

Sometimes we may be close to despair when trying to cope with the visual world through words: the harder we try the more we seem to get lost between shifting and elusive drifts of irrelevancy, inappropriateness or vacuity. Indeed an artist may feel that there is no place at all for verbal formulations in architecture and the visual arts; yet he will not be able to create without guidance from certain principles which he once acquired or formulated and which are in themselves not visual but conceptual. They may be as simple as a determination not to be influenced by any intellectual considerations during the process of creation, or they may be quite numerous and varied, and their validity may extend beyond the individual to an entire group where they appear linked to more general habits of thought and procedure.

How action, thought and language interact has long been a field of philosophical inquiry, and we have been taught to recognize language as a mirror that has to be kept as clear as possible if it is to reflect truly the facts and states of experience. The following brief essay is an attempt to increase clarity in a very limited area by considering three closely related yet distinct concepts which are of particular relevance to discussions of architecture: structure, construction and tectonics.

In colloquial usage the distinction between structure and construction is blurred and the word tectonics is rare. We may refer to a building at times as a structure and at times as a construction without really intending to denote in one case something different from the other. But such looseness seems inadmissible in critical usage, once we begin to think about the very real distinction that exists between the concepts linked to the words, and about the considerable increase in usefulness that accrues to the words if we insist on using them with precision.

In order to accentuate the difference between "structure" and "construction" all that is needed is a simple experiment of substitution: if we substitute "construction of society" or "construction of thought" in a statement where previously we had "structure of society" or "structure of thought" we recognize a drastic difference. While we find ourselves inclined to think of "construction" as the result of an activity which is "to construct," we don't seem to think as easily of "structure" as the result of a conscious activity which is "to structure." The real difference between these two words is that "construction" carries a connotation of something put together consciously while "structure" refers to an ordered

arrangement of constituent parts in a much wider sense.

With regard to architecture the exact relationship between structure and construction now appears clear. Structure as the more general and abstract concept refers to a system or principle of arrangement destined to cope with forces at work in a building, such as post-and-lintel, arch, vault, dome and folded plate. Construction on the other hand refers to the concrete realization of a principle or system—a realization which may be carried out in a number of materials and ways. For example, the structural system which we call post-and-lintel may occur in wood, stone and metal and its elements may be fastened together by a number of methods.

The visible and tangible form which results from the process of construction can be discussed and judged in various ways. As far as construction is concerned there are all the questions of selecting and handling materials, of process and technique. As far as structure is concerned it is possible to assess the appropriateness and efficiency of the system that was chosen.

To achieve a desired end in building we may rely on the accumulated strength and mass of assembled materials. This will be a constructional effort. But with a structural change, i.e. a change of arrangement which distributes its materials in another manner, the same end may be achieved in a more elegant fashion. A form may emerge that is a more direct result of, or reply to, the forces at work. In actual practice structural change and constructional effort are, or at least should be, inseparable and in continuous interaction. However, a fine structural system may sometimes find realization in a rather poor construction while something well constructed may be very inefficient from the structural point of view.

When a structural concept has found its implementation through construction, the visual result will affect us through certain expressive qualities which clearly have something to do with the play of forces and corresponding arrangement of parts in the building, yet cannot be described in terms of construction and structure alone. For these qualities, which are expressive of a relation of form to force, the term tectonic should be reserved.

The word *tectonics* derives from the same Greek root which we find in *architecture* and *technology*: we are reminded of the basic human activity of giving visible shape to something new. Today the term may be used in a variety of contexts, as in biology and geology, but originally it was restricted with reference to the craft of the carpenter and

the builder, who indeed in ancient Greek was called *tekton*.

When, in the early nineteenth century, neoclassicism brought an increased concern for a better understanding of Greek architecture, tectonics was one of the concepts that was discussed at length and consequently given greater depth and precision of meaning. A meaning, incidentally, which had been well understood in earlier architectural theory even though it was then linked to a different terminology. In French seventeenth- and eighteenth-century writing, authors would speak of the need to give a building visual qualities capable of convincing a viewer about its solidity, and in this sense *vraisemblance* (plausibility) became an important criterion. "*Ce n'est point assez de rendre un édifice solide,*

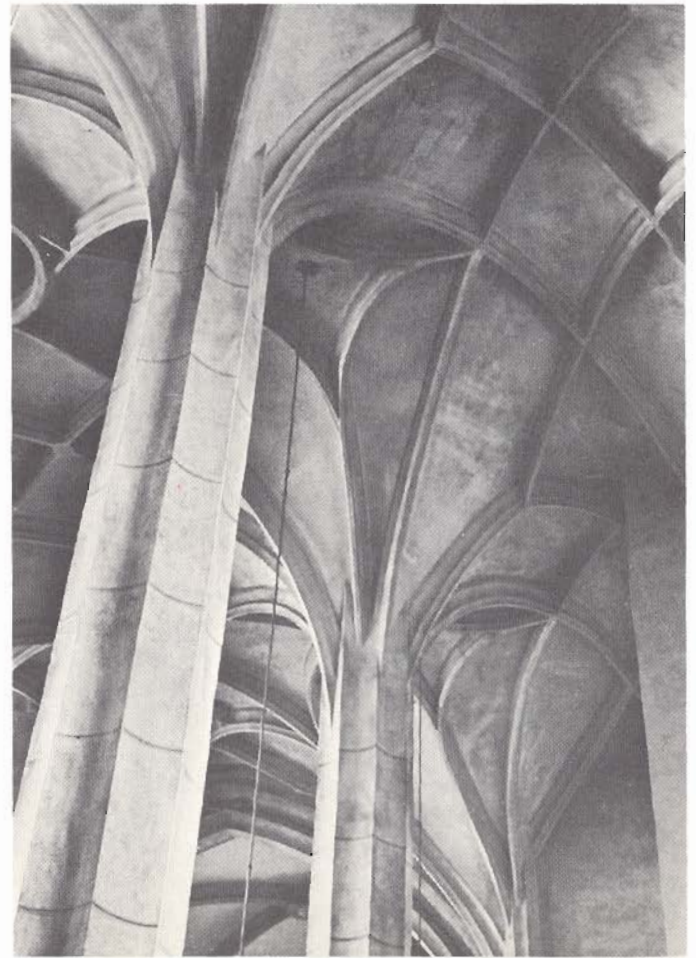
Fig. 1. Detail of the Greek Doric Order, Parthenon, Athens. (Photo Dolf Schnebli)



il faut que le jugement l'estime tel" (It is not enough to make a building solid, judgment must estimate it as such), as one critic put it.¹⁾

Around the middle of the nineteenth century two German architects and theorists of stature published books which had the word "tectonic" in their titles: both Karl Boetticher²⁾ and Gottfried Semper³⁾ treated as a key problem the relation of final and expressive architectural forms to prototypes born from technological, constructional necessity. However, the fruitful discussion which had its start here was to remain incomplete until the ancient belief in a direct relation between man and the forms of architecture (Vitruvius, Book IV, Chapter 1) was splendidly corroborated by

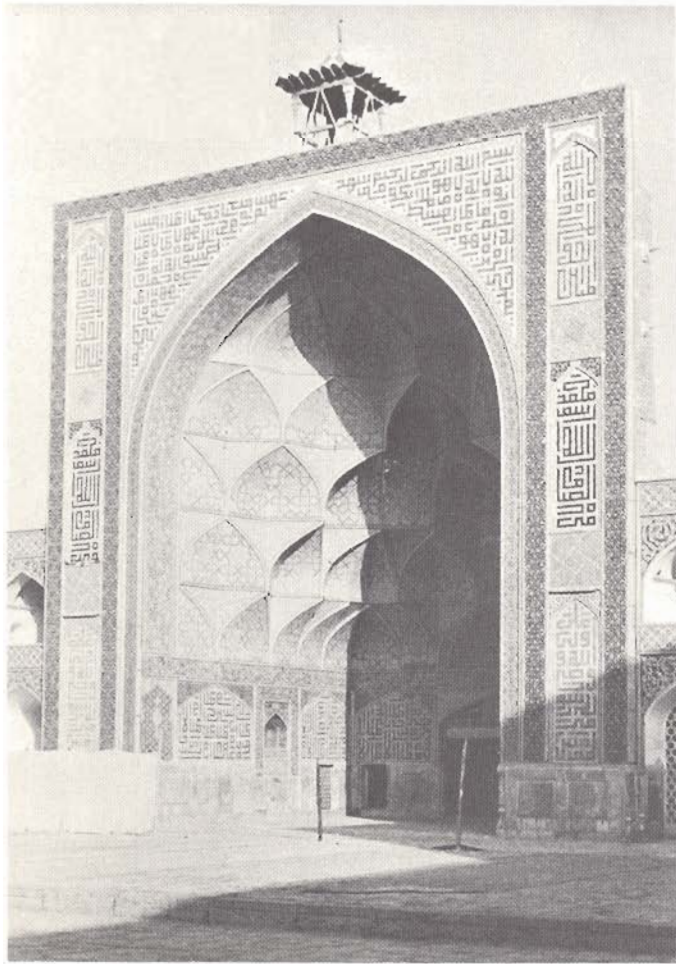
Fig. 2. Late Gothic Ribbed Vault, Parish Church, Ybbsitz, Austria. (Photo Dr. Walter Wagner.)



psychological investigations and the concept of *Einfuehlung* (empathy) was formulated and elaborated by a number of scholars, among them Theodor Lipps.⁴⁾

Empathy is one operating concept in Heinrich Wölfflin's brilliant early analyses of architecture and works of art to which all later writings on the topic owe such a gigantic debt. In his dissertation of 1886, significantly entitled *Prolegomena zu einer Psychologie der Architektur* (Prolegomena toward a Psychology of Architecture),⁵⁾ he recognized tectonics as the particular manifestation of empathy in the field of architecture. He asked himself: "*Wie koennen tektonische Formen Ausdruck sein?*" (How can tectonic forms be expressive?); he found the following explanation: "*Das Bild*

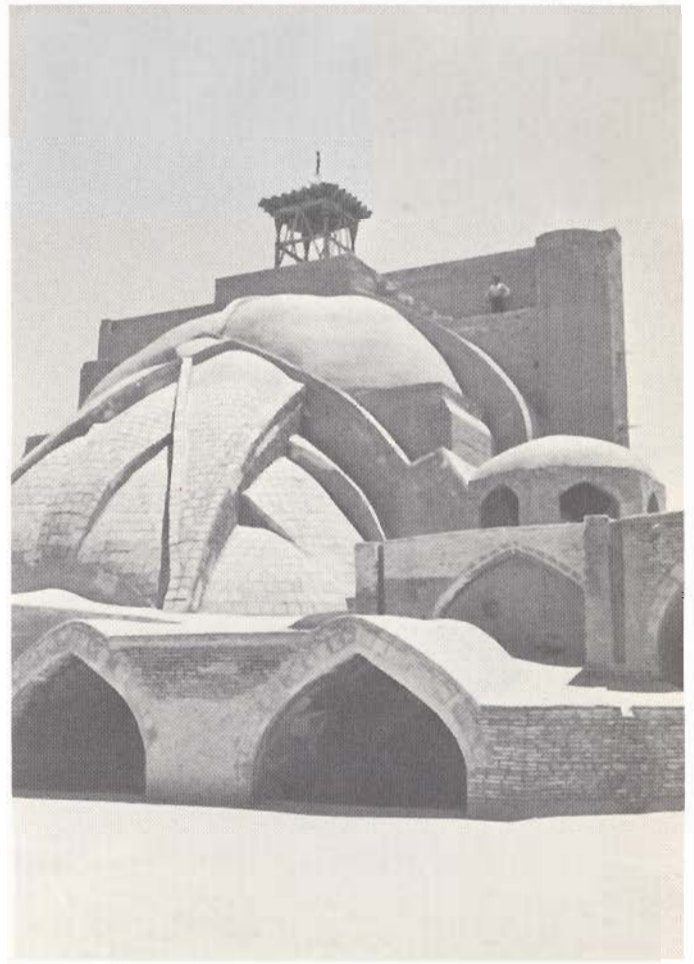
Fig. 3. Masjid-i-Jami, Isfahan, Western Liwan, seen from the courtyard. (Photo Friedrich Pfeil)



unserer selbst schieben wir allen Erscheinungen unter." (We supposit our own image under all appearances.) Fourteen years later Geoffrey Scott expressed the same thought in words familiar to most English-speaking architects: "We have transcribed ourselves into terms of architecture."⁶⁾ In exploding what he called the "mechanical fallacy" in architectural criticism he made an extremely clear and convincing distinction between construction and tectonics, but failed to distinguish with equal clarity between construction and structure.

While Scott has the merit of having transmitted the ideas of Wölfflin and Lipps together with his own lucid observations to a wide circle of English-speaking readers, we owe a more recent debt for a similar service to Sir Herbert

Fig. 4. Masjid-i-Jami, Isfahan, Western Liwan, seen from the rear. (Photo Dolf Schnebli)



Read. He drew attention to the writings of two other scholars who are extremely relevant in our context, Wilhelm Worringer and Conrad Fiedler.

Worringer, in his dissertation of 1906,⁷⁾ opposed the concept of empathy to that of abstraction and, illustrating his argument, arrived at well characterized descriptions of tectonic expression in architecture but also at some generalizations which have been criticized.⁸⁾ Fiedler, whose writings date from around 1875, became most important for the understanding of twentieth-century art through having introduced the concept of "pure visibility."⁹⁾ His thinking enables us now to recognize tectonic expression as one result of that universal artistic activity which Paul Klee called

"making visible"¹⁰⁾ and which for Fiedler was but one manifestation of a more general mental activity which he described as "taking possession spiritually."¹¹⁾

Through tectonics the architect may make visible, in a strong statement, that intensified kind of experience of reality which is the artist's domain—in our case the experience of forces related to forms in a building. Thus structure, the intangible concept, is realized through construction and given visual expression through tectonics.

Discussions of visual phenomena should not remain abstract. Three well known examples may serve to illustrate the argument.

Fig. 5. Mies van der Rohe, corner detail from 860 Lake Shore Drive, Chicago. (Photo Ben Weese)

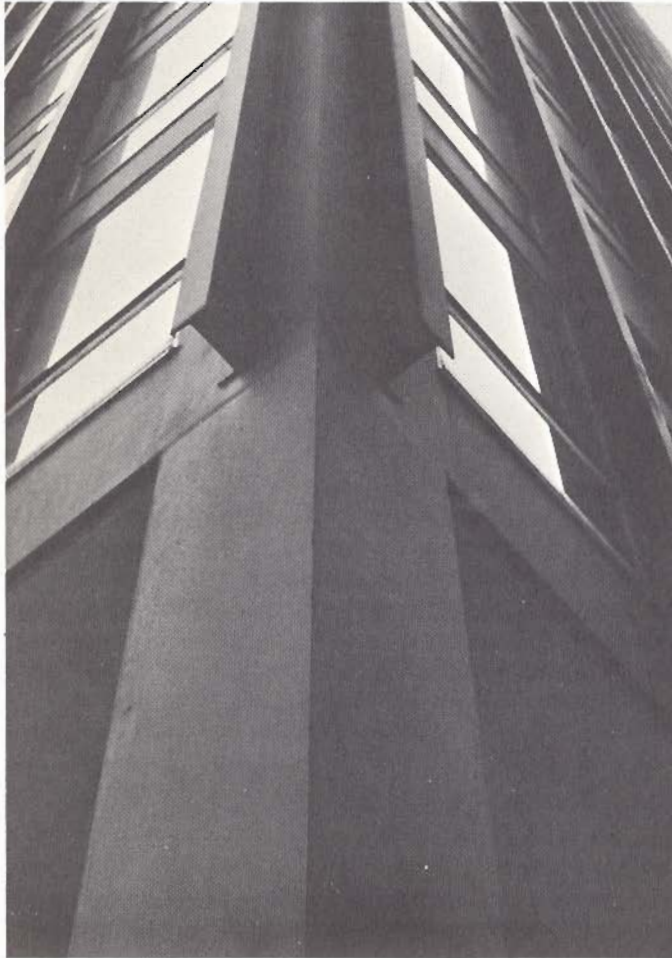
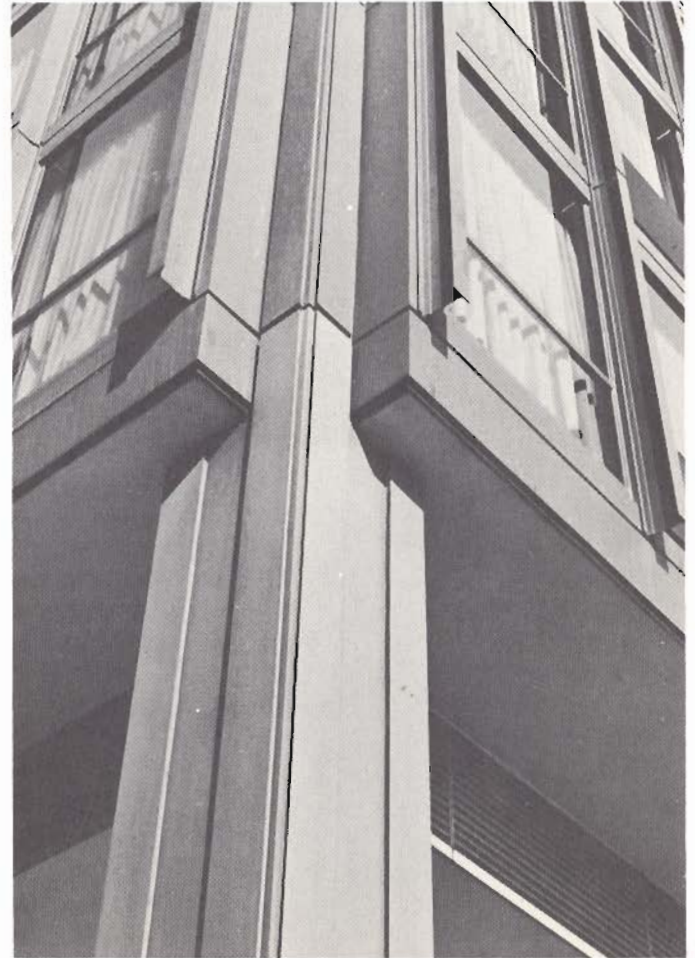
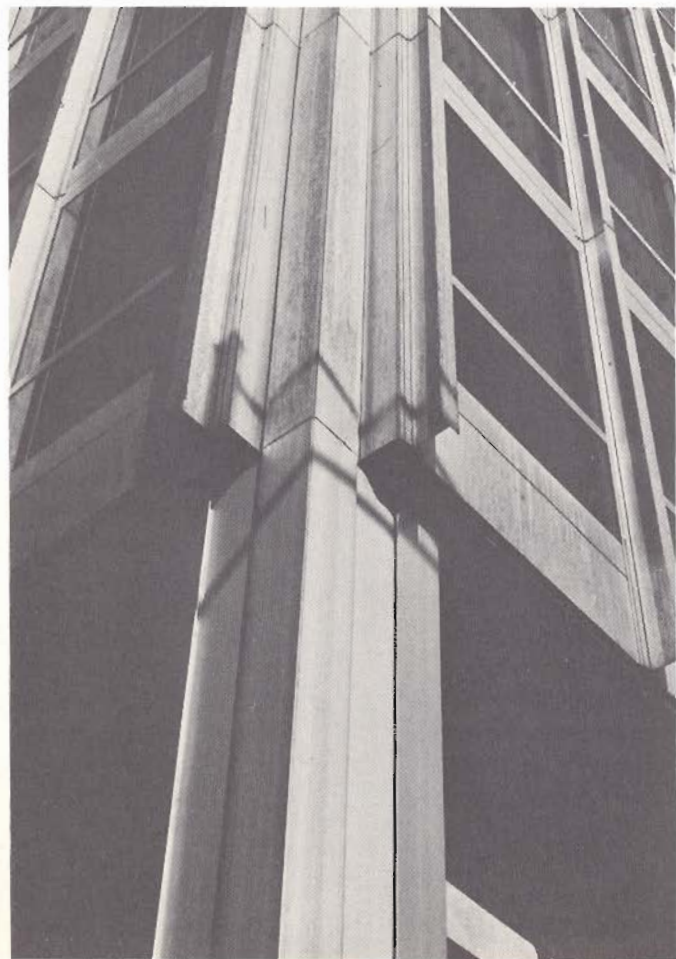


Fig. 6. Mies van der Rohe, corner detail from 2801 Commonwealth, Chicago. (Photo Ben Weese)



The Greek Doric temple never ceases to move us as an architectural experience (Fig. 1). Yet every beginning student of architecture knows today that its structural system of post-and-lintel, taken over from earlier timber prototypes, is ill suited to execution in stone—a material that does not lend itself to use in bending. Moreover as far as construction is concerned, few procedures can be more laborious and inefficient than to join together, carefully and without mortar, stones that had to be cut with extreme precision and, in many cases, had to be given their final complicated shape *in situ*. Yet who would apply criticism today in these terms when confronted with the reality of Paestum or the Parthenon? Obviously what matters, apart from other factors

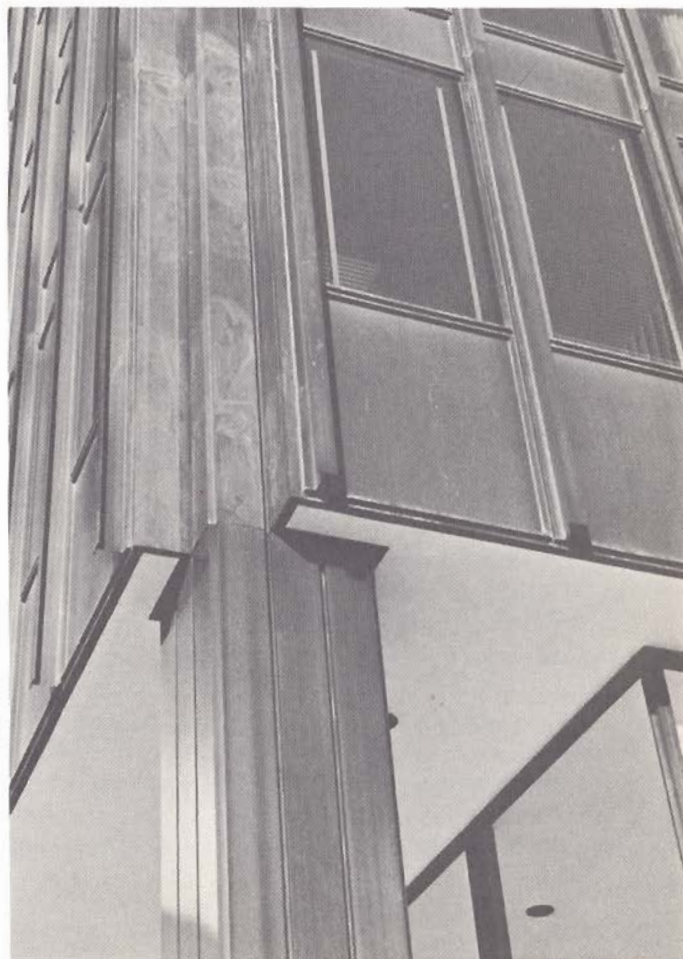
Fig. 7. Mies van der Rohe, corner detail from 2400 Lake View Drive, Chicago. (Photo Ben Weese)



which are outside the scope of the present essay, is the tectonic statement: the noble gesture which makes visible a play of forces, of load and support in column and entablature, calling forth our own empathetic participation in the experience.

Similarly, we have learned that in the experience of a Gothic church it is the tectonic statement which shares with space and light the task of conveying an anagogical meaning.¹²⁾ In order to direct the beholder's mind spiritually upward, a play of forces is enacted most dramatically and appeals directly through empathy, even though what goes on behind the scenes of ribbing and shafting may be different from what we are led to believe (Fig. 2). In

Fig. 8. Mies van der Rohe, corner detail from 1 Charles Center, Baltimore. (Photo E. F. Sekler)



retrospect it is not difficult to see how a great deal of effort expended in the fairly recent polemical discussion of Viollet-le-Duc's argument about "medieval rationalism"¹³ in Gothic architecture might have been saved, had a conceptual framework prevailed in which structure, construction and tectonics were clearly distinguished.

Perhaps the most convincing visual demonstration of the difference between structure, construction and tectonics that could be wished is provided by the ensemble of a great Persian mosque such as the Masjid-i-Jami in Isfahan. Standing inside the courtyard and facing one of the liwans—a high vaulted niche with a door in the center—the structural principle is immediately apparent (Fig. 3): arch and vault are exploited in a fashion as magnificent as in the Gothic cathedral, but the tectonic expression is entirely different. The tectonics here depend not only on the great arch-form but equally on the geometry of the ceramic surfaces which frame the arch and on the vaulting which seems to hang from the soffit of the arch, rather than to support it. What comes as a real shock, however, is a revelation of the rear of the same liwan (Fig. 4), when suddenly the world of construction—the agglomeration of brick arches and buttresses—becomes apparent which seems to have little in common with the architectural expression in front.

Our discussion could be extended to many more examples and we would find an amazing richness in the way in which our three concepts may enter new combinations. The actual construction may militate against the structural principle, as in those examples from early civilizations where forms were translated from pliable materials into stone. The tectonic expression may be deliberately unclear, leaving a beholder marvelling at vast expanses of matter hovering apparently without effort over a void, as in so many Byzantine churches. There may be a tectonic negation created with the aid of atectonic forms which tend to disturb the viewer, as in Mannerist architecture; and there may even be a tectonic overstatement of what once was a simple constructional device, as in the elaborate bracketing that is a chief feature of Japanese monumental architecture.

But finally there are those rare cases when a building is an almost perfect realization of a structural principle in terms of a most appropriate and efficient construction while, at the same time, a clearly related unequivocal tectonic expression is found. At one end of the scale such buildings may occur in anonymous architecture, as in the corrugated, beehive-shaped mud huts of the Mousgoum tribe from Lake Tchad, so often illustrated in recent years.¹⁴ At the other

end of the scale there are such magnificent realizations as some of Torroja's buildings and Nervi's exhibition hall at Torino which illustrates what he himself called a "synthesis of static-aesthetic sensitivity, technical knowledge and mastery of execution."¹⁵ In this description mastery of execution obviously stands for "construction" in our terminology, while technical knowledge may be related to "structure," and static-aesthetic sensitivity to empathy and thus to "tectonics." Torroja's and Nervi's work is also excellently suited to remind us of the simple truth that powerful tectonic expression need not be tied to a system which recalls the interplay of verticality and horizontality that goes with post-and-lintel.

Erich Mendelsohn must have recognized this at an early stage of his career when he wrote "*Die Beziehungen zwischen Tragen und Lasten—diese scheinbar fuer immer feststehenden Gesetze—werden auch ihr Bild undeuten muessen . . .*" (The relations between support and load—these laws apparently fixed forever—will also have to re-evaluate their image . . .).¹⁶

Great architects have always handled the elements of tectonic expression with extreme care and untiring imagination, whether they were aware of it or not. When Frank Lloyd Wright explained the form of his Unitarian Church, Madison, Wisconsin, by placing his hands together as in prayer, illustrating "the expression of reverence and aspiration . . ." he was not demonstrating structure but tectonics.¹⁷ Similarly, what so often is referred to erroneously as a concern with excellent construction in the *oeuvre* of Mies van der Rohe, turns out to be, on closer inspection, tectonic expressiveness refined to an extreme degree. A comparison of the ways in which he has handled corner-piers in a sequence of buildings will bear out the truth of this assertion, for we find variations which have but little structural or constructional justification but which are most telling tectonically (Figs. 5-8). A comparable study of Le Corbusier's concrete supports in a series of buildings also discloses a revealing variety of profiles which cannot be explained by structural or constructional reasons alone but which as far as tectonic expression goes is a "pure creation of his spirit" meant to provoke "plastic emotions."¹⁸

Among our three related concepts tectonics is the one most autonomously architectural; which is to say the architect may not be able to control the conditions of structure and construction as completely as he would like to, but he is the undisputed master of tectonic expression. Here his performance assuredly can be discussed on his own terms, and

his artistic personality and character will manifest themselves most clearly.

Accordingly, in architectural criticism tectonics would seem to deserve as much consideration as some of the other elements which have been singled out for special discussion, chief among them space. It will be important however to remember that whatever is singled out, is isolated by a deliberate act of the critic for purposes of analysis; to speak of architecture in terms of tectonics alone would be as one-sided as to speak of it in terms of space alone. Just as the

findings of psychology have moved from isolating such comparatively simple single explanations as "empathy" toward and beyond the complexities of interpreting "Gestalt" as a whole, architectural criticism also has to move in the direction of interpreting architectural experience as a totality. Both in creating and judging architecture those attempts will be most successful which are nourished from and return to a fullness of being that is no longer wholly subject to conscious control or completely amenable to intellectual analysis.

1. La Font de Saint Yenne and Ch.-E. Briseux, *Examen d'un Essai sur l'Architecture*, Paris (1754) p. 47, quoted in Emil Kaufmann, "Die Architekturtheorie d. französischen Klassik etc.," *Repertorium fuer Kunstwissenschaft*, XLIV (1924) p. 212.
2. Karl Boetticher, *Die Tektonik der Hellenen*, Potsdam (1852).
3. Gottfried Semper, *Der Stil in den technischen und tektonischen Kuensten*, Brunswick (1861), Munich (1863); 2nd edition Munich (1879).
4. According to Vernon Lee (*Beauty and Ugliness etc.*, London (1912) p. 20) the translation of "Einfuehlung" as empathy is due to Edward Titchener who used it in his *Psychology of Thought Processes*, London (1909) six years after the first volume of Theodor Lipps' *Aesthetik* had appeared.
5. Reprinted in: Heinrich Wölfflin, *Kleine Schriften*, Bäle (1946).
6. Geoffrey Scott, *The Architecture of Humanism*, 2nd ed., London (1924) p. 213. The author refers to Wölfflin in his preface and to Lipps in a footnote on p. 213. For a discussion of Scott's relation to Lippsian theory see Reyner Banham, *Theory and Design in the First Machine Age*, London (1960) p. 67.
7. *Abstraction and Empathy*, Worringer's dissertation was published as a book in 1908; an English translation by M. Bullock was published in New York in 1953.
8. Ernst H. Gombrich, *Art and Illusion*, New York (1960) p. 21; Meyer Schapiro, "Style", in *Anthropology Today*, ed. A. L. Kroeber, Chicago (1953).
9. Werner Hofmann, "Studien zur Kunsttheorie des 20. Jahrhunderts," *Zeitschrift f. Kunstgeschichte*, XVIII (1955) p. 136.
10. Paul Klee: *The Thinking Eye*, J. Spiller ed., London (1961) p. 76.
11. Conrad Fiedler, "Bemerkungen ueber Wesen und Geschichte der Baukunst," *Deutsche Rundschau*, XV (1878) p. 361 ff.
12. Erwin Panofsky, *Meaning in the Visual Arts*, Garden City, N. Y. (1955) p. 128; Otto von Simson, *The Gothic Cathedral*, New York (1956) p. 6; Paul Frankl, *The Gothic etc.*, Princeton (1960).
13. Pol Abraham, *Viollet-le-Duc et le rationalisme medievai*, Paris (1934).
14. *L'habitat au Cameroun*, Paris (1952) p. 33.
15. *The Works of Pier Luigi Nervi*, London (1957) preface.
16. Erich Mendelsohn, *Briefe eines Architekten*, O. Beyer ed., Munich (1961) p. 27.
17. *Frank Lloyd Wright: Writings and Buildings*, selected by Edgar Kaufmann and Ben Raeburn, New York (1960) p. 168.
18. Le Corbusier, *Towards a New Architecture*, transl. F. Etchells, London (1927) p. 11.