

STYLE AND STRUCTURE IN ARCHITECTURE

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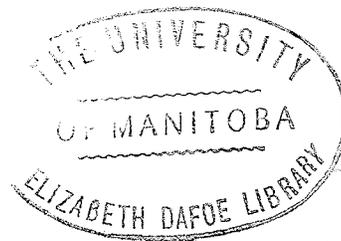


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INTRODUCTION

Obsolescence is a style-creating force without doubt. The fact that life styles, "stylish" things of the past are opposing the technologies of the present, never failed to create an anecdotic interest.

What is relevant...for the student of style is that the older method may be retained within certain limited contexts of ritual and ceremony. The queen is still guarded by men with swords and lances, not with Tommy guns. The Torah is still in scroll form, while the world has adopted the more convenient codex. It is clear that the expressive value of the archaic style will tend to increase with the distance between the normal technological usages and the methods reserved for these distinctive occasions. (Gombrich, 1968:354)

The idea that obsolescence as a style-creating force is the rule and not the exception, was brought to me by two striking examples from areas quite far from architecture. In the Buddenbrooks by Thomas Mann this family is struggling along, living and prospering without the outward sign of their recognition. The public recognition, the consulship for Thomas Buddenbrook arrives at a point, when the prosperity and the rule of mercantile virtues are long past. The other example comes from a real event; it happened in Hungary in 1957. In her thousand years of history, independent (or more or less independent) Hungary never bothered with exhibiting symbols of her independent statehood; but in 1957, after the crushing of the last national revolution, when the nation lost even the hope of an eventual liberation within our time, the ruling puppets of Budapest made a law that the traditional colors of the country should be permanently exhibited in front of the Parliament Building.

The reading of Understanding Media woke up again this interest of mine. The word "technology" has a very broad meaning in McLuhan's book; according to his statements we can consider just about everything technology. Even so, his insight--how technology turns its predecessor into an art form--is impressing; and it is highly interrelated with the idea how technology turns its predecessor into a style.

Each new technology creates an environment that is itself regarded as corrupt and degrading. Yet the new one turns its predecessor into an art form. When writing was new, Plato transformed the old oral dialogue into an art form. When printing was new the Middle Ages became an art form. "The Elizabethan world view" was a view of the Middle Ages. And the industrial age turned the Renaissance into an art form as seen in the work of Jacob Burckhardt. Siegfried Giedion, in turn, has in the electric age taught us how to see the entire process of mechanization as an art process. (McLuhan, 1966:IX)

I intend my paper to be a footnote to this paragraph; it contains the whole theory I wish to prove that architectural styles are created by obsolete building technologies. For this we take one level in the infinite series of media and contents, and prove that the subject of architectural expression is the structure.

Although architecture has been proven to be an art many times, the argument is not full until we have a clear picture on the problem of the artistic subject of architecture. No other arts are without clearly realized subject, but music and architecture. Since we are searching for a general theory of architecture as an art, we certainly cannot be satisfied with analyzing the different art forms on their own terms.

Does the earthbound usefulness of architecture stop it from being an art? What is the artistic subject of architecture? Does technology create styles? Or is it given to the liberty of

spiritual movements? Finally, is it necessary to express the real structure of a building?

This paper is an attempt to answer these questions and problems. These are troubling points, and they come up inevitably to any thinking man and to any practising or theorizing architect. Envyng all those who have already created their answer--even if it is temporary,--I recommend my thesis to their benevolence.

CHAPTER ONE. PROBLEMS, DEFINITIONS AND CONCEPTS

THE PROBLEM OF TECHNOLOGY AND STYLE

It is a truism now in architectural theory, that the architectural styles are created, regulated, and condemned by the available materials, methods of construction and building costs, together called technology. The necessary steps in going into the analysis of this area are then, to define the concepts of style and technology, to determine our working attitude toward these concepts, and to check their validity and their true relation on historical examples.

It is very hard indeed to find a bridge between the definition of technology by sociologists and the definition of style by art theorists, but these seem to be the only authors to bother with these questions. Fortunately, the problem is not half as difficult as architects' other attempts to link areas distant from one another. Technology is, according to Ferkiss (1969:31), "a self-conscious organized means of effecting the physical or social environment, capable of being objectified and transmitted to others, and effective largely independently of the subjective dispositions or personal talents of those involved."

Also Ferkiss warns us in his book (1969), that a variable cultural lag exists between invention and acceptance of a technology. Though he does not define these terms, the importance of calling it a cultural lag will be obvious in analyzing the relation of technology and style. Switching from technology to style, we have to avoid all those, who define style as a certain "way" or

"method", since these cannot help us in the search for the difference between style and technology. The words "way" or "method" would occur in any broader definition of technology, just as these words are likely to occur in any definition of style including wider areas than the world of art. Consequently we are looking for a definition of style in art.

"Style in art might be defined as those aspects of form that are correlated to produce a socially desirable expression consciously or unconsciously intended by the artist." (Rotschild, 1960:53) This definition is typical in its difference from that of the technology; here the emphasis is on the words "socially desirable...consciously or unconsciously intended." In Ferkiss' definition technology is largely independent of the subjective dispositions or personal talents.

Technology does not have an easy and automatic role in creating, regulating, and condemning the style. It has to go through social and individual filters, which also cause the cultural lag. We shall see these in the following chapters of the history of architecture.

THE PROBLEMS OF STRUCTURAL EXPRESSION

The second group of problems is by far not as complex and profound as the first one. In fact, it is all clustered around one question: is it necessary to express the real structure of a building? This question seems to be most vital to an architectural designer, since, apart from the theoretical importance, the answer to this question can help him in the everyday design process. Structure in my definition is the interrelation of the supporting parts under the effects of gravity and other physical forces (in everyday language: the engineering structure).

We shall conclude this problem after having looked at the history of architecture. To produce the proper perspective, I quote here two opinions on why we trouble ourselves with the question of this "expression."

In the first one Frankl (1968:112) insists on the anthropomorphic explanation, saying that we project ourselves (Woelfflin's "corporeal forms") into the structure and its expression, that our impression of musculature always corresponds to human musculature. He states that proportion in general has a relationship to the proportion of the human body, and that there is a mean of proportions that corresponds to the athletic, well-toned, fully developed human body.

I frankly wonder, how could we apply this theory to any other group of buildings than undersized residential buildings, since these at least are carrying the actual human sizes, if not

the proportions. Structural members usually do not carry human proportions; except by chance, or forced by the necessary imitation of reality, as in the case of the Caryatids. Neither is this theory able to explain the development of styles. It seems to be an absurd idea to suppose that the people were taller or more slender during the periods of Hellenism, High Gothic or Late Renaissance, than they were in Early Doric, Romanesque or Byzantine periods.

Instead, I suggest that the proportions are right when they follow the structural proportions of the material, and that sizes are right when they follow the functional (emotional, physical, etc.) requirements. As for the necessity of structural expression within these sizes and proportions, the explanation seems to be psychological: it satisfies our need of feeling security under the structure.

In the selection of tension for any job, the quality of the visible pull is worth at least as much consideration as the economics and the flutter. In tension design the candid exposure of the structure is more than merely a moral or artistic nicety; it is practically obligatory to the peace of mind of those sheltered. While an exposed tensile member is likely to communicate its task with remarkable eloquence compared with most stolid compressive members, concealed tensile structure is likely to produce forms which seem alarmingly defiant of natural laws, at least to eyes accustomed to compressive behaviour. The need of some sort of fake ceiling may do the damage, as in the case of the Villita Assembly Building, where an almost continuous ring of tidy acoustic panels slung under the chooping cables at a contrary angle gives a misleading suggestion of some insecure dome-like compressive structure. (Boyd, 1965:118)

But the theory which is true of tensile structures, is not necessarily true of any structure. Let us not make an ethical issue of this "expression of the truth." Covering a "secure" real

structure with an insecure fake is definitely wrong, but covering a neutral real structure with an untrue Renaissance facade, which conveys a high level of security to the viewer, is a completely different matter. Since the Greek classical period, architectural styles alternate from expressing the real structure of the buildings to the complete neglect of this problem as well as this "expression."

A theory which insists on the necessity of the expression of the real structure, would ban the Roman classical and the Renaissance styles from good architectural styles of sound psychological foundation. We simply cannot let it happen: architects and societies cannot be mistaken for twice four hundred years.

These periods do have a sort of structural expression-- a set of inherited elements, expressing not the real structural system, but an older one: the Greek classical structure. And this projected structure has its own development within each style, just as the "structural" Gothic or Modern styles.

The transitions within a style are serving the exploration of hidden possibilities of a material (and this way to find a better usage of it), and the discovery of a new material as well. But the driving forces behind these transitions are psychological ones, and they are concerning the style, not the technology.

Lincoln Rotschild (1960:60) states that later styles employ great ingenuity in obscuring structural requirements; most notable are the addition of structurally useless lierne ribs in Gothic vaulting (Fig.1), which abandoned not only the structural significance of the rib as a means of support, but also the clear divi-

sion into bays, characteristic of the high Gothic four-part rib vault. Structural realities of architectural design are likewise obscured in later periods by twisted columns, supports carved in the shape of human or animal figures, and other devices for weakening the appearance of solidity in supporting members (Fig.2).

Technological reasons are not enough to explain this particular kind of development from structural expression to structural obscuration. Though technology has a decisive role in any architectural development, we have already realized that technologies cannot create styles; and even less can technology control the structure-denying development within a style. Partly, because of the collective nature of technology and the individual nature of style, and partly because this structure-denying development is also technology-denying by definition, consequently it cannot have technological reasons.

Many theories exist to explain and to find the causes of this development. I would mention here two of these theories which attempt to explain the development of styles. The first one, quoted by Wölfflin (c.1964:75), is based on the hypothetical phenomenon of "form fatigue." It says that the jading of formal sensibility is the driving force to which we owe the progress in art; its cause is the sharpening of the memory image; and since the mental effort needed to create the memory of a beautiful form consists in the unconscious spiritual pleasure generated by this form, this hypothesis stipulates a state of constant change, for as soon as we have memorized the forms, they lose all their attraction for us.

This theory simply does not count with the facts. According to it we should be utterly bored with anything older than this "jading" period. But we are not. We are able to like two, fifteen, three hundred or three thousand year old forms. Or this theory is applicable only to the creative members of the society, only these people have their memory images sharpening, driving them toward new forms and styles, independently from their ideas and emotions, the social order, technology and finance of their age. This is not true, either. Also, the whole theory has the underlying, nay, admitted notion of art as a uniform progress,--and to maintain this notion is the theory of form fatigue needed.

The second theory of the stylistic development says, that the artistic style is a mirror of its age, and along with the social, political, moral and economic changes their mirror image, the style has to change, too.

What this principle basically says, is simply too wide for any analysis; it says that everything relates to everything, which is one of the very true generalities of this world. The problem is that here and now we cannot start anything with this generality, for it does not seem to solve the specific problem of the specific time. Coming down to the particular question, we find that no social, etc. change has the necessary parallel process to cause the structure-denying development of the different styles.

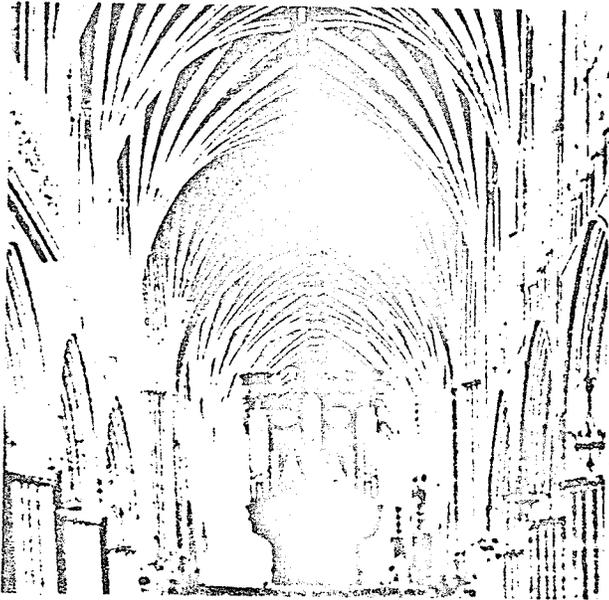
The common fallacy of these theories is that they attempt to find one principle which could explain why and which way the stylistic development occurs. Let us ask two questions for the two answers. What causes the change of styles? Time. Generations follow

each other, humans change their minds, even an ox could not walk through time unchanged. Change is woven into us and into the tissue of this world. The process of change does not need any special cause to explain it.

For the more difficult second question, why the styles develop the way negating or threatening the structure, we shall have to go into details on the problem of structural expression.

The first time I met with this problem was in Florence, at the foundation walls around the piazza in front of the Pitti Palace. According to the Late Gothic (or Early Renaissance) practice, the stone wall is supposed to express its immense loading by the bulging out of each stone block. In this case the strong deepening and widening of the channels makes the stones seem to float or stand in the air when viewed from a close distance,-- nevertheless, from far away it conveys the actual message of the wall, the suffering under the load (Fig.3).

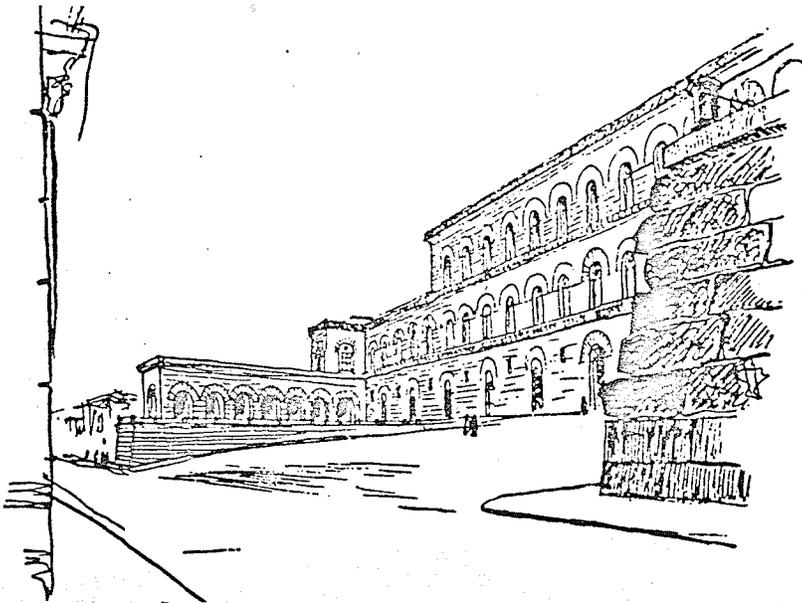
Chang (1956:45-46) describes another case, in which structure is expressed by placing the thinner sides of a series of buttresses, in consistency with physical reasons, toward the observers. When we assume that loading is constant, the front view of these buttresses will give an immediate impression of weakness, but the revelation of their depth either by shadows or by being seen from the sides will manifest their actual size and strength. Through size variation, respect for actuality thus is growing in our mind, and mental interpretation will move from the point of apparent risk to the point of actual safety. Often, such allowance for mental growth is achieved by partial hiding or even total conceal-



1. Gothic fan vaulting.
St. Peter's Cathedral,
Exeter



2. Episcopal Palace,
Würzburg



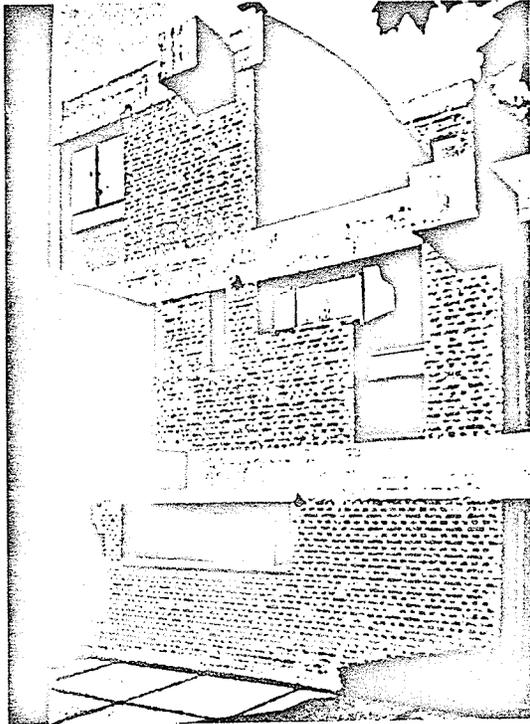
3. Pitti Palace,
Florence

ment of the resisting members.

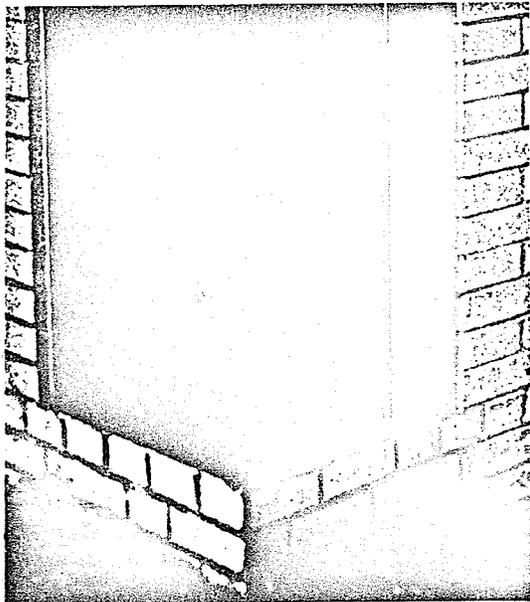
In its simpler form this duality is almost an everyday problem for the architectural designer,--the visible, showing part of a structure not only does not help, but it usually gives new problems to deal with. Classical examples are the beam-ends at the Maisons Jaoul by Le Corbusier (Fig.4), and the steel cover on the concrete-covered steel posts at the Illinois Institute of Technology by Mies van der Rohe (Fig.5).

Structural expression by containing intangible content means apparent heaviness in the supported part of a structure and apparent weakness in its supporting part. Through the suggestion by size variation, form movement, or material quality, an observer will experience the light bulkiness in apparent heaviness and the strengthened lightness in apparent weakness. (Chang, 1956:46)

Now, we have a clear picture of the reasons and the direction of the development of styles. By uniting the two answers we can say, that the the natural rhythm of change will set the pace and the inherent duality of structural expression will set the direction: toward seemingly denying the structure.



4. Maisons Jaoul,
Neuilly



5. Alumni Memorial Hall,
Illinois Institute of Tech-
nology, Chicago. Detail

THE PROBLEM OF ARCHETYPES

The great significant works in the history of fiction are variations of such archetypal situations and conflicts, which first occur in mythology, and are re-stated in the specific language of the period. Prometheus, Job, Sisyphus, Samson, Oedipus, Tantalus, Narcissus, etc., are the eternal "stories" of the inadequacy of the human condition. Their listing would be a gratifying task for a research thesis. Here is one example: the type of story based on the archetypal figure of the "idiot", the inspired fool...Other frequently recurring archetypes are: conflict between two loyalties (Penelope v. Trojan war, Katinka and the Five Year Plan); between instinct and convention (Bovary, Karenina); sensitive hero and callous world (all public school novels and most autobiographies); shock and conversion (a Russian specialty but also a favourite motif with E.M.Forster); the conquest of fear (from Hercules to Hemingway) and of the flesh (from Buddha to Huxley). There are perhaps a dozen or so more--but not much more. The themes of fiction are limited; only their variations are inexhaustible. Novels which are not fed from archetypal sources are shallow or phoney. They are like a house with elaborate plumbing, bathrooms, cold-and-hot-water taps, which the builder forgot to connect with the main. (Koestler, 1955:96-97)

This quotation sums up very well the role of archetypes in literature. It seems to be the same in architecture--the difficulty to search and select the archetypes is the same, and so is the gratifying clarity these archetypes emit. The architectural archetypes are structural ones; they are also based on the psychological need of sensing security in the structure. In his theory of the archetypes and the collective unconscious Jung explains the origin and process of birth of the archetypes--they are coming from the practical, material world, settling in layers on the mind and on the unconscious which select, memorize and pass them along.

For our purposes this term [archetype] is apposite and helpful, because it tells us that so far as the collective unconscious contents are concerned, we are dealing with archaic or--I would say--primordial types, that is, with universal images that have existed since the remotest times...Primitive tribal lore is concerned with archetypes that have been modified in a special way. They are no longer contents of the unconscious, but have already been changed conscious for-

mulae taught according to tradition... (Jung, 1959:4-5)

Since architecture is a conscious activity, it would be extremely difficult to follow the unconscious ways regulating the structural archetypes, but from experience we can recognize the archetypes. Considering their structural character, with a little imagination we are even able to discover their origin in the remote past. This is not the moment of the invention of archetypes in architecture; without using the word, architects and historians for many years recognized the concept of archetypes. This is how I interpret Sir Christopher Wren: "...a good building ought certainly to possess the attribute of eternal."

The grave

At a burial, no matter how small the corpse is, there will be some leftover earth; it would not be wise to carry it around, making the digging of the next grave more difficult. We have to arrange it some decent way. The dry earth has a definite angle for the steepest slope, above which it simply collapses. The obvious way is to arrange the earth to pyramid or mastaba shape. As for the ambiguous spiritual purpose of the graves, namely, to remember the spot and to keep the dead in the grave, both cases can manifest themselves only in structure; the earth, the structure does not know reverential or superstitious implications. To mention the flat graves, although we are in open argument about the meaning of the words "structure" and "building", we can agree that a piece of level land is neither structure, nor building.

The cave

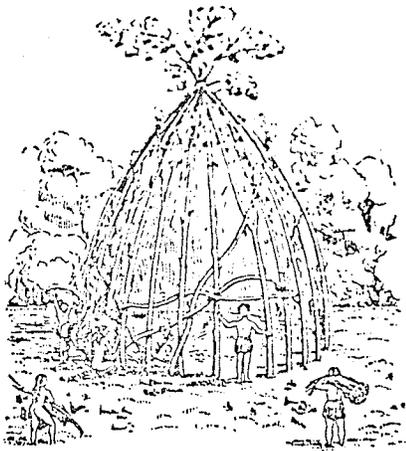
The most obvious living quarter for every higher creature is the found architecture; the cave. Originally the attack of other animals and extreme weather conditions forced the living beings to make use of the natural shelter of caves. On the other hand, these mountains and caves had the attraction of being able to withstand the erosions of time. At this point we can think about the three-fold advantages of the cave: not dying from exposure; having more free time and energy for hunting, resting, birdwatching, and art; and the long survival of magic and artistic achievements when painted or sculpted in the time-enduring cave (Fig.8).

In the cave man learns all the intrinsic plays of the monolithic and heterolithic stone structure, that stalactites do not support the ceiling, that the higher the natural vault is, the less chance it has to collapse, that fallen rocks can be built up using the miraculous phenomenon of balance. Yes, if the point was not so clear at the grave, it is so at the cave: the name of the game is balance.

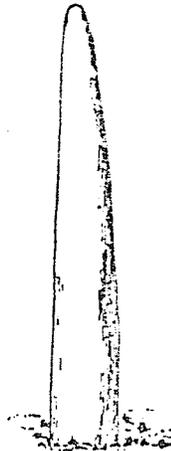
Functional intermingling occurs, for instance burial in caves, or living in ditches, but these aspects would not help us in our search for structural archetypes.

The dolmen and the hut

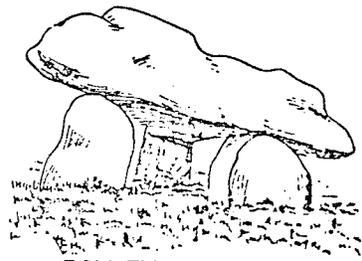
Opening his eyes to the wonders of nature, man realizes that not everything falls to the ground; the ceiling of a cave, the branches of a tree, the timber across the river, these objects are supported by invisible forces, by their own internal strength.



THE HUT



MONOLITH



DOLMEN



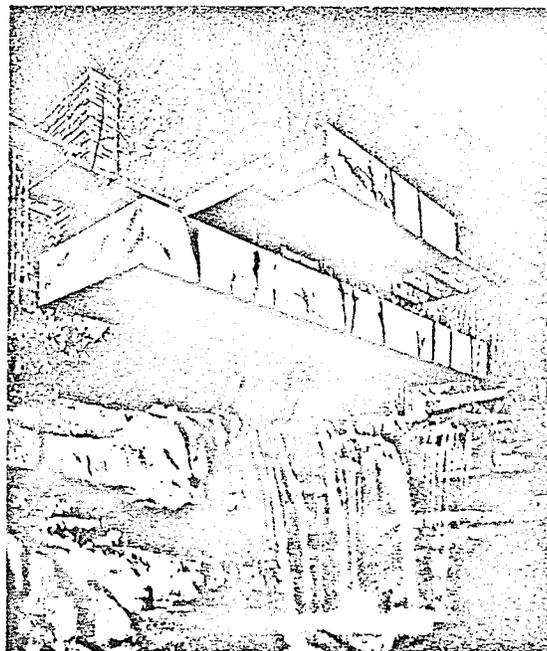
THE CAVE

6. The hut and the monolith

8. The dolmen and the cave



7. The wall



9. The floating body

Architectural archetypes

Man can produce it himself, and at this point the digging of hiding-holes and search for natural shelter are over. Two objects on the ground, a third one across; the third archetype, till this day the most important and often used, the dolmen is ready to develop, conquer, amaze, and preoccupy (Fig.8).

The same natural phenomena, the cave, trees, or timbers taught man to build in an entirely different way; the sight of meeting branches in the forest might have given the idea of a hut or tent. The hut structure offers two logical shortcuts: it does not abstract three-dimensional structures into the basically two-dimensional dolmen, and it does not break up the space-closing structure into the very abstract elements of wall and roof. For these reasons we can consider the hut as the archetype of the highest order (Fig.6).

The monolith and the wall

There are two other structural archetypes which, for special reasons did not become ruling archetypes of any style. Nevertheless, both occur in almost every style, defying the ruling types, and living their own functional and spiritual lives throughout history. The first is the wall, the unbroken symbol of ending and closing, built from elements carrying and carried by each other. The more we see the load-carrying of these elements, the closer the wall is to the archetype, the stone wall. Obviously without openings, the wall cannot fulfill any architectural functional requirements (or very few), so it can only partially achieve the role of archetype in architectural styles (Fig.7).

Similar circumstances prevent the monolith from becoming the ruling archetype in architecture, though it would be very difficult to understand the importance of obelisks, spires and towers without recognizing the archetypal character of the monolith. The religious or administrative role of the monolith structures are incidental from the structural point: the emphasis is on its simple verticality, and that it is made of one piece (Fig.6).

CHAPTER TWO. A HISTORICAL REVIEW

INTRODUCTION

This short review of architectural history is basically not more than the historical application of the problems mentioned in the first chapters: the relation of technology and style, the expression of structure and development of style, and the subject and content of architecture within a specific period.

In reality styles do not exist, only buildings do--styles are our mental grouping of buildings, for easier dealing with history. Dealing with historical images, we are inclined to accept a "Gestalt" outlook and ignore both the transitional stages and the periods which do not fit to our imaginary higher principles of order and classification. Breaking through these barriers is not the purpose of this paper, but whenever this problem acutely occurs, we shall include it in the argument.

THE LANGUAGE OF EARTH:

ARCHITECTURE OF THE ANCIENT KINGDOM OF EGYPT

Nobody needs great insight to recognize that the pyramids are variations of the first archetype, the grave. (In fact the pyramid constitutes a special case of archetypes: it is an archetype for us.) Someone might say that they are "designed ruins", because the pyramid would be the shape of any ruin at a greatly deteriorated stage, but is true only to a certain degree, since we know of the Fifth Dynasty pyramids which collapsed or almost completely disintegrated. The pyramid is not the natural shape of stone ruins or stone buildings, and many arguments point this out.

Since the pyramids are not built from sand or earth, but from stone, they could well have vertical walls and horizontal rooflines--in fact, knowing that the building elements of the pyramids are stone cubes, these would be even more "natural." Thinking with stone, it would also be difficult to justify why the pyramids, built from stone cubes, have straight tetrahedral edges of limestone.

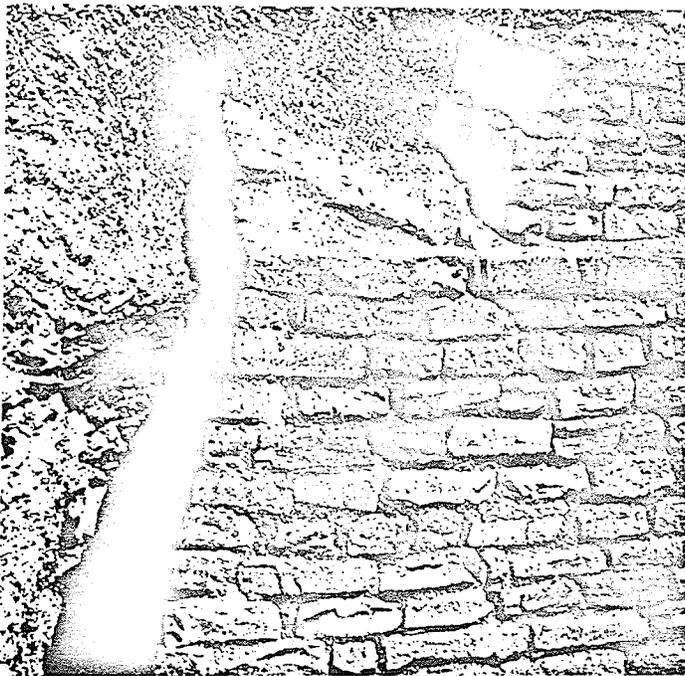
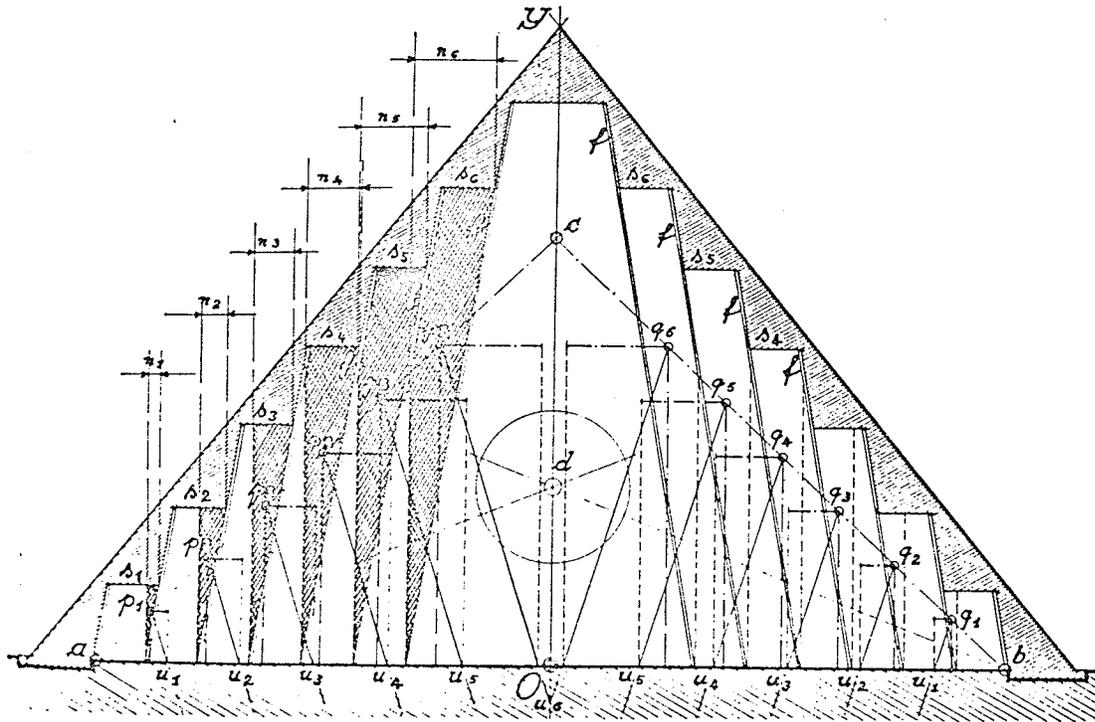
The pyramids were conceived in sand or earth, for which the tetrahedral shape was natural, and executed in stone, which caused many technical difficulties. The pyramids were constructed with an astonishing insight into the laws of statics and of the movement of forces. Volumes piled up like heaps of rubble cannot resist earthquakes or the ravages of time, and the pyramids of later dynasties, which did not follow the wise principles of early

times, have crumbled or lost their form. (Giedion, 1962-64:314)

Indeed, the technical execution of the pyramids in stone required more skill and cunning than we would suppose beyond the simple contours of the tetrahedra. Giedion (1962-64:317) mentions some of the structural devices applied by the Egyptian builders. Constructing the pyramids by vertical structural units rather than horizontal layers, it was achieved that the thrusts were directed toward the core at every level, thus reinforcing the stability of the structure. Thirty-five per cent of the vertical thrusts were transmitted to the inner core, reaching from summit to base. Only the remainder of these thrusts had to be carried down into the rock bed (Fig.10). Another sophisticated structural solution is visible on the corner of the unfinished pyramid at Saqqara; a line bisecting corners was avoided here by tilting the courses (Fig.11).

These arguments are convincing enough to explain that the pyramids are not built in their "natural" thinking material, but in one which gave the builders many difficulties and no reasons for the shaping of its world of form. The technology is superb, because the stone is able to fulfill every requirement in the hand of these ancient masters, but the style ("those correlated aspects of form, to produce a socially desirable expression...") is simply set by another material, the earth.

The discrepancy between technological material and stylistic material opens up the new insight about the subject of architecture, because from the previous statement we can logically deduct that the content of the stone pyramid is the sand pyramid, and the stone pyramid is the medium (for survival) of the sand pyramid.



10. The interior dynamics of a pyramid

11. Corner of unfinished pyramid. Pyramid of Sekhemkhet, Saqqara

Another argument to this effect is, that the southern pyramids are steeper than the northern ones, and the transition is continuous in three recognizable stages. All pyramids are built from almost the same material, but the northern ones seem to follow the natural slope of a sand-mound, and the southern ones (built close to the mountainous district) are so steep, that at some areas they constitute a transition between pyramids and obelisks.

The stylistic development is easily recognizable; so is the fact, that it proceeds from structural to less structural images. The mastabas are obviously better fitted for execution in stone than the pyramids, and the step pyramid still shows traces of thinking in stone, while the last stage, the full pyramid has completely lost all stylistic marks of stone structure. This last phase has a remarkable development within itself: the angle of the side of the pyramids seems to be steeper and steeper with the time.

No matter how independently they develop, mastabas, step pyramids, and full pyramids are all built as variations of one theme, the grave. For this reason I would risk the statement, that the object of the architecture of the period is the first archetype, the grave.

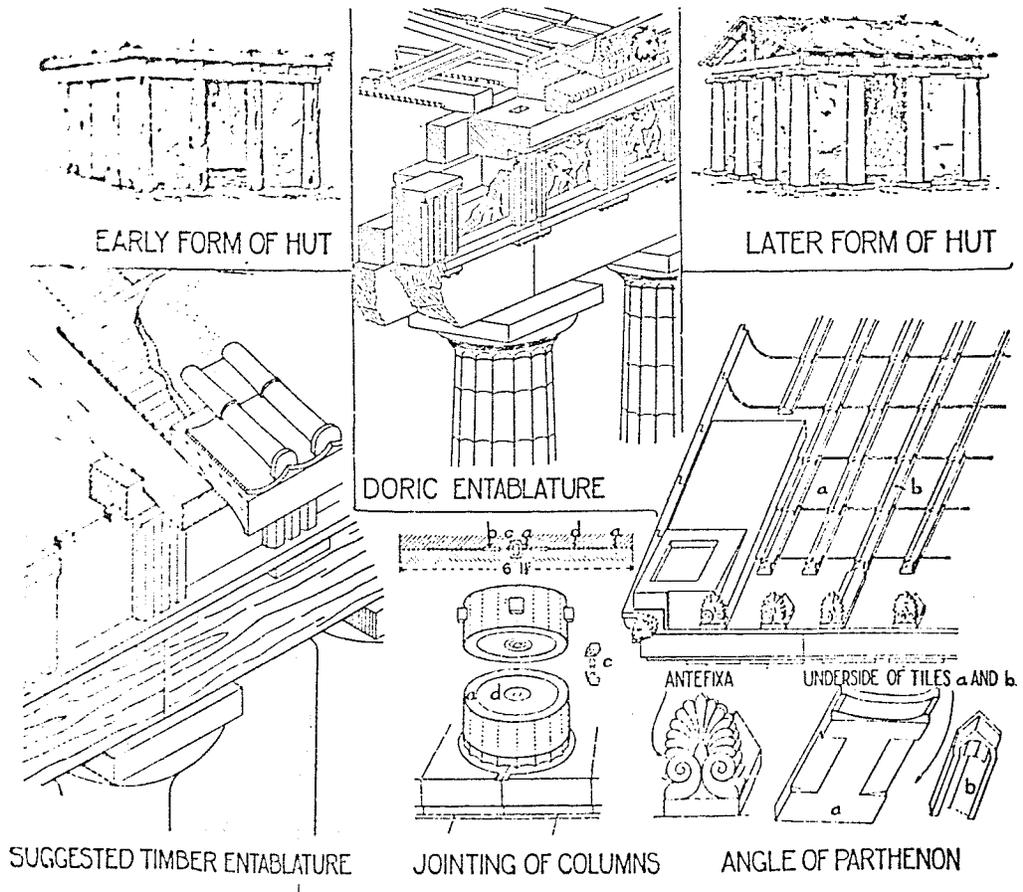
THE PETRIFIED WOOD: ARCHITECTURE

IN THE NEW EMPIRE OF EGYPT AND IN THE GREEK CLASSICAL PERIOD

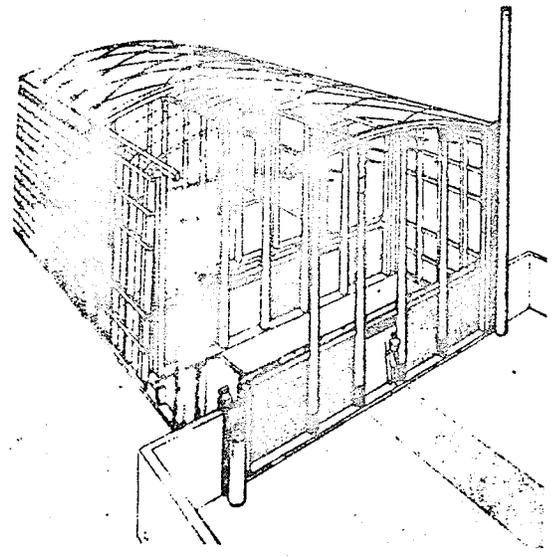
As the relation of sand and stone seemed to be significant at the pyramids, an analogy emerges from the analysis of Egyptian, Greek, and Roman temples: the building material is stone, but the style-creating "thinking" material is wood. Although the generating archetype, the dolmen can be either wood or stone, the stylistic roots of these buildings talk of wood (Figs.12,13).

The Egyptian invention of the column has persisted, with lasting effect upon the character of architecture. The monolithic column, hewn from a single block of stone, was originally copied from the wooden pole, and divided into three unequal parts, of which the shaft was the longest, rising from a base, with the shaped and ornamented capital at the top. No base was really needed for a stone column, but because wooden columns had rested on low, circular stone blocks, they were often perpetuated in stone columns. Builders have always continued to use familiar shapes, even when they were no longer structurally necessary. The base on the stone column is one example of such loyalty to the familiar; another is the slope or "batter" on a wall or a pylon with the gorge or coved cornice at the top. The mud brick walls of Egyptian buildings were originally sloped or battered so the base of the wall was thicker than the top, for this broadened base gave greater stability. It was a structural necessity when sun-baked mud brick was used, though not when stone replaced brick; but the form remained.

The custom of tying flowers and leaves to the wooden posts of early buildings was probably the origin of the ornamental



12. The wooden origin of the Greek temple structure



13. The wooden origin of an Egyptian government building structure

capitals of stone columns, for papyrus blossom and lotus buds as well as palm leaves were carved in stone, and below such decoration there was a band, separating the capital from the shaft, representing the cord that had bound flowers and leaves to the wooden prototype. Decorative forms in stone very often recall some forgotten function worked out in an impermanent material: bundles of reeds, tied together in rolls, may well have originated the vertical convex form of decoration on columns known as reeding. This is not guesswork, for early Egyptian paintings illustrate structures when wood and clay-daubed reeds were used, and show posts with projections at the top which are the obvious ancestors of the later stone columns with their swelling or bell-like capitals. (Gloag, 1964:20-21)

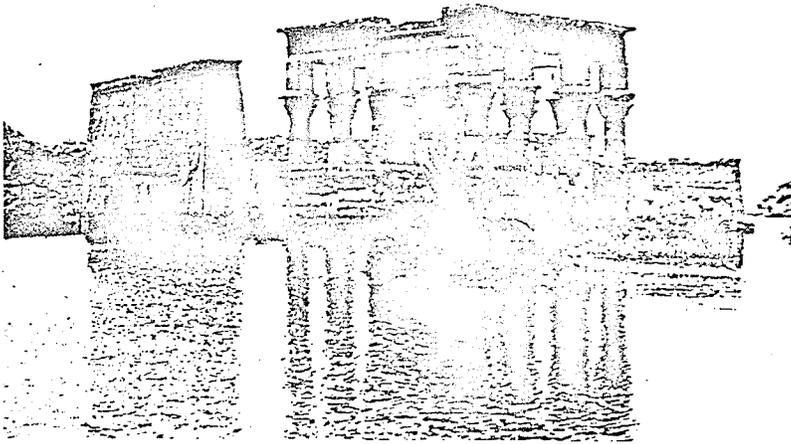
I hardly feel it necessary to repeat any further, or even less to analyze the stylistic elements of these temples. Everybody knows the lotus, papyrus, and palm capitals in Egypt, the classical orders of the Greek and Roman architecture, and most of us remember the theory that the stone ornaments of the Acropolis are wood details of excellent workmanship, down to the last guttae or mutules, remnants of a supposed earlier technology. (Fletcher, 1961:108-111, The Doric Order, and 1961:125-128, The Ionic Order)

One can ask, whether the Greeks and Romans gave up building wood temples when the building material "shifted" to the stone, or whether they were building wood temples along with the stone ones. As far as archeology is able to answer our questions, there is no trace of any wood temples from the period of stone temples. So we must not consider the stone temples the lucky survivors of a mixed technology: they are carriers of an obsolete construction method of an impermanent material, as the pyramids were in the first example. Realizing the material duality again, we can conclude that the content of the stone temple is the wood temple, and again the medium of the wood temple is the stone temple.

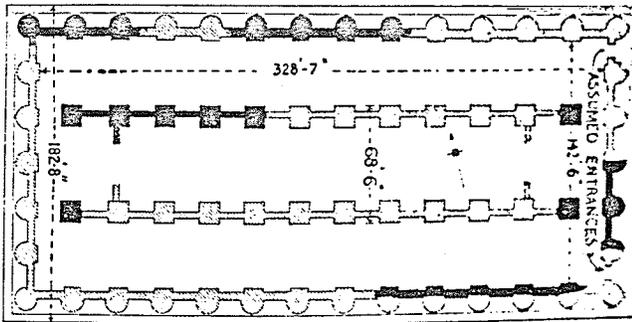
Whatever technical difficulties the Greek and Egyptian architects encountered on these wooden buildings, executed in stone, the solution of these problems did not hinder the expression of the real structure. The column is carrying the entablature, even if the stone joints are hidden and different from those shown for stylistic wood details.

The development of style in the period is only too well known. All the classic orders undergo the same type of change. The columns are more and more slender, the entablature becomes lower and lower, emphasizing "the weakness in the supporting parts", the abaci heavier to emphasize "the heaviness in the supported parts." Most interesting is the development of the column and its articulation. The columns become not only more and more slender, but have more and more canelluras to emphasize their height against the width, and finally, to lose all structural feelings, become decorated at the base. This development in Egypt reached its end in the New Empire and in the Ptolemaic period. The tall and extremely heavy abaci emphasize heaviness in the supported part. These are the least structural abaci in the history of post-lintel architecture; since they are so tall that their height makes the capital slide down to the top one-third of the column (Fig.14).

The Greek and Roman architects were consistent in employing an even number of columns on their temple elevations. This may be a circumstantial evidence for their expression and reminiscence of the dolmen, the archetype of the period, with its even number of uprights.



14. Temple of Isis, Philae



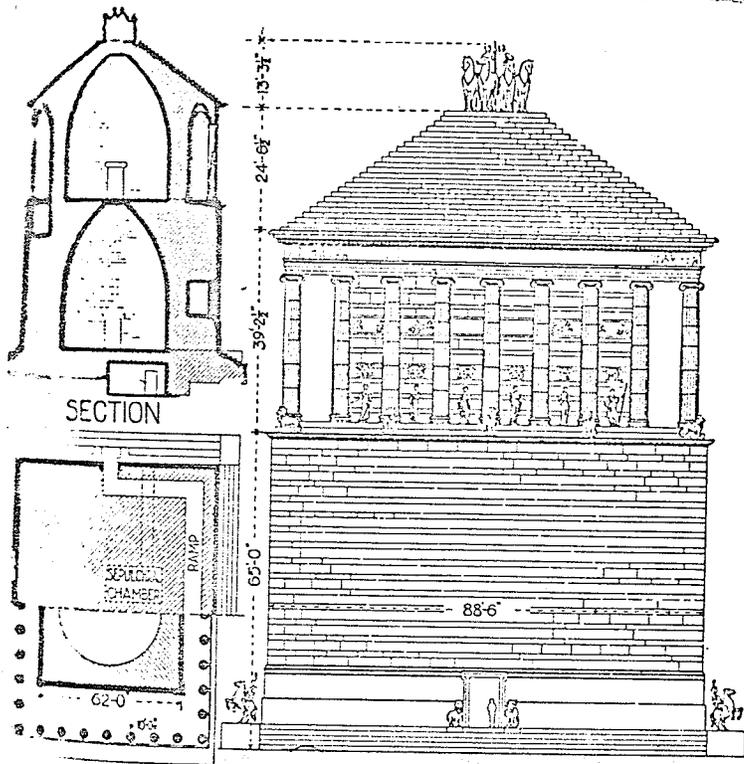
17. Greek pseudo-peripteral temple
Oympeium, Agrigentum

HELLENISTIC ARCHITECTURE

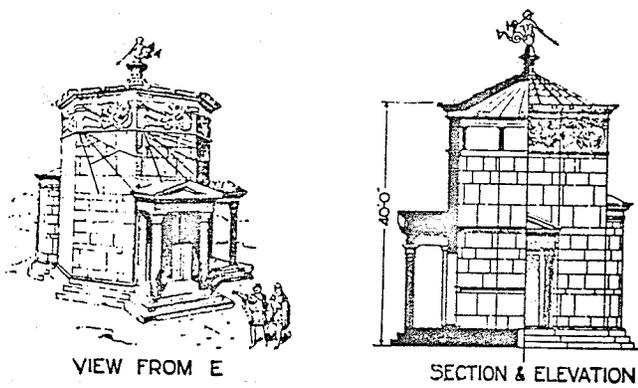
It is very difficult to get a definite picture of the structural archetypes of the Hellenistic architecture, and indeed, of its technological and stylistic development. We are reasonably sure, though, that the constructional technique advanced further, for instance wood trusses appear in the period. At the same time, the style seems to be disintegrating.

Robertson (1959:152) states that it is difficult to judge the original appearance of the great fourth century buildings. Their magnificence is indisputable, but it seems likely that, with the possible exception of Ephesus, they lacked freshness and interest. In the following centuries we can feel the beginnings of ostentation and vulgarity, though they often maintain a very high standard of technical excellence.

Descriptions and remnants of the leading monuments of Hellenistic architecture justify this feeling. The Mausoleum in Halicarnassos has two stories of stone arch structure in the inside, and its exterior is a temple-like structure on a high basis, carrying a pyramid which is crowned by a chariot-group (Fig.15). Among the remnants of the temple of Apollo Didymaios near Miletus, there are two stone passages pronaos and court. These passages, nearly four feet wide, and over eight feet high, were entered through arches and had sloping marble barrel-vaulted ceilings. The Tower of the Winds in Athens also shows marks of disintegration of the classical styles, along with some structural innovation at the roof construction (Fig.16).



15. The Mausoleum, Halicarnassos



16. The Tower of the Winds, Athens

It seems impossible to find a leading archetype of the period from among the grave, dolmen and wall type structures. We can still recognize the basic trend of the stylistic and technological development of the Hellenistic architecture. The stone elements are not satisfied by the role of perpetuating forms born by other materials and strange methods. There were early signs of this trend during the Mycenaean Greek architecture (Figs.37,38), and in the Hellenistic period certainly begins the process through which the stone will not only become the well-hidden real structure, but eventually also the expressive style-creating material.

A GLANCE AT EUROPEAN HISTORY AND ARCHITECTURE

From the time of the Roman Empire to the present, architecture seems to be a uniform process. Troedsson (1964) shows us, that European history, along with the history of architecture, has a very strong periodical character during this span of time. Politically, socially, and economically concentrative periods alternate with decentralizing periods, and these periods tend to last an equal duration of time. All the characteristics of the age seem to fit into this periodic process. In concentrative periods the political power is in the hands of absolute rulers "by the grace of God" (or Gods, as the case is), and religious feelings do not play a significant role beside the socially and militarily unifying national pride. (The periods of Augustus, Charlemagne, and Louis the Fourteenth are typical examples of this tendency.) The decentralizing periods are characterized by rising religious movements, population explosions and migrations, lack of uniform theories and ideologies, and brave experimentation in the practical world of science and construction. (Typical periods of decentralization are the Fall of the Roman Empire, the period of Communal Gothic, and our age.)

Table 1 shows the concentrative and decentralizing periods of European history according to this theory. Troedsson begins his analysis of the periods with the Roman Empire, and leaves it off with the first half of the twentieth century. The major differences between his description of history and Table 1 of this thesis are the addition of two previous and one future periods, and the comparison between the periods by Troedsson and

those by other influential authors of the nineteenth and twentieth centuries. The applied terms and dates do not need further explanation or elaboration. One exception: the use of the expression "Golden Age" is slightly ironical.

Table 1. Historical Periods after Troedsson

| period | | | | social order (Marx) | | |
|---------------|----------|------------------------|-------------|---------------------|---|------------|
| 650 BC-430 BC | centr. | Greek Classical | patriarchal | | | |
| 430 BC-323 BC | trans. | | slavery | | | |
| 323 BC-150 BC | decentr. | Hellenistic | ↓ | | | |
| 150 BC- 27 AD | trans. | | | | military development (Toynbee and Innis) | |
| 27 AD-200 | centr. | Roman Classical | industrial | | | |
| 200 - 365 | trans. | | slavery | | manipularis army | |
| 330 - 550 | decentr. | Great Migration | ↓ | | ↓ | |
| 550 - 725 | trans. | | | | | |
| 725 - 900 | centr. | Carolingian | feudalism | | cavalry | |
| 900 -1075 | trans. | | ↓ | | ↓ | |
| 1075 -1250 | decentr. | Communal Gothic | | | | |
| 1250 -1425 | trans. | (violence, death, war) | ↓ | | ↓ | |
| 1425 -1600 | centr. | Renaissance | capitalism | | artillery | printing |
| 1600 -1775 | trans. | | ↓ | | ↓ | ↓ |
| 1775 -1950 | decentr. | Modern Age | | | | |
| 1950 -2125? | trans. | (violence, death, war) | ↓ | | ↓ | ↓ |
| 2125? -2300? | centr. | Golden Age | communism? | | nuclear? | electronic |
| | | | ↓ | | ↓ | ↓ |

Let me emphasize the fact, that the Greek columns, originated from wood and perpetuated in stone, were still the real structure of the temple. These columns carried the load of entablature, since there was nothing else there to do so. This was valid almost without exception to all the Greek temples. Throughout the Greek architecture there was only one pseudo-peripteral temple, the Olympeium at Agrigentum, with load-carrying walls between the columns (Fig.17).

Here is the basic structural difference between the Greek and the Roman classical architecture. The Roman column-post-lintel

system did not develop from wood to stone structure, it was simply adopted from Greek architecture. Also, the Roman stone column not only did not develop according to the inherent rules of stone, but it is not the load-carrying structure either in Roman buildings. The pseudo-peripteral arrangement is characteristic of the Roman temple architecture, with load-carrying walls between the columns.

These differences have two practical consequences. The first one, that the Roman column and entablature have lost the strong grip of their wooden origin, and started their own development according to the new generating material, the stone, loosening the classical style. As a second consequence, the Roman architecture opened the way for the architecture of walls and arches, naturally still under the dominance of columns and lintels for a long time.

This search for stone-forms is the main theme of architecture from the Roman classical architecture to the fulfillment of the search, the Communal Gothic cathedrals. One of the reasons causing the unevenness of this development, is the influence of political power by the centralizing forces, mentioned in the previous pages. These forces appear and fade out periodically during these sixteen centuries.

As the expression of their worldly power, these concentrators wear Roman insignia and Roman titles, and their buildings are allowed to express the power only in the language of the Roman classical architecture: with column and lintel. This phenomenon occurs twice in European history. The first such post-Roman concentrative wave begins in the eighth century with Charlemagne,

and this starts the Carolingian Renaissance, which slowly merges into the more structural Romanesque. The second centralizing period is the Renaissance, also slowly changing into the more structural Baroque.

THE SLOW TRIUMPH OF STONE: ROMAN
ENGINEERING, EARLY CHRISTIAN AND BYZANTINE ARCHITECTURE

Lacking the urge the express the real structure did not stop the builders in the Roman Empire from developing the most ingenious stone, brick, and concrete structures. More interesting than the development of Hellenistic and Roman classical architecture is the simultaneous growth of new constructional techniques.

The Romans were the first builders in Europe, perhaps the first in the world, fully to appreciate the advantages of the arch, the vault, and the dome. Both arch and barrel-vault were used before in Egypt and Mesopotamia. In Egypt vaults with few exceptions were of sun-dried brick; the oldest stone vaults there known date from about 700 B.C. In Mesopotamia vaults were always of brick, sun-dried or baked. It may be doubted whether either vault or dome would have found any great development in Roman hands had their only material been cut stone, whether dry-jointed or mortared, but in concrete they found an ideal medium. It was cheap, for its best ingredients were abundant in Italy; it was economical, for it swallowed all the mason's waste; it was incomparably strong; and it eluded all the stone-cutter's difficulties.

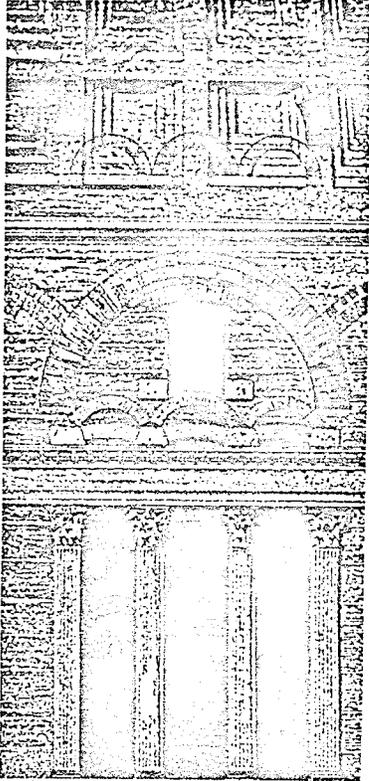
With the concrete, and its several combinations with stone and brick, the Romans greatly advanced the technique of compressive structures; they built walls, arches, barrel and cross vaults with or without brick ribs, constructed domes and semi-domes, used niche and spur buttresses, and knew the principles of pinnacles. Every medieval structural trick was antici-

pated by Roman architects. Their problem is only too well known to us in the nineteenth and twentieth century: the gap between engineering construction and architecture. Whatever fine stone and concrete structure the Roman builders applied, they covered them (they would have probably said: adorned them) by the classical elements of Greek architecture. The only exceptions were, just as they were in the last century, the utilitarian structures of civil engineering.

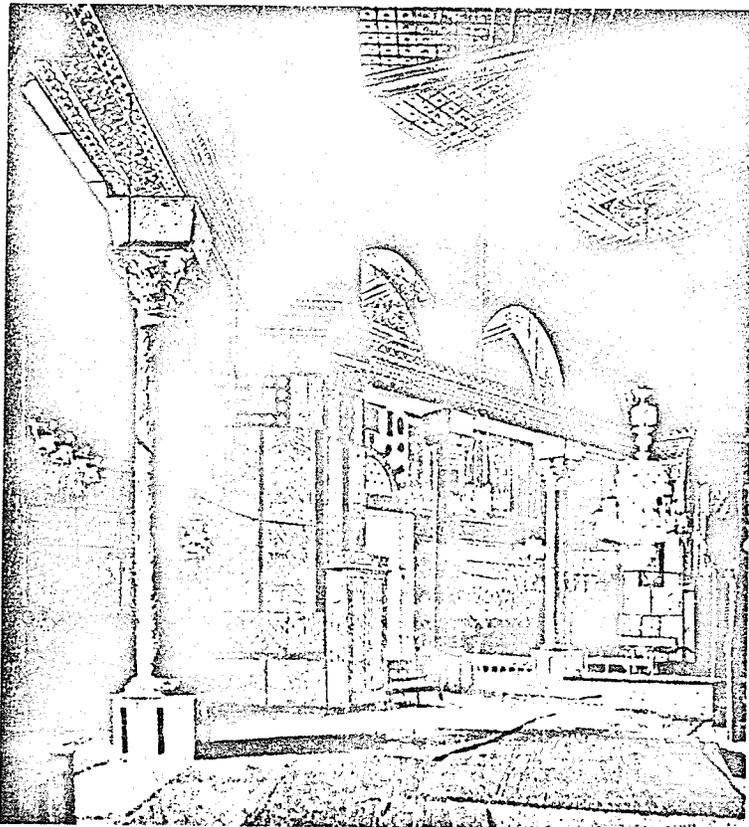
As the arch appears among the structurally expressive elements, the hegemony of Greek architecture is over. The brick arch is carefully hidden in the walls and dome of the Pantheon in Rome (Fig.18), but if the semicircular fillings were removed, the visible structure would be exactly the same as that of the Dome of the Rock (Fig.19). Although columns and arches appear together at the Palace of Diocletian in Spalato (Fig.20), the slow development of stone structure has to go through several "styles" to legalize the relation of column and arch.

First to go is the entablature, leaving the dossier in its place, next the column is slowly losing its stylistic remnants of wooden origin. The capital from a bouquet of flowers becomes a clenched fist of stone, which makes the dossier superfluous and disposes of it, and the shaft accepts its affinity to the stone wall and pier.

This is a technological process. At the same time the style is disintegrating: as the material, the stone, comes to its own, the buildings have less and less stylistic marks. As long as the structure shows the remnants of wooden origin, the



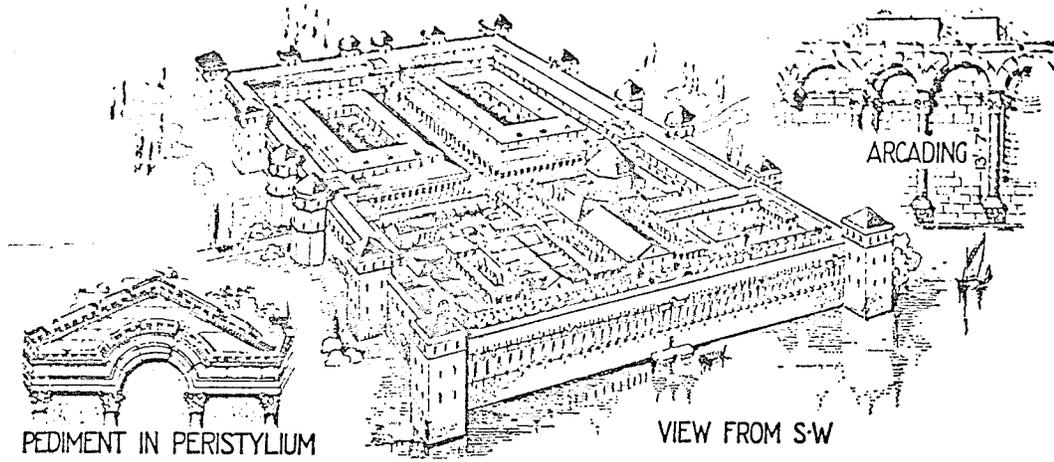
18. Brick arches in walls and dome.
Pantheon, Rome



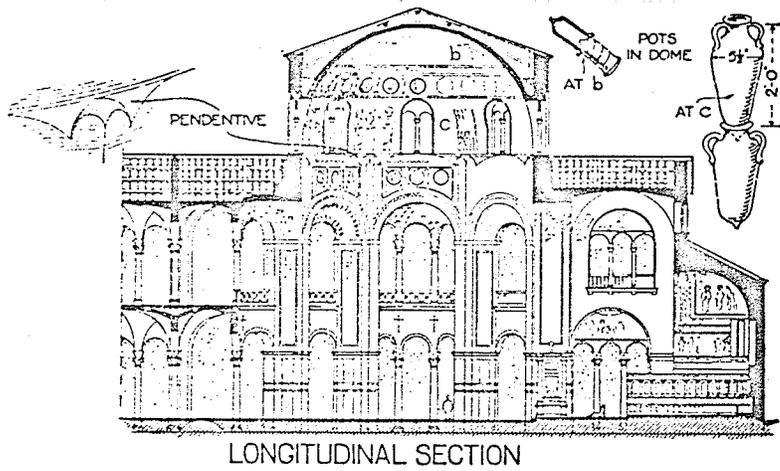
19. Dome of the Rock, Jerusalem

Greek and Roman classical elements, they set the style. When these disappear, the buildings become characterless and timeless. The Byzantine churches could have been built anywhere and any time (apart from the effects of the regular development of dome construction and the also regular disintegration of classical styles). Is it not characteristic enough that we have the most churches of uncertain dates from the Early Christian and Byzantine periods?

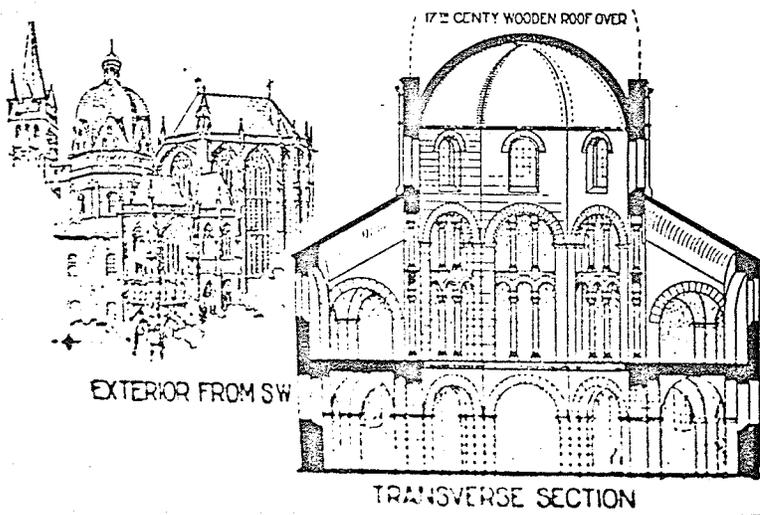
Since no coherent style emerges during these periods, it seems to be natural that there are no traces of the development within styles from structural expression to relative negation of structure. From this point we have to consider this period as a prelude to the Romanesque and Gothic periods. The predominant structural elements of the period are domes, so the ruling archetype seems to be the cave.



20. Palace of Diocletian, Spalato



LONGITUDINAL SECTION



TRANSVERSE SECTION

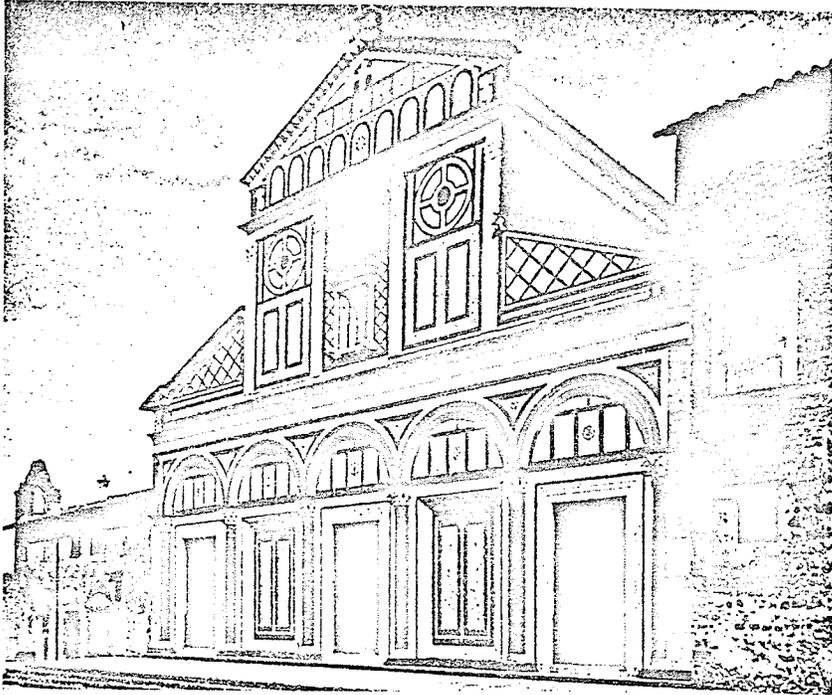
21. S.Vitale, Ravenna and Cathedral, Aix-la-Chapelle

ROMANESQUE ARCHITECTURE

If the name of this period is its true description, then the buildings of the Romanesque architecture should show Roman influence either in spirit, constructive principle or in details. Still there have been many arguments about the limiting dates and land borders of this style. In the definition of the Romanesque style we shall use the principles of structural expression, introduced in the previous chapters. The Roman architecture itself carried Janus' faces of structural techniques and their stylistic expression. So does the Romanesque. These buildings on one hand follow the structural principles of Roman stone buildings, having walls, buttresses, arches, vaults, domes and semi-domes, and on the other hand their stylistic expression wears at least parts and elements of the Roman classical orders: mostly columns, shafts and capitals.

According to this definition the Romanesque consists of three groups of buildings: the Carolingian architecture of the ninth century in Germany and in the Netherlands, the Southern French architecture of the eleventh-twelfth century, and the Tuscan and Lombard Proto-Renaissance in the eleventh-twelfth century.

The period begins with sheer imitation of the classical forms, not recognizing even their original, much belied role in the wood structure, and definitely awkwardly applied to stone. It happens at the Carolingian Cathedral of Aix-la-Chapelle (Fig.21). Despite the technical knowledge applied at the construction of the dome and arch, these columns represent an indescribably huge



22. S. Miniato al Monte, Florence



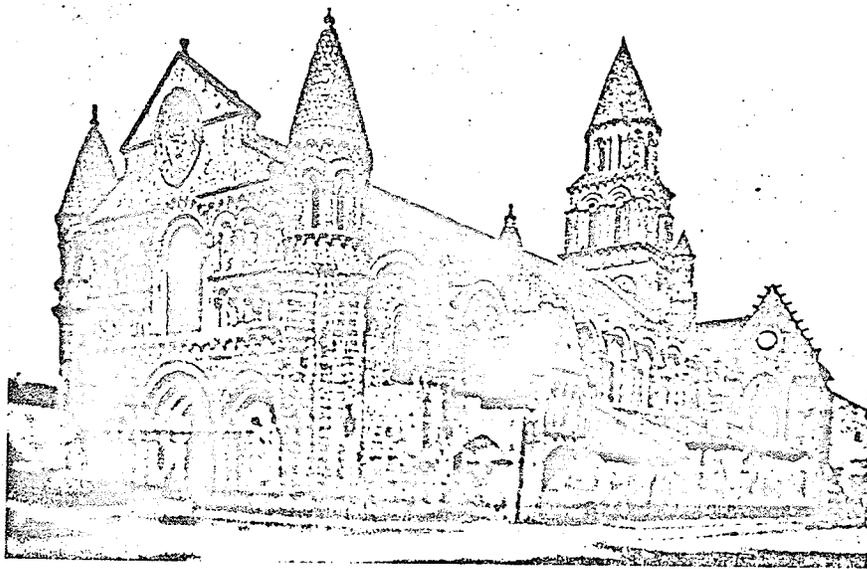
25. S. Gimignano

blunder of structure. "The...cathedral of Aix-la-Chapelle, which was built by Charlemagne as a mausoleum, much resembles S. Vitale, and in all probability was derived from it..."(Fletcher, 1961:280) Both the structural skill and the clarity of expression on this sixth century church is amazingly superior to those of the Cathedral, which was built three hundred years later.

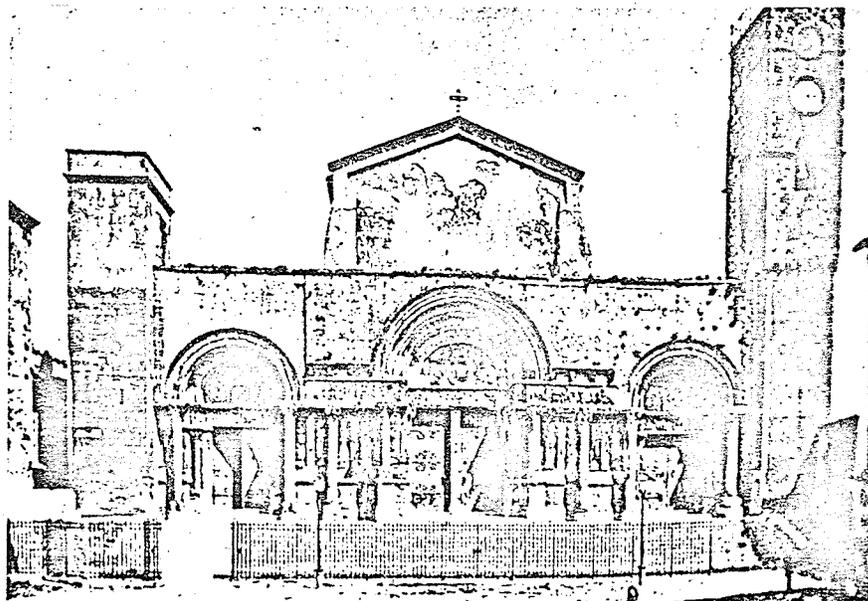
Buildings of the other two groups are monumental churches from the eleventh and twelfth centuries. The expression of structural clarity does not especially belong to the virtues of these churches. Instead of it, the Italian ones can boast of perfectly copied late Roman details (among others Corinthian capitals and antefixes), and with another feature, which will grow to full capacity only four hundred years later. The elevation of the S. Miniato in Florence features a completely self-supporting structure of columns, arches and pilasters, and it has simply nothing to do with the real structure of the church (Fig.22).

The chief characteristics of the French Romanesque churches are Roman triumphal arches, or structures reminding us of them (Figs.23,24). The ideologically sound unification of secular and sacred triumph changes the facades into monuments of resurrection. These appendices seem to fulfill the same role as their antique counterparts: they are parts of an ideological propaganda system, their structure coming from strange structural systems. The real structure of the churches develops its own way, visible only in the inside, approaching higher and higher levels of constructive skill.

The structural archetype of the period is something new: a dolmen-like structure composed of columns and arch. Its traces



23. Notre Dame la Grande, Poitiers



24. S.Gilles, near Arles

have already appeared on Diocletian's Palace, and later on the Hagia Sophia; in those past periods it constituted a step in the structural development from wood forms to real stone structures. Its forms tell us of stone. Indeed, the column-lintel archetype was of wooden origin, and the column-arch composition can be best described as the archetype of the stone dolmen. It does not express the real structure of the Romanesque churches, but it expresses a structure, which was real in late Roman and Early Christian times.

STONE IN THE SKY: GOTHIC ARCHITECTURE

In the Gothic period columns were still used both for supporting and expression, but the classical single column disappeared. The either joined other columns or piers and serve only as their articulation, or disappeared into the heavy wall leaving only the capital visible for support and expression.

The last step to achieve the full capacity of stone structure was brought about by the invention of painted glass. With this invention the windows became wider and taller, rendering the massive Romanesque walls impossible. For structural support buttresses and flying buttresses were invented, and the same time the pointed arch of openings became general for roofing structures; it solved the ancient problems of intersecting vaulting. No traces of wooden origin were left other than the very idea of capital.

Without giving much importance to the "biological" process of this technological development, let us proceed to the expressive problems of stone structures: we are not studying the development of structural and construction methods, but the stylistic expression of these.

So far we realized, that in most styles the content of a building was not its own structure, but an obsolete structure generated by a foreign material. The Early Christian and Byzantine architecture did not seem to fit this category, and the Gothic is the first period completely outside of it.

We do not know the reaction of population at the time

of the erection of the pyramids, but we have available sources for information about later technological or stylistic changes. It is very demonstrative to compare the mood of acceptance of the Gothic and that of the Renaissance style. The name Gothic means "barbaric", and the art of this period has been branded barbaric, unproportional, and rude many times since then. On the other hand, the Renaissance was accepted at an incredible speed; again we all know the fast success, the rapid steps with which this style became "in", that is, stylish in every field of art and life. Even better we know the grip of it on everything, up till the first decades of this century.

The peculiar phenomenon of the Gothic is simple; the thinking material is the same as the building material: stone (there is no structural difference between brick and stone, the differences are their production technology, price and size, which are irrelevant here). Consequently the artistic content of the Gothic church is the stone church itself. The very important point is, that its content is not obsolete, but a then-modern technology. This can well be the reason why it was not accepted (or very reluctantly accepted) in its time as a "style."

Gothic architecture simply eliminated style by using an up-to-date technology for its esthetical base. The notion of Gothic style can be originated from two sources: the first, that Gothic architecture rapidly developed its own ornaments from obsolete technologies, and the second, that Gothic is an obsolete technology now, so it is logical and proper for us to call it a style.

Both signs of the "development within styles" are so apparent and well-known at the Gothic, that simply mentioning them is

sufficient enough, without any elaboration. The gradual change of ornaments from structural to non-structural (among others "perpendicular") character has just been mentioned. The other road of development is so characteristically Gothic, that tall structures with liana-like supporting elements even in everyday terminology are called Gothic. This development seems to be even more true, if we consider that the larger part of this "development within styles" has been performed on pre-Gothic structures.

The vertical tendency is not necessarily an expression of the search for God. If not in other areas of human achievement, but in religious ideas and theology even the common men of those ages were definitely superior to us. They knew that God was everywhere, and they did not have to search for Him in the skies. If vertical tendency is the expression of religious search, Manhattan Island would be the ultimate expression of modern man's search for God.

Paradoxically as it sounds, verticality is not inseparable from height. Height can have many reasons, which would go beyond our topic: civil war and need of security created the towers of S.Gimignano (Fig.25); the Gothic cathedrals are mostly communal status symbols; land prices and other urban circumstances along with status-seeking contributed to our Modern skylines. Vertical tendencies, on the other hand, are natural parts of the stylistic development, as we have seen it in Egypt, at the Greek classical orders, and in the Renaissance and Baroque periods.

In the Gothic architecture the world of stone comes to its full maturity, both in structural clarity and its stylistic expression. The Gothic seems to finish the long line of periods

with structural experimentation and expression of the generating material. It started very vaguely during Hellenism, and appeared stronger in Early Christian and Byzantine architecture; the completion of it is the Gothic cathedral.

The Cathedral rose out of the fertile ground of the Commune, was an offspring of it, covered itself with statues, stained glass and light and brought forth a new architecture in which stone seems to float in the air, a structural system of the greatest constructive logic and elegance, in which pressures are balanced and transmitted on slender columns and the outward thrust of vaults is carried through graceful flying buttresses to solid vertical ones,...till all of it has been spread out into the generous bosom of the earth. With the perfect understanding and in sympathy with the material's inherent characteristics the Gothic structural system simply and truthfully proclaims its function. How different that is from the coming Renaissance architecture, but how exactly it describes the architecture of our own day, the Modern.

There is a fundamental similarity between the Gothic architecture--the architecture of a decentralized era--and the Modern architecture of today--the architecture of another decentralized era--while there is a fundamental antagonism between these two architectural expressions and the Renaissance--the architecture of a concentrative era.

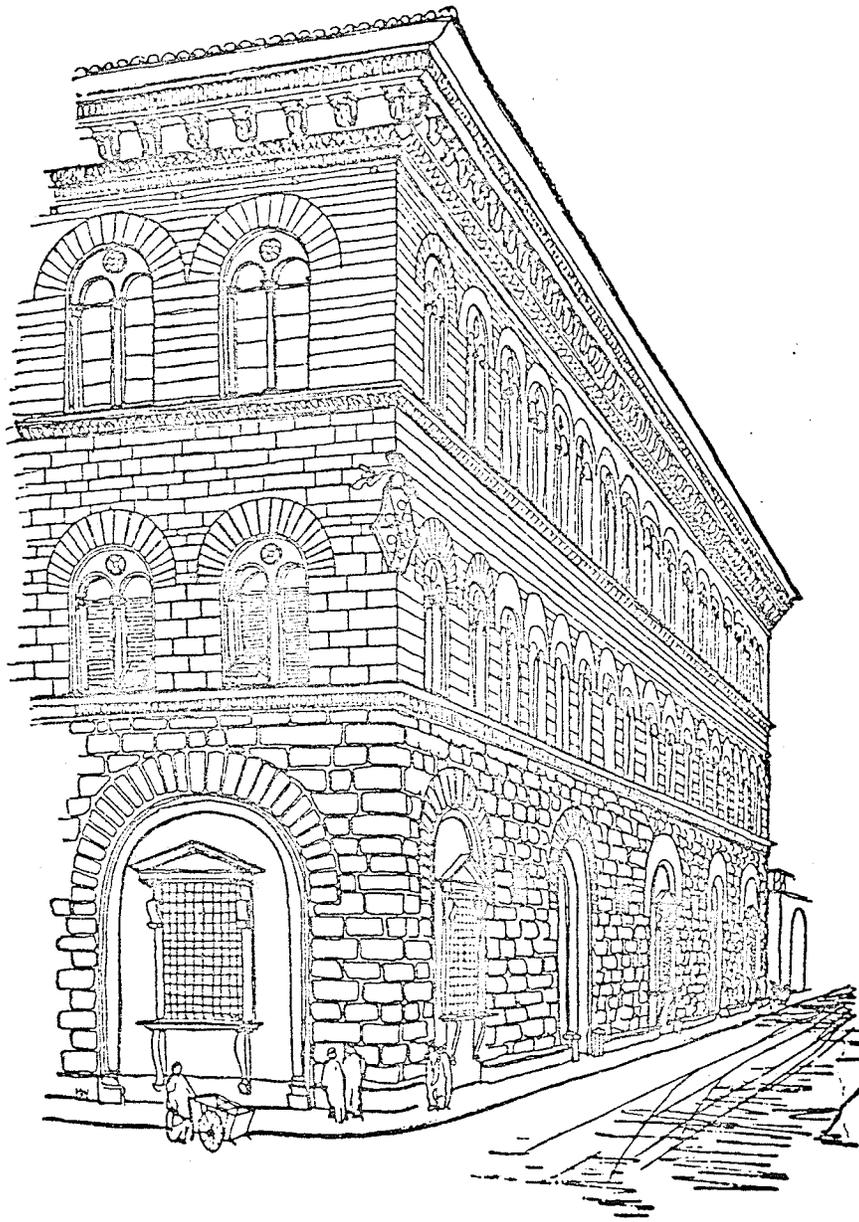
It may be stated that the architecture that is created during decentralized eras is similar in character, and that the architecture that is created during concentrative eras also is similar in character--but the two types are based on fundamentally different creative approaches. (Troedsson, 1964:68)

The archetypes of Gothic architecture, the cave and the hut, also create links with the previous and following structural periods; the cave is also the archetype of the Byzantine style, and the hut is the archetype of our, Modern architecture.

SECONDHAND BEAUTY: RENAISSANCE ARCHITECTURE

The worshipped "style of styles", the Renaissance originated from a double obsolescence. The post-beam-column system was an obsolete technology even at the time of the classical Greek-Roman temples, and even if it were not, the petrified world of wood structure was definitely out of time after a thousand years of technological development of stone and brick structures.

In the first classical period the style was set by a technology (obsolescence notwithstanding), but at the rebirth period the style is set by another style, well or badly digested. The mistakes in the imitation of Greek and Roman details are disappointing only in the context that these mistakes were structurally possible. For the first time in the history of European art, the style is severed not only from its generating material, but from structural reality in general. It is hardly necessary to do more than to list some of the phenomena characterizing this severance. The theoretical arguments about the applicability of column or pillar with arcade, or the search for the most beautiful dressing of the same old palaces in Florence and Rome are just the beginning. Domes, arches, and columns painted on flat ceilings, pillars widening upward (popping out of a bearing wall!) are coming, and before the orgy is at its full strength, people suddenly remember the beginning of Renaissance, then Gothic, then Late Renaissance again, and at the middle of the nineteenth century structure is a dirty word, and real structure, obsolete or up-to-date, almost ceases to have anything to do with architectural expression.



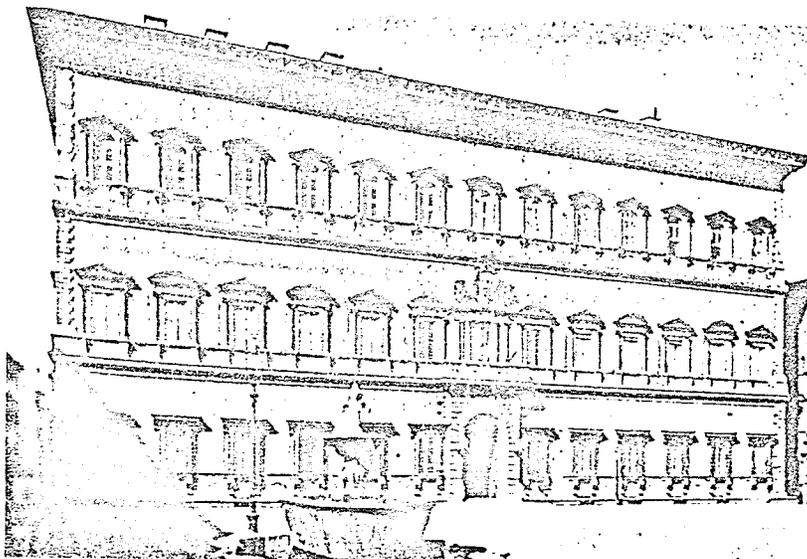
26. Medici Palace, Florence

In the non-structural cavalcade of the Renaissance certain periods deserve special attention from the point of view of our topic.

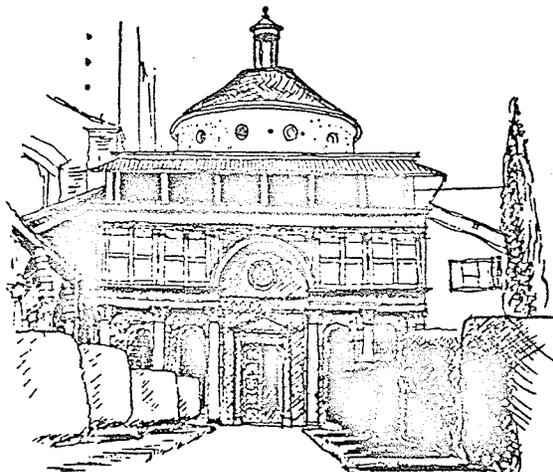
In earlier years of my architectural studies, I was constantly amazed by grouping certain palaces of Florence into the Renaissance. It was admitted half-heartedly that the Pitti Palace is partly Gothic; mostly because of unbeatable dates. But the Strozzi and Medici Palaces were proudly placed in the Renaissance, though they were Gothic in character. It was the same problem with the dome of S. Maria del Fiore.

Let us apply the principles of the introductory chapters to these buildings. Gothic buildings exceed in the bold expression of their real structure; the Renaissance in the decorative application of a classical structure which could substitute the expression of real play of forces. Occasionally a Renaissance building expresses its real structure too; but it can do it only in the classical language of wood.

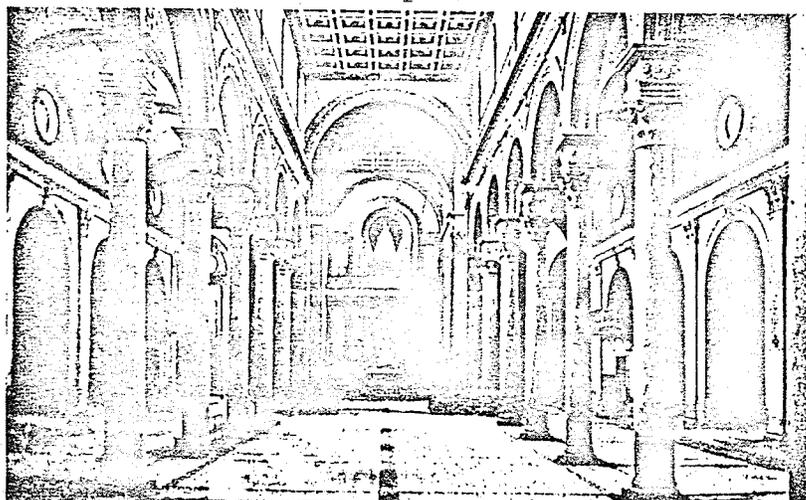
If we have a good look at that debated period between two styles, we cannot deny that the "Early Renaissance" palaces of Florence, as well as the celebrated dome by Brunelleschi are Gothic structures. As a rule, these palaces do not have classical details (neither has the dome). The archetype of these palaces is not the dolmen, but the wall. Their elevations express the real structure, the wall, with all sophisticated stylistic expressive force of the Gothic. The much-praised articulation of stone on the Medici Palace seems to be the last clear step in this direction; smooth wall on the third floor, fine channels on the second, and very rough treatment of stone blocks and channels



27. Farnese Palace, Rome



28. Pazzi Chapel, Florence



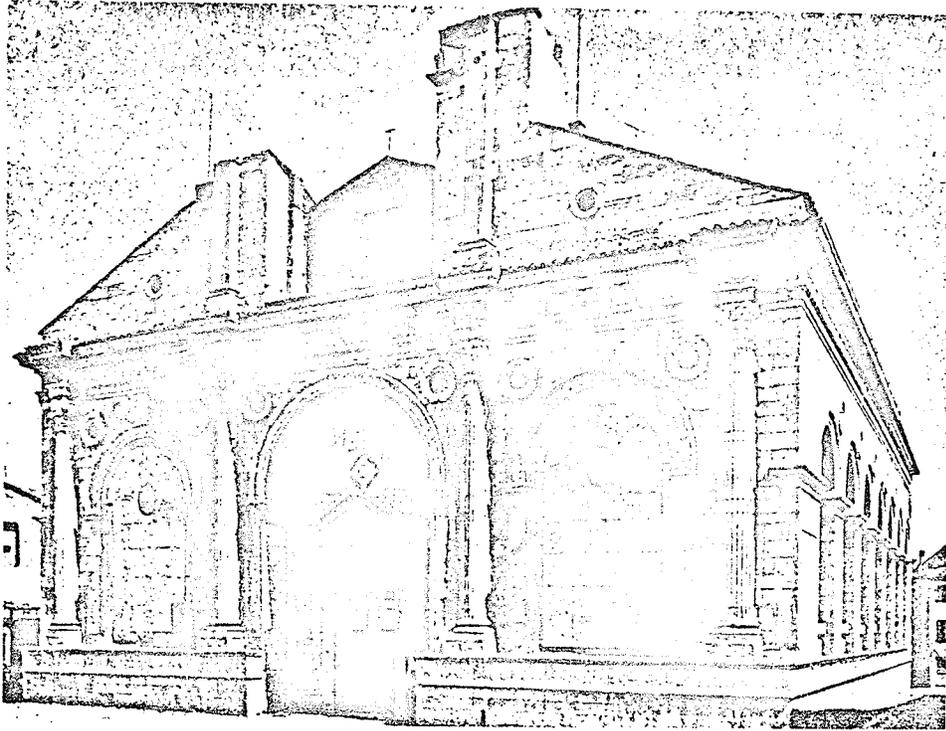
29. S. Lorenzo, Florence

on the first floor (Fig.26).

Another building, still showing clear archetypes according to its real structure, is the Farnese Palace in Rome (even after Michelangelo's engagement on its construction). It is a reasonably good mixture of two archetypes: the wall on the whole of the elevation, and the dolmen at the openings (Fig.27).

The buildings of Brunelleschi and Alberti stand on the borderline of the style. Brunelleschi, though he applies classical elements, and even full orders, does not fail to express the real structure of either one of his buildings. The Pazzi Chapel has the structural clarity of a Gothic building; witness to it the construction of arch and pilaster above the main entrance. Here Brunelleschi reinforces the wall by pilasters, but the arch is the real structure, and it must be shown even if it destroys the classical image (Fig.28). Similar observations can be made at the Foundling Hospital and the Church of S.Lorenzo. These examples show the Renaissance Brunelleschi slowly emerging from the Gothic. The stages in his development are the same as they were at Early Christian and Byzantine times, only in the opposite direction; for instance, he applies the long-forgotten dossierets in the nave of his S.Lorenzo and S.Spirito (Fig.29).

Alberti's ideas go through three recognizable stages within twenty years. The process begins with the exterior of S.Francesco at Rimini, in 1450. Around the medieval church he built a shell-like structure, screening the old walls with his Roman arches. The building is still unfinished, but no continuation of the existing part could give us the impression of a



30. S.Francesco, Rimini, Facade



31. S.Francesco, Rimini, South Side

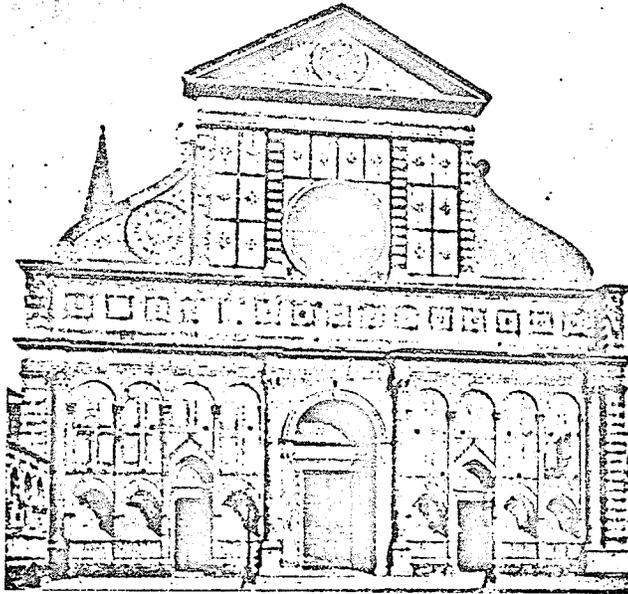
real structure, not even a "real Renaissance facade" (my term for a facade, in which the projected classical structure could stand by itself, were the supporting walls taken away). In fact, if the classical elements were left to uphold this building, it would collapse within seconds. The structure, which at least partly would not collapse, is the neutral, styleless south elevation (Figs.30,31,32).

Alberti's task at the S.Maria Novella in Florence was similar to that at the S.Francesco, with the little difference that certain parts of an earlier church elevation could not be hid by later building activities. But the solution belongs to an entirely different class of stylistic thinking. The old church is there, and the new elevation has very little to do with its structure, but the facade is self-supporting. The fake elevation, the tall, slender columns, incredibly high entablature, the volutes supporting the pillars on the upper story--this is a complete structure, and it would stand by itself without the filling wall between the classical elements. Alberti uses the two-colored stone layers and surfaces in markedly different ways on the columns-pilasters and on the wall. The colored stripes mark the "structural" elements, and the "non-structural" elements have the same neutralizing (immaterializing) treatment as the third floor of the Ducal Palace in Venice. The elevation of the S.Maria Novella is one of the major achievements of architecture: along with the elevation of the Rucellai Palace, it catches for us the Renaissance architectural thought in statu nascendi (Fig.33).

Before we proceed to the third stage of this development on Alberti's elevations, we ought to clear the question of the



32. Medal of S.Francesco



33. S.Maria Novella, Florence

relation of interior and exterior of a building. Do these have any relation to each other? In those ages, when the expression of real structure prevails, any deviation between interior and exterior seems to be impossible: these are only different sides of the same structure. But in ages, when only our needs of feeling security direct the expression of any structure, the answer is not so simple. Celebrated buildings attempt to hide their many stories; the windows are hidden and disguised, and the whole elevation, with its three or four stories, wears the decorative mask of a Roman triumphal arch or Greek temple. This system seems to be the last word in Renaissance elevations, so it is impossible to dismiss it as an incident in architecture. In the interior, security means security for the floor we see, with the tacit understanding of the same measure of security for each of the other floors, too. Also from the exterior this weblike structure of individual securities would be far more convincing than a united picture of the whole building, as one archetypal message of a cave or dolmen. This is the reason why the Odeschalchi Palace or Palazzo del Te never made a school. Michelangelo, on the other hand, did create a school by placing one-story high columns beside the multi-story pilasters on the Capitol in Rome. This, not quite neglected, but never enough emphasized feature can prove the healthy psychological application of stylistic elements in the Renaissance. The most celebrated buildings of the period in Rome share this feature (S.Peter's, S.Carlo alla Quattro Fontane, S.Giovanni in Laterano).

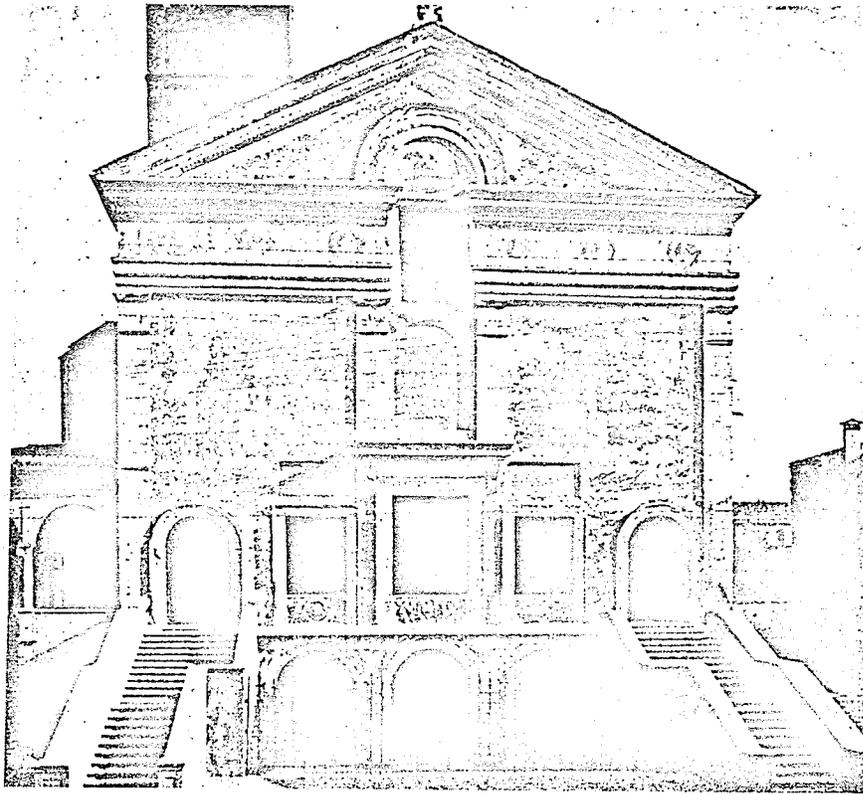
Returning to Alberti, the third phase of his church facades is represented by the S.Sebastiano and the S.Andrea in Mantua. In this stage the elevation is very close to expressing the real play

of forces, and the projected structure is also self-supporting. At this point Alberti has arrived to accept the wall and its reinforcements as stylistic expressive elements, which is a unique achievement from a Renaissance architect (Figs.34,35).

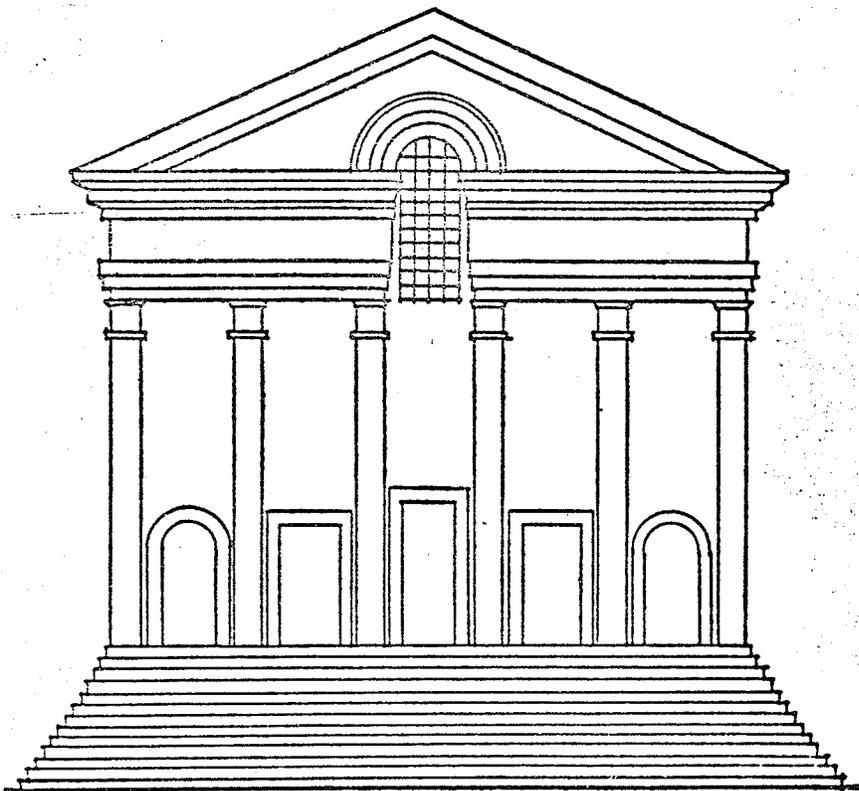
The repudiation of the column in S. Sebastiano and S. Andrea must...have been preceded by a change in Alberti's theory. He must have found that he had to decide between the authority of classical architecture and the contemporary demands of a logical wall architecture. As a result the compromise of linking together wall and column--the compromise of many a Renaissance architect--was rejected and a uniform wall system evolved. (Wittkower, 1953:41)

The S. Andrea in Mantua marks the victory of the structural thinking in Alberti's theory. On this building he has reached the unity of interior and exterior with a clarity unparalleled in non-structural periods.

We usually show a fair amount of understanding toward application of classical elements and substitution of the real play of forces with another, untrue, but also self-supporting structural system. But in later stages of the stylistic development there are signs of absolute lack of structural thinking; all three of them appear at the height of the Renaissance. The first one has already been mentioned, it is the use of pilasters running through more stories. Alberti's decorative idea at the Rucellai Palace "...sowed the seed of false design. It led to the use for mere ornament of features that had a meaning purely constructional; to the abuse of using columns without any reason for them, making them necessary parts of any design..." (Jackson, 1921:44) The pilasters, which expressed and reinforced the individual securities of the stories on the Rucellai Palace, were distorted into "giant orders" in the Late Renaissance. These



34. S. Sebastiano, Mantua
Present State of the Facade



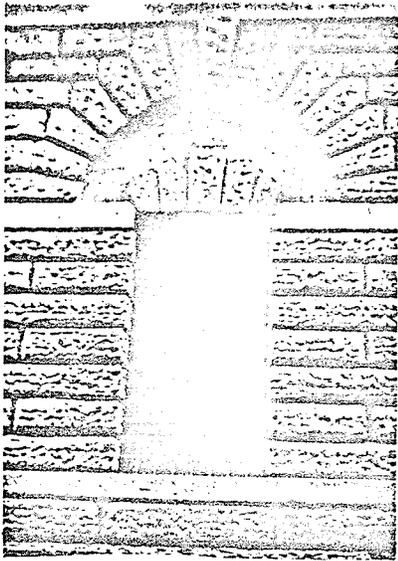
35. S. Sebastiano, Mantua
Reconstruction of Alberti's Project of 1460

giant orders neglected both the role of the wall between pilasters and the reinforcing role of these, and also the psychological necessity which can justify an untrue, projected structure only if it is related to the real structure.

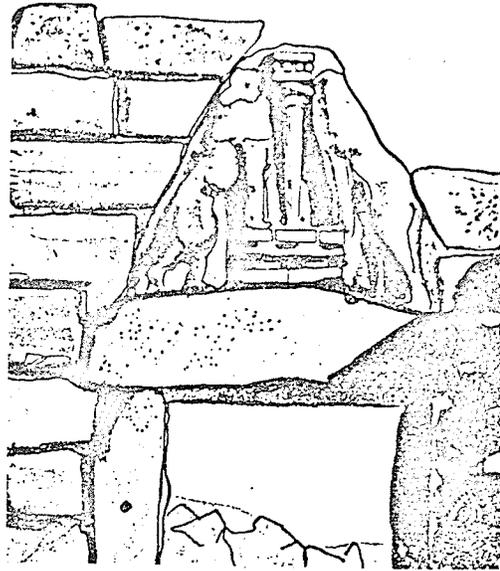
We cannot reject strongly enough the second such method either. This is inherited from late Roman triumphal arches, where columns, standing in front of a building, would have nothing to carry were the entablature not purposely broken out from the wall to cover them. This method of decoration does not express anything; it is not even a structure, and has nothing to do with the building placed behind it.

The third mark of this architectural mannerism is the confusion of different archetypes; the decoration of column as though it were a wall. At the Thiene Palace by Palladio the rustication of the wall is carried through the columns of the window cases in the form of square blocks. These devices definitely show that the development within the style goes toward more and more structure-denying and structure-neglecting stages. Frankl (1968:114) states that it was an exception--almost a great mistake--if on a building of the first phase of the Renaissance (1420-1550) the network of joints in the rustication was continued over the supports.

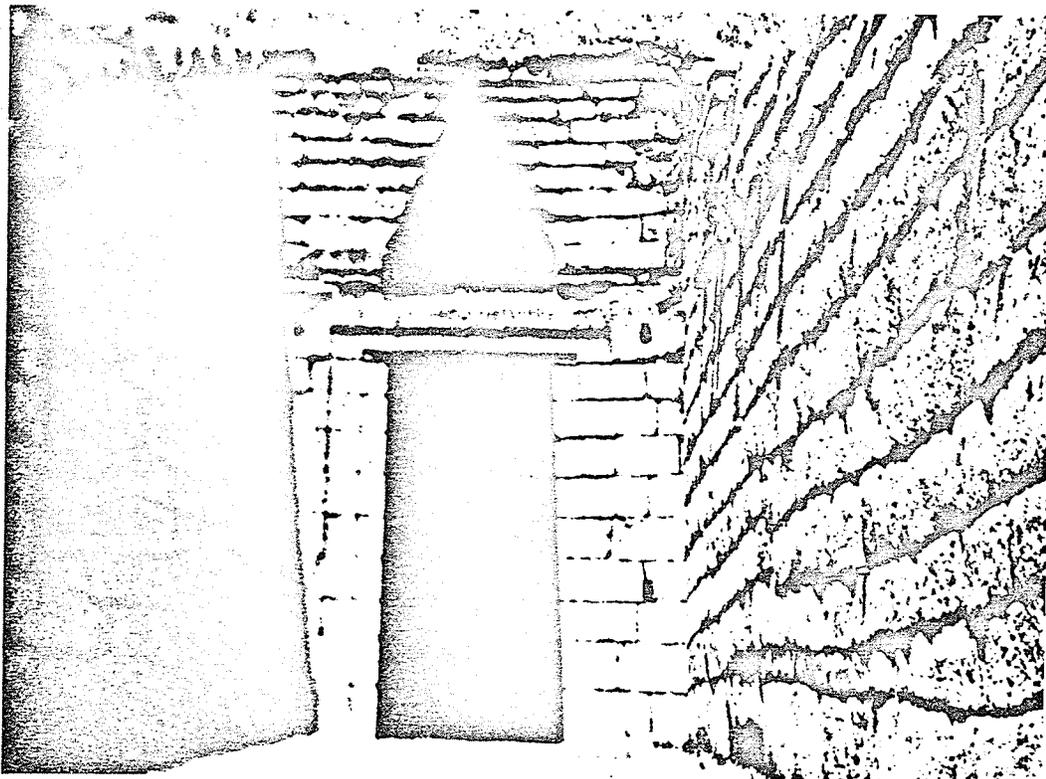
The Thiene Palace shows another structural misunderstanding; that of the dolmen archetype, above the first floor windows (Fig.36). The real structure is very likely an unsophisticated straight vault. The structure shown is a wedge built from vertically articulated stone, held together by the travertine layer of the wall. Ingenious, all right, but it is neither the real structure, nor does it give the feeling of security for the viewer. How much more pow-



36. Thiene Palace, Vicenza.
Detail of Ground Floor



38. The Gate of the Lions,
Mycenae



37. The Entrance to the Treasury of Atreus, Mycenae

erful was the expression of the real vault effect at the Gate of the Lions and the entrance to the Treasury in Mycenae (Figs.37,38). It was not less sophisticated than the decoration of the Thiene Palace.

Despite of the mannerism and lack of structural expression in the stylistic marks, it is still obvious that the ruling archetype of the Renaissance period is the dolmen, and that the stylistic elements, like those of other styles, were created by an obsolete technology, the Roman application of Greek wooden temple structure.

YESTERDAY AND TODAY: MODERN ARCHITECTURE

The end of the last concentrative era is similar to the end of the Roman classical period: the new treatment of structures and materials, and indeed the new structures themselves appear in the world of engineering construction. The history of the transitory period is again that of withering of the old elements, and slow victory of the new materials and their bold expression.

We are still too close to this period to have filtered conclusions about it, but even so, the last hundred years seem to be one of the decentralizing eras, preceded by a short transitional period. Applying the starting principles and the analogy with other ages, we soon realize that the basic phenomenon of the period is the switch to a new building material: steel (in reinforced concrete or in steel structures). The thinking materials are still wood and brick, but around the turn of the century there are gradually appearing signs of integration of thinking and building material in the works of well-known architects and engineers. On the other hand, architects of the second and third line keep on building "in style", that is, building in reinforced concrete and steel, and thinking in wood, stone, and brick. The technological architecture of our age has very similar difficulties to those of the Gothic architecture in becoming accepted by the society.

The ruling archetype of our period is the hut, mostly because this seems to be the natural structural arrangement for the reinforced concrete. Throughout the history of architecture the great

structures of collective character determined the archetype of a period, and in our age these buildings are definitely of the character of a hut. The Centennial Hall in Breslau, the Notre-Dame-du-Haut at Ronchamp, the MIT Auditorium and TWA Terminal, Palazetto dello Sport along with the Sport Arenas of Tokyo and the Yale Hockey Ring, the Sydney Opera House are all built according to this archetype. The whole activity of Buckminster Fuller goes even beyond that; he spreads the hut archetype into every other area of architecture.

These hut structures are not built in any "style"; these are the technological applications of the characteristics of reinforced concrete. "Style" is created by the architects of the Safeway department store, applying this structural form to decorate another structure, the traditional wall or frame structure.

Wall and frame are still ruling the mass production of the building industry and the rank and file of architectural profession. The leading pieces by Mies, Johnson, and SOM were created by treating steel according to the characteristics of wood; "Industrial" and "Levittown" styles were created by covering frame structure with wall-like veneers. (An alarming idea: the Romans covered their wall-structures with a projected frame of columns and pediments, we cover the frame with a projected stone or brick wall--the truth is never good enough.)

However, we cannot consider hut-architecture the only progressive or good architecture of our age. The secondary archetype of modern structural architecture is based on the wall and dolmen, with the frank expression of these structures (buildings of the Smithsons, Stirling and Gowan, Paul Rudolph). This movement

seems to be the one setting the "style" of the next concentrative era, called Golden Age in a previous chapter.

There is one non-structural archetype, characteristic so much of the "stylish" Modern architecture, that it does not seem to belong to the other archetypes. This is a floating body (Fig.9). It does not have a structural origin of common experience, on the contrary, its generating archetype never existed, and as far as our technology can predict, it will not exist for a long time. The well-spread application of cantilever structures, the enormous progress of glass industry and environmental engineering made it possible for the Modern architect to pursue his ideal of a well-shaped, clearly outlined geometric body (or surface) floating in the air, as the archetype of his architecture. The examples of this archetype could run as many as the 60-70 per cent of Modern architecture. Leading and pioneer structures are by Le Corbusier, Gropius, Breuer, and Frank Lloyd Wright.

We still lack the historical perspective for the evaluation of the role of the floating body as an architectural archetype. It may turn out not to be an original archetype, but the end product of the structure-denying development of our Modern period. In its negation of the structure its powerful allies are Supermannerism and Pop Architecture.

CHAPTER THREE. THE ARTISTIC SUBJECT

The artistic subject is a part of material reality, a basis for artistic creation, the underlying theme or topic integrated into a work of art. When we are searching for this underlying theme, architecture suddenly becomes simple and unified, perhaps a little too simple.

It is nonsense to say that the subject of architecture is the function of a building, or it is the social reality. These factors have very important roles in the creative process and determination of purpose, but as subject they do not suffice. These are not parts of the material reality, and are not recognizable on a building, as the subject is easily recognizable in a piece of painting, sculpture, or literature. The one idea worth arguing is the one expressed by Zevi (1964:241-244). According to him, the facade and walls of a house, church or palace, no matter how beautiful they may be, are only the container; the content is the internal space. In many cases, container and contained are mutually interdependent, as in a French Gothic cathedral or in the majority of genuinely modern buildings, but this cannot be taken as a rule, because it is not true of a vast number of buildings. His definition of architecture takes interior space into account. Zevi says that beautiful architecture would then be architecture in which the interior space attracts us, elevates us, and dominates us spiritually (as in the case of Chartres Cathedral); ugly architecture would be that in which the interior space disgusts and repels us.

Considering the importance of space, we have to make it clear, that in the architect's mind it is not the space that produces the structure; it is the structure that defines the space. Only with huge individual and collective experience is the architect able to create space and structure at the same time; but even then the structural factors are decisive. When the tribesman starts to build a hut of branches, does he think in a hut-shape space? No, he sticks the branches in the earth in a circle, and ties them together at the top. He might even be surprised when he realizes the pleasant interior space he created. The case is the same with the eskimo and his igloo. And why do our rooms have mostly vertical walls and horizontal ceilings? It is because of the structural method and material we apply.

It is significant that in both places where Zevi talked about interdependent and attractive spaces, he mentioned French Cathedrals; as we saw in the historical chapters, these are the buildings where the structure is most frankly expressed, thus creating the most expressive space embracing the structure.

To clarify the relation of structure and structural archetypes, and the relation of medium, content, subject and object of a work of art, I wish to introduce here Morris Weitz's sharp distinction of the latter terms. His ultimate aim is to clarify and eventually to do away with the form-content distinction. Every work of art, his hypothesis states, is an organic complex, presented in a sensuous medium, which complex is composed of elements, their expressive characteristics and the relations among them. This is a real definition of art; an enumeration of

the basic properties of art. In representational works of art we must single out one element and give it a name: the "subject." The subject is that element in a work of art that represent a specific person, thing, or event which exists outside of the work, and which is what we say the work is about. That which the work of art is about, is the object of the work.

[An] example will make clear our terminology. Consider... Cezanne's "Mont Sainte-Victoire. The subject is the lines and colors that constitute certain volumes within the art object which stand for, denote, represent, mean the actual mountain. Semantically, the subject is an iconic sign of its object, for it is like that which it means. It is to the mountain what a photograph is to the person it represents. The object in this case is real, but it need not be. The object may be imaginary, as it probably is in Rousseau's "The Sleeping Gypsy." In cases of this sort, the object is an idea in the artist's or spectator's mind, which is being represented by the subject. (Weitz, 1964:347)

After the analysis of different architectural periods, I suggest that the subject of architecture is structure. It has to be expressed for feeling of security, and has to comply with one or more archetypal structural images of the collective unconscious. In certain architectural periods the subject is the expression of the real structure (through certain stages of sublimation or sophistication), and in certain other periods the subject is an untrue, but self-supporting structure, which is able to arouse the feeling of security in the viewer. The object is in both cases one or more structural archetypes.

We come now to the content of a work of art. Weitz says that in order to come to grips with the essentially organic character of art, we ought to interpret the content of a work of art as all that is in it: all the elements, expressive characteristics, and the relations among them. In Cezanne's "Mont Sainte-Victoire",

the content can be said to be all the lines, colors, masses, volumes, drawing, design, space--in other words, the plastic--plus the subject and the expressive characteristics.

If the content of a work of art is conceived as all of its expressive elements organically related to each other, what, then, is the form? Form, I submit, ought to be construed as exactly the same thing: the organic unification of the several expressive constituents of the work of art... Form and content are to be regarded not as coordinates in art but as constituting the same coordination of elements, characteristics and relations. Thus, there is no distinction on this usage between form and content in art. There are elements and there are relations. But there are no elements, relations, or even grouping of them that can be singled out and designated as the content or the form except in an arbitrary and vitiating way. (Weitz, 1964:348)

At the pyramids we said the content of the stone pyramid was the sand pyramid, and at the Greek temples the content of the stone temple was the wood temple. It is also clear that the form of the Greek temples is also the wood temple, and the form of the Egyptian pyramids is the sand pyramid. Form and content seem to be the same in other architectural periods, too.

CHAPTER FOUR. SUMMARY

To close the paper, I wish to re-state the problems, as they seem to us now, after the definitions and historical review, and clarify the points we reached in the attempt to their solutions.

The first problem was the relation of technology and style, along with the pair of questions, why and how styles develop. According to the findings, architectural styles have technological origin, as forms are influenced by the nature of the material and techniques of construction. But technical factors themselves cannot create a style; style is born by the obsolescence of the technical factors.

Since a style is torn apart from its structural origin, and the expression of structure is carrying its own negation by its intangible content, development within styles leads from expression of structure to its fading, and many times to its straight denial. Architectural styles are created either by obsolete materials (Egypt, Greece and Rome), or by imitation of obsolete structures (Romanesque and Renaissance). In all cases the society of laymen is reluctant to accept the frank expression of up-to-date technologies, and much prefers elements of the past or future to these, as the obsolete or futuristic technologies carry more expressive value for the historizing human mind.

The second problem was the necessity of expressing the structural truth. Here we found that for psychological reasons it is necessary to express some structure on a build-

ing. The more self-supporting a projected untrue structure is, and the more it is close the expression of the real structure supporting the building, the more superior it is. In certain periods, when the selected expressive archetypes and the building methods are antagonistic, the question of expressing the real structure is completely neglected.

The political, social, cultural and architectural history of the Western World shows a periodic character. Centralizing and decentralizing ages alternate, and with this, architecture, structural experimentation, mass migration and urban phenomena rhythmically change. The archetype of architecture in concentrative periods is the dolmen, reaching back to the early wood structures. The archetypes of decentralizing eras change and develop throughout our history, according to the generating material of each of these eras.

The subject of architecture is structure, either expressing the real structure of a building, or some projected untrue structure (which is necessarily self-supporting for the mentioned psychological reasons). The object, which is represented by the structure, is an architectural archetype. The structural archetypes are originated from common human experience, and selected, filtered, and passed along by the collective unconscious.

Table 2 contains the architectural styles, their materials, archetypes and objects, mentioned in the paper.

Table 2. The Architectural Periods and their Archetypes

| period (style) | generating | | building material | subject of architecture |
|--------------------------------------|----------------------|--------------|-------------------|-------------------------|
| | archetype(object) | material | | |
| Ancient Kingdom, Egypt | grave | earth | stone | real structure |
| Greek Classical | dolmen (post-lintel) | wood | stone | real structure |
| Hellenism | grave, cave, dolmen | wood | stone | projected structure |
| Roman Classical | dolmen (post-lintel) | wood | stone | projected structure |
| Roman, Early Christian and Byzantine | cave | stone | stone | real structure |
| Carolingian and Romanesque | dolmen (post-arch) | wood (stone) | stone | projected structure |
| Gothic | cave, hut | stone | stone | real structure |
| Renaissance | dolmen | wood | stone | projected structure |
| Modern | hut, floating body | concrete | concrete | real structure |
| Golden Age | dolmen? | wood? | steel or concrete | projected structure? |

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