

EMULATING NATURE: THE INTERSECTION OF BIODESIGN AND INDUSTRIAL DESIGN FOR SUSTAINABLE INNOVATION

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Abstract: *This paper highlights the importance of Biodesign, which is the application of design principles to biological systems. Industrial designers use biomimicry to create products inspired by nature, focusing on both visual and functional aspects and greatly benefit from this. They also promote sustainability by using biomaterials and mimicking natural processes in manufacturing. Some designs even incorporate living organisms for enhanced functionality. Industrial design also contributes to health care by creating medical devices inspired by biological systems. Examples of successful biomimicry include the design of aeroplanes, sustainable agriculture methods, efficient water mixing systems, Velcro, bullet trains, wind turbines, and antimicrobial films. These innovations highlight the potential of Biodesign in driving technological advancement and sustainability.*

Keywords: *biodesign, industrial design, harmony, natural processes.*

Introduction

One field of biodesign is industrial design. In other words, you can apply design principles and vast areas of methodologies to create systems, products and solutions inspired by nature. I will explain the impossible made possible in the next paragraphs:

Biomimicry in the Design of Products - Designers often look to nature for inspiration, studying biological organisms and processes to inform their designs. In particular, this can include mimicking structural elements, functionalities, and adaptive strategies found in the natural world. Yet, biomimicry involves not just replicating the visual aspects of nature, but also integrating the functional aspects into industrial design.

The power of biomimicry

Biomimicry is a fast move on our alive planet called Earth. This study will entertain the most brilliant ideas over the past 3.5 thousand years and adapt them for everyday use. The results are booming in how high-tech materials are thought of, put into practice, and how we program, believe, heal ourselves, bring the best for the environment, and sustain the world [1]. There are a lot of sustainable materials and processes employed. Industrial designers explore the use of biomaterials, which are derived from biological origins. These materials may be more sustainable, biodegradable, and have a lower environmental impact compared to classical equipment. Designers also consider manufacturing processes that mimic natural processes, aiming for marginal waste, energy profitability, and lower environmental effects.

Approaching nature with the lens of biomimicry is connected to a child exploring the garden with a magnifying glass - it sparks a sense of excitement and curiosity, but with a fresh perspective. This biomimetic lens allows individuals to perceive nature in a new light, not merely observing its attributes, but also extracting valuable insights from its designs and functions. Consider, for instance, a shell. On one side, we catalog its biological and ecological characteristics - its name, shape, habitat, and more. On the other, we brainstorm the lessons it can offer us. All it requires is an inquisitive mind! By delving into why the shell possesses its particular shape, composition, and role within its environment, one uncovers a wealth of inspiration. It becomes

evident that nature's creations are not just beautiful; they are optimized solutions that can inform and inspire our own designs [2].

In contrast, the integration of living organisms is the game changer. Some industrial designs incorporate living organisms into the product itself. This could include designs that incorporate plants, algae, or microorganisms to enhance functionality, such as air purification or energy generation. Industrial designers also explore the creation of biohybrid systems that combine living and non-living components.

Usually, the design is adaptive and responsive. Industrial designers draw from biological systems that exhibit adaptability and responsiveness to environmental conditions. To highlight this, this could involve creating products that can adapt to changing conditions, such as shape-shifting materials or responsive surfaces. So far, designs may also incorporate biological feedback mechanisms, where the product responds to stimuli in a way similar to how living organisms adapt to their climate.

The big role is played in healthcare and medical sorts. Industrial designers in the medical field draw inspiration from biological systems for the design of medical devices and equipment. This includes designs inspired by anatomy, physiology, and natural healing processes. Additionally, designers also focus on the development of products using materials that are compatible with the human body. For example, biomimicry has led to some remarkable innovations in product design. Here are a few examples.

Examples and Applications of Biomimicry in Design

The flight is inspired by birds. Leonardo da Vinci studied birds and their anatomy to understand flight. His research later inspired the Wright brothers, who invented, built, and flew the world's first successful motor-operated airplane.

Another example was created by the Land Institute. It is a method named perennial grain cropping, or permaculture, which mimics the enormous stretches of flat grassland that hold the soil firmly. In contrast, this method prevents soil erosion, can sustain green with less water, has built-in pest resistance, and increases the health of the ecosystem.

An efficient water mixing system inspired by spiral flow. Scientists at Pax Water have developed active tank mixing technology and other applications like fans, which have reduced the energy required for similar outputs by about 30% [3].

Velcro is inspired by burdock plant. Swiss designer George de Mestral noticed how burdocks from a burdock plant stuck to his clothes and dog's fur, which inspired him to create Velcro [4].

A good example is seeing the beak kingfisher bird through a new lens. It is admirable how it was an inspiration for bullet trains, which allow them to dive into water without making any wave disturbance.

Wind turbines are modeled after Humpback Whales. The design of wind turbines was influenced by the unique shape of humpback whale fins, which increases their efficiency. Antimicrobial Film Mimicking Sharkskin: Sharkskin has a unique pattern that prevents algae and barnacles from attaching. This pattern has been mimicked to create antimicrobial films.

The last example is that termites build mounds with a complex system of tunnels that ventilate their nests. This concept has been used to design passive cooling systems in buildings [5].

These examples demonstrate how biomimicry can lead to innovative and sustainable solutions in product design.

Conclusion

To conclude, the role of industrial design in biodesign involves leveraging principles from biology to create more workable, useful, and forward-looking products. Hence, it encompasses biomimicry, the use of biomaterials, the development of adaptive and responsive systems, and the

integration of living organisms, contributing to a more harmonious relationship between human-made designs and the natural world.

In my opinion, industrial design plays a huge role in biodesign, leveraging the principles of nature to create solid, modernistic, and durable solutions. Upon reflection, it becomes clear that both human design and nature's design frequently aim to achieve similar objectives, albeit through different means.

Nature effectively manages bacteria, as do we. It must also devise methods to store water, a task we undertake as well. Nature ingeniously produces light, a feat we mimic in our own way. In Proverbs 6:6–8, the NIV version advises, "Go to the ant, you sluggard; consider its ways and be wise! It has no commander, no overseer, or ruler, yet it stores its provisions in summer and gathers its food at harvest." [6] The examples provided illustrate the power of biomimicry in various fields, from transportation and agriculture to medical devices.

This ability to harness nature's wisdom is applicable across all aspects of life. The first step involves stepping outside and engaging in observation. The dialogue begins when one allows room for curiosity and approaches with humility. Taking the time to observe something in nature and create a comparison diagram between "about" and "from" will reveal the insights we, as humans, uncover.

What emerges is the realisation that by pinpointing the functions we seek to fulfil, we can turn to nature for insights on how to accomplish these tasks, thereby forging a connection between biology and design.

By studying and mimicking biological systems, designers can develop products that are not only functional but also eco-friendly. In other words, by involving themselves in new conditions, people can boost their self-esteem and well-being.

So far, these innovations underscore the potential of biodesign to drive technological advancement while promoting sustainability and harmony with nature. As we continue to face global challenges, the integration of industrial design and biodesign will unquestionably play a key role in shaping a viable and strong hereafter.

Gratitudes to the “Biomimicry Institute” and the “Learn Biomimicry” programme for supporting, inspiring, and guiding me in the process.

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