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Analysis of Anthropogenic Learning Behavior in Construction Field by Mimicking the Nature

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Abstract: ***The current society's communication systems are usually depended on giving more priority for human – designed systems that only focus safety but not the health aspects. This anthropogenic learning behavior creates problems which have to be deliberation for present and is a severe threat to kindness. Many environmental professionals, who understood the impact of such system on the environment, are trying to solve these from nature as an alternative approach. This results in changing the aspect of approaching nature from enjoying nature to learning from nature. For past two decades, many new innovative methods were put forward to protect the humanity by providing sustainable solutions for the conventional construction process by mimicking nature. Bio mimicry engineering in architecture and civil engineering industry is an innovative and creative method, inspired by nature to solve various engineering and environment related issues like reduction in energy consumption, saving energy and cost, and finally all together leads to the reduction of environmental impact. This study gives possible concepts to solve the problems faced in construction field by mimicking the nature as an alternative solution.***

Keywords: Bio mimicry engineering, anthropogenic learning, natural architecture, Mem Brain, Engineered Cement Composite, eco-mimicry.

1. Introduction

We are familiar with the concept of collecting raw materials naturally, bringing them together in an organized way and putting them together in a reasonable and recognizable manner that result in some new form or a structure. In pre – historic era there was a stronger bond between nature and man – made environment. Man started to learn nature, from nature and for nature; i.e., the way animals find shelter and birds building their nest to eat, live and protect themselves [1-3]. We are doing this for thousands of years starting from Stone Age. At first, this was just a life-saving method, but later we understood the importance of it and started to manufacture new materials that could improve the life of the structure and to protect from even worst climatic conditions. This growth of human beings weakens the bond between nature and man – made environment and sometimes completely lost [4-6]. For the past two centuries, the needs of society have increased; the global population has continued to rise and the impacts result in environmental pollution and affects earth in the form of challenges such as climate change, resource scarcity and an increasing demand for goods and services [7-9]. To solve such problems and to create a better solution, scientist approached the science behind nature which leads to the concept of imitating nature's model named "Biomimicry" [10].

1.1 Natural Architecture

An endless source of inspiration for scientist and engineers to solve human designed problems. From seeds to trees, ants to mammals, nature provides various models that help engineers and architects to develop new solutions for complicated systems. Those regular building design might have been no separate in accepting impulse from nature, also it frequently all the dives deeper over imitating the polar surface features about way [11-13]. The best example was the Root Bridges of Meghalaya. The root of Indian banyan trees (Scientific name: Ficusbenghalensis) have a very strong and long rooting system, manipulated to grow horizontally through the tunnel of hollowed betel nut trunk, providing a

stable foundation and can carry 50 people at a time. Initially, a banyan plant was planted on each side of the bank and a length of bamboo was secured across a river [14]. Over the years, the secondary roots of the trees grow out along the bamboo until they meet the middle of the river which forms a stable foundation. A portion of these bridges, which take pretty nearly 15 A long time to get functional, are more than 30m (100 ft.) long and generally acknowledged that huge numbers need aid clinched alongside over abundance of 500 a considerable length of time of age [15][16].

Figure1: Living Root Bridges, Meghalaya, India

This natural architectural concept was studied and coined as “Biomimictics” in 1969 by Otto Schmittin He has mentioned that some human problems can be solved using certain natural models [5]. In 1997, Janine Benyus explains Biomimictics as a novel science that studies nature’s models and then imitates or takes inspiration from these designs and processes to solve human problems and coined that nature should be approached as a model (study nature model and imitate its design), as a measure (judge the rightness – what works, what is appropriate) and as a mentor (new way of viewing and valuing nature) [6].

2. Approaching Biomiimicry

Approaching a biomimicry as A plan procedure commonly falls under two Classes [7]: on take care of a human issue Eventually Tom's perusing gazing of the approaches different creatures alternately biological community unravel it (design looking with biology), recognizing specific properties or aspects done a living being alternately biological community Also translating that under An mankind's requirement (biology influencing design).

Design looking to Biology approach was carried out by identifying the problem, and then matching it to organisms that have solved similar issue. The approach was effectively led by identifying the initial goals and parameters for the designs. This approach helps us to solve a major problem of heat loss from the buildings, since 32% of energy produced at thermal and nuclear plants was utilized in residential and commercial buildings for humans’ comfort. Loss of heat will lead to discomfort for human beings and by reducing it, the temperature can be maintained that supports human life. The attempt of solving this problem was succeeded by deriving a solution from biology, inspired by leaves. During photosynthesis, the leaf uses the transpiration process to extract in the carbon dioxide and flush out oxygen into the atmosphere. The skin of the leaf covers by tiny valve-like stomata allows moisture and air to pass through the membrane while excluding large dirt and dust particles from the process. [1] This biology has helped to derive an idea of creating a vapor barrier in buildings that act much like a leaf’s stomata. Years ago, several researchers developed a product named MemBrain that acts like a continuous indoor air barrier and creates a better performing building envelope. This membrain was a temperature sensitive product that changes its process according to the temperature. During winter season, when those air might have been icy and stickiness might have been low, MemBrain shuts its pores to decrease air invasion What's more enhance vitality proficiency. Previously, summer camp months, the point when

stickiness might have been high, the pores of the vapor boundary open up and its permanganic corrosive builds What's more once more enhances vitality proficiency. This simulated skin faculties climatic states What's more adjusts its permanganic corrosive with permit the divider will inhale [8].

Figure 2: (a) Carbon dioxide enters, while water and oxygen exit, through a leaf's stomata - graphical image, (b) MemBrain blocks moisture – during winter, (c) MemBrain releases moisture - during summer

2.1 Biology influencing design

Needs a detailed study of principle, properties, and the process of biology. This methodology might have been at first reliant on people Hosting clear learning something like those important living alternately biological exploration instead of looking into resolved human outline issues. A sample for this approach might have been showed Eventually Tom's perusing mick Pearce's East gate fabricating for harare. The fabricating might have been In view of termite mounds which have latent ventilation so as with make a thermally stable inner part nature's domain. Termite lives in tall mounds that can maintain the inner temperature constantly (around 85 degrees), even when the outer temperature varies from 104 F to 34 F. This was because of the structure of the termite hill resembles a smokestack which comprises of little openings or passages at the base that get the overarching breezes. The wet mud of the openings or passages brings down the temperature of the air through evaporative cooling [11]. Designer Mick Pearce utilized the termite thought as the reason for his plan of the East entryway Building in Harare, Zimbabwe. He created an air - change system that livelihoods a central chamber to latently move air from the base of the structure of the stacks on the top. En route, it goes through those vacant spaces under the floors et cetera under every office through baseboard vents [12].

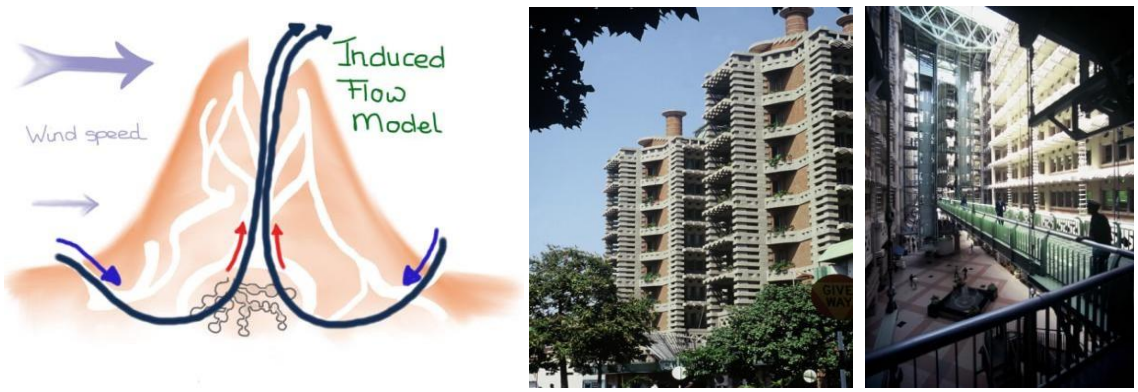

Figure 3: (a) Wind flow model in a termite mound, (b) Eastgate building, Zimbabwe, (c) Eastgate building, interior

3. Levels of Biomimicry

Nature has a vast and varieties of solutions that make us difficult to select an appropriate solution. To apply the approaches quite easier, three levels were made: The organism level (mimicking a specific organism), the behavior level (mimicking a specific behavior) and the ecosystem level (mimicking the whole ecosystem). Inside each about these levels, would a further five could be allowed measurements of the mimicry: the thing that it takes a gander similar to (form), the thing that it may be produced crazy of (material), how it may be constructed (construction), how it meets expectations (process) and what it does (function) [7].

The Organism Level refers to mimicking a whole organism or a particular portion of an organism. To mimic and produce a design with this level needs a little biological knowledge of the way the biology contributes and participates to the ecosystem. Cactus can be named as a best example for mimicking at organism level, since the plant can even grow in a dry climatic conditions (deserts) with the help of numerous spines that grows along the surface of the plant which not only protects the plant from animals, also they can collect water droplets from fog due to their conical shaped cross section and protects the plant from sun [3]. This concept was inspired by a designing company at Thailand named Aesthetics Architects. They designed a building for the new Minister of Municipal Affairs and Agriculture office (MMAA) in Qatar which has a dry and hot climate and an annual rainfall of approximately 3.2 inches. This building was designed based on the shading properties as like cactus spines in which the shades act like a filter which has the ability to an automatically fluctuate up and down, depending upon the desired interior temperature. This innovative solution allows this building to lower the usage of the artificial cooling system as well as providing a sustainable solution [13].

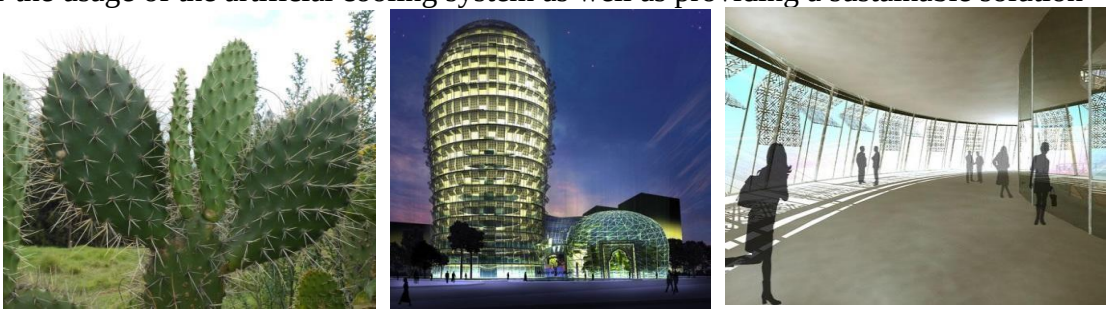

Figure 4: (a) Spines of Cactus plant, (b) MMAA Building, Exterior, (c) MMAA Building – Interior view.

In Behavior level, it was not the organism itself that was mimicked, but its behavior. As like organisms, several human organs also encounter various issues that tend them to change their properties naturally. The best example is the human skin, which has the property of bending, shrinking and expanding depends upon the need. In addition to this, whenever the skin was broken or cut, the tissues and the muscle cells, on each side of the wound start multiplying rapidly and build a cell-bridge across the gap results in a new skin. This self – healing and bending property of skin inspired Dr. Victor Li, University of Michigan. He developed a concrete known as an Engineered Cement Composite that bends instead of breaking and the cracks get cure by itself without any human intervention [2].

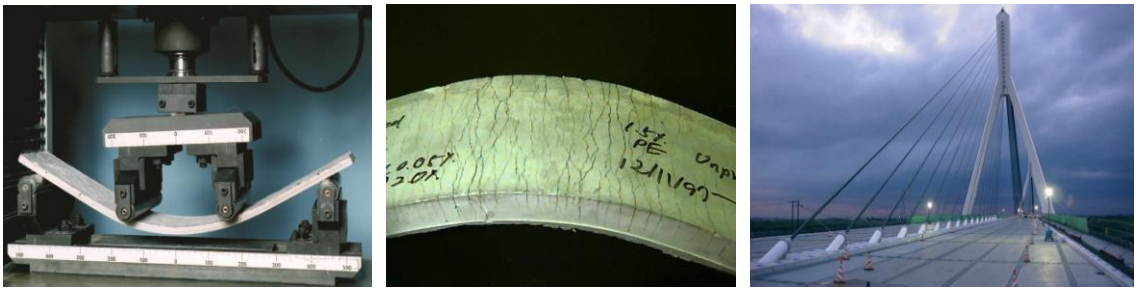

Figure 5: (a), 4 Point Flexural test on a concrete slab, (b) Concrete slab after flexural test (cracks

formed due to bending and cured itself without any human intervention), (c) Mihara Bridge in Hokkaido, Japan.

The weight of ECC was 40% less than traditional concrete, consisting mostly same ingredients except the coarse aggregates with some admixtures. Mihara Bridge in Hokkaido, Japan was constructed with ECC for deck slab, with an estimated lifespan of more than 70 years with no maintenance and the cost of construction of the bridge deck was 37% lesser than traditional method since the deck thickness was reduced from 10 inches (25 cm - average deck slab thickness) to 2 inches (5 cm) [10].

The **Ecosystem Level** refers to mimicking an ecosystem (i.e.) its principles, process and elements that are required for it to function successfully. This mimicking of the whole ecosystem leads to a concept called eco-mimicry. An advantage of this level was that it includes the other two levels of biomimicry (organism level and behavior level). Mimicking a forest can be considered as an eco-mimicry. A forest live and grow by itself (i.e.) it takes everything from natural source, no need for artificial or external source. In such a way, an island was designed by Beshbarmaq Group (BIG) architects that act as a Zero Energy resort, situated within the crescent bay of Azerbaijan's capital Baku, on the Caspian Sea. They designed the whole island that produces enough energy to power the entire island with the help of the sun, the water and the wind. The island also contains desalination plant that converts salt water into fresh water. Photovoltaic panels were designed to be installed on the exterior facades and at the top of the buildings to generate power. With all of these concepts working together, the island becomes a self-sustaining, independent ecological system [9].

Figure 6: (a) Zira Island Master Plan, (b) Zira Island – Beshbarmaq, Savalan Building.

4. Future Scope

For the past few years, biomimicry is often referred as the tool that increases the sustainability of human designed products and materials. These applications results in a sustainable outcome including better performance, increased efficiencies and environmental friendly. There is scope for further enhancing these applications to achieve solutions with multiple benefits. Future research will be done to replace the conventional shape and size of building foundation by mimicking tree's structure and properties.

5. Conclusion

Considering nature as a source of inspiration was not new, but when we look back, we get a clear picture of the damages that had been done to our nature. The better solution is that we should move in a different direction towards tomorrow without which we may lose our mother earth. Thinking about nature as our Model, Measure and Mentor can assist with structuring a superior and supportable future. Biomimicry offers a groundbreaking way to deal with address the issues of the development business through imitating common structure, capacity, cycle and frameworks. Many infrastructure projects understood the current problem and have begun to take measures to address their impact on the environment. Plants and animals have been hard at their work in the classroom of the natural world for a few billion years,

preferring solutions for problems and biomimicry offers us a whole new world of possibilities and answers for our modern world. Thus, approaching nature is the right step and is a natural choice. This project has made one understand about the alternate ways by which the construction could be bio mimicked ensuring sustainability of the nature.

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