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# Louis Kahn

## Essential Texts

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EDITED BY  
ROBERT TWOMBLY



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PAGE 2: Indian Institute of Management (1962-74),  
Ahmedabad, India, wall fenestration system.

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## 1

## Monumentality (1944)

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Implicit in Louis Kahn's first major essay as a sole author is a critique of modernism's poverty of form and variety, which he associated with neglect of the past. He chided his contemporaries for failing to examine, for example, the "magnificent variations" with which medieval builders had adorned cathedrals in their "search for clarity of purpose" based on "love of perfection." Defining monumentality as "the spiritual quality of architecture" that Kahn knew/could not be achieved simply by copying historical forms,<sup>1</sup> he called on young, creative minds to study the new materials and construction processes World War II had generated, so that architecture might return to those "basic principles" that in the past had been the "common characteristics of its greatness."

As Kahn matured he gradually and without fanfare dissociated himself from the conventional modernist forms of his early design work. Seeds of his fully developed philosophy are apparent in this contribution to Paul Zucker's *New Architecture and City Planning: A Symposium*.

*Gold is a beautiful material. It belongs to the sculptor.*

Monumentality in architecture may be defined as a quality, a spiritual quality inherent in a structure which conveys the feeling of its eternity, that it cannot be added to or changed. We feel

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From Paul Zucker, ed., *New Architecture and City Planning: A Symposium*. (Freeport, N.Y.: Books for Libraries Press, 1944)

that quality in the Parthenon, the recognized architectural symbol of Greek civilization.

Some argue that we are living in an unbalanced state of relativity which cannot be expressed with a single intensity of purpose. It is for that reason, I feel, that many of our confrères do not believe we are psychologically constituted to convey a quality of monumentality to our buildings.

But have we yet given full architectural expression to such social monuments as the school, the community or culture center? What stimulus, what movement, what social or political phenomenon shall we yet experience? What event or philosophy shall give rise to a will to commemorate its imprint on our civilization? What effect would such forces have on our architecture?

Science has given to the architect its explorations into new combinations of materials capable of great resistance to the forces of gravity and wind.

Recent experiments and philosophers of painting, sculpture and architecture have instilled new courage and spirit in the work of their fellow artists.

Monumentality is enigmatic. It cannot be intentionally created. Neither the finest material nor the most advanced technology need enter a work of monumental character for the same reason that the finest ink was not required to draw up the Magna Carta.

However, our architectural monuments indicate a striving for structural perfection which has contributed in great part to their impressiveness, clarity of form and logical scale.

Stimulated and guided by knowledge we shall go far to develop the forms indigenous to our new materials and methods. It is, therefore, the concern of this paper to touch briefly on the broader horizons which science and skill have revealed to the architect and engineer and sketch the faint outlines of possible structural concepts and expressions they suggest.

No architect can rebuild a cathedral of another epoch embodying the desires, the aspirations, the love and hate of the people whose heritage it became. Therefore the images we have before us of monu-

mental structures of the past cannot live again with the same intensity and meaning. Their faithful duplication is unreconcilable. But we dare not discard the lessons these buildings teach for they have the common characteristics of greatness upon which the buildings of our future must, in one sense or another, rely.

In Greek architecture engineering concerned itself fundamentally with materials in compression. Each stone or part forming the structural members was made to bear with accuracy on each other to avoid tensile action stone is incapable of enduring.

The great cathedral builders regarded the members of the structural skeleton with the same love of perfection and search for clarity of purpose. Out of periods of inexperience and fear when they erected over-massive core-filled veneered walls, grew a courageous theory of a stone over stone vault skeleton producing a downward and outward thrust, which forces were conducted to a column or a wall provided with the added characteristic of the buttress which together took this combination of action. The buttress allowed lighter walls between the thrust points and these curtain walls were logically developed for the use of large glass windows. This structural concept, derived from earlier and cruder theories, gave birth to magnificent variations in the attempts to attain loftier heights and greater spans creating a spiritually emotional environment unsurpassed. The influence of the Roman vault, the dome, the arch, has etched itself in deep furrows across the pages of architectural history. Through Romanesque, Gothic, Renaissance and today, its basic forms and structural ideas have been felt. They will continue to reappear but with added powers made possible by our technology and engineering skill.

The engineer of the latter part of the nineteenth century developed from basic principles the formulas of the handbook. Demands of enormous building quantity and speed developed the handbook engineer who used its contents, more or less forgetting basic principles. Now we hear about continuity in structures, not a new word but recently an all important word in engineering which promises to relegate the handbook to the archives.

The I-beam is an engineering accomplishment deriving its shape from an analysis of the stresses involved in its use. It is designed so that the greater proportion of the area of cross section is concentrated as far as possible from the center of gravity. The shape adapted itself to ease of rolling and under test it was found that even the fillets, an aid in the rolling process, helped convey the stresses from one section to another in continuity.

Safety factors were adopted to cover possible inconsistencies in the composition of the material of manufacture. Large scale machinery and equipment needed in its fabrication led to standardization.

The combination of safety factors (ignorance factor as one engineer termed it) and standardization narrowed the practice of engineering to the section of members from handbooks recommending sections much heavier than calculations would require and further limited the field of engineering expression stifling the creation of the more graceful forms which the stress diagrams indicated. For example, the common practice of using an I-beam as a cantilever has no relation to the stress diagram which shows that the required depth of material from the supporting end outward may decrease appreciably.

Joint construction in common practice treats every joint as a hinge which makes connections to columns and other members complex and ugly.

To attain greater strength with economy, a finer expression in the structural solution of the principle of concentrating the area of cross section away from the center of gravity is the tubular form since the greater the moment of inertia the greater the strength.

A bar of a certain area of cross section rolled into a tube of the same area of cross section (consequently of a larger diameter) would possess a strength enormously greater than the bar.

The tubular member is not new, but its wide use has been retarded by technological limitations in the construction of joints. Up until very recently welding has been outlawed by the building codes. In some cases, where it was permitted, it was required to make loading tests for every joint.

Structure designs must discard the present moment coefficients

and evolve new calculations based on the effect of continuity in structures. The structural efficiency of rigid connection, in which the sheer value and the resisting moment is at least equal to the values of the supporting member, is obtained by the welding of such connections. The column becomes part of the beam and takes on added duties not usually calculated for columns.

The engineer and architect must then go back to basic principles, must keep abreast with and consult the scientist for new knowledge, redevelop his judgment of the behavior of structures and acquire a new sense of form derived from design rather than piece together parts of convenient fabrication.

Riveted I-beam plate and angle construction is complex and graceless. Welding has opened the doors to vast accomplishments in pure engineering which allows forms of greater strength and efficiency to be used. The choice of structural forms are limitless even for given problems and therefore the aesthetic philosophy of the individual can be satisfied by his particular composition of plates, angles and tubular forms accomplishing the same answer to the challenge of the forces of gravity and wind.

The ribs, vaults, domes, buttresses come back again only to enclose space in a more generous, far simpler way and in the hands of our present masters of building in a more emotionally stirring way. From stone, the part has become smaller and cannot be seen by the naked eye. It is now the molecular composition of the metal observed and tested by the scientist through spectroscopy or by photoelastic recordings. His finding may go to the architect and engineer in the more elemental form of the formula, but by that means it shall have become an instrumental part of the builder's palette to be used without prejudice or fear. That is the modern way.

Gothic architecture relying on basically simple construction formulas derived from experience and the material available, could only go so far. Beauvais cathedral, its builders trying to reach greater spans and height, collapsed.

The compressive stress of stone is measured in hundreds of pounds.



While not only the compressive, but also the bending and tensile stress of steel is measured in thousands of pounds.

Beauvais cathedral needed the steel we have. It needed the knowledge we have.

Glass would have revealed the sky and become a part of the enclosed space framed by an interplay of exposed tubular ribs, plates and columns of a stainless metal formed true and faired into a continuous flow of lines expressive of their stress patterns. Each member would have been welded to the next to create a continuous structural unity worthy of being exposed because its engineering gives no resistance to the laws of beauty having its own aesthetic life. The metal would have now been aged into a friendly material protected from deterioration by its intrinsic composition.

This generation is looking forward to its duty and benefit to build for the masses with its problems of housing and health.

It is aware of our outmoded cities.

It accepts the airship as a vital need.

Factories have adopted horizontal assembly and shifting population has required the transformation of large tracts of virgin territory at least temporarily for complete human living.

The building of a complete permanent town was attempted and almost built for the workers at Willow Run.

The nation has adopted the beginnings of social reform.

War production may become normal production on the same scale accepted as sound economics.

Still untried but pledged stand the noble principles of the Atlantic Charter.<sup>1</sup>

In the days we look forward to must then the cathedral, the culture center, the legislative palace, world island—the seat of the congress of nations, the palace of labor and industry, the monuments to commemorate the achievements and aspirations of our time, be built to

1. The Atlantic Charter, jointly issued on August 14, 1941, by Winston Churchill and Franklin Delano Roosevelt, was an informal statement of World War II objectives adopted in principle on January 1, 1942, by twenty-six "United Nations" in a formal "Declaration."

resemble Chartres, Crystal Palace, Palazzo Strozzi, or the Taj Mahal?

War engineering achievements in concrete, steel and wood are showing the signs of maturity appropriate to guide the minds entrusted with the conception of buildings of such high purpose. The giant major skeleton of the structure can assert its right to be seen. It need no longer be clothed for eye appeal. Marble and woods feel at ease in its presence. New wall products of transparent, translucent and opaque material with exciting textures and color are suspended or otherwise fastened to the more delicate forms of the minor members. Slabs of paintings articulate the circulation in the vast sheltered space. Sculpture graces its interior.

Outstanding masters of building design indicated the direction an architect may take to unravel and translate into simple terms the complexity of modern requirements. They have restated the meaning of a wall, a post, a beam, a roof and a window and their interrelation in space. They had to be restated when we recall the conglomerations that style-copying tortured these elements into.

Efforts towards a comprehensive architecture will help to develop these elements and refine their meaning. A wall dividing interior space is not the same wall dividing the outside from the interior. Masonry shall always function as retaining and garden walls. It may be used for exterior walls for its decorative qualities, but be supplemented by interior slabs designed to meet more directly the challenge of the elements.

Structural ingenuity may eliminate the interior post, but as long as it must exist its place is reserved and its independence respected in the planning of space.

Structural problems center about the roof. The permanence and beauty of its surfaces is a major problem confronting science. The surfacing of the domes, vaults and arches appearing as part of the exterior contours of the building may be an integral part of the structural design. Stainless metal, concrete or structural plastics, structural glass in light panes, or great reinforced glass castings may be the choice for domes and vaults, depending on the requirements, the climate and the desired effect. The surfacing of flat roofs should be

given equally serious consideration whether it is planned for use or not.

The citizens of a metropolitan area of a city and their representatives have formulated a program for a culture center endorsed by the national educational center. The citizens' committee collaborated with the architect and his staff of engineers. Costs were not discussed. Time was not "of the essence." Its progress was the concern of many.

From above we see the noble outlines of the building. Much taller buildings some distance from the site do not impress us with the same feeling of receptiveness. Its site is a prominent elevation in the outlying countryside framed by dark forests defining the interior of broad strokes in land architecture.

On the ground the first reaction comes from the gigantic sculptural forms of the skeleton frame. This backbone of the architect's central idea successfully challenges the forces which during its design challenged to destroy it. To solve the more minute complexities of the entire organism, its creator had drawn his conclusions and made his decisions from the influences of many people and things around him.

The plan does not begin nor end with the space he has enveloped, but from the adjoining delicate ground sculpture it stretches beyond to the rolling contours and vegetation of the surrounding land and continues farther out to the distant hills.

The immediate ground sculpture disciplines his mind in shaping it into stronger geometric planes and cubes to satisfy his desire for terraces and pools, steps and approaches. The landscape designer countered or accentuated these planes with again geometric and free forms interwoven with the lacy leaf patterns of the deciduous tree.

The plans reveal that the vast spans shelter smaller areas designed for specific use, which are divided from the whole by panels of glass, insulated slabs, and marble. These partitions are free of the structure and related only to the circulation pattern. The ground plan seems continuous. The great lobby is a part of the amphitheater which dips down to the stage. The light comes from above through an undulating series of prismatic glass domes.

Ahead, some distance from the entrance, is a great mural of bril-

liant color. As we approach it the forms clearly defined from a distance seem to divide into forms of their own, each with its own color power, clear and uncluttered.

To one side is the community museum of sculpture, painting and crafts. It exhibits the work of the younger men and women attending the vocational and art academies. Here they are accepted because their talents can be judged by those who have themselves been instructed in the basic principles underlying the use of a material. The emotional adaptations are left for the exhibitor himself to evaluate by contact, comparison and experience.

Sculpture shows the tendency to define form and construction. Marble and stone is carved as of old. Castings in new alloys and plastics are favorite methods of obtaining permanency. Solids are interwoven with sheets and tubes of metal. The subject matter exhibited has no bounds. With the new materials and tools, chemical tints, and with manufacture at the artist's disposal, his work becomes alive with ideas. Metal sprays and texture guns, with fine adjustments have also become the instruments of the sculptor, painter and craftsman. One of the younger men had cast within a large, irregular cube of transparent plastic other forms and objects of brilliant color. A sphere, planes at various angles, copper wire in free lines are seen through the plastic.

From these experiments in form the architect will eventually learn to choose appropriate embellishments for his structures. So far he has omitted them. His judgment leads him to freestanding forms in space.

Some of the younger artists are influenced by the works of an older sculptor who has developed a theory of scale in relation to space. He has argued that as the size of the structural work is increased the monolithic character of smaller work does not apply. He chose for large work a small consistent part or module of a definite shape, a cube, a prism, or a sphere which he used to construct block over block, with delicate adjustments to the effect of light and shadow, the overall form. His work seen from great distances retains a texturally vibrant quality produced by these numerous blocks and the action of the sun upon them.

Before we can feel the new spirit which must envelop the days to come we must prepare ourselves to use intelligently the knowledge derived from all sources. Nostalgic yearning for the ways of the past will find but few ineffectual supporters.

Steel, the lighter metals, concrete, glass, laminated woods, asbestos, rubber, and plastics, are emerging [as] the prime building materials of today. Riveting is being replaced by welding, reinforced concrete is emerging from infancy with prestressed reinforced concrete, vibration and controlled mixing, promising to aid in its ultimate refinement. Laminated wood is rapidly replacing lumber and is equally friendly to the eye, and plastics are so vast in their potentialities that already numerous journals and periodicals devoted solely to their many outlets are read with interest and hope. The untested characteristics of these materials are being analyzed, old formulas are being discarded. New alloys of steel, shatter-proof and thermal glass and synthetics of innumerable types, together with the material already mentioned, make up the new palette of the designer.

To what extent progress in building will be retarded by ownership patterns, dogmas, style consciousness, precedent, untested building materials, arbitrary standards, outmoded laws and regulations, untrained workmen and artless craftsmen, is speculation. But the findings of science and their application have taken large steps recently in the development of war materials which point to upset normally controlled progress and raise our hopes to the optimistic level.

Standardization, prefabrication, controlled experiments and tests, and specialization are not monsters to be avoided by the delicate sensitiveness of the artist. They are merely the modern means of controlling vast potentialities of materials for living, by chemistry, physics, engineering, production and assembly, which lead to the necessary knowledge the artist must have to expel fear in their use, broaden his creative instinct, give him new courage and thereby lead him to the adventures of unexplored places. His work will then be part of his age and will afford delight and service for his contemporaries.

I do not wish to imply that monumentality can be attained scien-

tifically or that the work of the architect reaches its greatest service to humanity by his peculiar genius to guide a concept towards a monumentality. I merely defend, because I admire, the architect who possesses the will to grow with the many angles of our development. For such a man finds himself far ahead of his fellow workers.