STRUCTURE AND BUILDING FAÇADES. THE NEW CONCEPT OF ORNAMENT

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Abstract

The chosen structural system and the structural element can be implicated in different ways in the composition of the façades; their implication is determined by the concept of structural design in the architectural aesthetics. The concept of ornament in today’s architecture has different manifestations, for the purpose of anchoring in the cultural phenomenon, the idea of expressivity through consistency and not just decorum. The ornament is not considered anymore to be a prior determined mask, to create a significance, to have a certain meaning, the way it manifests itself in the Postmodern Period, it doesn’t have the role of concealing something, the way it happened in different historical periods prior to the modern period, when its existence was futile. Contemporary architecture produces “communication” through ornament, which manifests itself in different depths of the covering layer of the façades. The technological performance and the new digital techniques in building design, have determined a close relationship between structural engineering and architectural aesthetics.

Rezumat

Sistemul structural ales și elementele structurale pot fi implicate în diferite moduri în compoziția fațadelor implicarea acesteia fiind determinantă prin conceptul de design structural în estetica arhitecturală. Conceptul de ornament în arhitectura actuală capătă diverse manifestari, iar acesta are ca scop ancorarea în fenomenul cultural, ideea de expresivitate prin consistență și nu doar un decor. Ornamentul nu mai este considerat o mască determinată apriori, pentru a crea semnificație, a avea un anume înțeles, în felul în care se manifestă în perioada Postmodernă, nu are rolul de a ascunde ceva, așa cum se întampla în diverse perioade istorice anterioare perioadei moderne în care existența acestuia era inutilă. Arhitectura actuală produce “comunicare” prin ornament, acesta manifestându-se în diferite profunzimi ale stratului anvelopant al fațadelor. Performanțele tehnologice și noile tehnici digitale de proiectare a construcțiilor, au determinat o relație strânsă între ingineria structurală și estetica arhitecturală.

Keywords: concept, ornament, perception, façade, structural design

Introduction

The façade is responsible for the visual impact of a building, as the covering, as the interface between the viewer and the built space that has a purpose, a signification and a context. The compositional aesthetics of architecture has been explored through the course of time, in extremely
diverse ways from one historical period to another.

The modernism of the beginning of the 20th century uses as a main idea, “transparency” \(^1\) in order to obtain a direct representation of the architectural elements of the built space, of the architectural program and of the structure generating the concept of “architectural sincerity”. Later on, Postmodernism uses the concept of decorum, allusion, significance and Deconstructivism uses the geometry of collage, replacing the idea of transparency of the modernism. Currently, the idea of expressivity has become an objective to architecture, in a general context where the image is the main communication vehicle of the consumer society, which involves a number of constraints regarding the reevaluation of the necessary instruments for the construction of a building’s expressivity. Many new architecture programs have come up in the catalogue of building purpose, following the specificity of the social urban context of our days which is characterized by speed and communication. We are witnessing the emergence of a growing number of buildings the purpose of which does not require an exterior-interior relation that is defined by the covering, who’s façade is opaque, without transparency, interior cores, small polarizing centers that concentrate the functions of the city on a small scale. These buildings belong to the category of media centers, offices, malls, movie theatres, museum, libraries, etc. Contemporary technology concentrates on controlling the environment, on the energy efficient spaces, objectives that involve concentrating the design on the dimension of the spaces, of the covering and its relationship with the natural light and the bearing structure.

**Structure and building façade**

Making such buildings, contemporary as a complex system, that integrate the relationship of the interior space with the architectural volume as well as the relationship of the interior space with the urban context of the building, brings to the attention the performance of the element that mediates these relationships, namely – the covering, the façade of the building. The performance of a façade is assessed through aspects regarding the capacity in which the natural light relates with the interior space, aspects regarding the capacity to maintain the thermal efficiency of the building and the thermic comfort and least but not last the capacity to offer aesthetical value through expressivity and composition.

The role of the structure is multiple: firstly is providing stability and resistance, then is the role of sustaining the architectural aesthetic concept in the façades; another important role is that of the quality of the interior space, through the capacity of rhythm, distribution, liberation and maximizing the flexibility of the interior spacial configuration and also to allow for a good relationship with the natural light in the façade. So, the chosen structural system and the structural elements can be involved in the composition of the façades in various ways.

Using representative examples of architecture from across the time and a periodization specific to most important publications in the field of architectural history, three important instances of the relationship between structural form and architectural image can be distinguished in the universal architecture, namely:

1. The visible structural form – situation in which the structural elements can be identified visually in the image of the architecture participating alongside other elements of compositional and ornamental order, to the general form of the building. (Fig. 1)
2. The hidden structural form – situation in which the existent structural elements don’t participate in the image of the building, being in the «architectural covering» not having a role in the composition, the invisible structural form doesn’t coincide with the apparent contour of the building. (Fig. 2)

3. The determinative structural form – situation in which it generates the compositional volume concept of the architecture, determining the architectural form and implicating itself in the details and ensemble of the architecture. (Fig. 3)

All these demonstrate the certainty of the implication of structure in architectural aesthetics, determined through image in various ways and various degrees of participation.

Architectural aesthetics is concerned with beauty in the art of architecture. This premise places architecture among the visual arts, receiving aesthetic value it fits in the aesthetic markers characteristic to the area of general aesthetics and its theories.

Defining architecture in the field of aesthetics and philosophy, in different historical periods and then confronting these definitions with the characteristics of the architecture of those periods, relationships between architectural form, aesthetics and structural form can be identified.

The aesthetic attribute, followed in the study of architecture, demonstrates the relationship it has with structural form, in order to respond to the request of beauty that is addressed to the field.

Nature, interpretation, creation and the reception of «beauty» in architecture, from the point of view of architecture as an artistic phenomenon of some personalities form the field of philosophy, aesthetics and architectural theory, is an important analysis that underlines the aesthetic role that the structural element and structural system can have in the compositional concept of
architecture in different historical periods. Also, the identification of certain moments of change in
the definition of architectural aesthetics, such as the one in the beginning of the 20th century
when architecture accentuates its functional role, certifies the importance of structure in defining
architectural space and its aesthetic qualities. Various classifications of architectural space elements
and the various ways of receiving it in the modern period, determine the link between the evolution
of structures, of geometry of structural shapes, of technological performance and of new materials
that have made the evolution of the architectural phenomenon and as well as the aesthetic
perception in the field possible.

Architectural elements have determined the evolution of structures, the relation between the
geometry of shapes and the static function of the architectural structures and the relation between
structure and the architectural image.

Table 1. The structure-image relationship throughout different architectural historical periods.

<table>
<thead>
<tr>
<th>Historical period in architecture</th>
<th>Architectural special characteristics</th>
<th>Structural characteristics</th>
<th>Structure/Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>The primitive period</td>
<td>Labyrinthian agglutinated multiplied</td>
<td>Wood structures, clay, stone, simple</td>
<td>Visible</td>
</tr>
<tr>
<td>Greek antiquity</td>
<td>Composition, proportion, order</td>
<td>Transposition of the wood trilithic system into stone</td>
<td>Visible</td>
</tr>
<tr>
<td>Etruscan roman antiquity</td>
<td>Large dimensions, monumental</td>
<td>System of columns, arches, domes</td>
<td>Determinative</td>
</tr>
<tr>
<td>Early christian period</td>
<td>Simplicity, interiorization</td>
<td>Dome, vault, christian capital</td>
<td>Visible</td>
</tr>
<tr>
<td>Romanesque (early gothic)</td>
<td>Complexity, massiveness</td>
<td>Round arches, thick walls</td>
<td>Visible</td>
</tr>
<tr>
<td>Gothic</td>
<td>Space, height, stone lacing, spatial liberation</td>
<td>Simple arches, ogival arch, selfsupporting long columns</td>
<td>Determinative</td>
</tr>
<tr>
<td>Renaissance</td>
<td>Proportions, pure shapes</td>
<td>Pediments, flat ceilings</td>
<td>Visible</td>
</tr>
<tr>
<td>Baroque/rococo</td>
<td>Sculptural, complexity</td>
<td>Pilasters, pediments, keystone</td>
<td>Hidden</td>
</tr>
<tr>
<td>Neoclassicism (romanticism)</td>
<td>Proportions and classical orders, monumental</td>
<td>The interpretation of anchient architectural structure</td>
<td>Hidden</td>
</tr>
<tr>
<td>The modern period</td>
<td>Functional, free, transparent</td>
<td>Reinforced concrete structure, cast iron, steel bearing structure</td>
<td>Determinative</td>
</tr>
<tr>
<td>Contemporary</td>
<td>Stylistic pluralism, compositional diversity</td>
<td>Different typologies, structures, structural innovations, new technologies</td>
<td>Visible, hidden or determinative</td>
</tr>
</tbody>
</table>

In early times, the clarity of the shapes and the equilibrium of the proportions have been favored, as opposed to the complex drawing of gothic buildings. Mathematical relations have been used to establish harmony. A preference for symmetry and pure forms is established at the same time with the rational approach of projects. The study of perspective has allowed architects to progress in the display of objects in relation to spatial perception.

The new concept of ornament
The image of a building has always been determined mainly by aesthetic, formal criteria that are left to be satisfied by the architect. Along history, the idea of ornament as a decorative element with an aesthetic role had different positions in relation with the principals of each architectural style. The ornament, as a visual element that belongs to the façade, is known in the history of architecture due to the opposition between Gottfried Semper and Adolf Loos’ theories. For Semper, the functional and structural aspect of a building is second to that of aesthetic and artistic aspect of the ornament. On the other hand, for Adolf Loos, the ornament was futile, leaving in history the famous slogan “ornament and crime”. This moment the history of architecture marked a new attitude towards the idea of ornament in the image of building façades. According to Loos, the ornament has been used by the traditional society as a way of social differentiation, whereas the modern society didn’t have as an objective the exacerbation of individuality, but contrary, its suppression. So for Loos, as soon as the ornament lost its social function, it became futile.

The modern period from the beginning of the 20th century, brought to the attention transparency as a way to make the architectural image much more honest, in contrast to the bourgeois decorativism. This characteristic has dominated the architectural image up to the ‘60s. In the following period, Robert Venturi and Denise Scott Brown denounce the paradigm of modernism as being cynical and limited as propose the replacement of transparency with decorum. For them, the architectural decorum of the façades helps with the integration of the buildings in the urban objectives and offers significance to the public eye. A rupture is born, between the idea of building as function and building as representation accepting the contradiction between space, structure and building purpose as a creative factor. In this period, architects seek an architectural expressivity that is separated from the spacial organization; the cultural expression “ready-made” is now incapable of communicating with an intelligent and dynamic public. But postmodernism lost its strength and impact due to the absence of a language or system of understanding. The symbols that were used remained anchored in the particular cultural moments or certain contexts that couldn’t survive the changing conditions of the following periods. For architecture to remain convergent with culture it has to build mechanisms through which culture can produce new images and concepts, rather than recycling the existing ones.

In contemporary architecture, the concept of ornament acquires various manifestations with the purpose of anchoring in the cultural phenomenon, the idea of expressivity through consistency and not just decorum. The ornament is not considered anymore to be a predetermined mask, in order to create a significance, to have a certain meaning, in the manner in which it manifested itself in the Postmodernism period, it doesn’t have the role of hiding something, the way it happened in various historical periods prior to the modern period when its existence was futile. Contemporary architecture produces “communication” through ornament, which manifests itself in different depths of the covering layer of the façade. The classification of the manners of manifestation of the contemporary ornament can be made according to the relationship it has with the constructive system of the building, considering the type of material it is made of and according to the effects it creates from a visual point of view. The analysis of the three situations underlines the link between them: constructive system, the texture of the material, material – affect.

A) The concept of ornament related to the constructive system manifests itself on the level of architectural form, on the level of the structure, as a screen – partition wall that separates the interior space form the exterior, or as an applied surface.

1) The ornament resulted from shape (a), includes those architectures whose entire volumetric, plane and spacial organization determines repetitive elements in the façade that emphasizes the surface of the covering in an expressive manner. This type of ornamentation obviously implies choosing a structural system and certain structural typologies that best define the formal concept of the architecture. (Fig. 4)
1. Circular base plate, 140 mm dia., glued to glass
2. 2-piece inner guide ring, polished brass, with screws
3. Circular inner cover plate 120 dia. X 5 mm, with screws
4. Divider, 1.2 mm sheet metal
5. Frame, 2 mm sheet aluminium, bent to suit
6. Plastic-coated paper
7. Aluminium retainer with clip
8. Outer guide rail
9. Fixing, attached to window reveal
10. Theraded sleeve, 20 mm dia.
11. Fixed light, 6 mm toughened safety glass, 1300 mm dia.
12. Rubber gasket
13. Sheet aluminium, screwed to aluminium angle, 40 x 40 x 4 mm

Figure 4. Nakagin Capsule Tower, Tokyo, Japan, Kisho Kurokawa & Associates, 1972

2) The ornament resulted from structure (b) includes those instances when structural elements are visually involves in the façade of the building. The shape of these structures resulted through calculus, through choosing a certain typology and a certain material creates an ornamental texture of the building covering. (Fig. 5)

3) Ornaments that result from the structure of the enclosing system (c) involve the layers that are interposed between interior and exterior of the walls and participate visually-expressive in the interior as well as in the exterior. In this case, the structure is not visible but it has the role of ensuring a solid-hollow relation in the walls. (Fig. 6)

4) The surface ornament (d) is that which is applied independent from the enclosing system, a separation of the interior form the exterior space, on the exterior side, visually participating only to the external environmental context. In this case, the structure doesn’t have an apparent visual role, but only that of resistance in association with the enclosing elements that are involved. (Fig. 7)
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B) The concept of ornament according to the used material is different for the enclosing elements of the façades. The quality of the chosen material, the processing technology, the way in which it can associate with the desired shape, the tradition and the significance it has, are equally important in the making of façades.

The technological evolution and structural inventiveness have determined a great diversity of architectural expressivity. Creating diverse architectural shapes is ties to the new structural concepts, as well as to the discovery of performant building materials that make it possible. The evolution of building materials technics consists of improvements to the physical-mechanical characteristics of the classical materials as well as the invention of new materials.

Composite materials are made by integrating elements that belong to materials with different properties in various ways, either through associating of a matrix, either through association

Figure 5. Commercial Building, Lausanne, Switzerland, B+W architecture

1. 50 mm extensive vegetation layer
2. 80 mm mineral plant substrate
3. 10 mm drainage layer, elastomer 2-layer sealant
4. 180 mm foam glass insulation, bituminous treatment
5. vapour barrier
6. 280 mm reinforced concrete pre-stressed roof slab
7. aluminum sheet metal
8. 150/150 mm steel SHS
9. sprinkler
10. cable trough
11. pressurized air pipes
12. façade element, membrane cushion,
   - 4-6 mbar pressurized, U value = 1.3 W/m²K
   - 1x membrane PTFE white,
   - 3x membrane ETFE translucent
13. 70 mm screed; 40 mm insulation
14. 280 mm floor slab, reinforced concrete
15. floor duct
16. heating
17. fluorescent lighting
18. ventilation duct

19. 70 mm screed; 40 mm insulation
20. 280 mm floor slab, reinforced concrete
21. floor duct
22. heating
23. fluorescent lighting
24. ventilation duct
following the sandwich principle, by inserting a light material between two sheets, composition
following the organic structures model or through obtaining of films, plates or extruded profiles.

Figure 6. Publicly Assisted Housing, Vecindario, Spain, Pedro Romera & Angela Ruiz

The making of high-performance concrete by replacing traditional reinforcement with steel tubes
filled with concrete, or the post-tensioning of high-performance concrete for the placement of
buildings with large spans, fiber reinforced concretes which due to the lightness of the material
allow fabrication through pulverizing of very thin surfaces, method that argue the comeback of the
expressive and spectacular concrete membranes in contemporary architecture.

As a building material, glass has a multiplied role today; it can be the covering, an interface
between the interior space and the environment, a support for a large range of colors, textures and
images, creating a screen for communication. Smart materials obtained through film technics and
nanometrics, bring exceptional plastic qualities to the building façades, through phototropic glass,
photochromatic or glass with integrates circuits, as well as electrochromatic glass, that changes its
transparency and translucidity. Structural glass walls, the history of which started with the first
façade made from structural glass in 1986 at the Great Greenhouses at the Science and Technology
Museum, in the La Villette Park (arch. Adrien Frainsilber and eng. Peter Rice) that use cable rods
for stabilizing the glazing and the glass clamping system, which imposes a dissociation condition of the joint glass panels in order to allow movement and sealing with silicone or elastic neoprene bands, as well as the necessity of assembly only with elastic joints or spherical joints for spot fastening.

Figure 7. University Building, Paris, France, Peripheriques architectes

C) The concept of ornament after the visually-plastic effect is another criterion. The visual effect is the result of the connection between the constructive system in its different manifestations and the quality of the chosen material. Contemporary architecture progressively concentrates on the expressivity of the building covering, the specificity of the constructive material of the façade elements seeking the sensational and affect. Recent architectural experiments explore digital methods of visualizing the façade technology, its performance in the field of building structures and material capable of expressivity becoming the cultural force. Due to the new concept of façade ornament, the texture of the building material has the quality of producing an “Affect”\(^5\). Sensation and affect are concepts that belong to our perceptive structure.

1) The visual perception applicable to architectural perception can be suggested (a) with an interferential character, that refers to an information that is just sketched, that leaves the concept idea to be deduced.
2) Perception can be **selective (b)**, that chooses certain elements to be perceived through diverse selective psychological or cognitive mechanism, a character or perception that can be speculated through elements of interest accentuated in the architectural composition that attract the attention.

3) A different way of perceiving shapes is that **categorial (c)** when common features, similar to the components of the architectural image are distinguished and are mentally grouped in categories with the same characteristics, the repetition of certain elements in a particular rhythm, the replay of certain elements with different compositional rules on a chromatic, textural or formal level.

4) The **relational (d)** character of perception refers to the comparison of certain elements that are next to each other in a system of relation, the compositional elements of architecture are in a relation of juxtaposition or overlapping.

5) The principle of **adaptation (e)** of visual perception in the case or architectural image refers to the concentration of attention on certain important characteristics or façade compositions, through aesthetic special effects resulted after certain compositional processes.

6) The **evocative (f)** character or human perception is determined by the comparison of visual elements of architectural image with others that are similar, extracted from the image of other architectures or from representative historical architectural styles.

Therefore the chosen structural system and the structural elements can be implicated in the façade composition in different ways, their implication is determined through the concept of structural design in architectural aesthetics. (Fig. 8)

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**Figure 8. National Stadium in Beijing, Beijing, China, Herzog & de Meuron, 2008**

**Conclusions**
1) The concept of ornament in contemporary architecture has various manifestations, and it has the purpose of anchoring in the cultural phenomenon, the idea of expressivity through consistency, and not only through decorum.

2) The ornament isn’t considered a predetermined mask anymore, in order to create a significance to have a certain meaning, the way it manifested in the postmodern period, it doesn’t have the role of hiding something, the way it happened in various historical periods prior to the modern period, when its existence was futile.

3) Contemporary architecture produces “communication” through ornament that manifests itself in different depths of the covering layer of the façades.

4) Technological performances and the new digital techniques of building design have determined a close relationship between structural engineering and architectural aesthetics.

5) In architectural creation, the way images are explored through perception has as a source the human capacity to react to a series of stimuli such as light and acoustic intensity, shape, color, three dimensionality and significance. These markers quantify the quality of architectural perception, revealing the subjective component that it contains.

6) The contemporary architectural façade is a covering conceived to satisfy the comfort and security requirements as well as aesthetic requirements that animate the built landscape, and the ornament of contemporary architecture is the reflection of the new material technologies and of technical reasoning.

Notes:
1 Concept that defines modern architecture staring from the idea of “sincerity”, developed in the publication Transparence reelle et virtuelle, Les Editions du demi –Cercle, Paris written by C. Rowe
2 Robert Venturi and Scott Brown argue in this manner the progressive preoccupation of architects for the architectural expression - Learning from Las Vegas, Cambridge, MIT press, 1972
3 Especially in the baroque and rococo period, 17th–18th century, that developed the sculptural ornamental potential of façades
4 Created after biological patterns, are systems that self-monitor, self-adapt and self-repair.

References