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THE CONCEPT OF “SURFACE DEPTH” IN ARCHITECTURE

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Abstract. *In history of art and architecture, surface has always been the bearer of symbolic and aesthetic values, the subject of theoretical and critical analysis, with various ideological, discursive and philosophical interpretations. The subject of this research paper are different concepts of composition, artistic elements and materialisation of façade surfaces, which have the effect of “surface depth” as their primary characteristic. By analysing the potential of this concept in articulation of the structure of façade and other surfaces, three main emergent forms were noted: plasticity of surfaces (the use of small façade plastics), double skin façade with unused in-between space and double skin façade with used in-between space. By conducting scientific analyses of theoretical reference sources and characteristic examples, along with the application of the deductive methods, the characteristics of the „surface depth“ concept in architecture were explored, with the aim of systematizing the principles used to achieve it, the possibilities of its application, as well as ways to establish the dual character of spatial planes - surface and volume. This research has contributed to the clarification of this concept and laid the foundation for further research in the direction of finding, chronologically ordering and analysing other examples, in order to enable their more extensive typology and systematization.*

Key words: *architecture, expression, concept, surface depth, double skin façade*

1. INTRODUCTION

A surface is a two-dimensional entity in Euclidean space that can appear in the form of a region, shape, or infinite plane. In theoretical terms, the surface has two sides that can be viewed from opposite directions. The term can also stand for the furthest or the highest layer of a physical object or space, which the observer can first perceive using the sense of sight or touch (Sparke, Fisher, 2016). In the fine arts, "depth of surface" is usually associated with the illusion of spatiality, which in painting is equated with the term "depth of painting" (Friedenwald, 1955). The ways in which the depth of space is achieved in a painting are

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diverse and usually imply the application of some form of perspective (linear, aerial or coloristic), proportioning objects (*Scale Shift*), etc. In architecture, the surface is one of the essential elements of architectural expression and appears as an indispensable part of every concept. In most cases when it is mentioned, the surface means the external or internal visible side of the façade, roof or some other architectural element. In certain situations, when another close *spatial plan*¹, can be seen through the surface, usually physically connected, such a surface is said to have a third dimension or depth (Fig. 1).

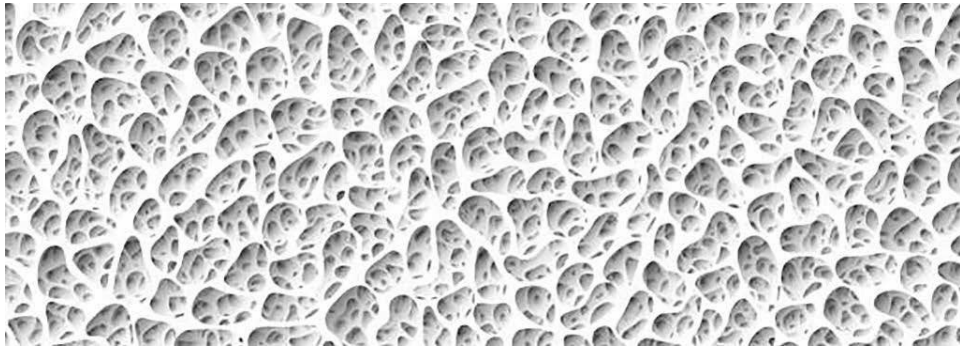


Fig. 1 Surface depth principle (Source: author's archive)

The subject of this research will be different concepts of composition, art and materialization of primarily façade surfaces, which exhibit the effect of "surface depth" as their primary characteristic. Using the deductive method, the characteristics of the concept of "surface depth" in architecture were investigated. By analyzing reference theoretical sources in which the meaning of the term is mentioned, as well as characteristic examples where this concept is present, the most important principles that determine the characteristics of the concept were extracted, with the aim of systematizing the principles by which it is achieved, the possibilities of its application, as well as the way of establishing a dual character of spatial planes - surface and volume.

The objectives of the research are: a) to consider characteristic examples and systematize the principles leading to achievement of the concept of "surface depth", b) to explore the possibilities of its application in architecture, and c) to re-examine the hypothesis that the concept of "surface depth" is achieved by placing parts of the basic surface into one or more secondary spatial planes according to the principle of depressed relief, whereby the resulting structure has a dual character - surface and volume.

¹ The term "spatial plan" in architecture can have several meanings. In this context, it stands for the distance of an element or surface in space from the position of the observer. The closer an element (surface or shape) is to the observer's eye, the closer plan position is considered to be. In this context, there are, the first, the second, the third, etc. plan, as well as the foreground or the background plan (Janson, Tigges, 2014).

2. REVIEW OF REFERENCES

The concept of "surface depth" in this formulation has not been researched in science so far, although, all over the world, numerous examples of architectural objects can be found where this concept is present to a certain degree. However, some authors use this term to clarify their architectural concepts.

When talking about his building Zepter Palace in Belgrade (arch. Branislav Mitrović, arch. Vasilije Milunović, 1997), Branislav Mitrović states that: "the dynamics of the in-between space vacuum in the entrance area, the contrast of the wall (history) and glass-steel (technology) create the impression of "depth of surface" in the decomposing of envelope into layers. What appear to be the two faces of the house enabled a range of dialogues with: history, the spirit of the place, the architecture of the context, the neighbours, the time when the building was created ... " (Alfirević, 2013:76)

In a similar context, Francis Ching uses another term "depressed base plane", which means a horizontal plane imprinted on the ground floor (or the ground) plane and uses the vertical surfaces of a lowered area to define the volume of space (Ching, 2007). Numerous authors build on Ching's interpretation and use the formulation of "depressed base plane" to describe the concept of plane distancing or depressing, thus achieving the effect of depth (Su, 2018; Seker Ilgin, 2008; Dahanayake, 2004; et al). Although Ching's term has, to a certain extent, already been accepted in architecture, this paper will use the term "surface depth concept", as pulling or pressing the surface is only one of the techniques used to achieve this concept.

This topic requires that we mention the position of the architect Kim Seunghoy, who in his essay *Depth of the surface - the potential of space* states that the task of creating the depth of the surface is not only to define the location's identity, but also concerns the "intermediary relationship" between the interior and the exterior. As the depth of the surface increases, it eventually turns into an in-between space. Using this space created on the boundary surface as a medium, the inside world communicates with the outside world" (Seunghoy, 2020). According to Seunghoy, the surface can have different depths. As the depth of the surface becomes larger, the surface is the first to become relief-like, i.e. it turns into multiple spatial layers, and then a third space (in-between space) is formed on the border between the exterior and the interior.

3. "SURFACE DEPTH" IN ARCHITECTURE

It has not yet been discovered when the concept of "surface depth" was deliberately applied for the first time in history, although indications of similar reasoning can be seen as far back as in the works of ancient Egyptians, who very early began to use the "sunken relief"² technique in surface treatment. The application of this technique involved engraving (cutting) the artistic representation in the stone surface and was used in various situations, from the decorative treatment of surfaces on the walls of tombs and temples, all the way to the façade at the entrances to tomb temples (hypogeum) (Fig. 2)

² "Indented relief" is a relief sculpture technique where figures or images are carved in low relief, but placed inside a sunken area, so that the relief never rises above the basic flat surface.



Fig. 2 Egyptian god Toth, Luxor temple, Egypt (left) (Source: Wikipedia, photo. Jon Bodsworth); Temple of Hathor and Nefertari, Abu Simbel (XIII c. BC) (right) (Source: Wikipedia)

Over time, the technique of sunken relief was relegated by other sculptural techniques showing the shape (shallow and deep relief) in a more spatial way. The significance of this technique is, among other things, that it has the effect of uniting pictorial and sculptural art as a whole. Throughout history, the use of relief in architecture has been widely used, primarily decoratively, in almost all cultures.

However, the emphasis in this research is not on the application of relief and its decorative role in architecture, although it is in some sense covered by "surface depth" concept, the focus is shifted on the potential of this concept in articulating the structure of façades and other surfaces, which is an area of a higher order, as it can affect both the spatial and functional organization of the house. If we consider theoretical possibilities of achieving the concept of "surface depth" in architecture, as in way was suggested by Kim Seunghoj, too, we can notice three main emergent forms:

- a) plasticity of surfaces (application of small façade plastics),
- b) double skin façades with unused in-between space, and
- c) double skin façades with used in-between space.

3.1. Surface plasticity

The concept of surface plasticity is closely related to the term "extreme articulation", first promoted in science by Charles Jencks (Jencks, 1993, 1979). In a stricter sense, extreme articulation is a term that appeared in architecture in the 1960s and 1970s and refers to the reaction against empty and "boring" surfaces of modernist buildings. In a broader sense, the terms "surface plasticity" and "extreme articulation" can be equated because they refer to approaches that appeared on several occasions throughout history (Baroque, Gothic, brutalism, etc.), referring to radical or extreme approach to solving relief, i.e. surface expressiveness. The topic of surface plasticity can be viewed from two aspects, through application of: a) primary plastics (bay windows, loggias, avant-corps, etc.) and b) secondary plastics (decorative elements). Depending on whether there is a functional justification for the introduction and application of plastic elements, we can talk about whether and to what extent the expressionist character is present in the building concept (Alfirević, 2016, 2015).

The projects carried out by some architects at the beginning of the 20th century, such as Hans Poelzig, Wassili Luckhardt and Fritz Höger, had certain characteristics of surface plasticity. Their aspiration was directed primarily towards the division of surfaces into a complex compositional system of spatial (depth) plans, consisting of profiles, fluting, pilasters, niches and the like. In the middle of the 20th century, as a part of the brutalist movement, numerous architects strived to achieve the plasticity of façade surfaces by applying deep reliefs treated in raw concrete, but their basic role was mostly decorative. There were rare examples such as the Elephant and Rhinoceros Pavilion in London (arch. Hugh Casson, 1965), where the rough relief treatment of façade surfaces was supposed to be associated with animal skin. Recent examples include Bruder Klaus Chapel in Mechernich (arch. Peter Zumthor, 2007), in which the depth of the interior surface was achieved with accentuated fluting (Fig. 3).

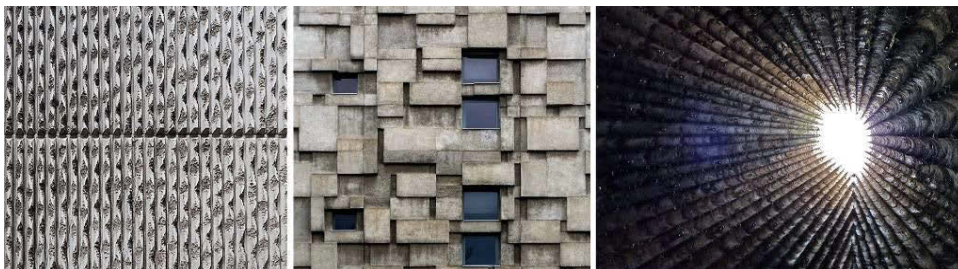


Fig. 3 Application of small façade plastic: The Elephant and Rhinoceros Pavilion, London (Hugh Casson, 1965) (left); Romtelecom Headquarters, Cluj-Napoca, Romania (Vasile Mitrea, 1969) (middle); Bruder Klaus Chapel, Mechernich (Peter Zumthor, 2007) (right) (Source: www.archdaily.com)

From what we mentioned so far, it can be concluded that the term "plasticity" of the surface implies primarily planning (articulation) of secondary elements on the façade: fluting, joints, pilasters, but also larger elements such as bay windows, balconies, loggias, etc. The effect of "depth" of the façade surface is achieved by indenting, pulling, slanting or twisting in relation to the basic, referential plane of the façade.

3.2. Multi-layer façades with unused in-between space

In many modern buildings, multi-layer façade systems have been applied, based on the principle of dividing the façade into two or more elements in depth. Such systems usually consist of an outer membrane, an in-between space and an inner façade. In most cases, the application of these systems is motivated by the inclination to preserve energy, but also by aesthetic (artistic) motives. The presence of external layers in front of non-transparent parts of the façade may have a slight impact on the building performance aspects, however, in cases when these layers cover the windows, one can notice a significantly weaker impact of daylight and decrease in energy performance in the interior (Paule *et al.*, 2017).

If the outer membrane of the façade, usually glazed, perforated or in the form of a brise-soleil, is placed in front of a window on the south, southwest or west façade, then it can play a functional role in shading the interior and preventing it from overheating (Boake *et al.*, 2002). Out of the different types of layered façades, the most commonly

used are "double-skin façades"³, made of two membranes placed in a way that allows the air to flow freely in the space between them (Arons, 2000; Hilmarsson, 2008)⁴ (Fig. 4).

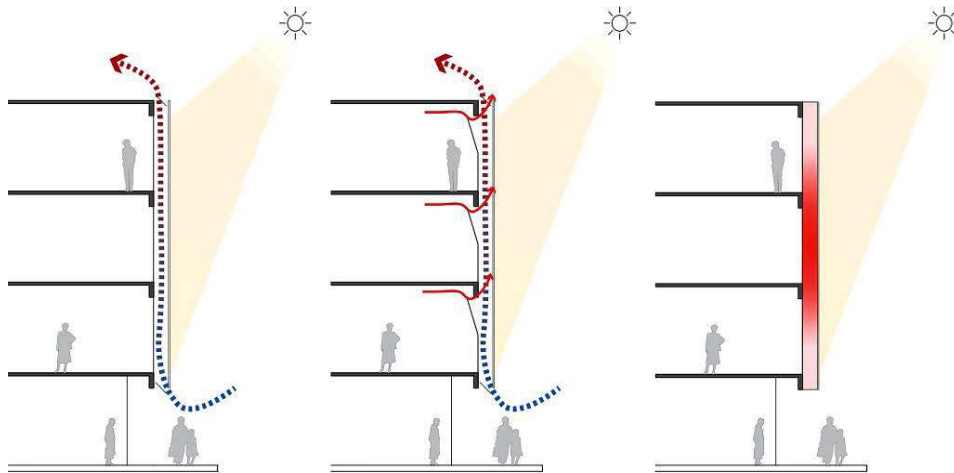


Fig. 4 Principles of functioning of a two-layer façade (Source: Souza, 2019)

Contrary to the generally accepted interpretation of a two-layer façade, where the essential feature is the uniformity of both layers, so that circulation can be achieved and the in-between layer can be ventilated, in some cases the outer layer is significantly perforated, which prevents steady air flow. Although the ventilated two-layer façade is a specific form of technological innovation, increasingly used in architecture in recent decades, there are a number of solutions that pay significant attention to the appearance and artistic aspects of the outer layer or the whole, at the cost of giving up the benefits brought by the two-layer system. This application of "layered" façades is formalistic, as the visual criterion is set above others (functional, technological, etc.), and the application of the concept of "surface depth" is primarily aesthetic (Fig. 5).

3.3. Multi-layered façades with used in-between space

A well-conceived functional organization of the building can result in the rooms being arranged in such a way that by pulling them towards the center of the building, the effect of "depth of surface" can be achieved on the façades. In residential buildings, it is common to position the living space in the zone along the façade, as this space, due to the frequency of use, requires a direct or indirect contact with the natural light and ventilation. In public buildings, by following a similar principle, rooms that are more frequently used and in which users stay longer are positioned along the façade. The space between the basic plane of the

³ The principle of "two-layer facade" was first mentioned in 1849 by Jean-Baptiste Jobard, director of the Industrial Museum in Brussels (Saelens, 2002), while the first application of this principle is associated with the Steiff Factory (1903) in Germany by Richard Steiff (Poirazis, 2004).

⁴ The distance between the layers usually varies from 20 cm to 2 m. The advantages of two-layer facades compared to single facades are most often improved sound insulation, protection of shading elements and providing natural ventilation in the interior. On the other hand, if the facade is poorly ventilated, i.e. if the in-between space of layers is inadequately designed, this can create problems of overheating of the interior space during the summer (Poirazis, 2008).

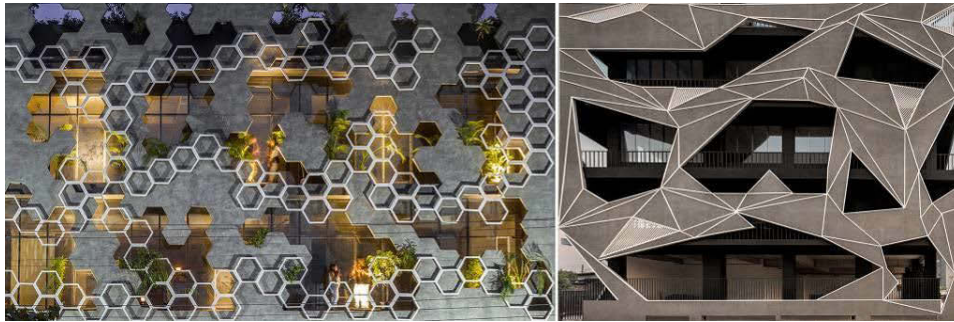


Fig. 5 Formalistic approach to the application of the concept of surface depth: Hexalace, Mohali (Studio Ardete, 2018) (left), Tessalace Commercial Office Space, Mohali (Studio Ardete, 2021) (right) (Source: www.archdaily.com)

façade and the withdrawn plane, the so-called in-between space, often has terraces, loggias, galleries, etc., areas which are transitional spaces, making up the interior, but also open to the outside. Depending on the degree of openness of the in-between space to the environment, the concept of surface depth may be more or less obvious. If indentations (recess) appear only sporadically on the façade, its basic surface is more complete and the façade has a planar character. On the other hand, if the recesses on the façade predominate, then it loses its surface character and acquires the appearance of a spatial structure. The concept of surface depth occurs between these two extremes, i.e. when the façade has a double character (Fig. 6).

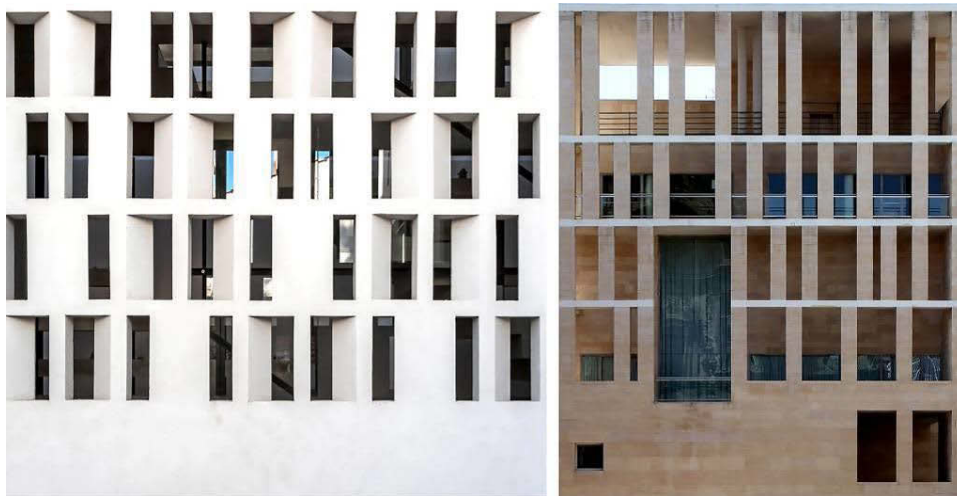


Fig. 6 The concept of surface depth between solidity and structure: ZM 4764, Buenos Aires (Estudio Arqtipo, 2016) (left), Murcia City Hall, Murcia (Rafael Moneo, 1998) (right) (Source: www.archdaily.com)

4. CHARACTERISTIC EXAMPLES

The concept of surface depth is widely used in modern architecture and is present most often in façade surfaces, less often in roofs (fifth façade) and the least often in ceiling surfaces (sixth façade). It is also present in the interior. A characteristic example of surface embossing in terrain topography is shown in traditional forms of underground Chinese villages in Lo-yang and Tungkwan, where the roof plane is united as a whole, while depressed segments of the basic terrain plane appear as randomly arranged atriums (Ching, 2007). A similar concept of surface articulation was applied to the Grand Egyptian Museum Competition in Cairo (Aires Mateus, 2002), where the topography of the natural terrain was imprinted with spontaneously arranged atriums to preserve the surrounding landscape and views of the pyramid complex (Yanguas, Gordo, 2020). (Fig. 7)

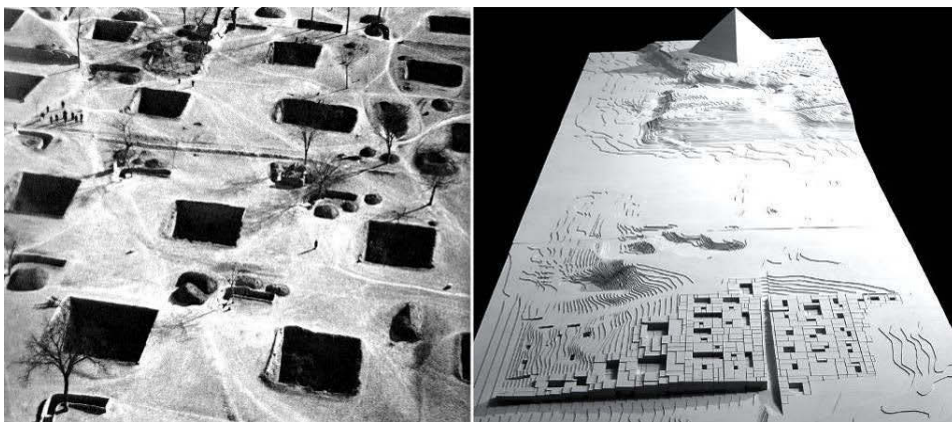


Fig. 7 Underground village in Tungkwan, China (left) and Grand Egyptian Museum Competition, Cairo, Aires Mateus, 2002 (right) (Source: author's archive)

Famous examples where this concept has been applied to façades are Casa del Fascio in Como (arch. Giuseppe Terragni, 1936) and the Palace of Italian Civilization in Rome, (arch. Giovanni Guerrini, arch. Ernesto Bruno La Padula, arch. Mario Romano, 1943). (Fig. 8) At the House of Fascists, the concept of surface depth was applied to the segment of the side façade. The rhythmic order of the windows is connected by horizontal façade strips, in order to preserve the continuity of the surface. A similar principle was used in the design of the façades in “Simply 11” residential complex in Vienna (Delugan Meissl Associated Architects, 2009), with glass loggias used instead of windows. At the Palace of Italian Civilization, by doubling the façade in a retracted plane, a useful in-between space was formed with circular terraces along the external perimeter of the building. The façade of the palace is in a sense reminiscent of the outer wall of the Roman Colosseum.



Fig. 8 Casa del Fascio, Como, Giuseppe Terragni, 1936 (left) and Palace of Italian Civilization, Rome, Giovanni Guerrini, Ernesto Bruno La Padula, Mario Romano, 1943 (right) (Source: author's archive)

The formation of useful in-between space in the double skin façade planes is recognizable in the Building with 86 apartments in Lyon (Eric Lapiere Architecture, 2014) and the villa in Ha Long (VTN Architects, 2020). (Fig. 9) In both cases, between the basic and the retracted façade plane, along with terraces and communications, some living quarters are located. This approach to the design of the building is more complex and demanding, due to the lack of unification of levels, but at the same time, it offers the possibility of synthesizing the concept of surface depth with the functional organization of interior spaces.



Fig. 9 86 Apartments, Lyon, Eric Lapiere Architecture, 2014 (left) and Ha Long Villa, Ha Long, VTN Architects, 2020 (right) (Source: author's archive)

5. DISCUSSION AND CONCLUSION

The concept of surface depth has been increasingly present in architecture in recent decades, although hints of it have been displayed in some examples for centuries. A significant impetus to the development of this concept was the invention of the double skin façade in the middle of the 19th century, when architects began to separate layers of the façade, aiming to improve performance of the building envelope. Since then, numerous variations of the original idea have appeared, grouped in three main directions of thinking, differing in the achieved visual effect - the depth of the surface, and the usefulness of the formed in-between space. The examples presented in this paper aimed to illustrate different starting points and the application of the initial idea.

When the concept of surface depth is applied to a horizontal plane, such as a roof or terrain topography, depressed secondary planes and vertical surfaces that occur along the circumference of the lowered area determine the volume of space, but also create the impression of visual integrity. If the field of imprinted space stands in contrast to the environment of the basic plane, different shape, geometry or orientation can visually strengthen the identity and autonomy of the imprinted field in relation to the wider spatial context. It is important to point out that the effect of surface depth depends to a large extent on the change of the recessed level, which results in a degree of continuity between the recessed field and the elevated area around it. Increasing the depth of the depressed fields weakens their visual relationship with the surrounding surface and strengthens the effect of the volume or structure of the space.

Therefore, if we summarize the observations from the previous analysis, we can conclude the following - in order to say that a façade has depth of surface, it is necessary for it to include three basic characteristics:

- a) to be more or less perforated or made of a transparent material;
- b) to have the second or more withdrawn plans, or to have a close background behind the base plane; and
- c) to have a dual character - surface and spatial, i.e. that its structure is not too decomposed.

The concept of surface depth is not one of the essential concepts in architecture, but its theoretical understanding and practical application provide an opportunity to form visually very attractive pictorial and spatial solutions. This paper aimed to present only some characteristic examples with evidently present the concept of surface depth. Therefore, further research could be directed towards finding, chronologically ordering and analysing other examples in history, paving the way for their more extensive typology and systematization.

Although there is still no explicit consensus in science on the use of the term "surface depth", nor its clear and generally accepted definition, this research hopes to have made some contribution towards its clarification, which can certainly be the basis for further research in this area.

The initial hypothesis that the concept of "surface depth" is achieved by pulling parts of the base surface into one or more secondary spatial planes following the principle of indented relief, where the resulting structure has a dual character - surface and volume, has been confirmed.

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KONCEPT „DUBINE POVRŠINE” U ARHITEKTURI

U istoriji umetnosti i arhitekture, površina je uvek bila nosilac simboličkih i estetskih vrednosti, predmet teorijskih i kritičkih analiza, sa različitim ideološkim, diskurzivnim i filozofskim tumačenjima. Predmet rada u ovom istraživanju su različiti koncepti kompozicije, likovnosti i materijalizacije fasadnih površina, kod kojih je efekat „dubine površine” njihova primarna karakteristika. Analizom potencijala ovog koncepta u artikulaciji strukture fasadnih i drugih površina, konstatovana su tri osnovna pojavna oblika: plastičnost površina (primena sitne fasadne plastike), slojevite fasade sa neiskorišćenim međuprostorom, i sa iskorišćenim međuprostorom. Naučnom analizom referentnih teorijskih izvora i karakterističnih primera, kao i primenom deduktivne metode, istražene su karakteristike koncepta „dubine površine” u arhitekturi, s ciljem sistematizuje principa pomoću kojih se on postiže, mogućnosti njegove primene, kao i načina

uspostavljanja dvojnog karaktera prostornih ravni - površine i volumena. Ovim istraživanjem ostvaren je doprinos u pogledu pojašnjenja ovog koncepta i postavljen je osnov za dalja istraživanja u pravcu pronalaženja, hronologije i analize drugih primera, kako bi se sprovela njihova opsežnija tipologija i sistematizacija.

Ključne reči: *arhitektura, ekspresija, koncept, dubina površine, dvostruka fasada*