

**ARTTE Applied Researches in Technics, Technologies and Education**

ISSN 1314-8788 (print), ISSN 1314-8796 (online)

The Scientific Journal of the Faculty of Technics and Technologies of Yambol,
Trakia University of Stara Zagora, BulgariaThe Journal is available online at: <https://sites.google.com/a/trakia-uni.bg/artte/>

Address of the Editorial Office: Graf Ignatiev 38, 8600 Yambol, Bulgaria

Phone/fax: +359 46 669183, E-mail: artte@trakia-uni.bg, artte@ftt.uni-sz.bg**EDITORS****Editor-in-Chief**

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ICTTE 2014 Edition**International Conference on Technics, Technologies and Education****ICTTE 2014, Yambol, Bulgaria, October 30 and 31 2014**<https://sites.google.com/a/trakia-uni.bg/ictte-2014/>**CONTENTS**

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BIONICS IN INDUSTRIAL DESIGN

Katerina Despot, Vaska Sandeva, Vladica Petrovik

Goce Delcev University of Stip, Krste Misirkov b.b. P.O. Box 201, Stip 2000, Macedonia

e-mail: katerina.despot@ugd.edu.mk, vaska.sandeva@ugd.edu.mk

Abstract: *The design represents the external appearance of a product or object. The design is what makes the product appealing, beautiful and desirable, and thus significantly affects the product sales and the increase in its commercial and artistic value. The industrial design of a certain product is consisted of three-dimensional and two-dimensional features of the product visible in its normal use. The three-dimensional features are the form and the lines of the product, and the two-dimensional are the patterns, lines, colours, texture and their combination. The basic conditions what a design should fulfil are individuality and uniqueness, and its features not only to meet the technical function but to have an artistic value as well.*

Keywords: *Design, Bionic, Aesthetics, Furniture, Architecture.*

1. INTRODUCTION

The designers and innovators are constantly searching for inspiration to create new designs. One of the sources for inspiration is the nature. Examples from the nature and inspiration from natural forms that surround us every day have been a solution for creating many designs, both in the past and today. The designers have used natural forms, compositions, and mechanisms and applied them in many designs. In the world of industrial design the natural forms were not visible in the past, but today there are serious attempts to use the nature as inspiration for design - Bionic, innovation inspired by nature.

In 1995, the American scientist Jackie Steele introduces the word "bionic" to express the symbiosis between nature and technology. This is an original interpretation of bionics, which derives from the terms "bio" and "technique". But Jackie Steele believes in the principle of "learning from nature", so he defines the bionics as learning from the nature. This principle is commonly used by various specialized sciences such as mathematics, engineering and architecture. It basically determines a way of exploring living systems with an analytical criterion, in order to find better solutions for our human needs. Bionics isn't a scientific discipline, but a certain method in which we should implement our fantasy with an understanding of why and how things work in nature. Bionic explains all forms representing imitation of the forms of nature. One of the main reasons why bionics is more popular today is that the man finally has the tools and capabilities to analyze the nature and learn many processes from it.

Historically, animals have served as inspiration in technological design. During the Renaissance, sea animals have been identified as balanced bodies with reduced resistance which can be used in the production of various products. Between 1505 and 1508, Leonardo da Vinci was particularly interested in the flow of water. He wrote for the function of the unified bodies that reduce resistance, and retains the shape of the fish as a good example. He claimed that the fish moves in the water with little resistance, due to its shape and allows the water to flow gently through the back without premature separation. Such a design similar Da Vinci showed in the hull of ships, although far better known is his flying machine that was based on the study of anatomy and flight of birds.

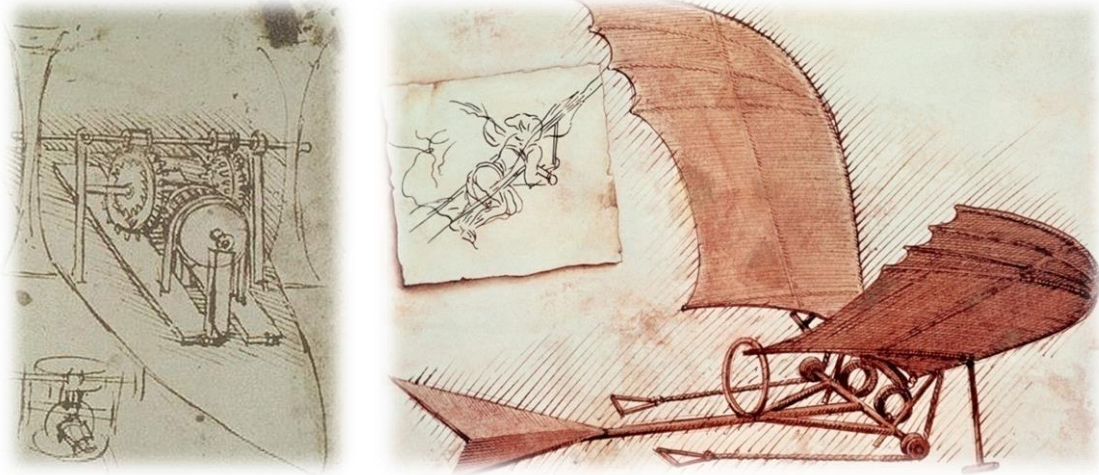


Figure 1. Da Vinci works inspired by nature

2. BIONICS IN INDUSTRIAL DESIGN

In recent years the bionic gained popularity, so more and more it is seen as a model and measure. Millions of years of evolution in nature produced mechanisms and compositions that are very effective, avoid waste and are sustainable in almost a closed system. The bionic can be defined as the study of the form, structure and function of the biologically produced objects and materials, as well as biological mechanisms and processes in order to create products that will be an imitation of nature. The field of bionics is interdisciplinary and covers the study of biological functions, structures and laws of the nature, which are studied by biologists, chemists and other scientists. By studying the successful solutions in nature, are solved many human problems in the field of design and construction of products. This way of designing and thinking can be defined as an innovation inspired by nature.

The inspiration for the development of new technologies is at the core of the approach of the bionics. The great diversity of biological forms allows certain attributes to be used as inspiration for new and innovative design solutions. The insects, plants and animals are everyday engineers and teachers with a lot of knowledge. They are one whole system that works and is all around us. The nature is a big secret to the man, and all his understanding of that system is a big step.

The conscious imitation of nature is a human strategy for survival and a path to a secure future. The more the man comes closer to the nature the more it grows the chance of survival. The inspiration of the designers did not just wake the forms in nature but also the processes and ways of survival of living organisms. Today, more and more one seeks to understand the nature and to take advantage of all its benefits, transforming its processes and forms in his designs that facilitate human life.

The bionic slowly finds its place in the design and in terms of form and materials of design decisions. While the methodology for complex imitations of nature in terms of structure, processes and functions will develop more and more in the future. The furniture industry has many examples that are created by the principle of bionic. Furniture, lighting fixtures, decorations and other items with natural forms such as bird nests, leaves, spider webs, flowers.

New bionic inspired aesthetics of lighting in interior design is achieved not only by imitating natural forms, but also with the imitating the natural bioluminescence process, a natural chemical phenomenon that organisms living in deep seas, and certain types of fungi,

bacteria, insects and worms, create light to survive in a hostile and dark environment. The bionic inspired lighting "Anemix" in the interiors create a 3D effect. Imitating the natural process of bioluminescence not only promises better lighting, but also more efficient and effective lighting.



Figure 2. Anemix lighting– 3D effect

The bionic researches on the properties of materials are particularly important for the design. According to the principle called "lotus effect" characteristic of the lotus leaf, and thanks to the discovery that microscopic lumps covered with a layer of wax reject water drops and also removes dirt, it is designed a fabric and "Lotusan" color with properties of rejecting water and self-cleaning. These materials have a high potential for use in interior design.



Figure 3. Lotus leaf

In the arrangement of internal spaces interesting are the bionic inspired discoveries of more material, such as anti-microbiological material that mimics the structure of the skin of the Galápagos sharks; the "Morfotex" fabric made by imitation of the morphology of the wings of butterflies, a blend of nylon and polyester whose colors can flare and cannot fade; bio-plastic derived from shells of crabs and CO₂ technology that mimics the metabolism of plants; strong adhesives and adhesive "Geckskin" materials that can hold items weighing up to 317 kilograms attached to smooth wall, inspired by the lizard's feet.

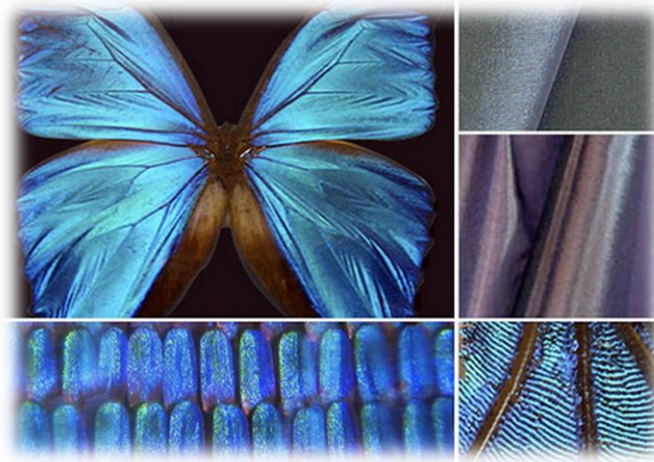


Figure 4. Morfotex fabric

Besides the aesthetic and functional values, the bionic design solutions have environmental and economic value also. Today, more and more attention is paid to the properties of such designs, and designers strive to create environmentally friendly design solutions. Such example is the "Columbia Forest Products PureBond" adhesive, which is inspired by the natural glue shell and is without formaldehyde.

These few examples of designs inspired by nature are mainly used in interior design, and although they are few and not sufficiently sophisticated unlike other areas where bionics is applied, it's clearly shown the extent to which bionics can and should serve as the basis for further development of interior design. Because of the wide field of application, as well as their aesthetic, functional, economic and environmental values, the bionic design promises great achievements in the future of humanity and changes once understanding of technology, industry and design.

3. DESIGNS INSPIRED BY NATURE

During millions of years of continuous evolution, nature has perfected solutions to many of the questions posed by contemporary engineers, architects and designers. But perhaps now, the most intriguing question is how the integration of bionic findings can transform into practice? The easiest way may be thought to be the direct imitation of nature, but this is often difficult if not impossible. Nevertheless, studies have found that is favorable to understand the principles of how things work in nature, than to perform copying natural models.

The bionic design is an innovative approach in which nature and natural processes look for inspiration to create products, processes and facilities, i.e. with it the functional design challenges are dealt with finding and applying natural strategies, methods and principles. In the bionic are made efforts to answer several questions, for example: how nature solves the problem of isolation, how nature reduces friction and stifling the noise, how nature solves the problem of moisture, how it collects energy and gathers water and many other questions which man tries to discover and to make life easier. The bionic approach aims to create a design that is not only visually appealing and elegant, but also functional. The design solution can be bionic in terms of shape, material, structure, function or process.

Today, there is a great interest for bionics and biologically inspired design that is used in a number of industrial areas and in a number of products. We see such products constantly, and they are especially noticeable in the area of architecture. Wide range of furniture is

exactly inspired by natural forms, and as such is used in all kinds of interior and exterior. The transformation of natural forms provides an opportunity for designers to combine different shapes, colors, textures.

The form of the shells is inspiring form, and is often transformed into some kind of furniture, and even architecture. This form provides an opportunity for designers to create interesting shapes that will suit multiple purposes. There is an elegant line, and fits into any space perfectly. Starting from sofas, shelves, chairs, armchairs, sinks and other parts of the interior, the shape of the shell is found in whole architecture buildings. Such buildings have interior space that can be adjusted in an interesting living space and the external look is unusual and interesting.



Figure 5. Sitting furniture inspired by the form of the shell

This interesting seating furniture inspired by the shell can be combined in the interior and exterior solutions. It can fit in different design styles, and can give emphasis to the space. Finding inspiration in the form of a shell, the designers have created interesting designs with a different purpose. In this way, through a variety of design solutions, industrial products are coming closer to the nature, mimicking its forms, processes, materials. But besides furniture, the shape of the shell was inspiring for architects as well who created interesting architectural buildings.



Figure 6. Shelves inspired by the form of the shell

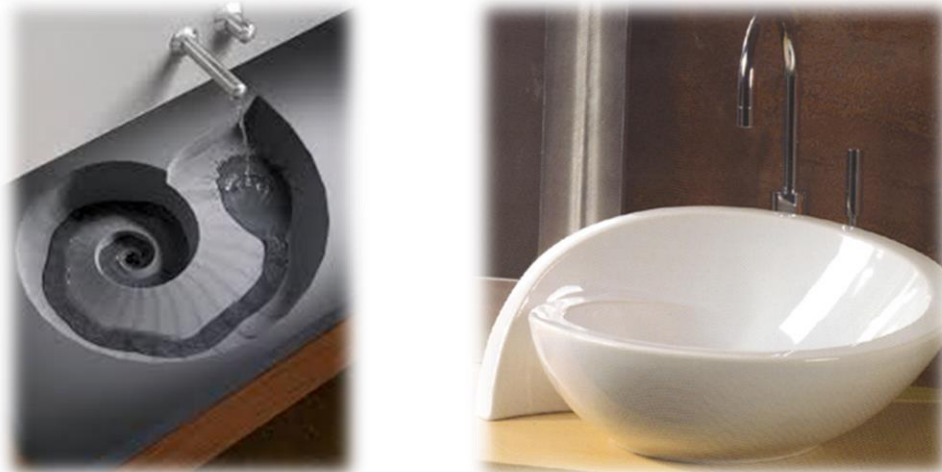


Figure 7. Sinks inspired by the form of the shell



Figure 8. Architectural buildings inspired by the form of the shell

The beautiful, unique and irreplaceable form of the shell is one of the cutting-edge designs of nature. The shell was inspiring long ago. Primitive civilizations made drinking vessels and vases shaped as a shell. Later in the Greco-Roman period were created domes, spiral staircases and moldings on walls in the form of a shell. At the time of rococo one of the main features of this style was the decoration in the form of a shell. Today this form of inspiration is reflected in the design of furniture, decorative items, and even architecture.



4. CONCLUSION

The inspiration from nature is expected to contribute to the improvement of technology and its impact to be felt in all spheres of life. Some design solutions may seem impossible to make today, but more and more is improved the human understanding of the nature and the skills so that in future all design solutions can be implemented.

Process modeling in bio-architecture includes a systematic study of natural forms and analysis of their geometric grounds. In this process, there is usually incredible precision with which nature makes its ideal geometry calculations, although sometimes it is hidden and difficult to distinguish. However, by consciously learning, feeling great and having an open soul, designers can find inspiration in such research.

Over the years, many designers and architects were seeking funds to help in the process of creating new harmonic forms. With the development of technology, the discovery of new materials the conditions were improved for new designs, new shapes and interesting solutions. Today, a very important feature is the ecological value of the produced goods. Man tries more and more to adapt to the nature and to create a healthy environment. Many design solutions, architectural buildings, industrial products, furniture and materials were created by transformation of the natural forms and processes. Studies of the nature and the desire of man to get closer to it and to create in the same way, is bigger and in the future will develop even more.

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