

# REVIEW

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On the dissertation of the subject

*Innovative Methods of Bionic and Biomimetic and  
their Transformations in Modern Architecture*

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The dissertation *Innovative Methods of Bionic and Biomimetic and their Transformations in Modern Architecture* that has been presented in the field "Theory and History of Architecture" (Modern architecture: innovations in architecture and urban environment) by arch. Nona Tsekova is an academic work of 162 pages, which includes the main text, illustrative material, appendix: Dictionary of some modern architectural terms. A catalog of over 100 pages is also included. It consists of an introduction, an exposition in 3 chapters, with several subsections, a conclusion, a bibliography, which includes: 11 titles in Cyrillic; 39 Latin titles; 134 pcs. individual internet source. Additional literature from 21 sources is also presented. The bibliography could be expanded a little more.

It is important to point out that the work is the result of in-depth research, on the one hand and the practical work of Nona Tsekova as an architect, on the other. The doctoral student has graduated from University of Architecture, Civil Engineering and Geodesy in 2015. She defended a diploma project on "Youth Complex for Culture and non-formal education." Her project was awarded the Coventry University Special Prize in the third edition of the City Academy - July, 2016. During her studies she participated in the Erasmus exchange program at the Technical University of Kaiserslautern, Germany, as well as in meetings of the European Organization of Students in architecture (EASA - European Architecture Students Assembly - 2013 and 2014). Her additional qualifications include participation in a number of courses and workshops on parametric modeling and design and digital fabrication (Dynamic Mutations, Computation Matters, ForMaking, etc.). In some of their next editions, she is also included as an assistant/teacher. Since July 2016, architect Nona Tsekova has been a doctoral student at the Institute of Art Studies, BAS. During her dissertation research she was approved to participate in the first international doctoral school of SARCOS for sustainable strategies in construction and architecture, held in Lisbon in January 2018. In 2018 Nona Tsekova expands her research on the topic of her doctoral studies with a successfully completed course for "Certified building specialists for passive

buildings", and in 2019 with participation in a seminar and creative workshop "Clay Storming" led by arch. Anna Heringer (one of the most recognizable contemporary architects in the field of sustainable eco-architecture with natural materials) as part of the program of the multidisciplinary summer architectural school of Domaine de Boisbuchet, France. Arch. Nona Tsekova is interested in the manifestations of architectural design in its wide range of scales and design categories. Her parallel creative activity includes participation in teams in the development of architectural projects and competitions, as well as mentoring in several formats for architectural and design workshops. She works on a variety of scale and focus projects in the field of architecture - from those related to digital fabrication, prototyping, product and exhibition design (as part of the team of Transformatori and SmartFabLab), to architectural projects on a larger scale - building and urban (as part of various collectives). As projects on which she has worked and received awards we should mention - Second place in the competition for renovation of the Youth House, Varna, 2016, as well as First place in the Architectural Plein Air "GET HOLD OF THE POUND NET", 2017.

The text has a clear structure. The introductory part includes a presentation of the topicality, the degree of research, the object, the subject, the goals, the boundaries, the methodology and the expected results of the dissertation.

The first section of the first chapter, entitled "Chronological overview of terms and definitions. Formulating the degree of innovation and a proposal for a new type of classification of biomimetic methods", covers the main concepts and approaches that describe the topic are considered chronologically. The next section presents their categorization according to different authors. The proposed classification levels are tested in the analysis of the dialogue between space and material (material covers) in architecture in order to clarify these relationships through the prism of nature-inspired analytical and formative methods.

The object of the research is bionic (biomimetic) approaches in modern architecture.

As the key goal of the work on the one hand points out Tsekova is the renewed systematization of bionic approaches and results in the field of modern architecture, tracing of characteristic transformations and their key features, as well as their possible interrelation with regional (and traditional) construction and architectural techniques and methods. Another goal of the dissertation research is to assess the possibilities for their transfer to the Bulgarian environment, as well as to assess the fields and directions for future development, transformation, upgrading of the principles as a whole, which is especially valuable as a study and outlining development prospects.

Some of the tasks are related to the study of formulating of key terms and definitions in historical terms; updating and clarifying the classification of biomimetic methods and the corresponding levels of inspiration from nature; tracking the bionic and bio-inspired trends in the Bulgarian architectural practice; tracing the characteristic

transformations and the transformative potential of certain biomimetic methods in architecture; revealing combinations between tradition and innovation in architectural design and pointing out new opportunities for experiment, transformation and symbiosis in this direction, etc.

In the first section of the second chapter "Bionics and bio-inspired trends in the Bulgarian architectural environment. Analysis of examples from world practice. Interrelation with sustainable concepts." is emphasized the application of the considered methods in the Bulgarian environment - from traditions to modern concepts, supplementing the historical review from the first chapter. The analysis develops again against the background and in comparison with examples and trends from the world architectural practice, with an assessment of the prevalence and presence of scientific interest, potential for development and connection with parallel trends in architecture. Possibilities for connection with traditional regional architectural and construction principles are discussed. The second section analyzes leading examples of architectural projects and concepts falling within the parameters described in the proposed classification. In the last part of the section a comparison is made with other contemporary trends that have points of contact with the latest levels of application in the proposed author's classification. Different approaches to ecological architecture and its connection with modern concepts of biomimetics in sustainable architecture are considered.

In the first section of the third chapter "Transformation and transformative potential of biomimetic methods in architecture. Symbioticity and author's criterion for symbioticity. New opportunities for experiment and symbiosis - a combination of tradition and innovation - discussion of hypotheses" introduces the author's criterion for symbioticism. The possibility of its use as an auxiliary tool in architectural design and research tasks for optimization analysis through a bionic prism, as well as for the direction of potentials for new design approaches, for opportunities for innovative, experimental combinations with increased sustainable characteristics is discussed. The focus of the second section is in the final discussion - "Guidelines for the types and nature of possible transformations of traditional techniques through bionic analytical principles and design approaches." The possibilities for a combination of biomimetic and sustainable approaches for the use of natural materials in architecture and their symbiotic and transformative potentials are discussed.

The conclusion summarizes some key lines of development of bionic methods and transformations reported in the analysis process. Some cultural and social reflections of biomimetic concepts in architecture are also presented.

The research methodology of the dissertation includes: analytical review of literature sources; terminological systematization and synchronous analysis of scientific points of view (when necessary and semantic analysis of certain concepts); selection and evaluation of key projects and artifacts; performing a comparative analysis of selected

cases, according to their components, characteristics and structural relationships; experimental productions. In general, the approach is a historical-theoretical analysis of multiple sources and rich empirical material.

The scientific qualities of the dissertation are related to its relevance, as the study traces the latest practices in the 21<sup>st</sup> century, which can be found in an interdisciplinary field. In its essence, the work is mainly focused on the study of bionics and biomimetics and their transformations in modern architecture in the era of medialization and digitalization. The text raises important issues that could be the basis for future debate and the further development of interdisciplinary tools.

A valuable moment of the research is the analysis of the areas of intersection of art and science, human and technological and ideas are proposed for expanding the interpretive and instrumental apparatus in a technological context. Specific examples are described and analyzed, considering iconic artists such as Anthony Gaudi, Joseph Paxton, Kisho Kurokawa, Janine M. Benyus, Sir Nicholas Grimshaw and others. Emphasis is placed on innovative methods and strategies to achieve the symbiosis between architectural (design) work, bio-resources and new technologies. The attempt to systematize the considered innovative architectural practices is praised. In my opinion, the prepared graphics are contributing.

The study focuses on some of the most significant new trends, strategies and paradigms in the global context, with examples from Bulgarian practices, which I would point out as a merit of the work, although some development of this aspect of research may be considered.

It should be noted that in the dissertation one of the important emphasis is on changing the functions of architecture and the application of innovative methods in the digital age. The dissertation examines the new challenges facing the architect today with the introduction of new technologies in architectural practices.

As a positive quality of the dissertation I would point out the fact that it has both theoretical and practical application. Especially valuable are those proposed by arch. Tsekova dictionary of some modern architectural terms, as well as a catalog of over 100 pages.

I fully agree with the contributions made by the dissertation student, which include rethinking basic and actively complementary terminology - in order to clarify its mutual semantic connection, from a contemporary point of view, and to trace its positioning in the architectural environment; creating an author's categorization of the methods of bionics and biomimetics in architecture of 4 main levels: bionic approach of the first degree and second degree as inspiration from nature on a formal level and on a functional level; bionic approach of third and fourth degree as development of complex gradient and interactive architectural and design systems and installations; electronics interference; "Smart materials", meta-materials and even with a possible

element of self-learning, evolutionary development of the system/structure, by applying a "living" system or components and experimenting with "living" materials, structures and systems; tracking and summarizing contemporary bionic trends in the Bulgarian architectural environment; comparison between the high levels of application of the considered bionic methods with other modern architectural tendencies (ecological and sustainable architecture), points of contact and directions of complementarity are determined; development of an author's criterion for symbiotics in architecture and two hypothetical transformations - bionically inspired and based on architectural approaches based on traditional techniques - a new combination of materials and strategies to increase efficiency and improved behavior and sustainable characteristics of the architectural "organism", summarizing the directions and levels of transformation of the considered bionic approaches and the potentials for future development and subsequent research.

Although the terminology is well developed in both the text and the dictionary, concepts such as modernism, postmodernism, digimodernism, transhumanism, cybernetics in relation to bionics as a study of mechanical systems could also be considered, which function as living organisms or parts of such, biomimetics as design and production of materials, structures and systems modeled on biological objects and processes, the new urbanism that promotes non-aggressive habitat, ecological architecture in which there is a desire to minimize the negative impact of buildings on the environment through efficiency and moderation in the use of materials, energy, development space and the ecosystem as a whole, the use of natural materials, etc.

It is also necessary to refine the bibliography according to bibliographic standards. This applies mainly to the indicated links, which require a bibliographic description.

The study could be extended diachronically in the direction of conducting a brief historical overview of the ideas and practices of prominent theorists in the field of fusion between bio systems and technologies such as Wiener, McLuhan, J.C.R. Licklider, Kirby, Creps, Baba, Haraway, Huxley, Vita-Mor etc. in order to expand the historical context of research.

Some stylistic amendments and correction of spelling inaccuracies and punctuation errors are needed.

Research would be important for everyone - researchers, teachers, students, practitioners who are interested in bionic and biomimetic approaches in modern architecture.

The dissertation includes more than the required minimum number of publications on the topic of the dissertation, which are six.

Despite the recommendations made, taking into account the prominent qualities of the work, as well as the undeniable potential of Nona Tsekova as an active architect and

researcher, I give a positive assessment and propose that she be awarded the educational and scientific degree "Doctor".

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