FORM IN ARCHITECTURE AND PRINCIPLES OF DESIGN

DANICA STANKOVIC, Ph.D., Associate Professor, University of Nis, Faculty of Civil Engineering and Architecture in Nis, Serbia

ALEKSANDRA KOSTIC, MSc. Arch., Ph.D. student, University of Nis, Faculty of Civil Engineering and Architecture in Nis, Serbia

VOJISLAV NIKOLIC, MSc. Arch., Ph.D. student, University of Nis, Faculty of Civil Engineering and Architecture in Nis, Serbia

ALEKSANDRA CVETANOVIC, MSc. Arch., Ph.D. student, University of Nis, Faculty of Civil Engineering and Architecture in Nis, Serbia

Abstract: The concepts regarding space and form are moved from one to the other in the course of history. Also, this change that space and form have undergone together should be considered based on the change and development in theory, discourse, technology, material, time etc. Depending on this development and change process, architectural form is also evident to change its expressions. The main goal of this research is to define the types of forms and their characteristics as well as the types of the possible spatial organizations in architectural design. The investigation includes analysis of the contemporary architecture. In this article are analyzed the examples from the practice with the aim of emphasising the significance of the conceptual design strategies used in architectural design.

Key words: form, architecture, principles, design, buildings.

1. Introduction

Form in architecture is not only related to space and the activity occurred within this space, Yilmaz (1999) claims that form is also instrument for meaning or a sign. A part from that architectural form is also related to the elements themselves; arrangements, and combination with each other (syntax); the meaning (semiotix), and the affects on people (pragmatics) [11]. Form can not reduce to the single of selection of elements and their organization. Neither can form be considered only as a tool of meaning.

The primary elements as point, line, plane, basic shapes and solids have given a base to variety of geometries as conceptual through the history. Also we could see all use of those elements in architecture nowadays. Those are the basic elements which are directly influence forming of space and architectural form as in either conceptual sense. Put differently, those elements have added aesthetic, symbolic and conceptual wealth to architectural design. For that cause, architects are broadly used those elements in particular in architectural space organization.

This paper consists of three main parts. In the first step, the author analyzes different groups of elements of a form in architectural design and their characteristics. Thereafter the study is attempted to define the types of form and space organisation as well as the conceptual principles in architectural design. And finally, the last part of this article shows examples from practice with the aim of emphasising the significance of the choice of architectural form, its development and articulation, depending on the basic types and the principles of organization.

2. Form and spatial organization in architectural design

Wong (1993) believes that design is a process of purposeful visual creation. Therefore it's a visual language is the basis of design creation. Elements of design may appear rather abstract, but together they determine the appearance and content a design. Four groups of elements are differentiated: conceptual, visual, relational and practical. In dictionary of architectural design each element is firstly considered as a conceptual element, then as a visual element [10].
Conceptual elements of architectural design are *point, line, plane and volume* [1]. Conceptual elements are not visible, they are not realistically present and if they really exist there they are no longer conceptual. Thus when conceptual elements become visible they have *shape, size, color, light and texture*. Yilmaz (1999) considers that they all combine to inject a quality or spirit that articulates space. Architectural forms as a three-dimensional forms are seen differently from different angles and distances. Under different condition as is lightning, color or texture visual elements can make the form in different situation to look differently [11].

The group of relational elements governs the placement and interrelationship of the shapes in a design. Some are to be perceived, such as *direction and position*; some are to be felt such as *space and gravity*. The practical elements underlie the content and extension of a design. They are *representation* (realistic, stylized, or near-abstract), *meaning* and *function* [10].

### 2.1. Types and characteristics

Forms can be regular or irregular. Regular forms are generally stable in nature and symmetrical about one or more axes. According to Ching (1996) forms can retain their regularity even when transformed dimensionally or by the subtraction or addition of elements. A form can be transformed by changing one or more of its *dimensions* and still retain its identity. A form can be modified by subtracting a part of its volume. Depending on the scope of the *subtractive process*, the form can retain its starting identity or be transformed into another form. A form can be modified by the *addition* of elements to its volume. The character of the additive process and the number and dimensions of the elements being attached define whether the identity of the initial form is altered or retained. So, while a subtractive form (Fig. 1) derives from the elimination of a part of its authentic volume, an additive form (Fig. 2) is created by connecting or physically attaching one or more supporting forms to its mass.

Irregular forms are usually asymmetrical and more dynamic then regular forms. As the focus is both solid masses and spatial voids in architecture, regular forms can be part within irregular forms. In the same way irregular forms can be included in regular forms [1].

Type of the spatial organization is defined by the formal characteristics. A spatial organization can be *centralised, linear, radial, clustered* or within *grid organization*.

### 2.2. Conceptual principles and strategies

Design principles play an important role for a better improvement of the concept of whole. Also the function of design is to arrange elements one by one or one to one as well as considering their relationship with whole. Design strategies are applicable in all architectural works whether is two-dimensional or three-dimensional form.

As the fundamental science of forms and their order geometry contributes to the process of composition and designing in architecture. Leopold (2006) observes that a composition in architecture starts with elements and their relations. Through history of geometry and architecture there were developed some rules based on geometry which formed the basis for architectural composition [6].

---

Fig. 1. Base and façade of the Orange Cube / Jakob + Macfarlane Architects in Lyon, France, 2011 (Source: https://www.archdaily.com/111341/the-orange-cube-jakob-macfarlane-architects), Fig. 2. Base and view on the PANEUM Center / Coop Himmelb(l)au in Asten, Austria, 2017 (Source: https://www.archdaily.com/881743/paneum-center-coop-himmelb-l-au)
According to Yilmaz (1999) conceptual design strategies used in architectural design are: **unity, balance, contrast, rhythm and proportion.** For Ching (1993) principles that are seen as visual devices that allow the varied and diverse form and spaces of a building are: **axis, symmetry, hierarchy, datum, rhythm, repetitition and, transformation.**

**Unity** is the quality possessed by a building or group of buildings in which the elements are seen to be bounded together for some reason. A grouping appears to have unity when the visual centers of gravity of the individual elements are clustered close to the center of gravity of the whole. Unity can be archived through similarities in texture, color and detailing of elements. In whole and integrated architectural design unity is a highly desirable goal [11].

**Axis** is the most elementary principle of organizing form and spaces in architecture. Although it is imaginary, it has powerful, dominating, regulating devices. The disposition of elements about an axis determines its organization whether is interesting, stable, attractive or monotonous.

**Balance** is equilibrium in a composition. Because of that, the forms are generally arranged about an axis. Balance and proportion usually go together. Equilibrium can be considered as a part of the unity between balance and proportion. There are two basic notions about balance. The first one is symmetrical balance where two halves of an object divided visually by a perpendicular plane is perfect of near-perfect mirror images of each other. The second is dynamic balance, describe an approximately equal summing up of the elements on either side of a readily of a perceived visual rotation in a building’s composition.

Any form gets its meaning by an opposite one. The interdependence of the elements is achieved by tension resulting from their opposing characteristics. Either existing or absence of **contrast** highly effects composition of architectural forms. It serves to give an unambiguous identity to two fundamental systems and it enables the designer to establish a hierarchy of meaning in the composition. As a result, contrast has importance that due to the elements highly be wanted to emphasize which becomes more dominant and more attractive. Consequently, contrast in composition involves the juxtaposition of elements that are strongly different from one another [11]. Contrast can be built into any of the physical attributes of elements or surrounding spaces: shape, color, texture, size, etc.

Another fundamental notion in the history of architecture is the concept of **symmetry** closely connected with the idea of harmony. Symmetrical condition cannot exist without implying the existence of an axis or center about which it is structured. There are two types of symmetry: bilateral and radial symmetry [1]. Symmetry now is understood as the invariance under a certain kind of transformation.

Ching (2007) states that there are three ways to classify **hierarchy** in architectural composition: hierarchy by size, hierarchy by shape and hierarchy by placement.

**Datum** refers to a line, plane, or volume to which other element in a composition can relate. It organizes a random pattern of elements through its regularity, continuity, and constant presence.

**Rhythm** is a time-based expression of balances movement in a processional sense. Rhythm is often established by the use of regular repetition. The simplest example would be a regular series of shapes with the same interval between them. A colonnade, with the repeated beats of solids and voids, represents such a pattern that it creates a rhythm. It becomes perceptible as the viewer physically moves by through, or another building or space. Rhythm can be formed by increasing the height or width of the units. Instead of the same form, rhythm can be used alternatively for repeating two or more contrast forms, colors or intervals.

**Proportion** is the ratio of one part of a building to another. Proportion generally refers to a relation between various parts of a building due to analogous ratios. Proportion theories attempt to describe nature in terms of mathematical ordered magnitudes. These are used to construct systems of rules governing relationships between constituents in a configuration, and between constituents and a whole. Throughout history, architects have sought to create pleasing
compositions by inventing proportional systems. The most perfect proportion was Golden Section.

The principle of *repetitium* utilizes both of two concepts of visual perception to order recurring elements in a composition. We tend to group elements in a random composition according to their closeness or proximity to one another, and the visual characteristics they share in common.

Design is generative process of exploring an idea and probing its potential. It is important designer to understand the fundamental nature and structure of the concept. *Transformation* is the principle that allows a designer to select a prototypical architectural model and transform it through a series of discrete manipulations.

### 3. Characteristic forms in the contemporary architectural practice

By remembering the historical relations between geometry and architectural design we help to keep the background of our culture but also to understand the combination between geometrical thinking and architectural designing.

Kuloglu and Samlioglu (2012) notice that the concepts regarding space and form moved from one to the other in the course of history. Also, they claim that this change which space and form have subjected together should be discussed based on the change and development in theory, discourse, technology, material, time etc. In accordance with this development and change process, architectural form is also obvious to change its appearance [4].

According to Last (2014) the first decades of the twentieth century saw the increasing theorization of the masses in terms of their spatial, aesthetic, and socio-political implications. Over the past decade, as the world has increasingly become digitized, architecture’s spatial imagery has increasingly aspired to a state of pure fluidity, acting as if in an opportunist fashion to take over a world of thought vacated. Along with spatial formations, fluid architectures are producers of spatial imagery that differ from their modern predecessors [5]. Against modernity’s advancement of the spatial image of production as repetition, is the increasingly common appearance of fluid formations in the work of numerous architecture practices.

In the following part of this article are analyzed the examples from practice with the aim of emphasising the significance of the conceptual design strategies used in architectural design.

#### 3.1. DH Triangle School / NAMELESS Architecture

The authors claim that the Triangle School represents relationships between people, place and education. That relationship between the three elements discovers the multiplicity of the architecture. Located in Namyangju, adjacent to Seoul, this high school building investigates new potentials of the educational architecture through the dialectical articulation of such complexity of the problem and simplicity of the form [7].

The composition of the form has a central organization. The building is perfect equilateral triangle (Fig. 3). The structure of the building creates units and developed composition as a combination of pillars and panes. In this central organization there are many types of units that are unique to each other. They are part of one whole central segment. Within the triangular volume there is a patio which provides multiple relationships, creating different viewing angles and changing lighting.

According to principle of hierarchy in this situation is made hierarchy by shape and function. That means that all units have unique shapes which have characteristic function. Also the principle of hierarchy is about relation public to private. Balance and symmetry both create a stable relationship between components. Balance is perceptually based and focuses on the composition of elements. The principle of rhythm is modulated in facade. Unique units are repeating on the rectangle facade of the building.

The building exists as a free-standing volume in the build surrounding.
3.2. Olmo Tower / LEAP Laboratorio en Arquitectura Progresiva

Project is comprised of an 8 floors office building in the shape of a cube plus a business center, an horizontal parking lot complements the composition, and under the cube shaped office building a commercial space faces the street. Basic geometric configuration that is used to determine a building’s form is square (Fig. 4). That square has grid configuration. In the intersection of both horizontal and vertical axis is set a column. From that is established the structure of the architectural composition of the building as a columns - structure. In this case there is 1:1 relationship between plan and section. The configuration of the whole elevation is equal to the plan.

According to principle of hierarchy in this example is made hierarchy by function. In the composition of the building there are zones that have its unique function.

The process of repetitive to the whole is emerged when the form of the unique element is established by the organization of repetitive elements.

The design of the facade coating gives the office building a specific character. From a distance and during the day it is perceived as a solid metallic cube. The texture is achieved with only two different 3D panels and all the possible organization allowed by the geometry of the panels. By night the skin of the building becomes transparent due to the tiny perforations of the metal sheet, modifying the building into an urban night lamp [8].

3.3. Rolex Learning Center / SANAA

The Learning Center is located on the campus of science and technology university EPFL in Switzerland, within site of the Alps. The building features the impressive concrete surfaces creating a fluid space for students to enjoy. „The concept of the building was to make one very big room, where people and programmes can meet together to have better communication”, explains Nishizawa. „There are no walls to divide, so any programme can meet anywhere. It is more like a park” [9].

The building appears from above as a large rectangle punctuated by variously sized non-geometrically perfect oval voids. That curves and slopes which define the interior space give the building a totally organic look. The fourteen voids, which act as entry points, provide light, and create a set of outdoor spaces, serve to define the center’s spatial organization.
Spatial components in composition are in asymmetrical balance (Fig. 5). The principle of subtraction is presented in the composition. Many irregular holes inside of the building are subtracted from the mass. According to principle of hierarchy in this case is made hierarchy by function. In the composition of the building there are zones that have its specific function. In this composition the hierarchy of size is presented too.

4. Conclusion
According to Erzen (2007), form and space have been existed as the two indivisible concepts from the beginning of architectural creations. From that time aesthetic and beauty interest existed, there have been aesthetic expression of views on form and this process continues [2]. In view of the form–geometry–architecture connection, in ancient times, square, circle and triangle were the most significant shapes. Forms obtained from these shapes were often used, as they were considered to be the most beautiful. Therefore basic geometrical forms were preferred in the architecture of the ancient times.

It would be insufficient to mention only the discussions about the physical dimension while dealing with the space and form concepts. It is because both form and space involve semantic expressions, as well. Since ancient times, considering the use of basic forms in architecture, it can be said that the pure geometry of form has been deformed day by day, additions and deductions have increased, and the void effect created in interior and exterior space is handled not only with functional, but also formal concerns [4]. The basic forms prevailing in architecture during the history are modified according to the changes in the design perspective and are developed under the influence of these changing design perspectives. When we research the history of architecture, we are aware that the architectural space and consequently form went through physical and semantic transformation.

The concepts in terms of the space and form are transformed during history. The modifications that space and form have suffered together should be discussed relying on the progress and development in theory, discourse, technology, material, time etc. According to this development and improvement process, architectural form transforms its expressions as well.

Hendrix (2012) concludes that there is the neglect of theory in architecture nowadays. Emphasis has been placed instead on the development of the technological means of architectural production, in particular computer programs, at the expense of the development of a theoretical or conceptual basis for architectural form-making [3].

Acknowledgement
The paper was done in the scope of the scientific project No TR36045 funded by Republic of Serbia, Ministry of Education, Science and Technological Development.

References
1. Ching, F.D.K. (2007). Architecture: Form, Space and Order. Hoboken New Jersey: John Wiley & Sons.
2. Erzen, J. (2007). Paradigms for a New Aesthetics in a Globalizing World’, Changing Historical Processes-Changing Concepts, 1, pp. 139-147.
3. Hendrix, J. (2012). Theorizing a contradiction between form and function in architecture. SAJAH, 27 (1), pp. 9-28.
4. Kuloğlu, N. & Şamlioğlu, T. (2012). Perceptual and Visual Void on the Architectural Form: Transparency and Permeability. Architectoni.ca, 2012 (2), pp. 131-137.
5. Last, N. (2014) Architecture and the Image of Fluidity, Globalizing Architecture / Flows and Disruptions, pp. 34-41.
6. Leopold, K. (2006). Geometry concepts in architectural design. Proceeding of 12th International Conference on Geometry and Graphics, Salvador, Brazil, August 6-10, 2006, Paper #T35, pp. 1-9.
7. URL: https://www.archdaily.com/638299/dh-triangle-school-nameless-architecture.
8. URL: https://www.archdaily.com/778036/olmo-tower-leap-laboratorio-en-arquitectura-progresiva.
9. URL: https://www.architectural-review.com/today/rolex-learning-centre-by-sanaa-lausanne-switzerland/5217744.article.
10. Wong, W. (1993). Principles of Form and Design. New Jersey: John Wiley & Sons.
11. Yilmaz, S. (1999). Evolution of the Architectural Form Based on the Geometrical Concepts. PhD Thesis, Izmir: Institute of Technology.

ФОРМА В АРХИТЕКТУРЕ И ПРИНЦИПЫ ПРОЕКТИРОВАНИЯ

ДАНИЦА СТАНКОВИЧ, Доктор Ph.D., доцент, Университет в Нише, факультет строительства и архитектуры, Сербия

АЛЕКСАНДРА КОСТИЧ, Магистр архитектуры, аспирант, Университет в Нише, факультет строительства и архитектуры, Сербия

ВОИСЛАВ НИКОЛИЧ, Магистр архитектуры, аспирант, Университет в Нише, факультет строительства и архитектуры, Сербия

АЛЕКСАНДРА ЦВЕТАНОВИЧ, Магистр архитектуры, аспирант, Университет в Нише, факультет строительства и архитектуры, Сербия

Аннотация: Понятия о пространстве и форме перетекают из одного в другое в ходе истории. Кроме того, это изменение, которое пространство и форма претерпели вместе, следует рассматривать на основе изменений и развития в теории, дискурсе, технологии, материале, времени и т.д. В зависимости от этого процесс, архитектурная форма также явно изменила свои выражения. Основной целью данного исследования является определение типов форм и их характеристик, а также типов возможных пространственных организаций в архитектурном проектировании. Исследование включает анализ современной архитектуры. В данной статье анализируются примеры из практики с целью подчеркнуть значимость концептуальных проектных стратегий, используемых в архитектурном проектировании.

Ключевые слова: форма, архитектура, принципы, дизайн, здания.