Water as an Integral Part in Creating a Unique Architecture

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Abstract: The article considers water as component of a high-quality architectural environment. The meaningful contextual inclusion of various forms of water in the architecture creates the opportunity to obtain non-standard solutions. Article systematizes the analysis of some of the best world practices related to the synthesis of architectural design and the aquatic environment, as a result of which the author made an attempt to form the most important principles of architectural design, which are based on the idea of combinations between water and architecture. The purpose of the article is to propose architectural principles that make it possible to achieve the uniqueness of architecture through the integration of water. Methodological basis: analysis of scientific literature and information sources, systematic, integrated, functional approach. The result of the research are 3 main architectural principles: Interplay, Teamwork and Fusion. The Interplay principle contributes to the fact that the architecture becomes unique and endowed with positive features, due to the presence of various forms of water inclusion in the design solution. The principle of Teamwork is that water is one of the constituent elements of an architecture. The Fusion principle makes it possible to obtain an architecture based on the placement of a building in a water environment or the opposite solution. Conclusion: integration of water as one of the key elements of architecture makes it possible to achieve a unique design solution, which at the same time allows to have a supply of water that is relevant in the context of its general shortage.

SCIENCE AND TECHNOLOGY PUBLICATIONS

1 INTRODUCTION

Man by nature cannot live without water. It is not only and not so much about physiological needs, but also about physical and spiritual dependence and connection. Water for us is a vital component, and also gives peace, tranquillity and promotes relaxation (Shebek et al., 2020). From this position, various water elements can be meaningfully involved by the architect in the surroundings or directly in the architectural object itself, and thereby significantly affect the individuality and quality of the architectural project being created.

Water elements can be conditionally divided into objects of natural origin (sea, river, lake, waterfall, pond, etc.) and man-made (lake, pond, waterfall, pool, fountain, etc.) (Bulakh et al., 2020). Thus, if the territory is endowed by nature with any of the types of water elements, then the architect only needs to masterfully fit the created architectural object into the ideal surroundings. In the case when the area is a waterless space, the architect has the opportunity at the level of a conceptual solution and a further architectural project to artificially integrate water (in its various forms and volumes), thereby significantly increasing the comfort of use and the innovativeness of modern architecture (Wierzbicka et al., 2018).

2 MAIN MATERIAL

The analysis of the architectural and urban world heritage allows us to find implemented architectural solutions that were obtained on the basis of harmony, balance and ideal relationships between man-made architecture and water as an element of nature (Shebek et al., 2021).

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2.1 Residential Architecture

One of the first and most famous examples, of course, is the famous Fallingwater, designed by architect Frank Lloyd Wright for the family of Edgar and Liliane Kaufmann in 1935. This house "flying" above the rocks and streams of water is an internationally recognized classic of modernist architecture, one of the most famous buildings of the 20th century and Wright's best masterpiece (Pleshkanovska, 2021). All his life he has been striving for "organic" architecture, which merges with the environment and becomes an integral part of it. And only in this architectural project, on the waterfalls of the Bear Creek, the master of architecture managed to fully realize his plan – to create organic architecture. The "House over the waterfall" stands on the rocks and seems to grow out of them, the horizontal divisions of its concrete terraces echo the layered structure of the local stone. This house does not imitate nature, but is still perceived as part of it – natural, powerful and eternal (Khalil Elmasry, 2018). The role of water in this architectural example: by incorporating water, a unique architecture has been created that conforms to the natural landscape and is in harmony with its surroundings.

2.2 Industrial Architecture

Another interesting example is the offices of the industrial chemical complex in the Chinese city of Huai'an. This project can rightly be called one of the most beautiful industrial buildings in the world. As conceived by the author, the complex took the form of a plan in the form of a letter U or a horseshoe, which also has an open and well-transmitting sunlight inner-central space that wraps around the building. The entire complex is located above the surface of the water, which made it possible to achieve visual lightness and soaring of the building, with a special atmosphere of calm and silence. The entire complex was built in a monotonous colour scheme of white concrete and the same idea was retained by the author for the interior as well. Thus, the entire beauty of the complex was achieved solely by the plasticity of the form of the building, which was harmoniously and poetically inscribed by the architect in an ideal aquatic environment (Bulakh et al., 2020).

Many people, seeing this object, poetically perceive it as a mystical or fabulous animal that seems to hover above the surface of the water. It is worth noting that this result became possible, among other things, due to the sculptural design of the architectural solution, which allows you to "understand" architecture at a subconscious level (without historical, cultural and other contexts). However, the water that surrounds the complex is not only an aesthetic element, it also has a functional value and is used for industrial purposes (cooling and technical needs). The effect of the visual hovering of the building above the water was achieved due to the placement of a grid of supports under the water and only a small gap between the visible base of the building and the water line (Bulakh, 2019). The U-shape of the building influenced a significant increase in internal transits, which prompted the architect to use the Mobius strip concept for additional horizontal transitions and also ramps (Grimmond, 2006). The role of water in this architectural example: the technical function of water (water is primarily necessary for the functioning of this industrial enterprise); visual and aesthetic appeal.

2.3 Bridge

The next noteworthy object is Moses Bridge, designed by RO&AD Architecten (Figure 1, Figure 2). The place where this bridge is located is an area consisting of a number of fortresses from the 17th century and small settlements in the Netherlands. As part of the complex reconstruction process, the task arose to build a new bridge across the water (Derek, 1991). Thanks to the creative and contextual design approach of the architects, this area not only solved the original functional task, but also unintentionally received a popular tourist and pedestrian attraction. From a logical point of view, building a bridge to a defensive structure is not the right approach (Derek, 1991).

The genius of the solution lies in the fact that the architects came up with the idea of an "invisible" or "recessed" bridge. This solution was made possible by the fact that the wooden bridge with waterproofing is completely submerged in water like a trench. Thus, when people approach the fortress, the question remains of a way to cross the water, and only in the immediate vicinity can a trench bridge be seen (Bulakh, 2020). One of the associations that often arise is the opportunity to overcome the water barrier as one of the biblical characters.

The role of water in this architectural example: on the one hand, water is present here historically as a natural barrier and protection of the fortress; thanks to the idea of immersing the bridge completely in water, it became invisible from afar and the water in this case performs a camouflage function; there is also a symbolic context that relies on the biblical character Moses, who could pass through the water.

Figure 1: Water as an integral part of Bridge.

Figure 2: Moses Bridge, RO&AD Architecten.

2.4 Museum

No less exciting and impressive is the Louvre Abu Dhabi. It is the theme of water in its various interpretations that makes this object one of the outstanding masterpieces of modern architecture. As conceived by the author of the project, this museum complex should have a contextual basis or idea in the form of a miniature of a city located in the sea (Bulakh et al., 2019). Also, the museum complex, made in white, displays a modern interpretation of traditional Arabic building forms. The dome of the building consists of multi-layer lattice structures, which, intertwined, let in "rain from light" – this was the key idea of the architect. This museum is built on the contrast – a very bold and bright architectural solution in the form of the idea of a marine "archipelago". Also very non-standard is the idea of placing a protective structure above the museum complex, which creates a sunny rain. It should be noted that the atmosphere of the museum complex generates a complex range of emotions, both pacifying and exciting. In this place, modernity and history, authenticity and innovation, a tribute to traditions and the latest technologies "clash" together. Moving around the territory of the complex, the viewer constantly observes the contrasts and alternations of water, land and architecture (Kovalska et al., 2019). The role of water in this architectural example: water is one of the most significant and valuable elements as the United Arab Emirates has a very hot climate and a significant part of the country is a desert. Therefore, water is in this case a symbol of life, wealth and future. Water in this architectural example was used both literally and symbolically (raining light).

2.5 Offices

Oscar Niemeyer is celebrated for his love for curvatures and soft lines in design and often uses water as an integral and key element in his architectural designs. The HQ features the main concrete structure with its colonnades, which are mirrored by the nearby pond. Niemeyer's design used different spans for every arch which gave the colonnade a new dimension resembling a "musical rhythm". It is the idea of the reflection of the building in the water that allows us to see the polyphony of architecture, which is rightly called "music frozen in stone" (Bulakh et al., 2020). The role of water in this architectural example: with the help of water, the building received additional special effects in the form of a reflection of architecture in the water surface and, accordingly, the building is perceived differently (more spatial, deep and complex); water also made it possible to emphasize the metaphorical essence of architecture, which can also be understood through reflection.

2.6 Exhibition Complex

Blur Building is a unique example of the synthesis of one of the forms of water (fog) and an architectural object. According to the concept of the architects, the building, located in the water and connected to the ground with a bridge, is constantly in a cloud of fog. This is made possible by the operation of the pumps and the water spray system. Also, the building is equipped with an automatic adjustment system that captures all changes in weather conditions (Bulakh, 2021). When visitors enter the building, they are completely immersed in the atmosphere of fog and water noise, everything else ceases to exist. It is at this moment that a person can realize his helplessness and small scale in comparison with the water element. Museum visitors are participating in a kind of experiment that aims to draw public attention to

growing environmental problems. Movement around the building is not regulated, people themselves can choose where and for how long they can stay. Thus, in this exhibition complex, water is both an environment and, in a way, a "building material". Also, visitors are offered the opportunity to "drink" the local water and thus immerse themselves additionally in this atmosphere (Bulakh, 2021). The role of water in this architectural example: it was thanks to water that the idea of this tourist site became possible. Water and all its forms are the key elements of architecture, which are aimed at drawing the attention of mankind to environmental problems and the need to take care of water.

2.7 Airport

The idea of creating the Jewel Changi Airport is to project the general concept of the garden city, which is rightfully the modern Singapore, in the "city gates". Thus, the airport complex is a place that combines cultural, recreational and characterful urban life in close connection with nature (Bulakh et al., 2021). To bring this concept to life, the architects included in their project various natural areas, including gardens and a forest valley, in which there are various water elements. It hosts hundreds of different types of vegetation, as well as one of the largest man-made waterfalls in the world. This water element is connected to the roof of the airport and accumulates rainfall, which can serve the rich landscape, as well as cool the interior space and use and re-use natural resources wisely. The role of water in this architectural example: technical function, reuse of natural resources and care for the environment (accumulation of water, watering plants, cooling the internal space, etc.); aesthetic function.

2.8 Winery

The example of the VIK Winery shows us a completely non-standard design approach for this type of architectural building, as much attention was paid by the architects to both the appearance of the building and the technological and functional processes. Undoubtedly, the source of inspiration for the architects was the natural environment of the area, which combines mountainous terrain and valleys (Pleshkanovska et al., 2021). The architects in their project tried to use an ecological design approach as much as possible and minimize the use of non-renewable energy. In this regard, the roof of the winery is made of translucent fabric, which reduces the cost of artificial lighting. Water is used in the central square in front of the main entrance to the building, which significantly enhances both the aesthetics of the entire complex and contributes to its natural cooling. Thanks to the placement of special paths along the water surface, visitors can enjoy and relax on the territory of the complex (Pleshkanovska, 2020). It should be noted that the main part of the complex is underground, which is associated with an energy-efficient technological process. The role of water in this architectural example: aesthetic and entertaining function, respect for water, its accumulation and natural cooling of the building.

2.9 Hotel

A public bath was once located on the site of the Emperor Hotel in Qianmen, so the key idea of the architects was to convey the history of the place in the new facility, to preserve the special atmosphere of magic that is characteristic of the bath. Therefore, the architects in this building tried to recreate and convey the memory of the past function with the help of a special atmosphere, emotions and fantasies (Kovalska et al., 2019). To implement this idea, the architects actively used water and created a design filled with a water theme. The building has a pool located on the roof, from which water flows in small jets along the walls of the entire building. The water motif can also be felt through the numerous plants that hang like threads in the public areas. In addition, the architects have developed a structure that generates rain indoors, as well as an underground waterfall. The role of water in this architectural example: the function of reproducing the historical memory of the original purpose of the territory; aesthetic and relaxation functions.

2.10 Aquarium

One of the most famous and popular aquariums in Europe can rightfully be considered the Danish public aquarium Blue Planet. Its design was based on the idea of a whirlpool, which can often be found in nature and in particular in water. Through this technique, the outer shape of the building is an announcement to visitors as to what they will be able to see inside the aquarium (Pleshkanovska, 2021). Also, the shape of the building in the form of a whirlpool helps to emphasize the beauty of the area, which opens up a wonderful landscape and sea views. The building has already become a kind of "magnet", which attracts visitors with its catchy and highly visible form. The use of aluminium tiles in the exterior of the building emphasizes the organic form,

evokes the association with fish scales, and also causes the effect of changing colour shades due to the ability to reflect the environment (Kovalchuk et al., 2019; Kashchenko et al., 2020; Leshchenko et al., 2019; Bulakh et al., 2022; Baiandin et al., 2022). At the main entrance to the aquarium, there is a water surface, which also emphasizes the connection of the building with the aquatic theme. The role of water in this architectural example: water is used in a direct (reservoirs for fish, decorative reservoirs on the territory) and symbolic meaning (the theme of a whirlpool in nature, a whirlpool in water, the shape of a building in the form of a whirlpool, the lining of the building in the form of fish scales).

3 RESULTS

In this research, as the main strategy that should be applied in years of water scarcity to compensate for it, it is proposed to actively and meaningfully use water in the formation of modern architecture. As one of the results of the study, it is proposed to single out two main groups-reasons: material and non-material use of water in architectural projects. Material reasons include: the need to accumulate water for its use and reuse for various purposes. Non-material reasons include: water, as one of the key natural elements, has a huge energy that allows people to be in comfort, relax and restore their own strength; water significantly enhances the aesthetic properties of architecture and contributes to the transfer of various symbolic and metaphorical meanings.

Also of great importance is the shortage of fresh water, which, due to global warming, is becoming more acute for many world countries and, as a result, increasing economic difficulties and a decline in many sectors of human life. From this point of view, the formation of water reservoirs as part of the architectural idea and design will allow local storage of water for its use and reuse.

The brief analysis presented in this article of some of the most famous and innovative architectural objects in the design of which water played a significant role made it possible to formulate the basic principles that allow achieving harmony and uniqueness of architecture and water. The Interplay principle contributes to the fact that the architecture of the building becomes unique and is endowed with positive features that become possible only due to the presence of various forms of water inclusion in the constructive solution. It can be both natural forms and man-made (lake, pond, stream, canal, waterfall, rainwater collection tank, etc.). The principle of Teamwork is that water (its various man-made and natural types and forms) is one of the main constituent elements of an architectural project. The Fusion principle makes it possible to obtain an architectural solution based on the placement of a building (or an architectural complex) in an aquatic environment or the reverse solution, when an aquatic environment is located in an architectural object.

4 CONCLUSIONS

Any form of water is important and significant for human life. Water makes life possible. Therefore, it is absolutely natural that a person consciously and unconsciously feels most comfortable only in being close to water. Based on this, architects need to take into account the importance of water (its various forms) when designing architectural objects and introduce water elements in the formation of man-made nature, which to some extent is also architecture. Future research directions and perspectives in this regard include: trends and new procedures applied in construction (separate groups of public buildings, residential buildings) to ensure the water cycle; it is also planned to study regional features for the collection and reuse of water in architectural projects in various climatic zones.

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