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USE OF NATURAL FORMS IN THE OBJECT BIODESIGN

Abstract: The possibility of using the results of studies of the structure of natural forms, structural design method of design objects defined by a list of major structural forms and their influence on the design of buildings and substantive content.

Keywords: bionics, biodesign, structure, structuralism morphogenesis.

Statement of the problem. The study of the laws of nature led to the understanding of natural objects as highly organized, harmonious system. Modern science has the necessary tools and concepts that allow you to explore the deep structure of the smallest living organism and features functioning.

The higher the level of take up new technologies, the focus turns to rapidly design design based on the transformation of biological objects into objects of design, thereby increasing the relevance of research and the use of the structure of natural forms as a formative factor in the process bionic modeling design in modern design .

Analysis of recent research and publications. AI Lazarev [4] considers the formation of the main provisions of bionics as a science in architecture and design. Research and development of methods of bionic design clothes within the overall strategy of the art design done Belka TV [2]. Charles Kemp and Joshua Tenenbaum [8] highlight the research of structural forms and flows. D'Arcy Thompson [7] described the numerous connections between biological forms, physics and mechanics, and in particular noted that the optimization process forms often inherent nature . Key provisions and principles of the system is determined biodesign Mikhaylenko VE and Kashchenko O. [5]

The wording of Article goals. You must identify the particular use of the structure of natural objects in the design process and identify key structural forms necessary in the design of public spaces.

The main material. The study of the patterns forming organisms to build their image of artificial objects are usually related to the field of science of bionics . Bionics - a new scientific field that emerged in the fifties of the twentieth century, adjacent between biology and technology that solves the problem posed by modeling the structure and activity of organisms. Akhutina VM [1] noted that this bionic approach to the study of nature, and especially its morphology , ecology , physiology of living organisms , their cells and populations are highly productive in solving the complex problems of scientific and technological progress.

To date, bionics deals with not only the form of parts or things as the ability to examine how the processes in nature, to understand the relationship of parts and systems exist .

It is the development of science of bionics and some allied sciences (biomorfolohiyi , biophysics , biochemistry and cybernetics) gave impetus to the creation of a new direction in design. Biodesign originated in the traditional design , with the extensive bionic design, when work began to appear , in varying degrees, based on biological form and structure. Biodesign provides almost unlimited opportunities to create objects of the substantive environmental , interiors and architecture .

Important role in the design planning is an investigation of the structure and forms, and their properties. Structure - is the internal structure of objects. Any object like a living organism has its own structure , each element of which can be considered as a whole or as a part of which has its own structure and can be viewed in the context of a single , relatively independent system . Each structural element is seen as an organic unity of certain qualities , properties, relations, describing not only the form but also the content. Darcy Thompson [6] was the first to systematize the structural variants of living structures and established patterns of occurrence. He believed that evolutionary biology is subject to physical and chemical laws , and these laws are playing a direct, causal importance in determining the form of general and particular forms in biology.

The design process of design- object in biodesign primarily involves the study

of natural analogues , in this case involves the study of the structure of natural forms in terms of distinguishing precisely the quality of the forms that are necessary to solve the tasks of the future product .

MS Stephen Tooth al [6] noted that the structural aspect of the study of forms suggests that the form can be naturally divided into parts , it allows to single out the form as a structure of three varieties:

- form of uncertain structure (for example , form a pair);

- form of a fixed structure (eg, mineral crystals, snowflakes, fractals);

- variant form of the structure (such as dynamic mechanical devices , natural organisms).

Identify relationships, study interactions and subordination of parts of different nature can detect similar structures in their organization and classify them into certain groups.

The structures of natural forms by the outline shape components can be classified into: cell structure, based on a structural unit - cell and branched structures with irregular grid, which is based on a structural unit - a branch .

Le Korbuzye as a social element architecture took cell. He wrote: "If the cell is the primary biological element , the" hearth ", in other words - a shelter for the family is a social cell " [1]. In turn, by considering the geometrical shape of the cell can be systematized into certain categories . There are four main types of primary cell shapes : triangle , square, hexagon and circle. Combinations of different combinations of cells forming structural shapes, different in character structure: the most common is a grid and a spiral. More advanced structural forms rozlyanuly Charles Kemp and Joshua Tenenbaum [8], they identified eight structural forms and generative processes that form them : partition chain trim ring , hierarchy tree and mesh cylinder (Figure 1.).

There are also branched structures having irregular grid, which is based on a structural unit - a branch . The nature forms branches are divided into the following types: branch, hook , fork , limb , socket, and a bunch of whorl .

Based on the fact that cell and branched structures have a fairly simple form,

which can be described geometrically and folded into a structure , they provide an opportunity to create a variety of form and size of the object biodesign . Modern technologies allow to create them by using special software , which greatly simplifies the design process , from idea development and definition of the tasks of design to visualize the completed project design product.

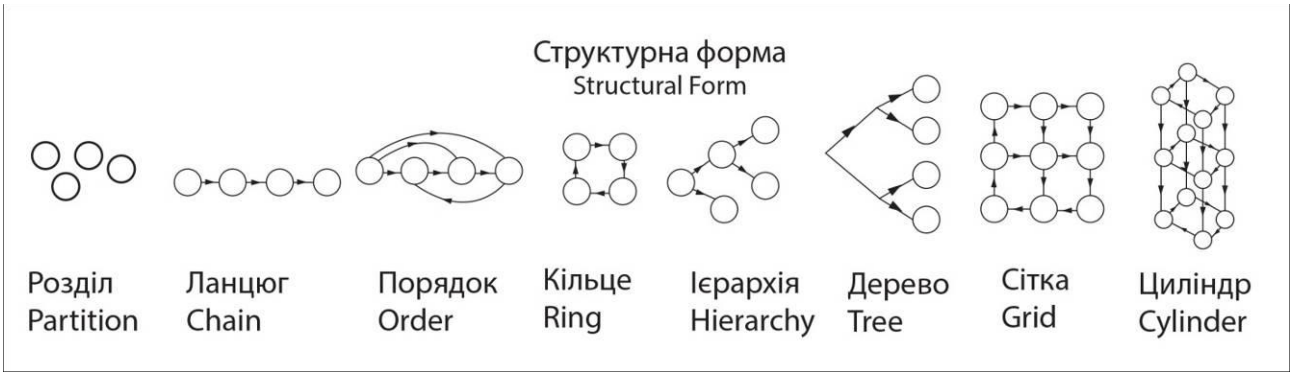

Figure 1. Eight structural forms for Charles Kemp and Joshua Tenenbaum

Consider the possibility of using cellular structural forms in the design of public buildings for example the development of museum premises. Getting to design any type of premises, primarily to develop space- zoning and space-planning decisions . Most appropriate in the museum is the use of structural forms "distribution" or " hierarchy" to host groups and service office space , forms of "chain" for consistent disclosure exhibition halls of the museum. Using structural forms in the design space , consider the scheme of visitors and staff to ensure the organized movement of people during the flow of the museum and its evacuation in an emergency .

For the development of structural elements characteristic shape of the ceiling was a " ring " and " grid ". For example , mesh grilles as essential to the design of the ceiling used in the British Museum, the American Museum of Natural History, and Museum of Modern Art Guggenheim. By designing the ceiling include not only space-planning decisions but also the design of the lighting system as a powerful functional and decorative part of the project. Designing lighting through the use of structural forms can be viewed from different angles. On the one hand, to design the layout of fixtures you can use all the structural form. Most

characteristic are the "ring" or "chain" . On the other hand, may not be a clear layout , but the lights themselves can consist of regular cellular structures and their transformations.

Individual elements of design are the columns that are quite common in the modern practice of building museums. They can use the structural form of " cylinder " and " tree " as the designs that are both functional and decorative shells. These structural forms found their place in the Museum of Modern Art in Metz (France), Museum of Sciences. Prince Philip (Spain).

Design of walls and floors in the museum may develop using the texture or the texture of all structural forms, but the most accurate is to use " section ", " hierarchy ", " grid " and " cylinder " to ensure separation of exhibition areas in order to create the necessary direction contemplation or a location system exhibits.
An important factor that influences the process of designing the interiors of museums is their substantive content. Key elements of the museum exhibit and information stands , decorative items and partitions . Depending on the tasks and goals for the design of substantive content , you can use all kinds of necessary structural forms , following the ergonomic requirements and composition laws.
The most common forms of structural design museum interior space is " sharing ", " chain ", " hierarchy " and " net ."

To confirm the use of the above described structural forms drafted interior design of the museum. During the project design development interior Regional Museum in Vinnitsa was elected zoning - " distribution " planning scheme areas and lighting systems "chain" , given the location of the exposure system enfilade rooms. In the thesis project of one of the authors of this article presents exhibitions of the museum , which is based on a high altitude hall allowed to use decorative wooden structures that move on the wall using the structural form "tree" Boolean division into separate exhibit space segments (Fig. 2).

Also, consider the example of a design object design patterns based on the use of natural crystals. The object of development serves a decorative element called "dynamic wall" , located in the lobby of the draft Regional Museum in Vinnitsa (

Figure 3.). The decorative element is a dynamic design with metal frame to which are attached decorative panels that move in accordance with the established algorithm of motion. Dynamic design was developed for a specific room based interactive system , presented at the seminar «A living System» in Lisbon in 2012.

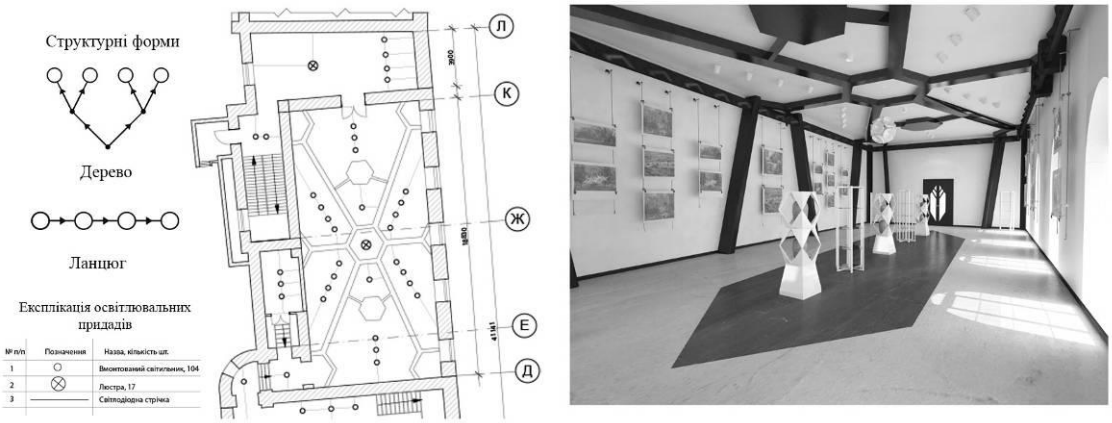

Figure 2. Using structural forms 'tree' and 'chain' in a design museum design

Subject of research in the design element was selected natural shape and internal structure of crystals of halite or rock salt (rys.4.a.).

Figure. 3. Decorative elements "dynamic wall"

First, it was determined the external characteristics of the mineral. They include : a cubic often granular form, color mostly absent or crystals with a red , yellow or blue color , transparent material is glass shine. The internal structure - a crystalline structure that has the form of a face-centered cubic lattice (rys.4.b.). Based on the above features crystal form was chosen structural grid " grid " as the primary form consisting of a metric repeat elements - panels. Since the crystals

have faceted surfaces that reflect light well , it was decided to make a panel with a mirror fastsetamy to create the effect of crystals that shimmer in the sun.

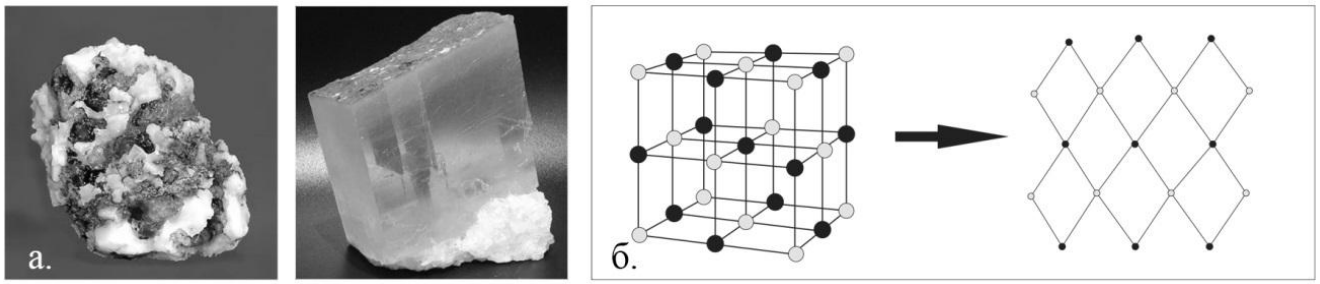

Figure. 4. Natural crystal salt (a) and its crystal structure (b)

Targeted identification and use of structural forms in the process of designing buildings or facilities design makes it possible not only to use the new form in the process of formation , but also to achieve a comprehensive , functional justification of the project design of the entire building and find the most optimal materials and ways to implement it .

Conclusions. Features of the structure of natural influence on the design process as follows:

- in planning public spaces most typical structural form is " sharing ", " chain ", " hierarchy " and " net " that enable a comprehensive approach to addressing the major space-planning and functional design tasks .

- properties are natural objects define the main characteristics of the product during the development of its design and implementation.

literature

1. Архитектурная бионика / [Рабинович В.И. и др.]; под. ред. Ю. С. Лебедева. – М.: Стройиздат, 1971. – 269 с.

2. *Белько Т.В*. Бионические принципы формообразования костюма : автореф. дис. ... канд. техн. наук : 17.00.06. / Т.В. Белько. – Москва, 2006. – 20с.

3. *Волкотруб И.* Основы художественного конструирования: учебник для худож. учеб. заведений. / И. Волкотруб. - [2-е изд., перераб. и доп.]. - К.: Вища школа, 1988. – 191 с.,

4. *Лазарєв О.І.* Сучасний досвід теорії і практики архітектурної біоніки в дизайні [Електронний ресурс] / О.І Лазарєв// Вісник харківської державної академії дизайну та мистецтва. – 2008. - №6. - С.33-42

5. *Михайленко В.Є.* Основи біодизайну: навч. посіб. / В.Є Михайленко, О.В. Кащенко. – К.: Каравела, 2011.- 224с.

6. *Шубенков М.* Структурные закономерности архитектурного формообразования: учеб. пособ. / М. Шубенков. – М.: Архитектура-С, 2006. – 320с.

7. On the Growth and Form [Електронний ресурс] / D.W. Thompson. - New York: Macmillan, 1942. – 1116с. – Режим доступу до вид.: http://archive.org/stream/ongrowthform00thom#page/n3/mode/2up (15.09.13). – Назва з екрану.

8. The discovery of structural form [Електронний ресурс] / Charles Kemp, Joshua B. Tenenbaum // PNAS. – 2008. – August5. – Режим доступу до журн.: http://intl.pnas.org/content/105/31/10687.full (14.09.13). – Назва з екрану.

Анотація

Кузнєцова І.А., Захарчук В.Л., Використання структури природних форм в об'єктах біодизайну. *Розглядаються можливості використання результатів дослідження структури природних форм і структурного методу проектування дизайн-об'єктів, визначається перелік основних структурних форм та їх вплив на процес проектування приміщень і предметного наповнення.*

Ключові слова: біоніка, біодизайн, структура, структуралізм формоутворення.

Аннотация

Кузнецова И.А., Захарчук В.Л., Использование структуры природных форм в объектах биодизайна. *Рассматриваются возможности использования результатов исследования структуры природных форм и структурного метода проектирования дизайн-объектов, определяется перечень основных структурных форм и их влияние на процесс проектирования помещений и предметного наполнения.*

Ключевые слова: бионика, биодизайн, структура, структурализм формообразование.