Early Renaissance discovery of Perspective and the discovery of Cubism towards 1910, from which modern Rationalism in architecture borrowed the concept of the fourth dimension?

And as a result of the same intellectual attitude leading to a rational and verifiable control of things, does not the Renaissance care for dimensions, proportions and composition methods recall Le Corbusier's early outline of proportions for the facades of his Maisons La Roche (1923) or the Villa at Garches (1927), or for the Modulor, that echoes so many studies on human proportions achieved by Renaissance painters and sculptors?

As for the interest shown by Rationalism in geometric patterns, not only for plans but also for volumetric elevations, similarities may be found between any modern modulated plan of the period and the Renaissance orthogonalism. Even, nowadays, the symbolism of Costa's bird-form pattern for the city-plan of Brasilia has the same spirit as the design for some of the

Renaissance built cities as Karlsruhe (XVIIIth. century). In matter of elevations, the same modulated use of a type of window can be seen in any of the Italian Renaissance palaces - Medici (1444) or Pitti (1458) - and for instance in the back elevation of the Swiss Pavilion of Le Corbusier (1930-32), or in the earlier American skyscrapers of the Chicago School (1883-93) that started the use of a standardized type of window; and the model factory designed by Gropius for the Werkbund Exhibition of 1914, with its combination of naked rectangular prisms and the two glass cylinders that contained the spiral staircases, does not it remind us of the juxtaposition of the roundish eastern apses to the rectangular prisms of the nave and aisles of some of the Renaissance churches?

Now, it was also natural that the same analytical approach common to both periods, the Renaissance and the Rational movement of the twenties, seeking in name of Reason an orderly reorganization after the previous Gothic "obscurantism" on one hand, and the emotional Romanticism and Art Nouveau on the other, led to the same decomposition of architectural spaces into separate functions. A Renaissance building, almost always, is a sequence of adjacent spaces, expressing different functions: the nave, the aisle, the apse, the dome on the crossing of churches; the tunnel-vaulted entrance leading to the concentric grouping of inner open courtyard, cloistered porticoes and surrounding ring of rooms and staircases in the palaces. As for the early Modern Movement in architecture, "Functionalism" was one of its aims and that meant

the strict architectural expression of Greenough's pioneering "Form follows Function", emphasizing each different function in an independent way with the most adequate forms it suggested.

Almost all the modern examples of architecture quoted are previous to the arrival of cubism. Now, after 1915, transcribing the same influences analyzed, in terms of the fourth cubist dimension, we have the late Rationalism between 1920 and 1930. Van Doesburg's theoretical neo-plastic designs worked with interpenetrating horizontal and vertical planes (1920), Gropius's Bauhaus building at Dessau (1926) and Mies van der Rohe's Barcelona Pavilion (1929), are the best Rationalist examples of the new goal this period reached: the "open plan" that, free from the orthodox three dimensional perspective, similar to the Mannerist freedom reached by Palladio's Villas within the formalism of the late Renaissance (XVIth. century), becomes one of the main features of modern architecture.

The morphology introduced by Le Corbusier into modern architecture was, instead, a direct transplanting from the original source: the idea of the isolated pure volumes, inspired by the temples and buildings of the Greek Acropolis; the free standing column; the careful planimetric and volumetric proportions of buildings; the modulation in plan shown by every Greek work of architecture; the grid-pattern in city planning, started in Greece by Hippodamus of Miletus; all these principles, translated into a modern language, can be observed when analyzing the whole series of his works of architecture. The Ville Savoye at Poissy (1929-

31) may be the most complete example where the pure rectangular prism, body of the building, raised on free standing "pilotis" that detach it from the ground achieving a strong opposition of architecture and site, is shown as a sculpture in its almost classic proportions obtained by means of a strict modulation and geometric design. Only the Chapel at Ronchamp (1955) and the Philips Pavilion at the Brussels International Exhibition of 1958 act as forecasting exceptions of a new powerful evolution.

Organicism affected the Modern Movement in a quite different way than the direct impact of Rationalism during the decades between 1910 and 1930. It reached modern architecture through several stages and by means of successive reevaluations of different organic tendencies: first came the discovery of the meaning of the Middle Ages, initiated in England by Ruskin (1819-1900) and materialized by Morris (1834-96) in the "Arts and Crafts" movement, while almost simultaneously France was reviewing the Structuralism of the Gothic style by means of Viollet-le-Duc's (1814-1879) researches and theories; and later the discovery of the Baroque thanks to Wolfflin's book Renaissance und Barock published in 1888.

If the "Arts and Crafts" movement, created as a reaction against the changes introduced by the Industrial Revolution, encouraged during the last quarter of the XIXth. century, a healthy Romanesque inspiration in the pioneer architecture of Europe and America and a reevaluation of city-planning concepts; and the French revision of the Gothic, also as a reaction but now against

the existing Neoclassicism, inspired formally, the refreshing linear lightness of the Art Nouveau, and technically, the engineering works using iron as the new material that industry provided, it was really the revelation of the Baroque that provoked, through the brief but rich experience of the expressionism, the Organic movement in modern architecture.

In fact, by means of the Neomediaevalism derived from the "Arts and Crafts" came the organic elasticity in the general composition of architectural problems; the rich variety of themes not subject to rigid formulas; the organic concept of total structure; the reevaluation of the wall as one of the primary architectural elements; the honesty in the use of natural materials; the garden-city idea in planning.

Through the revision of the Gothic, emphasis was put in the skeleton type structure; in the effect of transparencies; in the effect of the force-line idea; in the undulated surfaces; in the verticalism of architecture; and as a consequence of the analysis of the Baroque, the early expressionism in architecture made possible, after 1930, the reintegration of spaces that Rationalism had broken into separate units, liberating architecture and city planning from the conventions and geometry that had conformed the rationalist formalism.

The elastic freedom of Webb's design for Morris's Red House at Bexley Heath, Kent (1859); the country houses designed by Voysey (1857-1941); the Neoromanesque organic structuralism of Berlage's Stock Exchange at Amsterdam (1898-1903); the flat use

of massive stone walls in Richardson's Marshall Field Store at Chicago (1885-87); and the self contained garden-cities of Letchworth (1903) and Welwyn (1919) built according to Howard's theories, share the same elasticity in design and subject as any English manor house of the XVth. century; a similar structural concept of St. Ambrogio's, Milan (XIth. century); an analogous treatment of materials to the one used in the walls of any Romanesque building; and the same organic spirit in pattern and even scale prevailing in any mediaeval community.

The skeleton-structure principle of Amiens (1220-) or any other Gothic cathedral was translated into iron in the XIXth. century Exhibition Halls, as the Crystal Palace of Paxton (1851) or the later Gallerie des Machines of Dutert and Contamin (1889); the same effects of transparency can be found from the interior of a stone built Gothic cathedral or Perret's reinforced concrete Notre Dame de Raincy (1923); similar is the linear treatment of the Gothic ribs to the one found in any Art Nouveau design as, for instance, Horta's House in the Rue Turin, Brussels (1893); analogous undulating walls can be seen in Perugia's or Sienna's Town Halls of the XIII-XIVth. centuries, and in Horta's Maison du Peuple at Brussels (1897) or Root's Monadnock Block at Chicago (1891) with its repeated projections of bow-windows and the elegant vertical curvatures of its corners; and as for the Gothic verticalism transported to our time, the Eiffel Tower (1889) is the best example that also incorporates all the other indicated features of this tendency.

And as a resultant of the Baroque influence, does not Michelangelo's Mannerist stairs at the Laurenziana Library of Florence (1524-68) remind of the flowing forms of Mendelsohn's expressionism in the Tower of Einstein at Potsdam (1920), while after 1930, end of the Rationalist intermission, does not any work of architecture of Wright or Aalto call to mind the spatial continuity achieved by the Baroque reintegration of the separate functions and in consequence of forms and spaces, that the Renaissance had left?

Actually, modern Organicism in architecture is to the rationalist Functionalism of 1910-1930 as Baroque architecture was to the Renaissance and

> Frank Lloyd Wright went one step further than his contemporaries when he said: " 'Form follows Function' is but a statement of fact. When we say, 'Form and Function are one', only then do we take mere fact into the realm of creative Thought". In other words, dependence of form and function would be replaced by interdependence of form and function. And if we accept the mutual dependence of form and function, then the problem of form in modern architecture might well be studied as are the problems of function.[1]

And this intimate marriage between function and forms generated integrating architectural spaces such as the new Guggenheim Museum of Wright (1959) or the Finnish Pavilion of Aalto for the International Exhibition at New York (1939-40); spread open plans such as Wright's Roberts House of 1907, or undulated plans such as Aalto's Dormitory for M. I. T. (1949); and the theoretical "Broad-acre City" concept of Wright (1934) or the master plan for

---

1. Matthew Nowicki, "Composition in Modern Architecture", The Magazine of Art, March, 1949, p. 108.

Roveniemi by Aalto (1945), similar in character to the dynamic spaces defined by Vignola's spiral staircase in the Farnese Palace at Caprarola (1559) or the interior telescopic verticalism of Barromini's Ste. Agnese Church at Piazza Navona (1653-57); with the same freedom as Maderna's open-plan for the Barberini Palace (1628) or the curvilinear XVIIIth. century "Crescents" at Bath; and the same respect for Nature as the organic patterns of the English housing developments and squares of the XVIIIth. and XIXth. centuries.

PRESENT TREND IN THE EVOLUTION OF ARCHITECTURAL FORMS

As Nowicki says, when writing on the "Origins and trends in Modern Architecture",

> . . . thinking in terms of the contemporary, or should I say modern, period of design, we realize by now that it has passed its early youth. The experiments with form, of the new space concept, the playfulness with the machine to live in, the machine to look at, or the machine to touch, in architecture, painting and sculpture are more remote from us than the time alone would indicate. There was a freshness in those youthful days of the aesthetic revolution, a physical freshness of a beginning. There was a diversity in those days, of forms that grew without a direct precedent of form.[1]

Overlooking this last statement, that modern architecture has no direct precedent of form, opposed to a principle sustained in this work, that there is no architecture than can grow, generate itself spontaneously without that, at least indirect, precedent of form, it is true that architecture, at the present time,

---

1. Matthew Nowicki, "Origins and Trends in Modern Architecture", The Magazine of Art, November, 1951, p. 274.

has lost the fresh inquisitiveness of its early state - that powerful "archaism" of all experimental age outlined as the search for a definition - and that today architecture is going into that "brief quick delight" of a more mature, classic period, although as Louis Kahn,

> . . . whose teaching and philosophy are among the most stimulating to those among the emerging generation of architects in search for a rationalized version of Le Corbusier's highly personal plasticity, protested recently:
>
> "Here the Modern Movement is only thirty years old and we are already polishing and perfecting it. We should be in the archaic phase. Our buildings should reflect this crudeness."[1]

The thirty years of age pointed by Kahn refer specifically to the American modern architecture, and in doing so he is suggesting that simultaneous overlapping of the different ages of styles indicated previously. While for Europe he accepts tacitly the existence of an architectural maturity - there the Modern Movement is at least fifty years old - for American architecture he claims a revitalizing protest that, similar to the one represented by the abstract expressionism movement in the field of painting, and the Beatniks in writing, he considers the only means to save it from that premature oldness as forecast by its present sleekness.

But European maturity or American late archaism, where is the present trend of architecture going? Is it possible that the process in the search for form - as Saarinen called it - has

---

1. William H. Jordy, "The Formal Image, U. S. A", The Architectural Review, March, 1960, p. 164.

concluded and that the Modern Movement is ready for history? Is there today, by any chance, an architectural philosophy backing its present evolution? Because if the three great form-givers of the Modern Movement

> . . . created exciting buildings and have originated three kinds of space, . . . each has also possessed a large philosophy of modern life, and each created its building images out of his philosophy. Wright, Mies and Le Corbusier (Gropius too) had quite literally to fashion a modern world in terms of which they could build. Hence we see their buildings not only as formal entities, but as extensions of their philosophies, as images of what they conceived the specifically modern experience to be: the organic image, the structural image, the machine age (not identical with the structural image, however closely the two are allied), and the primitive age. If they gave (and still give) us their buildings, a major part of their heritage to the present is also the gift of their worlds.[1]

But Wright is gone, and Mies, Le Corbusier and Gropius are in the twilight of their lives and their followers - very few among the large number of imitators - lack the powerful creativeness of their masters, invigorated in the challenging polemic of a formative age. It seems as though, in the urgency of modern life, there is no time for a consistent development of ideas into a philosophy. Only derivative attitudes come out that, too sophisticated to accept the dependence of a naked functionalism within the rationalist attitude or the way back to the organic interdependence of form and function, prefer to fall into the pleasant abstractness of the formalisms.

On one side the "New Empiricism" - post war trouvaille to label the Scandinavian architecture differentiating it from the

---

1. Jordy, Op. Cit., p. 163.

International style[1] - the "New Brutalism" - as called in 1955 after analyzing the power of forms and the brute use of concrete in Ronchamp[2] - or "Action Architecture" - when in 1959 the last works of Kahn, Rudolph and Utzon's Sydney Opera House were studied among some others[3] - with their latest derivative, "The New Sensualism" - as the more emotional or sensual architecture when considering the plasticity of its spontaneous forms that follow no formula[4] - belong, pregnant with possibilities, to the realm of the present more organic formalism, while the new rationalist formalism, "associated first in the understanding of the sophisticated professionals as International Style; then in the perception of the public as modern architecture; and now in the production of plans of the manufacturers as curtain wall" architecture,[5] lies at the dead end of a new classicizing trend.

If Europe is still debating its choice,

> . . . in the polar opposition between the Miesian appeal to an urbane tradition and the Corbusian appeal to primitivism, the American choice was obvious.[6]

> American architects have recurrently embraced classicist formalism with exceptional fervour. Thus, Thomas Jefferson's Capitol for Virginia was the first use anywhere in the world of the complete temple form in modern architecture . . . Again, in the nineties, it was in Chicago, at the Columbian Exposition that the Ecole "projet" materialized.

---

1. Zevi, Op. Cit., p. 343.
2. Reyner Banham, "The New Brutalism", The Architectural Review, December, 1955, p. 355.
3. Gerald Kallmann, "The 'Action Architecture' of a New Generation", Architectural Forum, October, 1959, p. 133.
4. Thomas H. Creighton, "The New Sensualism", Progressive Architecture, October, 1959, p. 141.
5. Loc. Cit.
6. Jordy, Op. Cit., p. 159.

> Shortly thereafter, foreign observers registered astonishment at the greater correctness of literalness of American classicism. . . Now there are signs that a new formalism is appearing in modern architecture. . . Its most conspicuous appearance is the final version of the much redesigned Lincoln Centre for the Performing Arts in New York. Here, in the Philharmonic Hall, a symmetrical axis, portico and colonnades reintroduce neo-classic formalism in a major urban complex.[1]

As for the response to the why of "this recurrent fervour for formalism", Jordy gives different answers: it may be because, remembering Mies's phrase, the need "to create order out of the desperate confusion of our time" seems to be more desperate in this country than elsewhere; or due to the analyzed atavic tendency to embrace classicist formalisms; or on account of the impersonal nature due to the large scale of the buildings coupled with the drastic time limits on design, all of them encouraged by the present technological innovations in a country where "the refinement of components for mass production and their subsequent assemblage is profoundly congenial";[2] by a renewed interest in ornament in a country that has had the unforgettable lesson of Sullivan; and by a reawakened sense of history, natural in a new country that lacking it in extension, needs its frequent reevaluations in depth.

In fact, this new formalism has already gone through different stages that justify all answers: first it

> . . . was an exteriorized aesthetic which gridded simple rectangular containers and incidentally established the basis of the stereometric wall. The second stage was the

---

1. Ibid., p. 157-158.
2. Jordy, Op. Cit., p. 159.

> perfection of mechanical equipment which enabled bulk space to be functional. The third was the conscious appeal to Renaissance axial and symmetrical organization. The fourth is the transformation of the Miesian aesthetic by elements which deliberately confuse toward the ends of decorative enrichment and formal organization. Thus the potentiality for abstractness seems to burgeon in current production in opposition to the functionalism (real or polemical) traditional to modern architecture.[1]

The Illinois Institute of Technology Campus buildings (1942-55), the Promontory Apartments in Chicago (1946-48) and the Lake Shore Drive buildings, also in Chicago (1946-48), by Mies van der Rohe, could illustrate the first stage of that aesthetics exteriorized in grid patterns; the massiveness of the Seagram Building in New York (1958) by Mies van der Rohe and Johnson as apposed to the slablike Skidmore, Owings and Merrill's Lever House in New York (1952) or the United Nations Secretariat on the East River (1950), recall the second stage; the already mentioned Lincoln Arts Centre for the Performing Arts to be built in New York, or Bunshaft's design for the Skidmore, Owings and Merrill Banque Lambert in Brussels, now under construction, or the existing American Embassy at New Delhi by Stone (1958) could follow in the third stage of axial and symmetrical organization, while, for instance, the evolution discovered in the use of pierced screens made by Rudolph - first only for the form's sake at the Jewett Arts Center of Wellesley College (1959), and later following a strict functionalism at the high school designed for Sarasota (1959-60) - falls into the present last state of a search for an

---

1. Ibid., p. 160.

ornamental richness that, although sometimes confusing, opens a new way towards the liberation from the previous rigid plateau architecture of glass curtain wall prisms, determined by the new rationalist formalism that the American architecture chose to follow in the last few years.

And it is, indeed, the start of a reaction against that dangerous stylish stabilization previously indicated because, as a new search, it shows that the form-evolution sinusoidal line has not been broken and therefore, that the Modern Movement is still not ready for history. It has been only a short stop, for rest and assimilation, during which in the overwhelming majority of modern design, as a new experience, form followed form and not function. But the curve is shifting towards a rationally organic balance of forms, towards a marriage between both tendencies that, not following any functionalist or formalist slogan, will solve the old Rationalism versus Organicism conflict. And when reading the words with which Mies van der Rohe, responsible for the formalist movement in this country, recently thanked the A. I. A. for the Gold Medal Award, the hope for a coming new architectural philosophy becomes certain, because

> We are not at the end, but at the beginning of an Epoch; an Epoch which will be guided by a new spirit, which will be driven by new forces, new technological, sociological and economical forces, and which will have new tools and new materials. For this reason we will have a new architecture.
>
> But the future comes not by itself. Only if we do our work in the right way will it make a good foundation for the future. In all these years I have learned more and more that architecture is not a play with forms. I have come to understand the close relationship between architecture and

civilization. I have learned that architecture must stem from the sustaining and driving forces of civilization and that it can be, at its best, an expression of the innermost structure of its time.

The structure of civilization is not simple, being in part the past, in part the present and in part the future. It is difficult to define and to understand. Nothing of the past can be changed by its very nature. The present has to be accepted and should be mastered. But the future is open - open for creative thought and action.

This is the structure from which architecture emerges. It follows, the, that architecture should be related to only the most significant forces in the civilization. Only a relationship which touches the essence of the time can be real. This relation I like to call a truth relation. Truth in the sense of Thomas Aquinas: as the Adequatio intellectus et rei. Or, as a modern philosopher expresses it, in the language of today: "Truth is the significance of facts".

Only such a relation is able to embrace the complex nature of civilization. Only so, will architecture be involved in the evolution of civilization. And only so, will it express the slow unfolding of its form.

This has been, and will be, the task of architecture. A difficult task, to be sure. But Spinoza has taught us that great things are never easy. They are difficult as they are rare.[1]

CONCLUSION

The present comprehensive significance reached by the concept of form, not regarded any more as the mere essence of individual things - classical interpretation from which aesthetics picked for it the meaning of mere shape - but as a complex, ultimate structuration by means of component elements which lack

---

1. "Ludwig Mies van der Rohe was awarded the Gold Medal of the American Institute of Architects at the Annual Convention in San Francisco, April 1960". Arts and Architecture, June, 1960, p. 13.

individuality, has largely influenced not only the formal contents of architecture but also its historical meaning.

In fact, besides the possible analytical dissection of architecture into its different parts, a piece of architecture is now regarded as an organization of space defined by means of forms whose spatial arrangement may follow different ways according to the cultural moment it belongs to. This variable in the way forms are organized to achieve the architectural goal is in essence the vital force of styles that, according to the two contrasted temperaments in man's thought, fall into the opposite camps of Rationalism and Organicism.

While the former attitude visualized a straight ascending form-evolution line that, measured with the Hellenic, Roman, Early Christian, Romanesque, Renaissance, XIXth. century Neoclassicism and modern Functionalism scale of styles, considered the Greek Hellenic period, the Renaissance and the modern Functionalism as its prominent landmarks and the other intermediate styles on the other side of the scale as stationary periods, or even as devolutions, the present acceptance of the Organic movements as equally valid periods of architecture has changed the attitude of architectural criticism and this is why another graphic expression of the historical sequence in the evolution of architectural forms is proposed.

None of the architectural styles, whose different states or ages form part of this shiftable evolution line, can be regarded in isolation from the others. They are all in an intimate relationship that implies successive acceptances or rejections of the

forms used by preceding styles. These constant enrichments and renewals act as direct answers to the constant challenge provoked by the physical, social, economic and emotional adjustments of civilization, and in light of the existence of this continuous precedent of forms architecture, when analyzed methodically under the bifocal lens of the two contrasted tendencies previously indicated, goes into the dynamics of history.

The architectural features taken as common denominators of each attitude to prove the opposite formal similarities of both approaches to architecture, are almost classic and have been used for some time by the modern historians and critics of architecture. As for the architectural examples to illustrate and document these similarities, they have been picked in the most accurate way possible. If some could be discussed or even changed for others more suitable, the striking similarities of the styles common to the same tendency are too strong to reject the proposed analytical methodology.

Concerning the uncertain future trend of architecture, the prediction of a coming balanced approach that may break the existing dichotomy between Rationalism and Organicism may be an utopian visualization, but it has been outlined in the hope that the experience of today's architecture, struggling to get out of the prevailing formalism, may furnish the needed lesson against misunderstood extremisms as well as the idea for the urgent need of an architectural philosophy. And this philosophy, viewing towards the future, can be acquired only by a sense of historical awareness,

by the knowledge of the historical movement we are living in. Only then is it that architecture, set again in motion, may follow its endless and unbroken form-evolution line.

ACKNOWLEDGMENT

The author wishes to acknowledge the assistance and counsel of Professor Emil C. Fischer, Head, Department of Architecture and Allied Arts, during the writing of this thesis.

LITERATURE CITED

Books

Focillon, Henri.
The Life of Forms. in Art. New York: George Wittenborn, Inc., 1958.

Giedion, Siegfried.
Space, Time and Architecture. Cambridge: The Harvard University Press, 1947.

Greenough, Horatio.
Form and Function. Berkeley and Los Angeles: University of California Press, 1947.

Law Whyte, Lancelot.
Accent on Form. New York: Harper and Brothers, 1954.

Moholy-Nagy, Laszlo.
The New Vision and Abstract of an Artist. New York: Wittenborn and Company, 1946.

Pevsner, Nikolaus.
An Outline of European Architecture. New York: Charles Scribner's Sons, 1948.

Saarinen, Eliel.
Search for Form. New York: Reinhold Publishing Corporation, 1948.

Sullivan, Louis Henri.
Kindergarten Chats and Other Writings. New York: Wittenborn and Schultz, 1947.

Zevi, Bruno.
Architettura e Storiografia. Milan: Libreria Editrice Politecnica Tamburini, 1950.

_____.
Storia dell'Architettura Moderna. Milan: Giulio Einaudi, 1950.

Periodicals and Journals

Banham, Reyner.
"The New Brutalism". The Architectural Review, December, 1955, 708: 355-361.

Creighton, Thomas H.
"The New Sensualism". Progressive Architecture, September, 1959, 9: 141-147.

_____.
"The New Sensualism II". Progressive Architecture, October, 1959, 10: 180-187.

Jordy, William H.
"The Formal Image: U. S. A." The Architectural Review, March, 1960, 757: 157-165.

Kallmann, Gerald.
"The 'Action Architecture' of a New Generation". Architectural Forum, October, 1959, 4: 132-137; 244.

"Ludwig Mies van der Rohe was awarded the Gold Medal of the American Institute of Architects at the Annual Convention in San Francisco, April, 1960". Arts and Architecture, June, 1960, 6: 15.

Nowicki, Matthew.
"Composition in Modern Architecture". The Magazine of Art, March, 1949, 108-111.

_____.
"Origins and Trends in Modern Architecture". The Magazine of Art, November, 1951, 273-279.

EVOLUTION OF FORMS IN ARCHITECTURE

by

JOSE AVELINO REY PASTOR

B. Arch., University of Buenos Aires,
Argentina, 1953

AN ABSTRACT OF A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARCHITECTURE

Department of Architecture

KANSAS STATE UNIVERSITY
OF AGRICULTURE AND APPLIED SCIENCE

1961

Despite the few invigorating enrichments brought to architecture by some interesting renewals in the structural field, architecture in general has fallen during the last decade, into an alarming dangerous formalism of the basic language of forms enounced by the Modern Movement. If its immediate causes may be found in the too accelerated rhythm of today's technological advance and the continuous adjustments of social and economical nature, in this urgency of modern life a deeper motivation is the present lack of an architectural philosophy pointing towards the future, derived in turn from a total absence of an historical position.

The purpose of this work is to contribute, within its limits, to the clarification of some aspects of this intimate and reciprocal architecture-history relationship in light of the constant evolution of forms provided by the analysis of the architectural historiography, in the hope that meeting again its endless form-evolution line, the architecture of our time may find its place in history as a clue towards the elaboration of the needed new philosophy.

Accepting the modern reevaluation that the root of architecture lies in the mastery of the problem of space, as an organization of spaces by means of forms, and that the proper selection of these forms and their subsequent adequate spatial treatment, according to the premises involved with each architectural problem, makes the difference between a work of architecture and a building, form, as ultimate matter and substance of architecture, is the first concept to be analyzed. Meaning in general no less

than "the qualities which make any thing what it is", the evaluation of these qualities is not concerned any more with the essence of individual things - classical interpretation from which aesthetics derived for it the idea of mere shape. Instead, the present concept of form involves the idea of "structure", as the underlying pattern of a total organization, the whole complex being more important than its particular components which lack individuality, and this attitude, this reevaluation applies also to style as a syntax of forms, and to architecture as the resultant language ruled by the regional grammars of place and time. In fact, style is not regarded any more as an absolute, as the supreme quality of things, but as a variable, as the development in the grouping of forms in a fit reciprocal relationship whose harmony is constantly testing, building and destroying itself, and as for architecture, the previously mentioned spatial significance comprehends today the possible classical dissection into the different forms that define its spaces. Now, taking from this particular analysis of forms, space and styles leading to architecture, the common general denominators of the two extreme attitudes that, prevailing in the realm of man's thought, are responsible for the existing reevaluations seen (the atomistic, the classic, the rationalist as opposed to the holistic, the comprehensive, the organicist tendency) the whole Western evolution of architectural styles tends to fall within these two camps. While the Hellenic, Roman, Early Christian, Romanesque, Renaissance and XIXth. century Neoclassicism share with the modern Functionalism of the twenties the same common features common to

the Rationalist attitude towards architecture, the modern Organicism, Art Nouveau and Romantic Movements with the Baroque, Gothic, Byzantine, decadent Roman, Hellenistic and Pre-Hellenic belong to the Organicist field of architectural approach and this is why an ascending sinusoidal line shifting from Rationalism to Organicism is proposed as a graphic expression of these constant chronological reactions found in the evolution of styles in architecture. Thus, none of them can be regarded in isolation from the others; they are all in an intimate relationship that implies successive acceptance and rejections of the forms used by preceding styles, and when these enrichments and renewals are analyzed methodically under the bifocal lens of the two contrasted tendencies already mentioned, the lesson of the past set into the motion of the dynamics of history may give the required answer to our present architectural uncertainty providing the philosophical fundamentals claimed for architecture.