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Designing with Nature in Mind

Rajshekhar Rao
Associate Professor,
Department of Civil Engineering,

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ABSTRACT: *Biomimicry offers a different approach to sustainable building design and technology. Nature serves as a constant source of inspiration for architects, who create awe-inspiring structures. Solutions that have been improved and created by nature are the focus of biomimicry. Structural efficiency, water efficiency, energy supply, thermal environment, and zero-waste systems are all important aspects of sustainable building design. Solutions are at the heart of biomimicry. Over the course of a billion years of evolution, species in the biological realm have honed and improved their systems, functions, and technologies in response to the challenge of staying alive in the wild. They have, in many instances, found solutions to the same difficulties with considerably more economy of means, and they are frequently comparable to the problems that people face when they try to find new ways to live and build sustainably. The purpose of this research is to show how taking cues from nature may significantly improve resource efficiency. Investigating how biomimicry might be incorporated into modern architectural practice has yielded a framework of methods, stages, and concepts. Architects who drew inspiration from the natural world also feature prominently in the article.*

Key Words: architecture, biomimicry, sustainable building, zero waste system.

1, INTRODUCTION

Biomimicry is a relatively young field that seeks to find solutions to human problems by studying and mimicking the most effective designs and processes found in nature. The term derives from the Greek words bios (life) and mimesis (to copy). Researching the properties of leaves in order to develop more efficient solar cells is an example of "innovation inspired by nature." Nature, creative by necessity, has previously resolved many of the issues that humans are battling, according to the central notion. Microbes, plants, and animals are the ultimate architects. Here on Earth, they have discovered what is effective, suitable, and, most importantly, eternal. Here is where biomimicry truly shines: What surrounds us holds the key to our existence after 3.8 billion years of research and development; failures are fossils.

Biomimicry is an emerging field of study that seeks to find sustainable solutions to human issues by studying and modelling these solutions after those found in nature. When evaluating the long-term viability of our creations, biomimicry takes an ecological metric into account. Nature has figured out what sticks around after all these years of evolution. A fresh perspective that recognises the value of nature is biomimicry. What we learn from nature, rather than what we can take from it, ushers in a new age.

2, INSPIRATION FROM NATURE

Humans were able to acquire the technology of flying through one of the first instances of biomimicry, which was the study of birds. One may make the case that our forebears successfully hunted and gathered by emulating the habits of nearby animals or by building better shelters. A new level of sustainable development is emerging, one in which human-made structures are seen as complementary to, rather than antagonistic to, the natural world and its ability to support life. Natural phenomena have always provided architects with a wealth of material for their work.

In its aquatic habitat, the Venus flower basket sponge (Fig. 1) is able to withstand strong water currents thanks to its spherical form and lattice-like exoskeleton. The hexagonal exterior of the Gherkin tower (Fig.2), built by architect Norman Foster, was inspired by a Venus flower.



Figure 1: Venus Flower Basket



Figure 2: Gherkin Tower

It is fascinating to observe the building of new, state-of-the-art stadiums like the Water Cube and the Bird's Nest (Fig.4) from an architectural perspective. In addition to being environmentally conscious and energy efficient, these structures draw design cues from the outdoors. The geometric and crystaline systems concepts informed the creation of the Watercube (Fig. 3), an architectural structure resembling water bubbles in foam. Ethylene tetrafluoroethylene pillows make up the bubbles, while steel frames the building's framework. The 5 pools are kept warmer thanks to the membrane, which allows in more light and heat than regular glass. As a result, energy expenses are reduced by 30%.Efficient filtration and backwash systems gather and recycle rainwater from the roof.

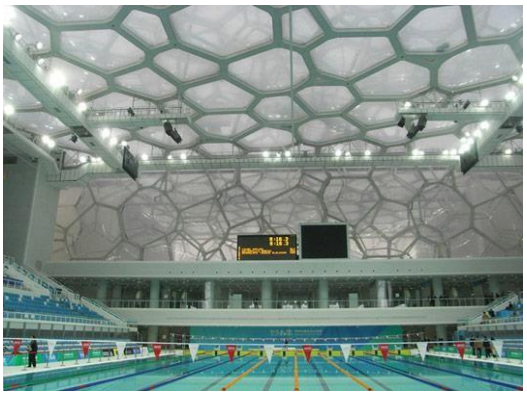


Figure .3 Water Bubble



Figure 4: Bird's Nest stadium

3. INFLUENCE OF BIOMIMICRY IN ARCHITECTURAL DESIGN:

Biomimicry design is not only adapting the design from the nature but also considering how to use nature's effective functions such as heating and cooling system, protecting natural light and ventilation.



Figure 3: Habitat 2020, china

Following biomimicry's lead is one of the best strategies to reduce buildings' ecological impact. An example of biomimetic architecture that incorporates cutting-edge technology with fundamental cellular processes to produce "living" buildings that mimic the behaviour of living things is the Habitat 2020 project planned for China (Fig. 3). This eco-friendly way of city life views cityscapes as living ecosystems in constant flux. As they open and close, buildings in this metropolis breathe and change to fit their surroundings. Perception of a building's surface is changed dramatically by the Habitat 2020 construction. Instead of a system of static materials utilised

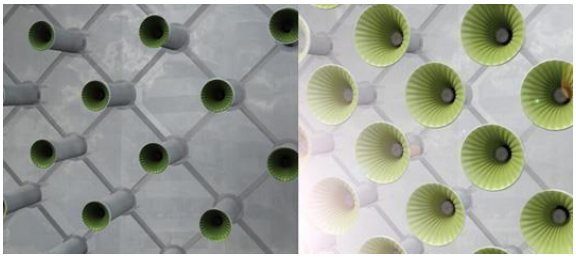


Figure 4: Living skin of Habitat 2020

primarily for building and defence, the outside has been planned to function as a living skin. Figure 4 shows how the skin acts as a membrane, linking the inside of the habitat to the outside. Another way of looking at it is that the skin is like the surface of a leaf, with its many stomata holes that allow gas to escape and enter.

with plant transpiration. Light, air, and water could all enter the house via the surface. It would open and close automatically in response to the angle of the

sun. Clean air and natural air conditioning would be provided by directing and filtering the wind and air into the structure. Active skin has the potential to collect rainwater, purify, filter, utilise, and recycle it. Even airborne moisture might be absorbed by the skin. The biogas energy that would be generated from the waste products might be utilised for various purposes within the ecosystem.



Fig.5 Tree pod

One of the interesting examples of beneficial biomimicry are the Treepods designed by Influx Studio. These Treepods (Fig.5) take the working concept of trees and incorporate these elements into the design of the structures. The aim of this project is to create air cleaning by creating a system that catches CO2. The tree that Influx Studio focused on mimicking is the Dragon tree because of the large canopy that provides maximum shading which also allows the structure to support solar panels used to power the air cleaning system. This approach to creating biomimicry is successful in many ways, it takes in consideration of the visual aspects as well as the working and functional aspects of the Dragon tree.

These Treepods are not designed to replace natural trees, but to act like small air cleaning infrastructures, increasing in many times CO2 absorption. This is interesting because the structures are not only mimicking the qualities of trees but pushing them further by enhancing the working aspects of the Treepods. Taking this approach to biomimicry is more beneficial to the earth than sculptural and visual biomimicry.



Fig.6 : Tent tower

Another example of Biomimicry is Looking like a strange sort of man-made volcano, the All- Seasons Tent Tower (Fig.6) by OFIS Architecture is a multi-function cylindrical tower powered with solar energy and covered in a mesh skin that filters sunlight for temperature regulation. As the city of yerevan is situated in a region prone to earthquakes, the main driver when deciding on a suitable structural system for the building was safety during earthquakes. The vertical structure, which resists gravity load and forces resulting from earthquake action, was rationalized to reinforce the tower's concrete cores and composite columns. Special care has been taken to optimize environmental conditions and minimize the energy demands of the tower. The external facades will feature a high performance skin with an adaptable external shading device to reduce solar gains in the summer. A concrete slab embedded pipe system provides cooling without draft problems and in winter comfortable heating. In the summer, the cooling of internal spaces is achieved primarily through the use of the slab system. During winter, the fresh air will be heated inside the units and distributed into the rooms using the displacement ventilation principle.



Fig. 7: Lily pad, a floating city

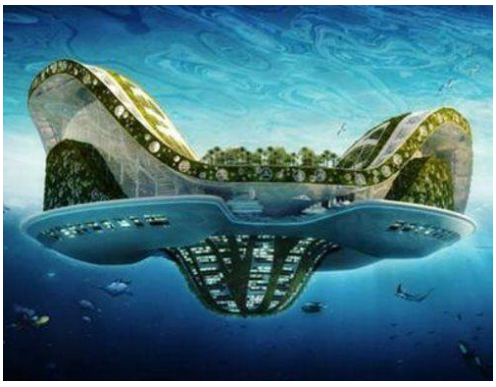


Fig. 8 Lily pod

There are very few urban design solutions that address housing the inevitable tide of displaced people that could arise as oceans swell under global warming. Certainly none are spectacular as this one. The Lilypad, (Fig.8 & 9) by Vincent Callebaut, is a concept for a completely self- sufficient floating city intended to provide shelter for future climate change.

Biomimicry concept implemented in the building Lilypad created as a water lily is planned to be a nil emission city floating in the deep. By means of several technologies, it is predicted that the plan would be capable of not only generating its individual power, but also dealing with CO2 in the surroundings. A fully self-reliant floating city aimed to afford protection for upcoming climate variation immigrants.



Figure 9: Mangal city

People thought cities deriving from nature in the past, but they have evolved that nature is coming inside cities central. The city space is a live organism. 'Mangal City' (Fig. 9) is an 'urban ecosystem' that mimics the nature of the Mangrove plant, spiraling plant growth patterns, and the interaction of natural ecosystems. It is Chimera design team is a series of futuristic spiraling skyscrapers for London, a beautiful example of Biomimicry. This project is an 'urban ecological system' composed of modular pod capsules that shift to adapt to environmental and contextual conditions.

CONCLUSION

Professionals in the field may learn eco-performance concepts from nature-based initiatives like these, and then incorporate them into their own designs to incorporate biomimcry solutions. In fact, in this new sustainable order, man-made structures such as buildings and outdoor artwork would serve a similar purpose to natural ones, such as collecting, purifying, and storing rainwater; turning solar energy into energy and carbon dioxide into oxygen; preventing soil erosion; spreading seedlings; and eliminating waste. In order to ensure that all buildings of the future are environmentally friendly, it is imperative that the next generation of architects and designers develop bio-inspired design adaptations that mimic nature's finest concepts.

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