Load-bearing Structure, Enclosing Form and Spatial Interpenetration:
On Tectonic Construction and its Relation to the Shaping of Space

Oliver Sack

As space and spatial design became the new paradigm of architectural theory at the turn of the twentieth century, tectonics disappeared as an architectural-aesthetic concept. Since its rediscovery, tectonics has been discussed as if it were detached from the design of space, rather than in relation to it. Quite admittedly, it is not self-evident to relate tectonics to space and spatial design. In considering tectonics, we think initially about matter, not space; we are concerned with its physical structure and not its spatial shape and configuration. However, we can relate tectonics to spatial design, especially if we understand tectonics as tectonic construction, and construction as a means of the shaping of space. In performing such an analysis only, the paper explores the *meaning* of tectonics for the *making* of space.

Tectonics as Tectonic Construction

Concerning the understanding of tectonics, Eduard F. Sekler argued:
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 and forces, the term tectonic should be reserved (...) Thus, structure, the intangible concept, is realized through construction and given visual expression through tectonics. (1965: 89, 92).
In the contemporary discourse, i.e. since the late 20th century, tectonics has also been in general conceived as an architectural realm dealing with the aesthetic expression of material, structural concept and construction in the archi*tectonic* built form. Focusing less on the relation of tectonics and structure, Fritz Neumeyer, for example, argues that the core of the concept of tectonics:
refers to the mystic relationship between the quality of the joining and the visible expression of things and affects the correlation between the order of a built and the structure of our perception (1993: 55).
As an art, tectonics is for him directly linked not only with representation but additionally with appearance:
In terms of construction architecture has not to be honest, but rather has to generate the appearance of an honestly built construction. The magic that is needed for this purpose is the art of tectonics (1993: 63).
Similarly to both concepts, the essence of tectonics is located in the realm of aesthetic expression, especially in the perception of this expression. Tectonics has a mediating function, mediating between the material-technical identity of a building and its aesthetic appearance.

However, as soon as we regard tectonics as tectonic construction, construction and structural concept themselves are conceived as being tectonic as well. Tectonics changes into an attribute that distinguishes a structural concept and construction as being tectonic. Accordingly, tectonics is, in this respect, not the aesthetic transformation, expression and representation of a structural concept and its construction anymore, let alone the appearance of an honestly built construction. Being tectonic is moreover seen as an integral quality of certain structural and constructional content.

At first sight, this understanding of tectonics seems merely to reduce the meaning of tectonics to construction and structure as such. At the same time, however, this reduction enables us to go beyond the idea of tectonics as an art of material-aesthetic representation and to put tectonics in relation to spatial design. Here, spatial design is confined to the *shaping* of space, that is to say, to the part of spatial design that comprises the immediate shaping and structuring of space. In this relation, construction – and tectonic construction as well - is conceived as a means of the shaping of that space. Being such a means, so my main argument goes, tectonics gains another architecture-aesthetic quality, next to the aesthetic expression of structure and construction.

How can tectonic construction be related to the shaping of space? In which way it is a means of the shaping of space? To what extent can we speak about a specific space shaping quality of specific tectonic constructions?

My answer to these questions is subdivided in four steps.
First, I give an explanation of the term 'tectonic construction' and show that this understanding of tectonics refers to the 19th century theories of tectonics of Karl Bötticher and Gottfried Semper.
Second, the paper follows an architecture-theoretical conception, which has strongly influenced the understanding of the relation between tectonic construction and the shaping of space: the contradistinction be-

tween bearing structure and space enclosing form, formulated already in Hegel's ([1842] 1984: 55-56) distinction between column and wall as a bearing and enclosing element respectively.
Subsequently, this dualism between tectonic structure and spatial enclosing is questioned on the basis of the advanced understanding of the shaping of space in the twentieth century, when the idea of the shaping of space as spatial enclosing has been completed with the idea of spatial interpenetration. As a result, this paper argues in favor of the concept of the shaping of space as a synthesis of enclosing and interpenetration. This conception allows us to relate tectonic construction to spatial design in an explicitly space-shaping way, resulting in the idea of the relation between tectonic construction and the shaping of space as interplay of load-bearing structure, enclosing form and spatial interpenetration.
Finally, and with the focus on the space-shaping quality of tectonic construction, this conception is illustrated by an analysis of three different principles of tectonic construction: the modern skeleton frame, grid tube constructions, both from steel or reinforced concrete, and the, as I want to call it, pre-modern 'tectonic wall' of stone.

Tectonic Construction

What defines a structural concept and its constructional implementation as *being* tectonic? Firstly, it refers to the term 'structure' and it does so in terms of a *constructional* structure. This means that it relates to a system and order of a structural concept that deals with the static interaction between load and support under the conditions of interrelated working forces, such as gravity and thrust. The constructional implementation itself also refers to structure, however, rather in the sense of a systematic joining of the respective constructional elements.
Though any material construction is exposed to the static interaction between load and support, a tectonic construction is the representation of it. The tectonic structure represents it by arranging the support of load and the corresponding working forces in a systematic way and by differentiating the built form in structural and non-structural elements, according to their specific load-bearing and non-bearing function. Such representation by the means of structural differentiation is the second and main difference between tectonic and non-tectonic constructions:
Without any differentiation a visual expression of a structural concept does not exist. A clear example is a monolithic wall of concrete. A monolithic wall of bricks that shows its formation of joined elements is not a tectonic construction either since the represented structure of bricks does not know any structural differentiation. Therefore, a massive wall of bricks is defined not as a tectonic but as a stereotomic construction. Just when the bricks get differentiated according to different static and non-static functions a brick wall *starts* to get a tectonic construction.

The Big Mosque (Narthex), Kairuan, Tunisia, 800-836

Correspondingly, any tectonic construction tends to be a skeletal construction. Here, the skeleton as an entirely independent load-bearing structure is the extreme implementation of a tectonic construction. Likewise, a cross-rib vault is a tectonic construction as well.

This conception of tectonics as tectonic construction draws on the discourse of tectonics within the archeological and aesthetic theory of the 19th century. In particular, the architect and theoretician Karl Böttticher (1852) linked tectonics to a bearing structure as well as to a skeletal mode of construction. In his well-known scheme of core-form and art-form ('*Kernform*' and '*Kunstform*'), the former is the physical manifestation of one, in this sense, structural concept that finds its artistic implementation in the tectonic art-form. Here, the respective structural concept, which is characterized by a specific systematic arrangement of support and load, poses the architectural content, as such, represented in the idea of the core-form ('*Kernform*'). This core-form becomes aesthetically expressed and, by doing so, artistically sublimated

into the shape of the art-form ('*Kunstform*'). Here, Bötticher placed emphasis on the identity of both core-form and art-form:
After their structural combination to a complete form, all the structural elements appear in one expression, which represents both, most clearly, the inner concept, i.e. the essence or mechanical function of each element, and the mutual joining - juncture - of all of them in the whole ensemble. [...] *The form gives the building material the capacity to fulfill its function, and vice versa: the function can always be identified through the form* (1852: 4).
Werner Oechslin points out that in Bötticher's idea
inner coherence and truth were regarded as a yardstick of a complete architectural concept" (1994: 53).
He emphasizes that Bötticher was concerned with the mutual relation of core and art-form, in the sense of an organic connection or entity of content and form.
Bötticher conceived the core-form as a built of limbs ('*Gliederbau*'), built up as a whole system of various structural elements, and in the form of the joining ('*Junktur*') between these elements. Representing the skeletal character of the '*Gliederbau*', its archetype was for Bötticher the pavilion roof construction, containing
the pure existence of the concept of a free structure. (1852: Exkurs 6: 101).

For Gottfried Semper (1851, 1860-63), tectonic construction was a craftwork rather than a structural concept and its artistic implementation. Although, he discussed tectonics not in terms of a structural concept, for him tectonics was also bound up with a skeletal mode of construction. According to Semper, such construction developed as a specific handicraft and by the application of the material wood. In the course of evolution of the cultural practice of building - and as one of its four basic elements out of which this practice has been developed - the pre-architectural tectonic craftwork found its application in architecture. At a certain stage of this application, it found its architecture-aesthetic sublimation: based on the principle of dressing ('*Bekleidungsprinzip*'), conceived by Semper as the general basis of the cultural practice of building, tectonic construction found this sublimation in the symbol-like integration, in the so-called *dressing* art form.

Roof Shelter, Andaman Islands, South-East Asia

Concerning Bötticher's scheme of core-form and art-form, we could argue that Semper did not understand core-form and art-form as an aesthetic system of content and form. The art-form itself was for him the real and only constitutive element of architectural aesthetics: the so-called aesthetic content as such.
As a constructional system, tectonics remained for him outside the realm of aesthetics. Indeed, for Semper the architecture-aesthetic form also referred to the material-technical content. However, this reference was a historical one. As Mitchell Schwarzer puts it:
Everywhere, Semper contended, the stonewall could be looked at as a painted carpet. Architectural decoration, far from a meaningless additive to structural systems, was an integral amplification of that system's higher evolution through history (1995: 175).

Regarding the architecture of one building, Semper separated here the architecture-aesthetic quality of tectonics from the physical level of structure and construction.
In the subsequent art-theoretical discourse on architecture, tectonics became more and more separated from construction and structural concept. For both Heinrich Wölfflin (1886) and August Schmarsow (1894, 1905), tectonics was already *exclusively* conceived as tectonic shapes. Schmarsow, who was first to define the essence of architecture as the art of spatial design, even had the opinion that we are the happiest in our homes:
when we are not bothered with the question of stability and a real conflict of load and support (1905: 164).
Finally, Schmarsow questioned the value of tectonics as a fundamental term for aesthetic theory. Tectonics disappeared from the stage of modern architectural theory, not only in terms of tectonic construction but also as a basic architecture-aesthetic concept. In place of tectonics, space became the new and modern paradigm of architectural theory.

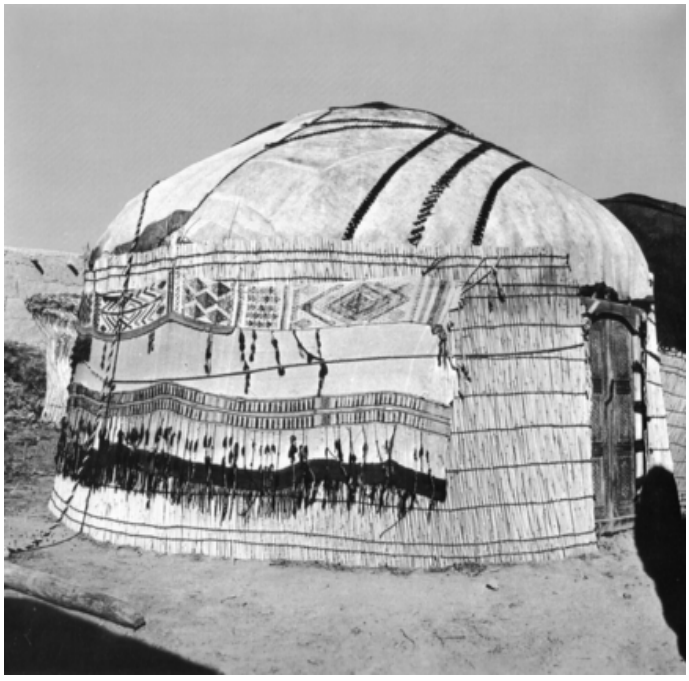
Tectonic Construction and the Shaping of Space

As explained above, any tectonic construction tends to be a skeletal construction. At the same time, any shaping of space is bound up with a certain enclosing and covering of space. In this respect, it is rather bound up with the built form as an entity of surfaces than with the form of a skeletal structure. Accordingly, the skeletal character positions a tectonic construction in opposition to the shaping (enclosing) of space. Thus, if we want to conceive tectonic (skeletal) construction just in relation to the shaping of space, we have to look for a connecting element that overcomes this opposition.

Interestingly enough, already Bötticher (1852) and Semper (1860-63) discussed tectonic construction in relation to the shaping of space. For Bötticher, the origin of a structural, so tectonic, principle lay in the way it covered a space. Here, he distinguished between two basic possibilities: the horizontal and trabeated roof or floor construction and the curved vault construction. The first results in the tectonic construction of beams and columns, representing the structural system of vertical support of the horizontal load. It finds its aesthetic perfection in the Doric temple *(see illustration 8)*. The second possibility results in the tectonic construction of cross-rib vault and buttress, representing the structural system of the vertical and horizontal support of thrust producing loads. It finds its aesthetic perfection in the Gothic cathedral *(see illustration 9)*.

As Bötticher related tectonic construction to the covering of space, he opposed it to its enclosing, following Hegel's distinction between the wall as a primary space enclosing and the column as an exclusively load-bearing element:
Appears, for whatever reason, to the buildings concept the requirement to organize a completely open wall next to the space-enclosing and simultaneously roof-carrying walls, then a new element appears in the spatial composition - the freestanding, space-opening pillar, the column. (...) As the wall represents the complete opposite of the colonnade-roof generating column, it stands in opposition to the roof itself. (...) The wall is exclusively related to the space it encloses... (1852: Exkurs 1: 7, Exkurs 6: 76).

Semper made such a distinction between bearing and enclosing, too. Differently from Bötticher, however, he did not distinguish between the enclosing and covering of space. Semper, as later Berlage ([1904] 1991), referred to the shaping of space in the general understanding of spatial enclosing. Within his classification of four basic crafts, he related the shaping of space to the textile, i.e. to the woven and 2-dimensional enclosure of space. He argued that the shaping of space began with a woven separation of the home from the outer life:
Scaffolds that served to hold, secure, or support this spatial enclosure had nothing directly to do with space or the division of space…. They were used for fortification and defense, for ensuring a durable enclosure, or for supporting the spatial enclosure above them, as well as for supplies or other loads - in short, for reason foreign to the original idea, namely that of enclosing space.
([1860-63] 2004: 248)



Turkmen house, North of Afganistan

Semper conceived textile as the original architectural element, not only in terms of material culture and its visual representation, but also as in terms of the shaping of space. For him, the textile shapes space by its screen-like enclosure and its definition as a place within the surrounding space.

Semper opposed tectonic construction and construction in general to the shaping of space, at a time when the paradigm of architecture focusing on the design of space still had to be developed. As long as designing of space was first and foremost understood as the design of enclosed space, it was developed by following

Semper's contrast between space and construction. Adolf Loos (1898), for example, agreed explicitly with Semper's principle of dressing in separation from a mere technical understanding of construction:
The task of an architect is to create a warm and homelike space. Carpets are warm and homelike. Therefore, he decides to unfold a carpet on the floor and to hang up four, in order to build the walls. But it is not possible to build a house with carpets alone. Both the carpet on the floor and the tapestries need a constructional scaffold that keeps them in the right position. To invent this scaffold is the second task of an architect ([1898] 1962: 105).

As long as spatial design is at the same time understood as the design of enclosed spaces, it is consequent to oppose it to a skeletal mode of construction. At the beginning of the twentieth century, however, space did not only replace tectonics as the main paradigm of architectural theory. The understanding of space changed too. The approach towards space was that of its perception. Moreover, space was linked to movement and conceived in relation to time. With this understanding, especially the modern movement surmounted the conception of built space as fixed enclosed volumes.

Concerning the shaping of space, this new understanding of space has found its expression in the idea of spatial interpenetration, namely the opening of the enclosed spaces and their connection with the continuum of the outside space. In his publication "Building in France, Building in Iron, Building in Ferroconcrete", Siegfried Giedion (1928) is, to my knowledge, the first architectural theorist who connected skeletal modes of construction with spatial interpenetration. He made this connection on the basis of a rather programmatic approach towards architecture, understanding it as part of a socio-economic practice. Within this scope he connected architectural aesthetics with real developments in the field of construction. He discussed spatial interpenetration as an aesthetic phenomenon of modern architecture, being bound up and beginning with the lightweight and filigree iron constructions of the nineteenth century and finding its architectural culmination in the application on the modern housing production, especially in the reinforced concrete architecture of Le Corbusier.
Like no one before him Corbusier had the ability to make the ferroconcrete skeleton resonate… Out of the possibility of hanging the whole weight of a building on a few ferroconcrete pillars, of omitting the enclosing wall wherever one so desires, Corbusier created the eternally open house.... Cubes of air within, cubes of air without… Corbusier's houses are neither spatial nor plastic: air flows through them! Air becomes a constituent factor! Neither space nor plastic form counts, only RELATION and INTERPENETRATION. There is only a single, indivisible space. The shells fall away between interior and exterior ([1928] 1995: 168-69).
Giedion discussed construction in terms of skeletal constructions without, however, conceiving it in terms of tectonics – since his focus was that of the surmounting of materiality instead of its representation. Nevertheless, he described a space-related quality of skeletal constructions that also counts for tectonic constructions: their ability to enable the opening of the enclosing form and to enable a spatial interpenetration of the separated spaces.

If we regarded architectural space exclusively in terms of spatial interpenetration, we could indeed talk about a relation between tectonic construction and spatial design. Yet, we would not establish a relation between tectonic construction and the shaping of space. If we want to do this, spatial enclosing must remain a part of this relation. If spatial enclosing became completely dissolved, also the interpenetration would be gone. What would remain is one continuum of space. However, as soon as we understand the shaping of space as a *synthesis* of enclosure and interpenetration, we are able to relate tectonic construction not only to spatial interpenetration but also to the enclosing of space. Here, this synthesis is the crucial element necessary for a connection between tectonic construction and the shaping of space, we are looking for. What is more, as soon as establish this relation, we conceive the shaping of space as an interplay of load-bearing (tectonic) structure, enclosing form and spatial interpenetration. The actual space-shaping quality of a specific tectonic construction is determined here by the interrelation between the (at least potentially) space-opening tectonic construction and the space-enclosing form.

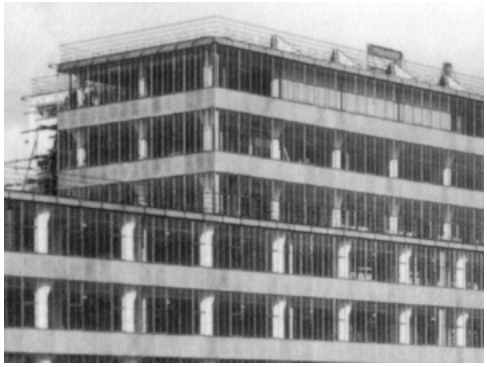
Three Principles of Tectonic Construction

In the following sections, I will explore the space-shaping quality of the three mentioned principles of tectonic construction: the skeleton frame of steel reinforced concrete, grid (geodetic) constructions of the same materials in the shape of tubes, and the 'tectonic wall' of stone, and I will do so in two ways.
On the one hand, I am wondering whether the skeletal structure is differentiated from or integrated into the space enclosing and covering form; on the other hand, in which way does it take part in the implementation and expression of the opening of the enclosing form and its spatial interpenetration?

The correlation between the aspects of bearing, enclosure and interpenetration, and the three dimensions of space - height, width and depth - are of particular importance here. In order to simplify matters, I confine myself to *horizontal* interpenetration between the inside and outside space of a building.
On the basis of well-known buildings, all three principles represent a distinct implementation and expression of the space shaping quality of the respective tectonic construction principle

The Skeleton Frame

The skeleton frame is bound up with the paradigm of structure and skin and with the idea of the *plan libre*. In contrast to the massive wall of stone or bricks, the skeleton frame has allowed previously unknown flexibility in the design of built space and form. As being expressed by Le Corbusier's scheme of the Domino house, the load-bearing construction is, in principle, completely separated from the space-enclosing form or skin. The design of the facades has become entirely free, up to a completely glazed envelope. The reduction of the bearing structure to a set of columns and beams with large distances in between allows a far-reaching free arrangement of the inside spaces, both in horizontal and in vertical direction.

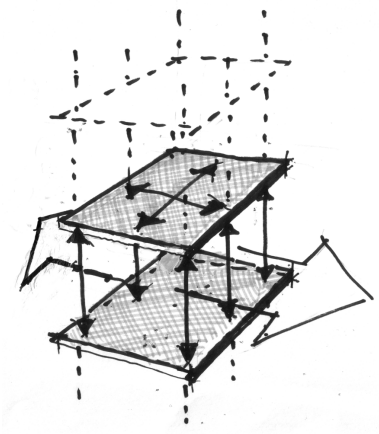


Van Nelle Factory, Brinkman en Van der Vlugt, Rotterdam 1931

Musée des Traveaux Publics, Auguste Perret, Paris 1938

Due to a twofold dualism, the skeleton frame poses the maximal possible distinction between a tectonic construction and a space-shaping form: on the one side a 3-dimensional bearing structure of linear elements, and on the other side 2-dimensional non-bearing planes, enclosing in the shape of vertical facades and covering in the shape of horizontal slabs. As long as it stays outside or inside the vertical planes of the outer skin respectively, the bearing construction remains in an absolute dualism to the enclosing of space. This changes as soon as the skeleton frame is directly connected to or even integrated into the space-enclosing form. In the shape of a stabilizing and spatial matrix it gains a certain space-shaping quality, which remains, however, rather marginal, depending on the spatial distance in between the skeleton's limbs and on the corresponding filigree appearance of the tectonic frame.

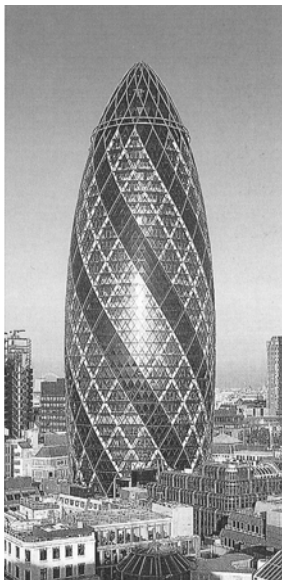
The essential relation to the shaping of space lies in the function of supporting the covering slab or roof. Here, the skeleton frame is principally opposed to both, slab and roof in spatial direction - vertical support versus horizontal covering above and horizontal separation below. The result is an indirect relation to the space-covering element. This contrast does not change either in the case that the beams are visible and function as a connecting element between the vertical bearing structure and the horizontally covered space. The predominant relation remains that of horizontal covering and vertical support. Concerning the interrelation between covering and interpenetration, the plane of covering is parallel to the orientation of interpenetration. In connection with its filigree appearance, the essential aesthetic quality of the skeleton frame is therefore that of absolute openness and horizontal spatial interpenetration.



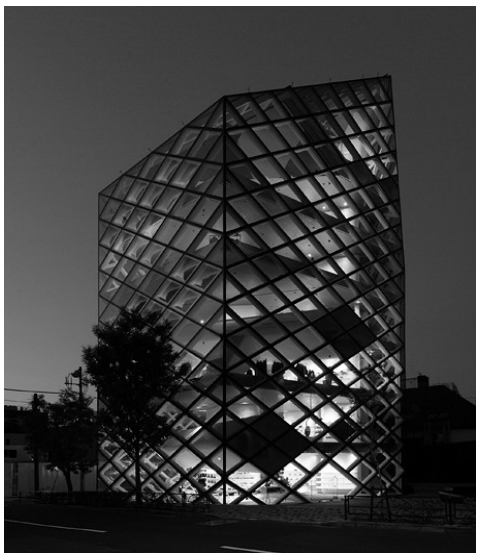
Grid Tube Construction

With a grid tube construction, the load-bearing capacity of steel and reinforced concrete in relation to structure and skin has been realized in an opposite way: the tectonic construction is not detached from the space-enclosing form. In contrast, the skin itself is changed into a skeletal structure. In terms of design, the tec-

tonic structures exposes itself, as an aesthetic synthesis of both bearing structure and ornament of the skin. As Axel Sowa puts it:
As with basketry, their structure is both support and surface. Their beautiful visible skeletons meet both their static and aesthetic requirements. These high-performance coverings are both load-bearing structures and visual ones that enliven and decorate their external surface: the facades (2007).
The term`` grid construction`` comprises a lot of different types of grids: geodetic or not in structure, dome, shell or tube in shape. In recent years, grid constructions has been integrated into the so-called morphological or morphogenetic design strategies (Testa 2002; Hensel, Weinstock, Menges 2004). In order to simplify matters and to facilitate the comparison of the three modes of tectonic construction, I confine myself to grid tube constructions.

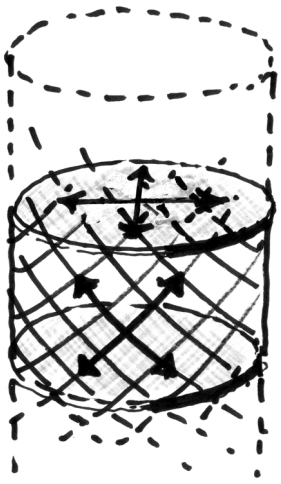


Swiss Re HQ St Mary Axe, Foster & partners, London , 2004



Prada Epicenter Store, Herzog and De Meuron, Tokyo, 2001

Such grid construction differs from the skeleton frame in two ways. First, it is characterized by an absolute integration of the bearing structure into the space-enclosing form. However, it is not simply integrated into it. Depending on the density and massiveness of the grid, the grid itself shapes and represents the space-shaping envelope, culminating in a fabric-like character and a corresponding screen-like appearance of the grid. This kind of textile character is the second difference.
In terms of its static principle, the grid's tectonic structure is characterized by at least two, neutralizing each other, vectors that span up the space enclosing fabric. By doing so, the correlation between tectonic construction and the vertical axis of gravitation is disintegrated. The result is an absolute synthesis of bearing structure and space-enclosing form. The grid supports as a fabric. Therefore, the predominant expression of a grid construction - not merely in the shape of a tube - is always the expression of enclosure, however open it may be.

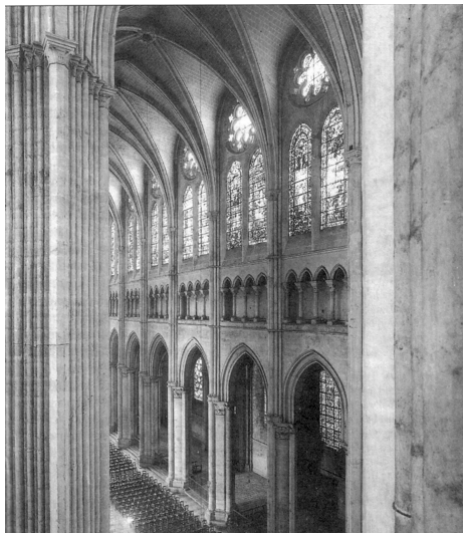


'Tectonic Wall'

The third principle, with which I describe the space-shaping quality of tectonic construction, is the 'tectonic wall' of stone. By introducing this term I refer to the German term *Mauer,* as it was defined by the theorist of art Max Raphael ([1934] 1976). Referring to ancient Greek, Romanic and Gothic stone architecture, Raphael defines the *Mauer* in contradistinction to the *Wand* that represents a monolithic wall for him. As a result of a historical process, following Raphael's argumentation, the *Mauer* represents a joining of struc-

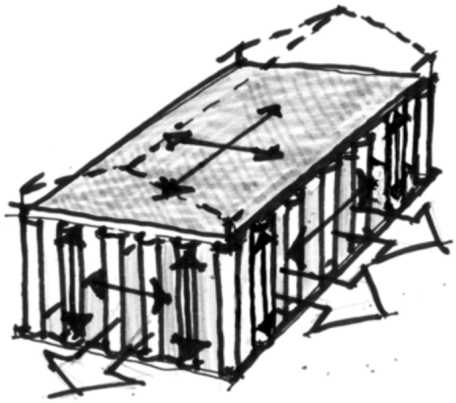
tural elements. Subsequently, this technique of joining results in a differentiation between load bearing and non-bearing, thus supported elements, naturally connected to the structuring of the built form in open and closed parts. Additionally, this differentiation is architecturally realized as an articulated differentiation of the bearing structure from the enclosing form. Thus, Raphael conceives the *Mauer*, in contrast to Hegel, as a space-shaping construction principle, in which the differentiation between bearing and enclosing remains a relative differentiation. In this sense, I refer to Raphael's concept of the *Mauer* as a tectonic wall, representing the embodiment of a skeletal structure of stone, as it is to be found in the structural principle of beam and column in a Doric temple, as well as in the shape of cross-rib vault and buttress of a Gothic cathedral.

Doric temple, Segesta, Italy, 570-560 B.C



Gothic Cathedral, Chartres, France, 1194 -1220

Similarly to grid constructions, the tectonic wall poses a synthesis of bearing structure and space-enclosing form, as well. Similarly to the skeleton frame, it still has *one* load-bearing tectonic axis: that of the vertical axis of gravitation. Accordingly, the identity of bearing and enclosing is not as absolute as in the case of the grid. The columns of the Doric temple, for example, support the roof construction, and they enclose the space between the cella and themselves. By analogy with grid tube constructions, they are bearing and enclosing at the same time. In its spatial direction, however, the function of bearing remains perpendicular to the function of enclosing: vertical versus horizontal. Since the enclosing shape is a horizontal row of vertical columns, it also gets opened in a vertical and to the spatial enclosing perpendicular direction. Therefore, the row of columns encloses *and* opens the surrounded space at the same time. Here, the proportion between the diameter and circumference of the columns, on the one hand, and their distance to each other, on the other hand, determines the balance between enclosing and opening.



The tectonic wall of a gothic cathedral is also characterized by a synthesis of bearing and enclosing in one plane and by the simultaneous distinction in two perpendicular directions: vertical support and horizontal enclosure. In this respect, the perpendicular to the nave positioned buttresses also form a vertical element. The opening of the in horizontal direction-enclosing wall is vertical too. Due to the glass painting, the corresponding spatial interpenetration between inside and outside is not to perceive. The outside space remains an ideal space, represented by the illuminated paintings on the glass. However, that spatial interpenetration is clearly perceived with regard to the connection between the different naves.

The meaning of tectonics for the making of space

The paper discussed tectonic construction as a means of the shaping of space. As such a means, tectonics gains another architecture-aesthetic quality, next to the aesthetic expression of structure and construction.
As a result of the given analysis, we can conclude that the interplay of load-bearing structure, enclosing form and spatial interpenetration is designed in different ways, and that it is always *constructionally* designed: the skeleton frame allows openness without enclosing, and by doing so, without shaping space immediately. As a mixture of a tectonic and a textile construction, grid constructions enclose the space with an open structure. As a change from a stereotomic into a tectonic construction, the tectonic wall opens the enclosing form tectonically.
In this context, I find it very interesting to think about principle relations between the spatial structure of construction and the structure of space. Referring to Semper, Schmarsow (1894) was the first to connect the three dimensions of space with the perception of proportion, symmetry and rhythm. In a similar way, we can relate the dimensions of space to the aspect of bearing, enclosing and interpenetration: height in relation to bearing, width to enclosing and depth to interpenetration. The way in which tectonic construction acts within this spatial structure seems to me one determining aspect of its space-shaping quality.

In post-modern times, space has been discussed in relation to the concept of place. Referring to the social and cultural meaning of a specific space, the concept of place represents the idea of meaningful space. Concerning the discourse on tectonics, Kenneth Frampton's (1995) approach to tectonics as *tectonic culture* just defines tectonics as a means of the creation of such place. By doing so, he succeeds to connect meaning in terms of material and construction with meaning in terms of space. In contrast to the modernist idea of space in terms of movement, spatial openess and spatial interpenetration, however, his connection of tectonics and place is bound up rather with spatial enclosing than spatial interpenetration.
Understanding in this context tectonics as tectonic construction and as a medium of spatial interpenetration, the aesthetic quality of tectonics would get - different to Frampton's focus - the quality of creating and expressing the spatial connection of a place with the space around and with other places. Tectonic culture, in this sense, would be the constructional creation and expression of such socio-spatial relation.

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