Interaction between design elements in organic trend as input for product design

Assist. Prof. Dr. Wesam Oncy Ibrahim
Department Of Metal products and jewelry - Faculty of Applied Arts, Helwan University
Delegate to Faculty of Applied Arts, Product Design Department, Badr University
tswesam@gmail.com

Research Summary:

In the age of enormous technologies and accelerated scientific development, the production of a commodity is no longer an end in itself. The consumer and purchasing requirements and personal aspiration have become the main target. This is why the functional design of any product is primarily aimed at creating a combination of the individual and the producer. Human beings are usually more inclined to organic objects and prefer them to engineering objects that carry decorative values or carry an organic chemical meaning. So the designer works to find a synergy between product design elements and organic proteins. Although it requires more scientific effort combining nature and products, this effort works on the interconnection of the design forms of the product in the abstract forms that lack the artistic characteristic and are away from the natural elements. Therefore, the designer must study the effectiveness of the elements of the organic design and its application in the design of the product, allowing the transition to innovative visual and functional images. This shows the importance of studying the effectiveness of the elements of organic design, and its application in the design of the product, to access innovative visual and functional images. Through the formulation of organic design standards and analysis of different relationships in the design construction, help to achieve the required functions of the product, which contribute to increase and improve the functional structure of the organic design.

The research has studied the organic trend, the methods of organic inspiration in the design of the product namely representation of nature, expression, sculpture, and analytical kinetic. Determination of inputs to organic design is anatomical, cellular, engineering and structural. Also, study examples of the interaction between elements of design in the organic direction, form, content, style, idea, character, and organic unity, which helps to develop products and predict future technology. Organic design helps achieving the ergonomic and function aspects of the product using organic direction and taking advantage of aerodynamic studies and energy sciences. The research concluded the criteria for using the organic trend in product design.

Research problem:

1- Studying organic systems in nature and showing how it could be used in achieving the ergonometric and functional aspects of the product.

2- Analyzing the various potentials of organic design sources and determining their levels in product design.

DOI: 10.12816/mjaf.2019.11798.1123

Research aim:

Reach basic standards for using the organic trend in product design.

Research Methodology: Descriptive analytical methodology.
Keywords: Design elements, organic trend, product design

1. Introduction:

One of the most influential trends on product design that has a positive impact is the organic design, which was formulated within the scope of the organic theory of the 18th and 19th centuries, and thus paved the way for the emergence of the "Bionics" Science, this science combines biology and technology where the search for a solution to the problems of design through the exploration of natural components.

One of the most prominent uses of this trend was Colony and Philip Ron among others where their ideas were related to the nature that could suggest valuable ideas, as well as the technical value of designing products related to life needs and movement.

Organic design can be an inexhaustible source of product development and interaction with its design, functional and formal elements. Each of which has its own privacy, which contributes to the interaction with organic standards to access non-traditional products, and represents a real experience where the designer can reach the basic standards of organic design.There is also a great role for organic design in the design of facilities, products, devices, equipment and products.

2. Evolution of organic trend:

The architect Frank Lloyd Wright is the leader of this trend in architecture, where he says that the meaning arises from the inside out, and the external form must reflect what is inside the building, and there must be a strong relationship between the shape and the materials used in the surrounding environment.The organic system is the coordination of nature of its forms, which is achieved by various natural factors such as biological growth and various biological functions in living organisms and environmental factors as erosion factors and their effects on the formulation of objects in special forms. In universal knowledge, Organism represents a logical association of forces that are connected and self-contained. Bionics is also known as a science that simulates the constructions and functional actions of living organisms to meet the different living requirements of each object, which is used in many designs. Simulations are used in radars and sonar.

These devices mimic the bats and how they make their way in the dark through the method of locating sound resonance. They produce high-pitched sounds that bounce off the objects in their path and are picked up through their sensitive ears, thus creating the path of the journey. In the same technique, sonar uses sound waves, and radar uses ultra-high frequency waves. One excellent example of inspiration for design through simulations is a precise velocity indicator of aircraft developed using the same principle as the beetle. The study of the sensors of this beetle and its measurement of the speed index are designed in a similar way to how to measure the time elapsed between passing two known points on the ground and translating it to speed. Therefore, our use of the term organic in the term organic system is to describe that formative pattern corresponding to the format of geometric shapes and sequences are together the known features of forms in nature, and our use of the character, Bionics reflect a

simulation of the construction or functional carried out by the living organism used by the designer in the production of ideas and designs.

3. Methods of organic inspiration in design:

The main ideaof organic systemsis its concept and its intrinsic essence must be reached, so that the design becomes not merely a physical representation but a representation of the idea, not just a tradition. In this approach there are many styles that the designer or artist can follow to reach the final design.

3.1. Representative of nature:

The representative approach to nature is one of the organic trends. It is the unity between the design and the natural environment around it, and they are considered one thing and the use of natural raw materials in its original form.

Frank Lloyd Wright and Javier Barba took the lead. Wright's idea of form was an explicit expression of creation, his way of introducing modern ways of constructing his ideas from nature, and the explicit expression of construction materials without concealing its nature.

"The high performances elicited by biosystems are the legitimate result of the optimal design principle, a universal principle governing living matter, itself a consequence of natural selection. Due to this principle, living nature is an inestimable and inexhaustible reservoir of optimal solutions that could be imitated or transferred, in a creative manner, to the coming future biotechnologies." [2]

A baby chair inspired by the shape of a flower, designed by Dominika Drezner [3]

3. 2. Expressivemethod:

The expressive method of living organisms is one organic trend, looking at the forms of plant, animal and human, through anatomy, to illustrate the quality of the structures of some skeletons. The study of the shape and functional properties of a natural body can provide inspiration for product design and help to improve the marketability of manufactured products, where inspiration can be either from Direct observation, or capture by digital techniques for configuration information (3D format and color), where the designer begins with a two-dimensional drawing while engineering software is used to transform this design into three-dimensional products.


The water mixer designer inspired by the shape of the attractive spirals of a lily flower, [5]

3.3. Sculpture style:

Style aims to inspire the formative relations of nature and express them by means of free organic designs, which are not restricted by geometry, and which build on flexible relations. This trend has been addressed by many designers, most notably Jacques Couelle and Daniel Grataloup.

"The biologically-inspired design practitioners emphasized that the visual domain was an important element in their work practices, where being able to visualize the ways in which bio-inspired features would work in a new product, and how the finished product will look and function, these were often the first steps in the development of new products and technologies. Some practitioners considered that working together with people from disciplines that privilege visual information, such as the arts, would be beneficial to biomimetic innovation projects."[6]

Examples of this are the use of the humpback whale fins as a source of inspiration for wind turbines, and the use of the whale fin design makes the turbines quieter and higher in performance even when the wind calms down.


Use the humpback whale fins as an inspiration for turbines [5]

3.4. Kinetic analysis:

Is one of the organic trends in the expression of the structural basis in nature, through the studies of the analytical shape and its relationship to movement, and designers have addressed these studies under the name of the science of balance of strength.This type of study is broad and exciting, offering many innovative alternatives from nature, where nature gives us a variety of motor systems as well as functional and mechanical solutions, which can be applied to the process of product design. "Nature gives us a various aesthetic range as well as functional and mechanical solutions that can be applied in a product design process. Bionic design also offers an active learning concept that increases the quality of the educational

content taught to the industrial design students, through exercises, experimenting, and application of creative principles found in the nature." [1]

The kinetic principles inspired by nature [1]

4. Organic Design inputs:

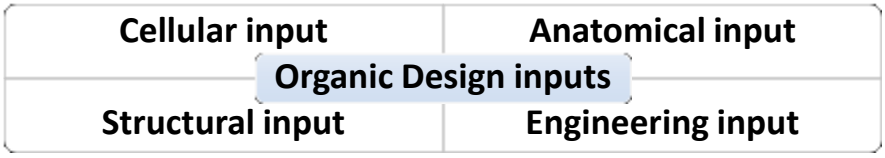
Through the process of inspiration the designer takes one of the inputs to the construction of organic forms, the constructions of organic forms are configurations and relationships.

4.1. Anatomical input

4.2. Cellular input

4.3. Engineering input

4.4. Structural input



5. Design elements in the organic direction:

The physical elements of the design are known as point, line, level, size, color, and texture in addition to balance, rhythm and proportion. But, when studying elements of design using organic direction, the elements are form, content, method, idea, character, and material, in addition to the organic unit. These elements are identified until the construction of the design work is completed through the very essence of the design, and these elements are criteria associated with the design and the success of the final product is determined.

5.1. Form:

One of the efforts that can be taken to increase intense competition in product design is attention to form, given the fact that the first impression taken by consumers is the appearance of the product itself, the product is closely linked to aesthetic value or beauty that is used to attract consumers attention. In addition, the interest in the form of product design provides a unique value or characteristic of the product compared to competitors.[11]

Biomimetic design can be inspired by biological materials and by the surface structures and body shape or form of certain species. In 2004, a team of engineers at the Mercedes-Benz Technology Centre and at Daimler Chrysler Research decided to develop a bionic concept vehicle, looking for ways to optimize the mono-volume approach with aerodynamic performance and strength. The biological model from which they drew their design inspiration and lessons was the boxfish (*Ostracioncubicus*). Surprisingly the cube-shaped body of this tropical fish is extremely streamlined. Models of the fish tested in a wind-tunnel achieved wind drag coefficients of just 0.06, an aerodynamic ideal. The resulting full-scale

concept car was among the most aerodynamic vehicles in this size category ever developed. According to Daimler, fuel consumption was reduced by 20%.
In addition to taking inspiration from the boxfish's aerodynamic shape, the team also studied the strength-to-weight ratio of the skeletal structure of the fish that gives it optimal strength with minimal material (weight) use. Again according to Daimler, transferring the optimized skeletal design of the boxfish to the concept car allowed the engineers to increase the rigidity of the external door paneling by 40% compared to conventional designs and led to a reduction of one third in the overall weight without diminishing strength or crash safety. [12]

5.2. Content:

The design of the product must have a content that expresses the personality of the designer and also the content of the product. There are two types of content represented by design work:
- Representative content: The contents of the content of the work, and may be simulated or related to nature.
- Non-representative content: the designer expresses the content of his work, but far from nature in geometric forms.
Therefore, the designer should consider when taking the organic direction as a design approach, as follows:
• Organic direction is a tool - not more or less.
• Organic direction is not a cure and not a copy of nature.
• Organic direction is a tool that should not always be used because it may be an inverse factor and not an ideal solution.
• Organic orientation is not a global problem-solving tool, but it can be an excellent aid.

5. 3. Style:

The method of design work is the style of the designer unless it is an imitation of the other, and the method is the way the designer achieves his character. The style varies between the subjective and the objective and is determined in the design according to the nature of the designer and his own way of understanding and accepting those that formulate the content of his work and form it, we can say that the design of the product is part of the nature seen through the artist's vision.The style is more comprehensive, precise and individual than the form. If the form organizes the elements and gives expression to its sensory faculties, the style is able to define this more precisely and comprehensively.

5.4. Idea:

The idea of all forms of aesthetic expression is closely related to indivisibility, so it is said that civilization is the general construction or human activity in the fields of ideas and objects." The visual appearance of products plays a significant role in determining consumer response. Product form may provide for unarticulatedconsumer requirements and suggest product qualities that are otherwise difficult to ascertain. Judgments on whether a product is attractive include not only consideration of whether the product looks good, but also whether it appears functional and says the right things about the owner. As such, product appearance influences commercial success and consumer quality-of-life. Remaining cognizant of these different elements of response, and conceptualizing them as part of the framework presented,

will assist any further attempts to understand consumer response to the visual domain in product design." [15]

The fundamental value of creative practice in product design in the organic direction is the ability to visualize and explore alternative ideas and possibilities through which the designers' familiar ways of thinking can be developed.In an attempt to minimize the very loud sound that came when the Japanese bullet went out of the tunnels, Japanese engineers sought to find the most suitable solution by detecting an element that could penetrate the air medium calmly, reducing the noise problem, and showing the solution through a bird known as kingfisher bird after considering the smooth penetration of birds of this species using a water-purified first where nosecone was designed for the train using the design of this bird's beak.

5.5. Character Style:

The nature of the expressive use of materials and media can be attributed by designers to the subjective nature of their work. It does not arise suddenly and does not come from ~~a~~ vacuum. The result of several stages of evolution is always due to the demands of the environment and society through abstraction, unity, diversity, rhythm and proportionality in aesthetic creations.In short it can be said that nature is the result of nature to employ the former form factors away from simulations. "Design involves a wide range of concepts. Design begins by acknowledging needs and dissatisfaction with the current situation, recognizing that some actions need to be made to solve the problem, incorporating many associated knowledge and disciplines, and common characteristics that form the framework through which different models are used."[16]

The character is often the designer's fingerprint in the product, and despite the differences in product objectives, the character of the designer may often be on his or her ideas, which may appear as a methodology in design.At the present time, with a broad view of the design and the appearance of designers such as Karim Rashid (one of the most famous Egyptian designers residing in America), whose designs are flexible in many areas of product design and interior design as well as architecture, we find that the organic trend in product design is predominant On his designs, which are characterized by the flow of lines. For example, a double seat, a lighting unit, and a number of simple units, as in the following form.

5.6. Organic Unity:

It is an internal and interrelated link to all elements of design within the appropriate framework between compatibility and diversity to give a sense of loneliness and uniqueness. The unit also takes the meanings of composition. Where the designer finds unity in all the natural elements around him in the plant in the confluence of the paper with alarm, and the formation of the palm of the hand in man, and seeks the designer to achieve unity using the following components: rhythm - proportion - repetition - echo - compatibility - diversity - balance - movement, Design and overall unit. In the following example, the product contains many of the previous elements, the rhythm in the external line and the internal configuration line as a chord, the proportion of the length and width of the object, and the repetition of the component in the product, as well as other elements of echo, compatibility, diversity, balance and movement. The designer uses the elements above to emphasize the design unit.

6. Achieving ergonomic aspects of product in the organic direction:

The proposed design process is completed with a product in the organic direction that carries the aesthetic character until it is accepted by the user, with the attention of both sides to achieve the function while maintaining the ergonomic aspects. This is due to the direct interaction between the product and the human, which requires taking care of the aesthetic and functional side in a manner that achieves the highest functional performance with comfort.

Competitiveness in the use of products depends on two main axes:

• First: the aesthetic aspects in the form of the product.

• Second: the need for the ergonomic aspects of the product.

In the organic direction, achieving this goal through the structure which gives the product its final form is the main factor in the acceptance of the product to the consumer, through the lines of design characterized by smoothness and aesthetic harmony, and the designer to connect forms of designs in organic form and simulate nature in a manner appropriate And the user's reaction to the shape and acceptance of the curved lines that characterize the organic shapes and their association with the function designed for them.

Therefore, when designing the product using the organic direction, it is necessary to arrive at the correct proportion of the relationship between the whole aspects and the ergonomic aspects until we reach a product compatible with the user, with knowledge of the new materials and the production technology which is developed rapidly, thus supporting the designer in putting the perfect touches which helps to achieve the ideal compatibility.

When designing ideas and perceptions of design solutions without resorting to nature, the designer is subject to a set of academic, practical and scientific standards and values. This may be obscured by many more mature and evolving ideas, unexpected new functions or design innovations.

When the design process begins with solutions in nature through the organic direction, with the possibility of using an interactive simulation of the proposed solution, this can undoubtedly lead to a real development of design ideas, resulting in a set of experiences for designers, consumers and all those interested in the design process.

The participation of product designers and costumer in a study of a design problem using the organic trend in product discussion, modification, testing and comparison with similar products that were designed without considering the nature of finding alternative solutions shows the richness of nature by simple solutions that may provide a lot of innovations and solutions without trouble.

7. Basic criteria for the use of organic trend in product design:

From all above the design criteria using the organic trend in the field of products are the following:

• The clarity of the special objective studying the organic direction makes the designer deals with an integrated system and a consistent idea in nature, which can come out by solutions and modify the design after the study of the most appropriate solutions available.

• Incorporate the organic trend as a design solution through the analysis of natural elements in biological systems, and study and conversion of the functional and aesthetic solutions used in the design.

• Commitment to the study of biological models found in nature as organic design methods helps to promote the process of generating ideas by providing multiple strategies for consideration, increasing the likelihood of access to innovative solutions.
• The integrity of the selection of the appropriate input from the entrances to the organic direction enables the designer to find a balance between the aesthetic and functional aspects with the availability of the ergonomics aspects in the product.
• The availability of design alternatives using organic trending methods as a tool for exploring alternative concepts that can be used as solutions in design.
• Presentation of ideas available through the study of multiple sciences to support the field of the organic trend in design, from the science of anatomy and dynamics of movement as well as many sciences according to each product and its variables.
• Design mode using organic direction is a tool and not a cure.

8. Results:

The results are as follows:
• Studying the evolution of the organic trend through its time, and through many designers, as well as its use in many fields.
• Recording methods of organic inspiration in product design, representation of nature, expression, sculpture, and analytical kinetics.
• Determining the inputs of the organic design, the anatomical, cellular, engineering and structural inputs.
• Study the examples of the interaction between elements of design in the organic direction, form, content, method, idea, character, and organic unit, which helps to develop products and predict future technology.
• Extracting the criteria for using the organic trend in product design

9. Reference:

1- Emami, Jamshid. Tashakori, Mahshid and Tashkorina, Zahra. Bionic Design In Industrial Design Education at University of Tehran. International Conference on Engineering and Product Design Education. September 2008. Universitat Politecnica De Catalunya. Barcelona, SPAIN
2- Popescu, Aurel I. The Principle of Optimal Design as a Legitimacy of Bionics. Proceedings of the Romanian Academy. Series A. Volume 4. Number 1/2003.
3- Drezner, Dominika. www.behance.net/DominikaDrezner , (20 July 2018)
4- IWen, Hui. Zhang, Shu-jun.Hapeshi, Kevin.Wang, Xiao-feng.An Innovative Methodology of Product Design from Nature. Journal of Bionic Engineering. 2008 Vol.5 No.1.
5- Seth, Radhika. Ten inspirational and creative bionic designs, www.yankodesign.com/ 2009/06/03/ten-inspirational-and-creative-bionic-designs, (5 August 2018)
6- Yargin, Gulsen Tore. Morosan, Roxana and Crilly, Nathan. User requirements for analogical design support tools. Learning from practitioners of bio-inspired design. Design Studies. Published by Elsevier Ltd. Vol. 58 No. C. September 2018.
7- Gili, Anna. The armchair "Tonda" sentimental design, www.maison.com/design/ mobilier/fauteuil-tonda-anna-gili-design-sentimental-6181/galerie/23436, (5 August 2018)
8- Simplidecor, Frank Lloyd Wright, http://www.simplidecor.com/frank-lloyd-wright-furniture/wonderful-frank-lloyd-wright-furniture-and-frank-lloyd-wright-for-heritage-

henredon-daniella-on-design (5 June 2018)
9- Hovelskov, Jorgen. www.artnet.com/artists/jorgen-hovelskov/ (6 June 2018)
10- Aziz, Moheb Sabry. El sheriff, Amr Y. Biomimicry as an approach for bio-inspired structure with the aid of computation. Alexandria Engineering Journal. 55. 2016.
11- Tamaa, Ishardita Pambudi. Azliaa,Wifqi. Hardiningtyasa, Dewi. Development of customer oriented product design using Kansei engineering and Kano model, Case study of ceramic souvenir. Procedia Manufacturing. Published by Elsevier Ltd.4.2015.328– 335.
12- Wahl, Daniel Christian. www.hackernoon.com/biologically-inspired-product-design-1161497707c , (5 August 2018)
13- Helms, Michael. Vattam, Swaroop S.and Goel, Ashok K. Biologically inspired design, process and products. Design Studies. Published by Elsevier Ltd.Vol.30 No.5September 2009.
14- Industrial Design Foundations, https://www.lynda.com/CAD-tutorials/ Industrial-Design-Foundations/ 624268-2.html, (5 August 2018)
15- Crilly, Nathan. Moultrie, James. and Clarkson, P John. Seeing things: consumer response to the visual domain in product design. Design Studies. Published by Elsevier Ltd.Vol.25 No. 6 November 2004.
16- Braha, Dan. Maimon, Oded. The Design Process, Properties Paradigms, and Structure. IEEE Transactions On Systems, Man, And Cybernetics-Part A. Systems And Humans, VOL. 27, NO. 2, March 1997.
17- Rashid, Karim. www.lesbonsviveurs.blogspot.com/2013/04/designer-karim-rashid.html, (20 July 2018)
18- , Diane. Interview: Karim Rashid on His Move into Architecture and Designing Pham Colorful NYC Condos.15 September 2014. www.6sqft.com/interview-karim-rashid-on-his-move-into-architecture-and-designing-colorful-nyc-condos/. (5 August 2018)
19- Design skill. www.designsketchskill.com/portal.php?mod=view&aid=83 (6 June 2018)
20- Stress Engineering Services. http://innovation.stress.com/industrial_design/ human_factors_ergonomi. (6 June 2018)