The Process of Transformation Natural Forms into an Associative Design Model

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Abstract. The article analyzes the process of transformation of natural forms into a figurative design form on the basis of the associative design method. The purpose of this article is to show the possibility of using associative design objects in certain urban conditions, in particular in recreational areas of the city. It is proved that associative modeling is subject to the same objective laws of harmonization, which determine the development of each design form. As a result of the study, an experimental urban luminaire was designed, which can be combined with urban design objects of various styles. Its main functions are identified: engineering (decorative lighting source) and aesthetic (formation of aesthetically attractive urban spaces), and the possibility of integrating the luminaire into the urban environment of pedestrian streets and parks. The principle of associative-figurative form reveals the artistic idea more clearly. Therefore, figurative form has a stronger emotional and aesthetic impact on the viewer than a simple utilitarian form. In General, the article touches upon the design problems of creating visually comfortable subject-spatial urban environment for favorable human activity. The natural simulations introduced into the fabric of urban development are able "to unload" the technogenic urban visual field.

1. Introduction
In modern project practice, wildlife occupies a special place among the directions of finding analogies and creative sources. As you know, in nature, expediency is inseparable from the overall harmony of its forms. The structure of the natural form, color, texture of its surfaces – all subject to a single idea: optimal functioning in natural conditions. The uniqueness and dynamism of natural forms, enhanced by the color solution – this is their ability to emotionally affect people.

The purpose of this study is to analyze the process of transformation of natural forms into a design model based on the associative method. The relevance of this problem is due to the disclosure of the theme of borrowing natural forms in the creation of a plastic design image and achieve harmony in an urban environment. This requires a deeper understanding of human perception of objects of natural forms. As a creative source of inspiration were taken natural forms of trees and birds in nests. The main objective of practical experimentation was not to obtain the result of accurate copying of natural forms, and the development of common methods of formation of living structures. The main goal of the project is to create a harmonious shaped lamp for urban open spaces: pedestrian streets, parks and other recreational areas.

2. Materials and Methods
The imitation of natural forms in design practice have different approaches and titles. The most famous area of research is bionics, which brings together scientists, engineers and architects to create
sustainable technologies. Bionic method is also used by designers to transfer an interesting idea, principle, method from nature objects to design object [7]. In the English-language literature, the term "biomimetics" is more often used – imitation of natural analogues. The term is used in the meaning of developing approaches to the creation of technological devices in which the idea and the main elements are borrowed from wildlife. Biomimetics is a conscious effort to use the immaculate principles of nature. That is why scientists and engineers around the world are trying to replicate natural elements [12].

E. Zherdev proposes to introduce the term "metaphor" into the designers' circulation as a universal category of forming artistic imagery and bio modeling in various types of design due to the variety of its manifestations and meanings [23]. Imitation of natural forms is also called the stylized design method. In design, it is an example of cultural and environmental thinking [22].

Biomorphism is more indirectly connected with the simulation of living organisms. Biomorphism models artistic design elements on naturally occurring patterns or shapes reminiscent of nature and living organisms. Taken to its extreme it attempts to force naturally occurring shapes onto functional devices. Biomorphist art focuses on the power of natural life and uses organic shapes, with shapeless and vaguely spherical hints of the forms of biology. But the creation of plastically adequate forms in design is also possible with the help of reasoned design, as consider V. Miroshnikov and V. Miroshnikova [9].

The opposite approach is the method of geometric structuring of natural forms. Patterns in nature are visible regularities of form found in the natural world. These patterns recur in different contexts and can sometimes be modelled mathematically. R. Mainstone reveals the processes of design, showing how the freedom of choice of the designer has been expanded due to the growing understanding of the structural behavior and indicates the features which distinguish the forms created from forms generated in nature [8]. However, effective structures and forms often have no aesthetic value. Therefore, there is a need to pay attention of structural engineers and inventors to the natural morphology in order to create optimal models with an artistic quality [15].

Even external imitation of natural forms helps to reflect the beauty of the environment, which is especially important for urban spaces. Urban design creates an artificial environment that reflects the values of society and fosters artistic taste [11]. Therefore, the aesthetic side of urban design objects is important. Studying the historical and theoretical issues of the visual, the researchers reveal the ideas of the whole culture's desire for clarity in the modern period [16]. I. Nikitina analyzes figurative forms in graphic design and connects this with the increasing role of visual culture [14]. C. Ellard notes the negative impact of urbanization on human health, which invariably leads to a review of the principles of environmental management with the aim of harmonization [4].

Currently, the directions of research related to the study of artificial nature are formulated, which indicates a creative and scientific interest in this problem and the special relevance of the chosen topic. In particular, the questions of the correlation of building and nature, architectural and natural forms are analyzed. The questions of categories of beauty, structure and functions of design, and the ratio of these categories [6] are touched upon. In this regard, the problem of the scale of the urban environment to man becomes urgent. J. Gehl emphasizes the need to creating cityscapes on a human scale [5].

To date, the mechanisms and methods of interpretation of natural forms in the urban environment have been identified and identified [13, 19, 21]. A. Yakovlev concretizes the concept of "artificial nature" and introduces a new concept of "natural-interpreting object" [21]. A new direction in modern landscape design is emerging-art-natural design, which is based on abstract and symbolic compensation of nature in the urban landscape. To date, landscape architecture and urban landscape design are increasingly introducing new types of figurative existence of natural forms – artificial imitation of nature are becoming full elements. Objects can take into account natural processes, and be completely artificial – are artistic and imaginative understanding of nature.

The works of A. Bazilevsky and V. Barysheva, O. Chepurova, V. Sidorenko, E. Zherdev, Yu. Trusov are devoted to the design image issues [2, 3, 17, 23]. Features of creating a light image at night reveals
N. Shepetkov [18]. The designer is always interested in the form in General, the pairing of volumes, a combination of various constructions. In modern design, bright imaginative thinking is understood even as a fundamentally new way of design. In this view, it is necessary to study the features of the associative method in the design process, leading to the transformation of subject, abstract and psychological associations in the graphic search for solutions to the object.

Creating a figurative form is directly opposite to the logical design process – the image appears immediately as a blaze [1]. Artistic and figurative modeling, in contrast to the logical, is not based on a rational, impartial and consistent account of all the necessary factors, but primarily on the emotional, intuitive and holistic vision of the final result of the project process. Unity in the image form of rational and emotional means compliance, on the one hand, with the ideas of its expedient form formation and intuitive vision of the author – on the other. This correspondence creates a deep and vivid artistic image, which has a strictly rational and at the same time "live", emotional character. If the rational component prevails, the form looks "dry", uninteresting, inexpressive. When excessive of her emotional condition she becomes uncertain, "fuzzy" meaning, uncollected. The last couple of components of the image – its content and formal beginning. Harmonization of this pair involves the removal of the image of the contradiction between its meaning and the form in which it is embodied. Harmonious fusion in the composition of deep content and bright form gives rise to a holistic, very expressive image. It determines the strength and depth of the artistic and aesthetic impact of the form on the viewer.

3. The results of the study

Thus, the image in the design forms has a different degree of conditionality, ranging from images close to natural objects, and ending with extremely conventional, abstract symbols. Here it is necessary to take into account first of all the content of the form and functions that it performs – including artistic ones. If the function is to provide, first of all, clarity of understanding of the image, the form is as close as possible to the pictorial. When reaching the speed and clarity of its perception from a distance, which had to be taken into account when designing the city lamp, the form is as conditional as possible. It is obvious that for the effective performance of both functions – the speed of perception and clarity of understanding – it was necessary to create a clear, simple and concise form of design model. It will correspond to the principle of its figurative development or simply imagery.

Another specific feature of the shape – clear-cut functional dependence. As in all bifunctional arts, in design the image contains ideas that meet the specific material and spiritual needs of man. In the presence of such ideas, the design form acquires a deep, figuratively meaningful character. If only one of them is disclosed in the form, for example, "material", the design object can be convenient, but not expressive. However, the design image is always functional and in this case lighting is considered not only as a design task, but also engineering.

We call the project process of interpretation of natural forms transformation based on the associative method. The method of Association is one way of forming ideas and the transformation of the bioform in the design object. It can give the greatest effect if the creative imagination of the designer appeals to different ideas of the surrounding reality. The associative method involves the study of various relationships of environment contexts [10]. Any work of art is the result of associative ideas about objects and phenomena of the real world, recreated in memory. The creation of an associative form of the lamp is a subject form in which there is a connection with wildlife at the level of associations.

Since constructive systems in nature form a certain form, create a three-dimensional-spatial structure, we can say that the composition of natural forms is due to their content, i.e. it is semantic. By its features can be judged on the functional nature of the form. In this case, the basis of the transformation is the method of the figurative approach, which contains the heuristic potential-the image and function of the object arose immediately without the pre-project stage, but included a structural and functional analysis of the external and internal space of the natural form. The search for a harmonious form for the design project of the luminaire contained all the stages: the construction of
a bionic structure based on a natural analogue; the constructive adaptation of a natural analogue in the design-design system – generalization of form, stylization, linear-constructive construction of a natural form at the top, side view; the construction of an associative model using a computer program.

As you know, project modeling, that is, the ability to reproduce the object-model through its analogue is organically integrated into the design process. The principle of modeling is an effective method of developing a design solution, characterized by innovation, technological realism, ergonomic validity. Design and technological capabilities provided by the computer allow to calculate all the parameters at the stage of creating a design model. Such a multi-aspect transformation of the natural object of development leads to the appearance in the design process typologically different in content and form of design models.

When perceiving the "form-Association", the viewer should have semantic analogies with wildlife. Typically, this is a static decorative abstracted forms-the design, the overall composite plastic and light color scheme which "contains" Association of nature – images of people, animals, birds, plants, etc. Such borrowing from nature's forms in this article is used to create irregular, plastic image design and the design of the urban lighting.

The image of birds sitting in the nest has brought to life an experimental street lamp that simulates nests in trees. The original design object is a stylized tree trunk with nests and birds sitting in them. Steel construction of lamp poles with solar panels in its form resemble tree trunks. Standard lamps, supports and masts of outdoor lighting often do not meet all the requirements that are necessary for the lighting of a particular area.

![Figure 1](image)

**Figure 1.** Luminaire for urban lighting "White birds": a) general view with dimensions; b) top view; c) type of lamp during the day and evening.

For example, the recreational area of parks and pedestrian streets has for a leisurely walk with a short rest, so there are appropriate lighting with a figurative component. The specifics of the illuminated recreational area requires the introduction of appropriate structural changes in the design of the supporting structure. In this case, the selected seamless steel pipes with high performance properties of different height from 3.6 m to 5 m. In the cross-section is a circle with reduction and extension. The bending of metal pipes is carried out hydraulically to achieve visual plasticity and flexibility, which should cause associations with the natural bending of trees. They are grouped into one composition and connected with each other. On the pipes are attached "nests", located at different heights. The dimensions of the luminaire are made on the scale of small urban spaces for recreation. Usually these recreational areas are different chamber.
"Nests" made of a net-like structure made from steel wire, reminiscent of straw and a twig. The basis for them can be composite materials made from a mixture of reinforced epoxy fibers and thermosetting resins to achieve a combination of light weight and strength. For the "nests" can be applied bionic retina led – in this case, night-time illumination will be the volume of birds "Nests." "Birds" – led lamps white glow. Their number can vary – from two to three in each nest. In this case the form will be more expressive if the artistic properties of the materials used are more clearly revealed in it – so the image through the material finds its bright conditional expression in the form.

In General, these levels of design forms are subject to the laws of harmonization of a single stylistic design. The principles of consistency (human-subject-environment) and artistic-figurative approach used in the design of the lamp, coincide with the basic principles of harmonization in design.

The main functions of the luminaire with a figurative form are as follows: engineering – decorative lighting sources and aesthetic – participation in the formation of aesthetically attractive urban spaces. The figurative form with built-in lighting devices in the dark visually emphasizes their artistic qualities of the constructive structure. They can be installed along a pedestrian street or in parks. An independent project of urban design can be the concept of "Light garden", if a group of lamps installed on the site, in a secluded place, near a pond or lake – for meditation and recreation. Such "light forms" with artificial light contribute to the humanization of the urban environment, affect the development of evening tourism. Together, it enhances the visual appeal and diversity of the urban environment.

4. Conclusion

Figurative modeling of natural forms by means of artificial equivalents is provoked by ecological and utilitarian degradation of natural spaces. The necessity of application of certain methods of co-organization of natural and artificial components of the city in order to establish the semantic relationship between man and nature is obvious. Natural imitations introduced into the fabric of urban development are able to unload the man-made visual field of urban spaces.

The process of transformation of natural forms into associative design model is shown taking into account the basic method of design – harmonization of all elements of the composition. Forming on the basis of the principle considered is an extremely promising trend in modern design. It appears already at the first stages of compositional work when there is a selection of options of the decision of the same form when differently its elements are made (combined, combined, completely change). Particular importance is attached to it in the design work on the computer. The disclosure of the General nature of the composition, built on a contrasting combination of elements, and the achievement of integrity contributes to the consistency of the elements due to their grouping around the main center. The figurative form ultimately has a stronger and deeper emotional and aesthetic impact on the viewer.

Associative modeling is subject to the same objective laws of harmonization that determine the development of each form: finding a harmonious relationship between the elements that make up the form, which is expressed in the subordination of the elements of the composition and the integrity of the form. The goal of harmonization in this case is the most vivid identification of the artistic properties of each element and at the same time finding the harmonic connection between the elements built on the contrast.

The principle of associative-figurative form reflects a more clear disclosure of the artistic idea. The figurative form has a stronger and deeper emotional and aesthetic impact on the viewer than a simple utilitarian form. Here it is important to achieve a balance of artistic ideas and the feasibility and practicality of the design form.

5. References

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