

INNOVATION OF THE BIONIC THINKING IN ARCHITECTURE AND DESIGN EDUCATION

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Modern challenges in architecture and design require innovative approaches to design aimed at sustainability, adaptability and harmonization of the environment. Accordingly, the necessity of solving these problems puts forward new requirements for the formation of specialized skills and modern approaches of future architects and designers. The educational process modifications of the content are also required by including certain disciplines in the specialists' preparation programs. The latest achievements and contemporary trends in architecture and design are incorporated into the educational curriculum, ensuring that students receive comprehensive exposure to these developments. One of the key of the development is bionics. This science studies the principles of organization of natural forms and processes and adapts them to solving engineering, architectural and design problems. The bionic design can become a strategic tool for sustainable development in the context of urbanization, resource shortages and climate change. The development of bionic thinking in the educational process contributes to the research for innovative solutions that combine functionality, aesthetics and environmental efficiency.

The implementation of analysis of natural forms in modern solutions to current architectural and design questions makes it possible to find effective and rational ways to create the most natural spaces for humans. The bionic approach contributes to the creation of harmonious unity both in the artificial environment itself, and the careful interaction and relationship of artificial objects with the natural environment. Having studied the advantages and ways of finding new original design and architectural solutions, future specialists will receive a powerful and effective tool for successfully finding the best design solutions and their implementation.

First of all, attention should be paid to the need for students of architectural and design specialties to become familiar with and study the principles that underlie the bionic approach to finding original and effective design solutions. Biophilic design is a subject that is receiving significant attention to meeting human needs for comfort while minimizing the adverse effects on the natural environment. Research in the field of ecopsychology and cognitive sciences confirms that natural forms, textures and colors have a positive effect on the emotional state of a person, reducing stress and increasing the comfort of the environment.

The main principles of biophilic design include creating solutions based on the analysis and application of fractal structures that evoke a sense of order and harmony.

The study of the structure of bionic forms is one of the most promising approaches to finding effective solutions in the careful interaction of artificial forms with nature. Bionic design is presented as a synthesis of functionality and aesthetics and is aimed at creating adaptive, ergonomic, and environmentally friendly solutions inspired by natural processes. The key areas of bionic design include *transformable forms*, such as furniture and architectural elements, inspired by natural dynamics; *bionic lighting*, imitating natural light processes; *energy efficiency and environmental friendliness* of objects with minimal impact on the environment; usage of *closed production cycles*. Modern research conducted in architectural bureaus and design laboratories proves that biophilic principles applied in the design of objects increase satisfaction with the urban environment and contribute to psychological well-being. By studying the possibilities of using bionics in project activities, students receive a tool for creating new, effective, and aesthetically valuable objects.

The advantages of including bionics into architectural and design education are considered in the context of new educational approaches. The formation of bionic thinking requires the introduction of an interdisciplinary approach to the educational process. The main components that now successfully included to the educational practice are: *Bionics in architecture and design* which aimed at studying natural structures and their adaptation in design; *Project-based learning*, including the development of student concepts based on bionic principles; *Interactive laboratories* that carry out digital modeling of bionic processes; *Collaborations* with biologists, engineers, and ecologists, within which the natural sciences are integrated into project-based learning. Currently, many educational institutions pay close attention to the formation of bionic thinking and include in the program the preparation for the implementation of the bionic approach for practical application in architecture and design. Some educational institutions have developed and successfully applied special programs, such as: research of bioadaptive structures in Harvard GSD – BioDesign Lab; digital bionics and parametric modeling in IAAC Barcelona – Advanced Architecture; application of AI and biomimetics in architecture in MIT – BioDigital Design Lab.

Integration of digital technologies and an interdisciplinary approach into the educational process may train future specialists to be capable in developing adaptive and environmentally friendly solutions. Bionic thinking is becoming an essential tool for sustainable design, allowing architects and designers to find innovative solutions based on natural processes. The use of bionic forms helps to harmonize the environment, increase energy efficiency and adapt architectural and design objects to changing conditions. Thus, the educational process should become a platform for experimentation and implementation of bionic concepts, forming a new generation of architects and designers ready for the challenges of the 21st Century.