Biomimicry In Architecture

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Abstract- *Biomimicry is the study of mimicking nature, where it has been used by designers to help in solving human problems. From centuries ago designers and architects looked at nature as a huge source of inspiration. Biomimicry argues that nature is the best, most influencing and the guaranteed source of innovation for the designers as a result of nature's 3.85 billion years of evolution, as it holds a huge experience of solving problems of the environment and its inhabitants. The biomimicry emerging field deals with new technologies from bio-inspired engineering at the micro and macro scale levels. Architects have been searching for answers from nature to their complex questions about different kinds of structures, and they have mimicked a lot of forms from nature to create greater and more efficient structures for different architectural purposes. These complex ways and forms of structures couldn't been mimicked without computers and thus using computers had risen the way of mimicking and taking inspiration from nature because it is considered a very knowledgeable and accurate tool for simulation and computing, as a result designers can imitate different nature's models in spite of its complexity*.

Keywords- Mimicking, Nature, Environment, Technology, Complexity.

I. INTRODUCTION

Biomimicry from bios, meaning life, and mimesis, meaning to imitate is a new discipline that studies nature's best ideas and then imitates these designs and processes to solve human problems. Biomimicry is an evolving field. Biomimicry design can create architecture with maximum comfort for inhabitants with least impact on the environment,while being economically efficient.

Biomimetic architecture is on lookout for solutions for sustainability in nature, understanding the rules these it is multi-disciplinary approach to sustainable design not by the copy the natural form and that follows a set of principles rather than stylistic codes. It is part huge movement known as biomimicry, which is study of system, process and nature for the purpose of achieve inspiration in order to solve man-made problem.

1.2 Aim

The aim of this research is to study the possibility of linking or applying biological principles in designs, and studying various case studies of solutions from biomimicrical designs.

1.3 Objective

- Explore the potential of biomimicry in architecture.
- Study the idea of biomimicry how it is incorporated in sustainable building designs through case studies.

1.4 **Scope**

- The scope of biomimicry is how it can help in designing more sustainable and environment friendly buildings by studying nature.
- How we can become more nature friendly by constructing such buildings.
- Explore the different technologies that can be mimicked from nature .

1.5 Limitations

- This research will study only two types of biomimicry processes.
- The study is only focused on understanding and relating the case studies of biomimicry architecture, which is not a detailed one and focuses only on the key biomimicry aspect.

II. HISTORY ANDORIGIN

The term 'biomimicry' appeared in scientific literature in 1962, and grew in usage particularly amongst material scientists in 1980s. Some scientists preferred the term 'biomimetics' or less frequently 'bionics'. During the last ten year there has been an wide surge of interest, brought about to a large extent by individuals like biological-sciences writer JanineBenyus, professor of biomimetics Julian Vincent and professor of biology Steven Vogel, who have all written extensively in this subject area. The abstraction of good design from nature' defines by Julian Vincent, while for Janine benyus it is 'the conscious emulation of nature's genius'. There is no difference between 'biomimicry' and 'biomimetics', where biomimicry is used for developing sustainable design solutions and biomimetics has been applied to the military technology field.

The biomimicry term appeared in 1982 and it was published and invented by the famous scientist janinebenyus in her most significant 1997 book (biomimicry innovation inspired by nature). Biomimicry was manifested in her book as “the new science that studies nature’s models and imitating these designs to solve human problems”. She also claimed looking to nature as a “model, measure, and mentor” and she also suggested that the main aim of biomimicry is sustainability. Biomimicry is the most brilliant and genius way to look for sustainable solutions to human’s problem by mimicking and emulating nature in its analogies, phenomenon and patterns. Biomimicry’s main aim is making great designs by mimicking the different living organisms which have been evolving through 3.8 billion years.

III. LEVELS OF BIOMIMICRY

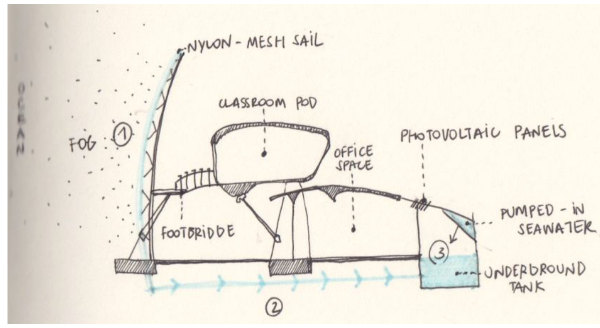
There are three levels of biomimicry have to be applied as well to design problems. From the biomimetic technologies and techniques, it is obvious and well noticed that there are three levels of mimicry: the organism level, behavior level and ecosystem level. The organism level illustrates the mimicking of certain organism or the mimicry of a part from the whole organism. The second level is the mimicry of behavior of which every organism behaves. The third level is considered the hardest level the mimicking of the whole ecosystem and it focuses on a functionally very hard issue to mimic. There are five dimensions through each level which determine at which extent the mimicry exists. The design is listed as biomimicry in the way it looks like (form), what it is made of (material), how it is made (construction), how it works (process) and what it’s capability (function). The three levels of mimicry are described. They complete the biomimicry approaches and these levels are very important.

3.1Organism level

The first level is organism- this refers to mimicking a specified organism. This could be the entire organism or a portion of the organism.

Namibian beetle and water collection the beetle lives in a desolate desert that rarely sees any rainfall. Many animals have to find alternative ways to survive and obtain an adequate water source since the area is dry for the majority of the year, but not the stenocara beetle. Water droplets from the fog are combined and collected on the beetle’s shell, when the morning fog rolls. As the water droplets form, because of the shape of the bumps, the water droplets stay in tight spherical beads which make them more mobile and easier to channel towards the beetle’s mouth. When the water droplets have formed, the beetle tilts its back and the droplets rundown the channels or hydrophobic groves and into its mouth. After it has had its desired amount of water, it runs back underground and starts the procedure all over again.so how can this be applied in architectural design? Matthew parkes’ of kss architects has used the design of the stenocara beetle to design a hydrological center for the university of namibia.

fig :- 1.1



a.

image source-wikipedia

His fog-catcher design won the architecture award for best first-time exhibitor at the royal academy of art summer exhibition in 2001. The building is a series of shell that are situate behind a tall, slightly-curved nylon mesh screen which is used to collect water. The nylon mesh wall is align towards the ocean so that it can adequately capture as much moisture as possible from the fogs that come easing in off the ocean front. The procedure that happens in parkes’ design follows the same principles as the beetle. The collects on the mesh screen , the water naturally runs down the mesh into gutter system located at the bottom of the screens because of its shape and vertical orientation. The water is then transported through the gutters into large cisterns that keep the water at an appropriate cooler temperature so that the water does not evaporate.

3.2Behavioral level

The second level is behavior- this refers to mimicking a specific type of behavior or act that the organism does to survive or replicates on a daily basis in relation to a larger context.

Temperature regulation and Termite mound a great example of how the behavior of one organism can be studied to solve human design problems . The termite's home, a termite mound, was studied by architect Michael Pearce to solve the complex problem of heating and cooling a large structure. When the aboveground nests grow past the capacity that was initially made then extreme termite mounds are formed. The fungus can only and be sufficient and grow if it is kept at exactly 87 degrees f. The temperatures outside of the mound fluctuate greatly due to the location, Africa. At night, the temperature can fall to a chilling 35 degrees f and during the day can reach a scorching 104 degrees f So how does the termite keep the fungus at exactly 87 degrees f Simple, they open and close specific "vents" which are precisely placed in the mound to regulate the air within the mound itself.

Termite mound temperature regulation with a system of carefully adjusted convection currents, air is sucked in at the lower part of the mound, down into enclosures with the muddy walls, and up through a channel to the peak of the termite mound.18 what also makes this design so interesting is that the termites also plug some of the vents and create new ones if the old ones become inadequate and are not functioning to their full potential. It was precisely this type of instinctual behavior of termites that inspired Michael Pearce in his design of the east gate center in Zimbabwe.

FIG- 2.1

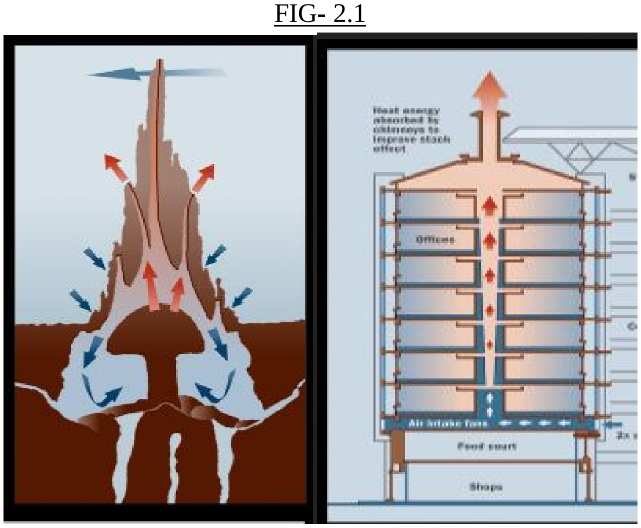


Image source:-wikipedia

The east gate center is mostly made of concrete which is an excellent material to use as an insulator as well as absorbing heat from the sun. The outside air that is conduct into the building is either warmed or cooled depending on the temperature of the buildings mass. If the buildings mass is cooler, than the air that enters the structure would be cooled if the building mass is cooler. The air is then directed upwards towards the chimney but on its way up to the top it passes into the building's floors and offices.

Advantages

- Produce a more advanced architecture in terms of sustainability.
- Design biomimicry is a bridge that can connect architecture and design professions on a route to linking design and environmental issues in a sustainable solution.
- Biomimetic technology would help us also overcome environmental issues, such as the greenhouse effect, global warming, or even the ozone hole, by reducing the vast amount of co2 emission's from built material , and purifying the surrounding environment.

Disadvantages

- Greatest limitation is that biomimicry is an emerging discipline and therefore still in developmental phase.
- Yet, within the built environment, biomimicry is still in its infancy.
- Also there are only a very less number of building projects throughout the world that have truly integrated biomimicry at the macro scale.
- When it comes to city level, number of research and the very awareness is not developed, but obviously there is a positive attitude towards moving contemporary sustainable design towards biomimicry development.

IV. CONCLUSION

- The goal of biomimicry is to follow the natures principles and invention of something according to that principle.
- We have to find the solutions to our design problems from nature by studying how they overcome those problems.

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