Tectonic Expressions in Brick Architecture

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Tectonics, architectural design theory, brick architecture

Introduction:
This paper is part of a broader research effort which contributes to the understanding of the term *tectonics* in the field of architectural design theory leading to a general theory of tectonics, which broadens and differentiates the term's comprehension. Preliminarily, I have named it *Framework for Tectonic Thinking (FTT)*[1]. It provides a mapping of potential tectonic expressions and a vocabulary for their distinction. The FTT is considered to be a conceptual tool of the architect that can be employed in the analysis of buildings, in their conception, and as a trigger for imaginations of tectonic possibilities. In this paper, I will apply the FTT to the analysis of historical and contemporary brick architecture.

Before I will start to reflect on tectonic expressions in brick architecture I will shortly summarize my ideas about the Framework for Tectonic Thinking. To propose such a conceptual framework is motivated by my wonder about the use of the word tectonics within the metier of architecture which appeared to me often as unprecise and sometimes contradictory. In old Greek the term was originally associated with carpentry, then with working on hard building materials (besides metal) before it was associated with making in all building crafts.

Today tectonics is associated with a variety of things: building construction as a craft; with material and making; industrial ways of building; digital fabrication; particular ways of detailing (the tell-tale-detail); the motive of the frame and the infill (coming from carpentry); the expression of the loadbearing structure; a poetics of construction; a value judgement distinguishing good architecture from bad architecture, or architecture from mere building; just as synonym for architectural; etc.

In most cases the term tectonics indicates a way of building that exceeds mere functional construction; it considers construction aesthetically, and vice versa aesthetics constructionally. Therefore, I define tectonics as an architectural expression in which the dual notions *construction* and *appearance*, or *technique* and *aesthetics*, or *firmitas* and *venustas* (to use two terms of the Vitruvian triad) are considered as complementary.

[1] I had the chance to present my FTT at several occasions: Tectonic Perception symposium, 2017, Utzon Centre Aalborg, https://vimeo.com/219141776; CA2RE conference 2017, KU Leuven, Ghent; EAHN conference *The Tools of the Architect*, 2017, TU Delft.

Referring back to Karl Bötticher's *Die Tektonik der Hellenen* (Bötticher 1874) a major strand of the discourse, most importantly represented by Kenneth Frampton (Frampton and Cava 1995), has identified the concept of tectonics with the artistic articulation of the loadbearing structure. Preferably this concerns the actual loadbearing structure, but it may also be articulated through representation. I regard this loadbearing position as an important and at the same time a very productive position on tectonics. However, I find it restricting to limit the discourse on tectonics to this position alone, especially if I think of Gottfried Semper's theory on tectonics. (Semper et al. 2004) It is also employed by the loadbearing fraction to substantiate their position, but it actually suggests a more comprehensive and diverse account of the subject.

My other issue with the loadbearing fraction is that it comingles descriptive uses of the term tectonics with assertions that imply a value judgement, and as a result it turns its own position into a normative criterion.

With the *Framework for Tectonic Thinking* I should like to propose a descriptive and analytic approach to tectonics which broadens and differentiates the understanding of term. I regard it as a non-essentialist and non-dualistic classificatory system. It combines three constructional categories, each with two oppositional poles:

1. Loadbearing construction: loadbearing versus non-loadbearing
2. Conjoining construction: solid versus filigree
3. Constructional appearance: tectonic versus atectonic

The constructional categories should be seen as vectors that exert their conceptual influence on a space of potential constructional appearances where *tectonic* forms express aspects of loadbearing construction and conjoining construction, while *atectonic* forms of appearance suppress or dissimulate any reference to these. The FTT distinguishes eight conceptually pure constructional forms of appearance:

Four of them coincide with the primordial technical arts:

- textile
- ceramic
- stereotomy (stone construction)
- carpentry

The other four constitute their opposites:

- atectonic textile (e.g. air wall)
- atectonic ceramic (e.g. thermal radiation)
- atectonic stereotomy (e.g. floating substructure, dematerialized floor)
- atectonic carpentry (e.g. floating roof, dematerialized supports)

These conceptually pure constructional appearances should not be understood as ideals or essences that should be approximated as close as possible. For any of the pure positions a multitude of appearances is conceivable. Between the pure tectonic appearances there is a field of hybrid tectonic appearances in which characteristics of pure tectonic appearances are combined. Hybrid appearances are considered equally valid as pure appearances.

The categories and their polar distinctions are considered to be non-dualistic, that is they do not imply a value judgement. The expression of loadbearing construction is neither better nor worse than the expression of non-loadbearing construction. The same goes for each of the poles of conjoining construction and of constructional expression.

Due to the space-time limitations of this conference presentation I have to refer the discussion of the atectonic side of the FTT to a different paper. In what follows I will only concentrate on the tectonic side where the four primordial technical arts provide a reservoir of "typical" motives or formal principles. Semper addresses this at great length in *Der Stil.* I will recapitulate the important formal principles that he defines and relate them to possible expressions in brick masonry. But before I will shortly reflect on the question:

To which of the four primordial technical art can brick masonry be related?

From material point of view brick's raw material lets one immediately associate it with ceramics, however, from a formal point of view the principles and motives of other technical arts are more important. As Semper asserts, '[…] there are objects that certainly belong to ceramics from the point of view of materials, inasmuch as they were formed from a soft mass that was then hardened and fixed. But they should be seen as relating to ceramics only secondarily, because formally they are in a different sphere. Objects of this kind include bricks, roof tiles, terra-cotta, and glazed tiles–used both for dressing walls and tiling floors.' (Semper et al. 2004, 109–10)

But if not ceramics, to which other primordial technical art can brick be related? In this context it actually would be more precise to speak of *brick masonry* instead of just brick. Herewith two aspects come to the fore: firstly, brick – different from "proper" ceramic products – is only a semi-product which is assembled into brick masonry which is the actual product of our considerations; secondly, brick masonry is usually not only assembled from brick alone but also from mortar.

The rectangular and regular shape of its composing building parts, and their horizontal stacking into a regular assemblage are formal characteristics of *stereotomy* (or stone construction) that associate brick masonry with this technical art. The mortar joints, in contrast, create a mesh of jointing, and in their interplay with the bricks a surface pattern that associates brick masonry with the *textile arts*.

For Gottfried Semper the formal principles of the primordial technical arts were not necessarily contradictory or mutually excluding. However, it is perhaps due to this reference to the two so different technical arts that the discourses on the tectonics of brick masonry at times turn out to be rather oppositional. Ákos Moravánszky has characterized these two discourses as, 'one on the surface as a signifier and spatial delineation, the other on the mass as a product of a craft' (Moravánszky 2013, 90). This distinction suggests a number of opposing poles which can inspire the formal expression of brick masonry: solid versus filigree, loadbearing versus non-loadbearing, volumetric mass versus planimetric surface, heavy versus light, deep structure versus surface appearance, and so forth.

These oppositions are comprised in the German language in the distinction of two different words for the English word wall: *Mauer* (the loadbearing wall) and *Wand* (the wall as spatial delineation); the first referring to stone construction or *stereotomy*, the latter to the *textile* arts.

To nuance Moravánszky's characterization of the two polar discourses on the masonry I should like to suggest that the masonry wall that in its formal appearance is referring to textile should also be regarded as a product of a craft, and that the masonry wall that formally is referring to stereotomy can also be regarded as a signifier or symbol.

Meanwhile we can summarize already that the tectonic nature of brick masonry is ambiguous, because it can refer to two technical arts as distinct as *stereotomy* and *textile*. In the following paragraph I will discuss how brick masonry can emphasize in its tectonic expression a reference to any of the four primordial technical arts, also *ceramics* and *carpentry*.

Textile expressions in brick masonry

Semper considered textile to be the oldest technical art from which a host of formal principles originated; the string, the band, the cover, the seam (the principle of making a virtue out of necessity), the hem, the principle of dressing, the principle of masking. Important for us is that in Semper's understanding the wall as spatial enclosure emerged from the textile arts – the wall as *Wand*. This textile origin constitutes the essence of the wall. It suggests the *principle of dressing* which means that the textile reference of the wall should be maintained even if the material from which the wall is made changes. It is the surface appearance of wall, not its deep-structure, that matters. A wall made of stones should still express textile principles.

Another often referred to principle is the *principle of masking*. It means that technical mastery should be aimed for in order to make the beholder forget any material constraints or technical efforts; loadbearing, keeping a construction together, waterproofing, etc. should not be expressed.

> 'Only complete technical perfection, only the judicious and proper treatment of the material according to its properties, and above all only the consideration of these properties in the act of shaping form can cause the material to be forgotten, can liberate the artistic creation from it […].' (Semper et al. 2004, 439)

For brick walls the reference to textile is productive.

> 'To start with, one could say that all bonding patterns resemble textile patterns in the first place. They develop a formal motive (the bonding pattern) from the technical necessity of joining the bricks, just as weaving patterns emerge within the technical constrains of warp and weft. The use of two contrasting colours of brick intensifies the resemblance of the bonding patterns to ones used in textile. The most decorative brick patterns, in which the function of the bonding is subordinate, evoke the strongest association with textile patterns.' (Garritzmann 2016, 123)

Koen Mulder describes in his book *The Thrilling Surface* the pattern making in brick masonry as the result of the interplay between the primary horizontal stacking and the secondary vertical alignment (of headers, perpend joints and stretchers). As a third aspect he considers the edge condition of a brick wall which also influences the visual reading of the pattern. (Mulder 2016, 5) His brilliant book shows that with basic bricks there are already countless ways to develop brick patterns.

No need to say that all brick patterns have to conform to the formal logic of the brick, that is its modular measures, and the constructional restrictions and possibilities following from it. This is actually the case for all tectonic expressions in brick. Textile tectonics in brick architecture enjoy articulating patterns out of the technical necessity of conjoining that make this very necessity forgotten. From history to the present we can find diverse textile expressions in brick masonry. A few of my favourite examples are: the dovecote of the manor of Ango in Varengeville-sur-Mer (1532); the former opera house (today: high court) in Copenhagen by V.F. von Platen (1703); the Sprinkenhof in Hamburg by Hans and Oskar Gerson and Fritz Höger (1925-1943).

Ceramic expressions in brick masonry

To begin with this paragraph, I should like to suggest that Semper's assertion that brick articulates formal principles of a ceramic only in secondary way should be slightly nuanced; at least in the case masonry that employs *moulded bricks.* It adopts through its moulding a formal principle that Semper actually considers to be ceramics most important contribution to the formal repertoire of architecture. It is the 'formal articulation of parts and the contrast between these parts' (Semper et al. 2004, 554). Mouldings in brick masonry are used just like in ancient Greek architecture to articulate transitions between parts such as a tripartite arrangement of a wall.

The German art historian and oriental archaeologist Friedrich Sarre had identified the moulded brick as a typical building element in the so-called North German Brick Gothic. 'The capacity of clay to easily adjust to the forming hand of the artist, with advanced exercise and experience lead to the creation of gothic profiles and foliage ornaments, and even figurative depictions. […] everywhere we encounter the glazed and in manifold coloured dazzling moulded brick which appear to be vitalizing to the massive and heavy masonry.' (Sarre 1890, 7)

Towards the end of 19th century the catalogue of many brick manufacturers in Germany and in the Netherlands contained a number of standard moulded bricks, which were used in Neo-Gothic architecture (e.g. Central Station and Rijksmusem in Amsterdam), as well as in other architectural styles.

Timber expressions in brick masonry

Semper defines carpentry as 'the art of assembling stiff, planklike elements into a rigid system' and considered it 'indisputably the most important art for the theory of monumental style, if only because the gable roof with its supports has been the traditional symbol of the *sanctuary*.' (Semper et al. 2004, 623) However, carpentry is the technical art which according to Moravánszky masonry in the first place does not relate to. Many brick buildings from history nonetheless do through the wide-spread classical paradigm. Curiously enough, Greek temples express carpentry's formal principles in stone construction, while the formal principles of stereotomy are here only of secondary importance. (Semper et al. 2004, 725) The most important motives are the frame (triangular, rectangular upright, or rectangular horizontal) and the supports; moreover, the integration of the previous two motives in a self-completed whole.

When formal principles of carpentry are expressed in brick masonry, the presence of various building parts that fulfil different structural functions, actually or symbolically, are articulated. Brick masonry is in this case structured by the expression of walls and floors, posts and lintels, pilasters and cornices, and supporting and supported building parts. Brick masonry that naturally is inclined to textile principles of surface making – due to the presence of the web of mortar joints – now has to articulate linear elements. Formal means in support of this effort are the articulation of edges in combination with relief. We can also think of contrasting brick patterns in adjacent elements. Textile patterns become useful in framed areas and support the reading of the linear elements as structural (even if only symbolically).

Brick buildings that subscribe to a classical paradigm are easily associated with the expression of carpentry's motives. Many of the later brick building of the office of Hans Kollhoff serve as a good example. (The Dutch Ministry of Internal Affairs in The Hague (2008-2012); Housing Malchower Weg, Berlin (1992 - 1994)

In contemporary brick architecture the motive of the post and lintel also find a freer interpretation, such as in the work office Winhov. (Housing Towers De Loodsen , Amsterdam, 2001-2006; City Archive Delft, 2014-2017, in collaboration with Gottlieb Paludan)

Stereotomic expressions in brick masonry

In terms of tectonic expression, stereotomy is quite a difficult technical art to use as a formal reference, because its repertoire of formal motives is relative small. Its technical and formal ideal is the monolithic, undivided stone mass. Semper asserts that 'The most perfect stone construction does not reveal that its construction is composed from many pieces, such as in the foundations of the Parthenon.' (Semper et al. 2004, 727)

The craft of the stone cutter strives for a perfect fit of surfaces at which stone blocks meet; the better the surfaces fit one another the lesser the expression of the joint. To achieve a kindred perfection of the joining surfaces in brick is hardly possible due to the material clay and the production process that turns it into brick. The mortar joint is needed in brick masonry to mediate the brick's inevitable imperfect measurements. Technically it turns the assembled building parts of relative small size into a monolithic or solid construction, while formally it expresses that this construction is conjoined. The monolithic characteristic of stone construction in brick masonry can formally be approximated in quite different ways that even can contradict each other.

One way is to suppress the expressiveness of the mortar joints by matching their colour with the colour of the brick, drawing the two materials closer to each other and subduing the composite nature of brick masonry. Also, the size of the brick in relation to the size of the whole building is relevant in this regard. Take for example the Pireus housing block in Amsterdam (Hans Kollhoff and Christian Rapp, 1989-1994); it is of such an immense size that when the building is perceived as a whole the single units of the bricks are no longer perceived. The Pireus appears as a huge monolithic mass which is sculpted.

Another way is to express the monolithic character of brick masonry is by stressing its earth relatedness by emphasising the horizontality of its stacking. This can be done by accentuating the bed joints, by reducing the size and/or number of the headjoints, and through the use of extraordinary long bricks.

A different way to express the earth relatedness is to deliberately use bricks which are irregular in shape, colour and surface texture. A combination with a very expressive joint which can contrast in colour, is thicker than conventional joints, is flush brush-finished to accentuate the irregularity of the bricks can accentuate this.

Wild bond as joining pattern seems to strive or the same effect.

The surface percentage of the joints may equal or even exceed that of the bricks. (e.g. Islev Church in Rodøvre by Inger and Johannes Exner, 1970).

The roughness, irregularity and unevenness of the surface texture evokes an association with the drawing in natural stone or the rough grain of the monolithic stone layers of the earth. The Kolumba Museum (2007) by Peter Zumthor is a building that combines a few of the previous principle.

Another formal principle of stone construction is 'the gradual reduction of the constructional mass from bottom to top' (Semper et al. 2004, 734); it is at the time a technical principle. It finds expression in military fortifications and in works of civil engineering, but it is hardly expressed in civic architecture. Cities such as Amsterdam or Berlin prescribed this gradual reduction of the loadbearing wall in its 19th century building codes by relating the number floors to the thickness of the walls. Usually this reduction of the wall thickness was accounted for at the inside of the building volume resulting in the gain of half a brick in the nett floor area per higher storey.
One of the few brick building that exploits this motive at the outside is Hans Heinrich Müller's *Stützpunkt Zeppelin* in Berlin (1928). The façade thickness of this five-floor building is reduced by half a brick per floor at the exterior. The ground floor and the edges left, right and at the top stay in the building line. Each recess per floor is horizontally accompanied by a rowlock that terminates the lower level. With every higher floor the recesses on the vertical edges gradually turn into square mouldings of finally four, header-sized steps that at the top of the façade culminate in the cornice which they articulate at the same time by turning into the horizontal direction.

But we have not yet touched upon the important motives that associate stone construction with a spatial idea: the arch and the vaulted ceiling. Semper asserts that the history of masonry construction 'virtually amounts to a history of architecture because of the vault's victory over the straight tectonic ceiling and roof structure paired with its columnar apparatus'. (Semper et al. 2004, 757) He wanted to discuss this topic in the third volume of his magnum opus which, however, he never succeeded to complete.
The era of arches and vaulted ceilings certainly did not last to the present day. More economic ways to span wall openings and interior spaces have long ago concluded at this mode of construction. But for Louis Kahn the spatial idea was substantially related to the loadbearing construction. Consequentially, he considered the arch an essential motive in brick masonry which he meant to revitalize with his well-known mystical dialogue asking 'Brick, what do you want?'; and letting the brick answer 'I want an arch', despite of the economic restrictions that he was well aware of. (Kahn and Latour 1993, 125) In contemporary brick architecture, we witness quite recently perhaps the harbingers of indeed a recurrence of the arch. I am thinking of the Bremer Landesbank by Caruso St John (2016); or of WestBeat, the winning tender for a mixed-use urban block in Amsterdam by Studio NineDots (2019).

Conclusions

The previous reflections show that the tectonic nature of brick masonry oscillates between the poles of textile expression (non-loadbearing, filigree construction) and stereotomic expression (loadbearing, solid construction). It is the mode of construction that suggests this ambiguous nature of its tectonic expression, while brick masonry also can assume expressions of ceramic and of carpentry.

Tectonic expressions may be combined as in traditional architecture or the primitive hut, where each tectonic realm was associated with one of the four elements of architecture (the fireplace, earthworks, the roof and its supports, and the spatial delineation). A particular tectonic expression may also dominate the appearance of an entire building.

Already in the primordial technical arts tectonic principles or motives could be combined and generate hybrid forms of appearance; for example, as in the basket, which is a bowl that is constructed with textile means; or, the other way around, as in the ceramic vase that is dressed with coloured and indented textile motives.

As if the ambiguous tectonic nature of brick masonry were not enough, also here motives of different tectonic realms can be combined. An extreme example is the cigarette factory Haus Neuerburg in Hamburg (1928) by Fritz Höger, which famously combines a columnar pilaster with the linear textile motive of a round cord.

What can we learn from this thoroughly ambiguous tectonic nature of brick masonry? First and foremost, there is no single truth of tectonic expression in brick architecture. There is neither an honesty of material(s), nor one truth of construction which would imply a single tectonic expression in brick masonry. Instead there are manifold possibilities for tectonic expression.

This, however, does not mean that anything goes. The materials brick and mortar, combined in brick masonry, come with restrictions and with possibilities which have to be considered; Semper would say, they have to be mastered. The restrictions concern technical and constructional matters; and they also concern formal matters (presence of joints, sizes of bricks, modularity of brick, logic of linear and of surface pattern making, edge conditions of these patterns). Each of the possible tectonic expressions must master these constraints to arrive at a convincing tectonic articulation.

The reality of contemporary building construction is entirely hybrid, a façade with facing brick is a layered construction: interior facing, gypsum board or loadbearing wall, vapour barrier, insulation, waterproofing, cavity, brick wall-ties, steel auxiliary constructions with their own assemblage of linear bracing at intervals supporting brackets, the facing brick masonry, eventually with reinforcement in the joints. Technically spoken, the facing brick wall is today almost everywhere a cladding.

This “truth” of constructional reality could actually be utilized as an argument for the expression of a textile tectonics, but this is not the point that I want to make here.

My position on tectonics is inclined to the surface position which in my opinion may adhere to all modes of tectonic expressions independent of its actual structural performance. But I am also concerned about the deep structure as soon as it exerts an effect on the surface of brick masonry that can be experienced. Then these technicalities should be addressed aesthetically, that is, tectonically. Contemporary construction techniques of brick masonry do challenge the surface appearance of brick masonry: The expansion joint, the montage joint of prefabricated brick elements, material fatigue of steel substructures, and other technicalities require such an attention.

To return to Louis Kahn’s dialogue, it seems that the brick could have also replied: I want a monolithic mass. I want a brick dress. I want a moulding. I want a tripartite articulation. I want post and lintels. All of these tectonic expressions in brick masonry are fine with me as long as they are addressed with according tectonic thinking.

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