Recognition Nature Related Concepts in Bionic Architecture and Their Effects on Contemporary Architecture

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Abstract. The purpose of this paper: assessing ideas and concepts of Bionic architecture and their effects on contemporary architecture. Methods of research: Research on this paper is done mostly by searching related library materials and internet search and also by translating related material from different languages. Aim of this research: It has been found that Bionic science, considered one of three most important science of modern era and its relation with nature and environmental objects, is the prominent factor in creation of Bionic-based contemporary architecture. The aim of this research paper was re-assessing ideas of Bionic architecture elements and their effect on modern architecture. Findings and conclusions: Due to use of nature inspired architectural designs, bionic architects have created structures with unique designs and properties in all details of buildings. Solidity of structures and also relaxed and tranquil environment of these structures are some of important and most noticeable elements of this specific architectural discipline. These structures look more alive and vibrant than structures built based on other disciplines.

Keywords: Bionic Architecture, contemporary Architecture, Nature, Ideas

1. Introduction

One of the emerging idea and discipline in architecture in twenty first century, which we believed that will have ever-lasting effect on whole architecture designing, is Bionic Architecture. Bionic Architecture is more in tune with nature and environment. Bionic architecture uses more nature inspired curved shapes in designing. It is on contrary of straight lines used in traditional and classical architectural designs. The word BIONIC, which for first time was used by Lieutenant Jack Steel of USA army in 1959, implies use of artificial objects in natural structures. The reason for using this unknown but yet pointing to a living world was making this branch of science more in tune with nature and more interesting to general public. Lieutenant Jack Steel has a very clear definition of this science which is, Bionic is science of systems which are either alive or based on live systems or look like live systems. By this definition, Bionic sciences are a very broad area science and contain huge systems and sub systems. The common points of all bionic systems are followings:

- Nature as main inspiring element
- Human being as main designing part and also main consumer of created spaces
- Human being as main element in finding unknowns
- Human being as a living element with different physical and mental needs
- Environment as a property of whole human race and each man has equal right to it
- Technology as a solution element in design, not as main goal

2. Bionic Architecture and Nature

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The word BIONIC has created from combining two words together, Biology and Technique. The word Biology by itself is a Greek word, a shortened combination of BIOS meaning alive and logy meaning Knowing. Biology is a very broad science which is human being knowledge of him and living world of this planet. Since beginning, human have tried to get inspired by nature in designing and building structures and living quarters and use natural raw materials in constructions.

To give an example: bats body shapes was main inspirations for LEONARDO DA VINCI to build his flying machine or dolphins body shapes and muscular strengths were main inspiring elements in designing first sub-marines. Spiders’ webs were main inspiration for creator of Montreal exhibition centre. To give another example: Termites try to dig long tunnels to overcome heat of their natural habitats in Sahara and use these tunnels as elementary air-conditioning systems. CHARLIE LUXTON, one of the pioneers of Bionic architecture, believes that Focusing point of Bionic architects should be implementation of natural designs in creating of strong structures which should create relaxing and calm environment of user of that building. Creating this kind of environment and making it vibrant is main focus point for Bionic architects.

Main inspiration for Bionic architects is always nature and adapting nature based finding in designing and building technologies. All structures in this discipline should follow nature inspired rules and architects of this discipline believe that all regulation and rules of architecture should be written and applied in accordance with natural rules and designs. There is a working and effective simplicity in natural designs that if used in building design and build, it can be certain that created structure will be beautiful and efficient one. Nature teaches designing to us and if we use simple but effective rules of nature in designing, we can be certain that we could create countless forms and designs with least used energy and with least used designing elements. As told before, Bionic is one of three main science of this century, beside IT and Nano-technology. Here we will look at five samples inspired by nature and use Bionic science in architecture.

3. Turning Torso, Sweden

Turning Torso in Sweden is one of the tallest buildings in Scandinavia designed by famous Spanish architecture SANTAIGO KALATERAVA. It is the second tallest residential complex in Europe with height of 264 meters. It comprises of nine turning cubes and has very beautiful apartments, conference rooms and offices in it. Some believe that design of Turning Torso is not realistic, but truth is that this building is in total harmony with surrounding environment and in build with Bionic architecture rules in mind. Its unique design makes it one of the most prominent buildings in Europe. Main inspiration for designing of this building was a turning human figure which was adapted in building as nine turning cubes.

4. Selfridge Building, Birmingham

This building is designed by JOHN CAPLIQUE and has very unique curved design and it is known as symbol of beauty in Bionic architecture. The main inspiration was a kind of armors named PAKORABANE which is made from interlocking chains. To create chain like effect in exterior of this building, close to 15000 aluminum diskettes have been used. It has four floors and each floor is a masterpiece of architectural
designing. Building of this structure had been commissioned by FUTURE SYSTEM COMPANY. Building operation started in 1999 and finished in 2003. One of main feature of this building is forward movement in exterior of structure. The owner of building wanted a very unique and attractive building and by applying Bionic architecture rules such building can be very different and attractive yet functional.

![Fig. 3: view of building and use of 15000 aluminium diskettes in elevations.](image)

![Fig. 4: concept; using a chain of clothing](image)

5. Tree Scraper Tower of Tomorrow

Tree Scraper Tower of Tomorrow was design by William McDonough. As its name implies the main inspiration on designing this building was natural shape and growth pattern of a tree. William McDonough is well known for designs inspired by growing ecosystem. In building this structure absolute minimum row materials have been used and air movement was maximized by use of round corners. Water supply ducts and system is imitation of nature as used in actual tree. Water, after usage, is recycled and utilized in washrooms. Energy needed for this recycling is obtained from a solar power plant.

![Fig. 5: Water recycling and reuse in building](image)

![Fig. 6: Imitation of a tree's growth and change](image)

6. Anti Smog Building, Paris

This building was design by young French architect VINCENT CALEBOUT in 2065 square meter land in 2007. Natural ponds and nice view of Paris from roof of this building are two major attractions that attract most people to this building, which is known as environmentally friendly building. In designing of building elements of Green Designs are used. For example, city smog is sucked by special machines from air around building and effect is a clean air inside and immediately outside of building. This structure has helped people to be more vigilant about environmental issues in Paris.
7. Bionic Tower, Shanghai

Skyscrapers, due to their shapes and their limits, were not a good and proper solution for necessity of living vertically (lack of space and land). But in 1931 with designing and building of Empire State Building with height of 380 meters, which was inspired by flexibility of vegetables stems and strength of birds’ wings and shape of certain trees with long over spanned roots, unfitness of skyscraper for human habitation is solved. Design of Bionic Tower in Shanghai is mainly inspired by process of change in vegetables. Like any vegetable, who tries to grow higher than other around it, this tower is very high and again like any vegetable that uses its veins and duct to transfer food and water to higher parts, this tower has ducts on side for transporting people and materials en mass.

In building this tower special enwrapping strings and very special concrete is used to counter effect of wind and un-symmetric movements inside tower. Whole tower shape is inspired by bird egg, strong but penetrating and accessible and look like giant capsule. Design of tower allows for air movement in and out of tower and provides plenty of light. It has a floating anti-earthquake foundation which is inspired from large trees root system. Construction was started in 1993 and will be finished in 2020 and total area of construction is over 2 million square meters. Tower was designed by XAVIER J PIOS and MARIA ROSA SERVERA.

8. Conclusion

Use of nature inspired architectural designs; bionic architects have created structures with unique designs and properties in all details of buildings. Solidity of structures and also relaxed and tranquil environment of these structures are some of important and most noticeable elements of this specific architectural discipline. These structures look more alive and vibrant than structures built based on other disciplines. Nature is not build with beams and four by sixes. It uses lots of row material and countless of functional designs which are flexible as well. In general, Bionic Architecture can be shown as following:

9. References
Reference of pictures


Fig.11: Conceptual diagram