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Biophilic Design in Macedonia: Examples and Proposals for Greater Implementation

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Abstract

Biophilic design enables connection between man and nature to bring the natural environment closer to users, using different patterns such as visual and non-visual connections with direct and indirect nature. Implemented on an individual building or at a city level, this concept has advantages in terms of health, improvement of the environment, and the economy for both occupants of buildings and urban settings. Moreover, biophilic design reduces stress, enhances creativity and clarity of thought, improves well-being, and expedites the healing of the users.

The presence of natural motives in historic structures and places suggests that biophilic design is not a new concept. Several examples in Macedonia show some patterns of biophilic design. Unfortunately, contemporary architecture in Macedonia is mostly oriented towards quantity and financial benefits, while taking care of qualitative aspects, is to some level, neglected.

In this paper, various examples of biophilic design in Macedonia are presented. In addition, the benefits of this concept, as well as the ways of its greater involvement in the architecture in our country, are presented and proposed.

Introduction

Biophilia is defined as an unbreakable biological connection between humans and nature. The objective of biophilic design is to integrate natural components and patterns into constructed environments, fostering physical and mental well-being, productivity, and a profound connection with the natural world. Achieving this goal involves incorporating organic shapes and forms, establishing visual connections with the surroundings, employing methods such as aromatherapy and soundscapes, and implementing biophilic planning. Additionally, biophilic design frequently aligns with sustainable practices, leading to heightened energy efficiency and reduced environmental impact. The numerous advantages of biophilic design include stress reduction, enhanced cognitive function, improved work and creative capabilities, and promotion of overall well-being and accelerated healing.

With today's lifestyle, most people spend time indoors in various facilities, whether it is at home, in the office, in the shopping center, in the supermarket, etc. This way of life negatively affects people at several levels, because it reduces their connection with nature, which is one of the most important elements for a quality life. Therefore, designers, engineers, and architects are constantly working on solving this problem and bring nature closer to people. It is one of the reasons why biophilic design is so relevant today. Many studies confirm the positive impact of biophilic design (Zhong, W. et al. 2021), (Huntsman, D. D., & Bulaj, G. 2022). For example, there are scientific researches that prove that patients in hospitals recover faster and easier if they are connected with nature in any way, directly or indirectly (Huseyin, T. B. et al. 2022). Moreover, creativity, performance, and commitment to work increase among workers, who work in spaces where biophilic design is applied (Hähn, N. et al. 2021).

Biophilic design is not a new concept. Themes, inspired by nature can be found in the earliest human structures: stylized animals characteristic for the Neolithic Age; the Egyptian sphinx; the acanthus leaves adorning the Greek temples; the leafy filigrees of the Rococo design and so many more. Representations of animals and plants have been used for decorative and symbolic ornamentation from ancient times. Cultures around the world have brought nature into homes and public spaces, like the garden courtyards of the Alhambra in Spain, the porcelain fish bowls in ancient China, the bonsai in Japanese homes, the papyrus ponds in the homes of Egyptian nobles, the cottage garden in medieval Germany, or the elusive hanging gardens of Babylon (Butt, A. N., & Dimitrijevic, B. 2022).

The consistent presence of natural themes in architecture in the past indicates that biophilic design is not a recent innovation. It is ingrained in human intuition and

it is a phenomenon that unfolds effortlessly and naturally, requiring minimal conscious effort.

According to “14 Patterns of Biophilic Design: Improving Health and Well-Being in the Built Environment”, biophilic design can be organized into three categories – Nature in the Space, Natural Analogues, and Nature of the Space. Each of these categories encompasses several design patterns, 14 in total (Butt, A. N., & Dimitrijevic, B. 2022).

Methodology

The method entailed a thorough investigation of biophilic design in Macedonian architecture, which included examining its historical context and current trends and suggesting ways to enhance its integration. The research was focused on examination of the past use of biophilic design, evaluation of its present state in modern architecture, and proposal of methods to improve its integration. The study encompassed a comprehensive investigation of relevant literature, a thorough appraisal of historical locations, a critical assessment of current architectural practices, a careful discussion of issues, and highlighting of efforts undertaken by students and young architects.

Review of Examples

Architects and designers often seek inspiration from nature in their designs. It means that building structures and designs are inspired by processes and objects that already exist in nature, concepts that are functioning well in the natural environment, which can be adopted in different ways. When a design uses biomimicry, it is more sustainable, resilient and efficient.

Biomimicry is the study of imitating and mimicking nature to find a solution to human problems. Most designers and researchers contend that nature stands as the foremost, most influential, and assured source of innovation. (Lienhard, J. et al. 2015). Figure 1 shows the Beijing National Stadium, built for the 2008 Beijing Olympics, inspired by a nest.

Antoni Gaudí’s Casa Milà is another notable example of biomimicry in architecture (Figure 2). The undulating exterior of Casa Milà mimics natural landscapes, deviating from conventional man-made structures. Gaudí intentionally drew inspiration from the organic world to create a structure that reflects the shaped and animated qualities of living organisms. The building’s rooftop terrace further showcases Gaudí’s adept integration of anthropomorphic and biomorphic design, featuring sculptural elements that imitate organic shapes found in nature.

Figure 1 Beijing National Stadium, built for the 2008 Beijing Olympics, inspired by a nest, structure found in nature [<https://www.chinahighlights.com/beijing/attraction/birds-nest.htm>]

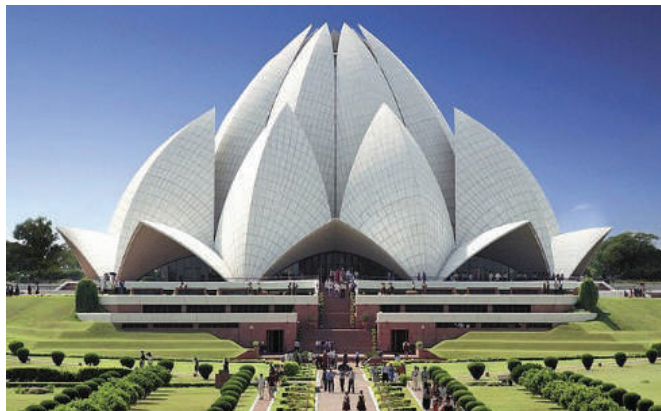


Figure 2 Antoni Gaudí's Casa Milà as an example of biomimicry in architecture [private photos]



The Bahá'í House of Worship, also known as the Lotus Temple, in New Delhi, India (Figure 3), is another architectural masterpiece that seamlessly incorporates biomimicry. Designed by Iranian architect Fariborz Sahba, the temple's circular layout is inspired by the lotus flower, with its sections resembling leaves. The temple's unique design has functional purpose, organizing the space into entry leaves, outer leaves, and interior leaves, each playing a specific role in the overall structure.

Figure 3 *Bahá'í House of Worship, also known as the Lotus Temple, in New Delhi, India* [https://www.archdaily.com/158522/ad-classics-lotus-temple-fariborz-sahba?ad_source=search&ad_medium=projects_tab]



The Elytra Filament Pavilion in Weil am Rhein, Germany (Figure 4), is a remarkable example that integrates biomimicry, design, engineering, and robotic technology. Completed in 2016 by the ICD/ITKE University of Stuttgart, the pavilion draws inspiration from the fibrous structures of flying beetles' forewing shells. The use of advanced robotic production technology allows to utilize composite materials, such as carbon fibers, to mirror the lightweight construction principles found in nature. The result is a lightweight and precise framework that showcases the impact of robotics on architectural innovation.

Figure 4 *Elytra Filament Pavilion in Weil am Rhein, Germany* [https://www.archdaily.com/806242/elytra-filament-pavilion-icd-itke-university-of-stuttgart?ad_source=search&ad_medium=projects_tab]



The Overwater Bamboo Restaurant in the Maldives (Figure 5), designed by Atelier Nomadic, ingeniously incorporates biomimicry inspired by Pink Whiprays. The restaurant's architecture mirrors the graceful form of these marine creatures, with bamboo playing a significant role in construction. The design prioritizes natural ventilation and bio-climatic principles, creating a visually captivating and immersive dining experience that highlights the potential of sustainable design using bamboo. The restaurant's name, Madi Hiyaa, adds cultural significance to the bio-mimetic design, paying homage to the rays in the indigenous Dhivehi language. The use of bamboo underscores its role in carbon sequestration and its contribution to a more sustainable future.

Figure 5 *Overwater Bamboo Restaurant in the Maldives* [https://www.archdaily.com/1011142/overwater-bamboo-restaurant-atelier-nomadic?ad_source=search&ad_medium=projects_tab]



To summarize, the several instances of biomimicry shown in architecture emphasize the significant influence of nature on innovative design. Each architectural endeavor demonstrates a remarkable capacity to incorporate natural principles into architectural conceptions and bring about transformation, including the Beijing National Stadium, the Gaud's Casa Milà, and the Lotus Temple, which pays homage to the lotus flower. The Elytra Filament Pavilion showcases the integration of biomimicry, design, and robotics, illustrating the changing impact of technology

on architecture. The Overwater Bamboo Restaurant cleverly uses biomimicry that draws inspiration from the Pink Whipray to highlight cultural significance and ecological design with bamboo. Together, these impressive architectural wonders demonstrate the capacity of biomimicry to produce visually appealing, durable, and environmentally beneficial buildings, thereby promoting a more balanced and cooperative relationship between human creativity and the natural environment.

Design Research

Biophilic Design in Macedonia in the Past

Since biophilic design is not a new concept and it is uniquely coded in humans, it is logical that it has been applied in architecture in Macedonia since ancient times.

One example are the prehistoric pile settlements, built at several locations in Macedonia, such as Ohird Lake, Prespa Lake, and Dojran Lake. One of the most famous is the recreated Bay of Bones – Prehistoric Settlement, an archeological complex located at the excavation site of Plocha Micov Kamen, near Gradishte and Peshtani along the Ohrid coast (Figure 6). These settlements are a standing proof of the application of the biophilic design in Macedonia in the past. They are built with natural materials, found locally and completely connected with the surrounding, especially with the water element.

Figure 6 Bay of Bones – Prehistoric settlement, an archeological complex located at the excavation site of Plocha Micov Kamen, near Gradishte and Peshtani along the Ohrid coast [<http://www.exploringmacedonia.com/bay-of-bones.nspix>]



Animal and plant-based themes can be seen in many structures from the past, such as residential, religious, national, public, and other structures. Such motives are especially present in the archaeological sites in Macedonia. One of them is the

Archeological Site Stobi, where a breathtaking floor mosaic is inspired by natural elements and animal motives (Figure 7).

Figure 7 *Animal and plant-based themes on a floor mosaic at the Archeological Site Stobi, Macedonia [https://helenmilesmosaics.org/]*



Biophilic Design in Contemporary Architecture in Macedonia

For the last decades, the concepts and the choice of materials in Macedonia have been very limited. Companies have been accustomed to building with the same materials, without creativity or chance to try something different. The predominant structural system used in the construction of buildings in Macedonia is the reinforced concrete frame structural system. In addition to reinforced concrete, which is the leading construction material in Macedonia, steel is used for warehouses and industrial halls where larger spans between structural elements are needed. Most of the buildings have financially viable energy efficient façades. Panels and glass façades are added to some parts of exteriors in administrative buildings (Figure 8) to achieve a striking appearance that will attract attention. Investors typically prioritize the saleable net area, often favoring quantity over quality.

Figure 8. *Administrative buildings in Macedonia [private photos]*



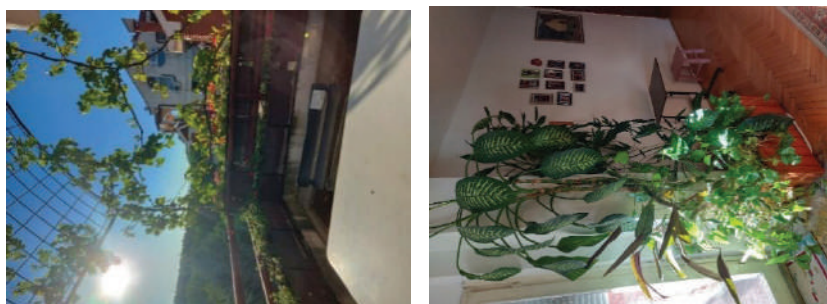
A growing trend in certain new residential buildings involves incorporation of vegetation, particularly on rooftop terraces (Figure 9). Moreover, vegetation is part of the interior design of apartments and terraces, as well (Figure 10), for achieving a better aesthetic appearance of the space, but also for improving the living comfort of the users. Bringing vegetation to the exterior and interior spaces of a building provides a direct relationship with nature. This can be created by application of living green walls, closed gardens, planters, or many potted plants. Plants and vegetation have been proven to increase physical health, performance and productivity, and reduce stress, as part of the biophilic design.

Figure 9 Residential building in Skopje [private photos]



However, several things should be taken into consideration when vegetation is incorporated into interior and exterior of buildings, such as its weight and its impact on the structural and non-structural elements of the buildings, the maintenance requirements, the waterproofing and drainage, accessibility and safety, cost considerations, etc.

Figure 10 Apartment in Skopje [private photos]





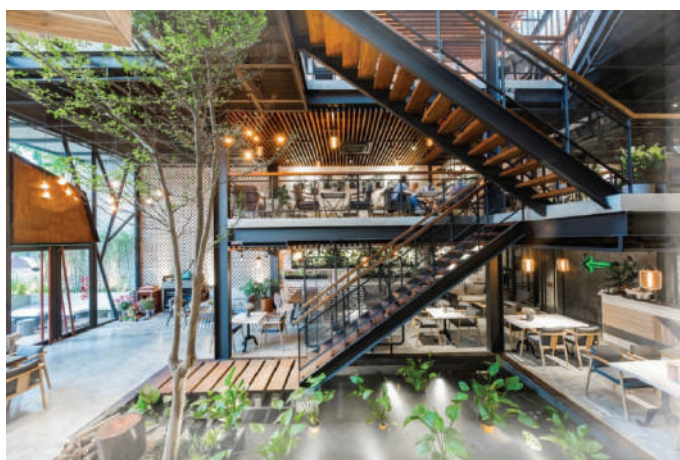
In recent times, biophilic design has gained notable prominence in restaurants across Macedonia. It is most often achieved through application of natural materials, plants, and vegetation, presence of water surfaces, insects, and animals (Figure 11). Owners are motivated to invest in creating spaces dominated by nature, as it helps to attract increased attention and a larger guest turnout. Visitors experience a sense of comfort and relaxation when they establish a connection with nature, whether it is direct or indirect.

Figure 11 *Restaurant in Veles [private photos]*



It is noteworthy to highlight the initiative among young architects and designers who are incorporating elements of biophilic design into their projects. Students, as well as young architects, have the will, but also the knowledge, to use these concepts of sustainable architecture, biophilic design, and energy efficiency and thus improve the quality of projects, contribute to the connection between man and nature, and create beautiful buildings. Figure 12 represents a Project for a Green Café in Skopje of a student from the International Balkan University.

Figure 12 3D Representation from a Project for a Green Café in Skopje [Diploma Project of a student: Abida Susevic, mentor: Marija Miloshevska Janakieska, Department of Architecture, Faculty of Engineering, International Balkan University]



Conclusions

Biophilic design is a concept employed in the field of architecture and the building industry, aiming to enhance the connection between individuals and nature, leading to numerous benefits for the users. It has been applied in Macedonia since ancient times, which can be confirmed by several examples.

For the last decades, the concepts and the choice of materials in Macedonia have been very limited, so the focus has been put on financial benefit and quantity over quality. Nevertheless, some instances bear witness of the gradual adoption of biophilic design, particularly through incorporation of natural materials, inclusion of plants and vegetation in both interior and exterior designs, integration of water surfaces (especially in public buildings and areas), as well as presence of insects

and animals. The increased use of biophilic design in Macedonian contemporary architecture is an important element of a more sustainable future built environment and therefore more information about its application and perceptions is needed.

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