Biomimicry: A new term for ancient wisdom?

Date: May 1, 2021

Type of Case: Meso

Colombia / Latam; Worldwide

4REVS
CO-CREATIVE ECOSYSTEM

Main Theme

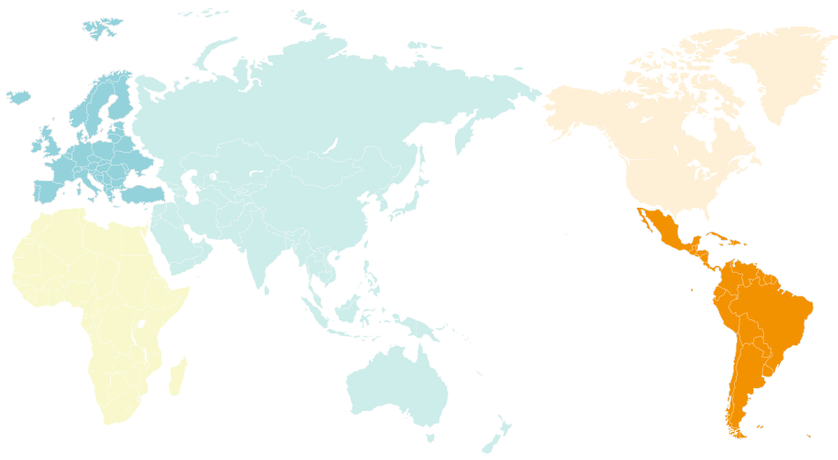
Food
Agriculture
Protein Supply

Water
Water Tech
Water Management

Resources
Circular Systems
Ecosystem Usage

Energy
Climate Change
Greenhouse Gasses

Region



Sub-theme: Design, Architecture, Circularity, Regenerative Design, Ancient wisdom, natural technology.

Abstract

Biomimicry: the art and practice that learns from nature's designs and strategies to solve human design challenges. The term biomimicry appeared in 1982 when scientist Janine Benyus developed it in her book *Biomimicry: Innovation Inspired by Nature.* According to Benyus: **"When we look at what is truly sustainable, the only real model that has worked over long periods is the natural world."**

But today, biomimicry is no longer just an "art." It is now a new science that offers a comprehensive framework of knowledge, understanding, and science. According to the most prestigious biomimicry institute, this framework has three essential elements: **emulation**, its **"enabling life"** ***ethos***, and the conception of **(re)connection**. To emulate means to learn and replicate nature's forms, processes, and ecosystems. Its *ethos* is about understanding how life works and what we can do from a design perspective to create conditions that enable life. Finally, the (re)connection concept builds on the belief that we are all nature and we must observe the surroundings to find the best biological strategies.

Back in 1992, buildings were responsible for 50% of the total energy consumption in the U.S alone. According to the Pennsylvania Housing Research center, 0.5 tons of CO2 could be associated with every 10 feet of construction. However, many ancient practices have been emulating nature´s strategies for a long time. Some traditional buildings have biomimetic air conditioning structures. In some countries, indigenous structures have seismic resistance, and they are made using natural and simple resources like mud, sand, and palms.

This case study explores some classic examples of biomimetic implementations in Latin American to see how *linked* they are with biomimicry's contemporary science and theory. It will give some pointers to consider and take ancient practices into the present.

Sustainable Development Goals Chart

Biomimicry: a new term for ancient wisdom?

Main Highlights

Problem

- After the Industrial Revolution, the economic system lies on mass production and heavily relies on virgin material extraction.
- Our disconnection as a species from Earth's cycles and natural processes has taken us beyond planetary boundaries.

Solution

- Biomimicry: *from the Greek bios (life) and mimesis (imitation),* is a new science that values nature for what we can learn from it, rather than only from what we can extract from it.
- Biomimicry changes our lens: following biomimicry´s principles can guide us towards a unique and eco-efficient outcome.
- With 3.8 billion years of evolution since the first bacteria, Planet Earth has many lessons and strategies that can help us reshape our current society and create sustainable solutions faster.

Context

- Biomimicry is not an umbrella for all-natural buildings. We should address the differences between biomimicry, bio-utilization, biomorphism, and bioinspiration.

Impact statement

Every possible design can apply biomimicry by taking

a. Nature as a model;
b. Nature as a measure;
c. Nature as a mentor.

Case Overview

- **What is biomimicry?**

Biomimicry: *from the Greek bios (life) and mimesis (imitation),* is a new science that values nature for what we can learn from it, rather than only from what we can extract from it. The term biomimicry appeared in 1982 when scientist Janine Benyus developed it in her book. *Biomimicry: Innovation Inspired by Nature.*

According to Benyus: **"*Biomimicry is about valuing nature for what we can learn, not what we can extract, harvest, or domesticate. In the process, we learn about ourselves, our purpose, and our connection to each other and our home on earth*."**

- **Some examples (before the concept even existed)**

According to some scientists, the "flying machine" made by Leonardo Da Vinci was the first recorded sketch of a biomimetic design long before the concept itself emerged as such. In his own words, he once said: "Learn from nature: that is where our future lies."

Image: Leonardo Da Vinci's design of a flight machine

Leonardo Da Vinci produced more than 500 sketches dealing with flying machines, the nature of air, and the birds' flight. In fact, **not only did he design one of the first aeronautical structures inspired by nature, but he also wrote a short handbook called "Codex of the flights of birds."**

In this text, made centuries before the first actual airplane, he outlines many observations, notes, key engineering elements, and concepts that would later lead humans to fly in planes. He observed nature and learned from it.

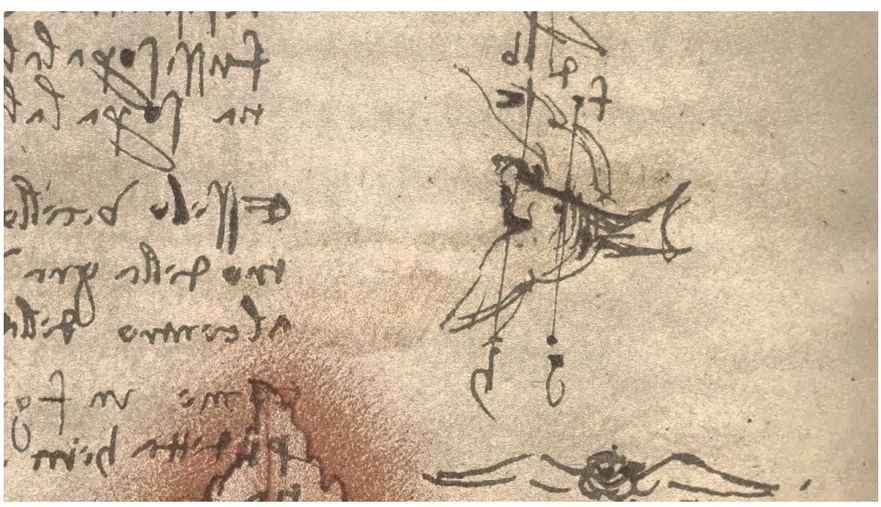
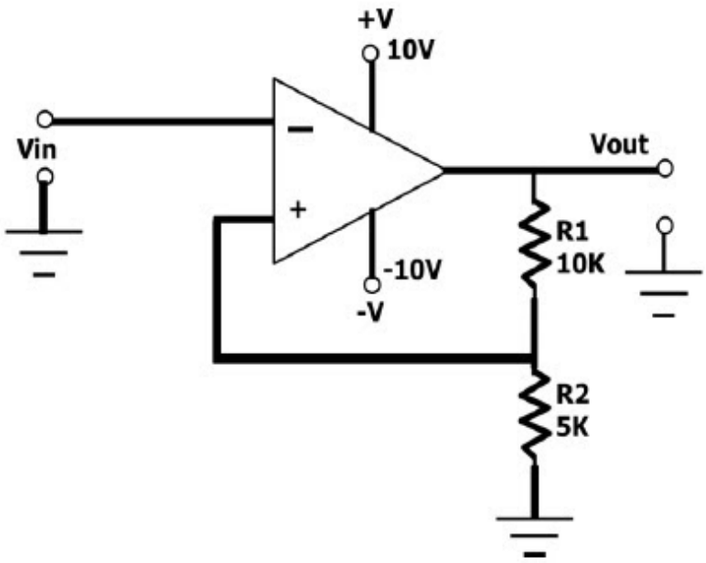
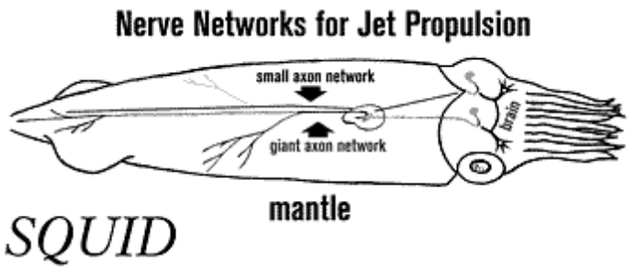


Image: Leonardo Da Vinci's "Codex of the flights of birds."

But taking inspiration from nature is not something new. In the 20th century, Otto Schmitt established **biomedical engineering** and coined the term **"biomimetics"** as he invented the Schmitt trigger, inspired by the squids' nervous system.





Images: Schmitt trigger circuit and squids' nervous system

Da Vinci's "Flying machines" and the Schmitt trigger circuit are some of the many examples of how humans can make technical and technological advances by translating nature´s strategies into designs and practices. **Biomimicry is a multidisciplinary field that can involve architecture, engineering, mathematics, and many more areas**.

However, are the two previous examples related to how biomimicry has affected how we "learn about ourselves, our purpose and our connection to each other and our home earth," as Benyus said?

- **The difference between biomimicry, bio-utilization, biomorphism, and bioinspiration**

The science of biomimicry is new and responds to a context. Today, like never before, humanity needs to reverse the Climate Crisis and figure out how we could have better resource management and ecological balance while learning and understanding our role as human species on Planet Earth.

Latinamerican ancient wisdom is full of engineering, ecological examples of resource use, and a profound understanding of the materials of properties of the surroundings.

Image: Nazca *puquios*, spiral wells to access and clean aqueducts.

Today, much of the **ancestral knowledge** is not only present in rural areas. It arrives at the metropolis and is also taking part in a new generation of architects and builders. Low-impact practices like making bricks using soil or large buildings inspired by the bamboo structure are examples of this.

Impact Statement

- **Biomimicry´s key principles**

According to the Biomimicry Institute, three fundamental principles can help apply biomimicry in every possible design: A) **Nature as a model**; B) **Nature as a measure**; C) **Nature as a mentor**.

A) **Nature as a model**

Using nature as a model refers to studying nature´s models, processes, systems, and strategies and emulating them to solve human problems. For example, an airplane imitates birds and the air system model to optimize stability and fuel efficiency.

Biomimicry changes our lens: **following biomimicry´s principles can guide us towards a unique and eco-efficient outcome**. With 3.8 billion years since the first bacteria, Planet Earth has many lessons that can help to accelerate and get us to sustainable solutions faster.

In 2006, a study made by Guillermo Arboleda revealed through a deep analysis that vernacular architecture ("*bajareque*") often has seismic resistance, technical facilities, is cheaper, and much more eco-efficient. Arboleda also points out that **materials can integrate the natural environment again after their life cycle because they are usually local and biological**.

B) **Nature as a measure**

Using nature as a measure can be translated into using an ecological standard to judge whether innovations are sustainable or not. Nature has plastics or polymers, for example, but they are minimal and simple. There are a total number of approximately five kinds of polymers in nature. But humanity has developed more than 450. Taking nature as a measure means reducing the number of different types of polymers.

C) **Nature as a mentor**

Finally, taking nature as a mentor is significantly related to the **(re)connect concept**, where the main goal is **not to see nature based on what we can extract from it, but instead from what we can learn from it.**

Image: A rural house in South America made with "bajareque," a cement alternative often made using wooden poles and structures filled with a mix of mud, sand, water, and leaves.

Because biomimicry is a new science born due to the need to reduce environmental impact, the Climate Crisis, and many of today´s main challenges, **wouldn't it be falling into an "umbrella" term for all ancient practices long before humanity was facing the agricultural revolution?**

Systems Perspective

Ancient civilizations have been applying sophisticated construction systems and processes. For example, if we take the air conditioning, we may be surprised to learn that around 10.000 B.C, hunter-gatherers figured out that caves were perfect for geothermal-cooled homes.

Bajareque houses in Latin America offer various benefits: biodegradable materials, local consumption, seismic resistance, low environmental impact, and economic advantages. These practices are sustainable, and they use biological elements and many of biomimicry´s principles. **But can or should they be considered *biomimicry*?**

It is clear by now that Biomimicry is the science that studies how we can learn from nature to emulate and be more integrated with it. However, according to Edgar Sanabria, an architect and anthropologist specializing in biomimetics, **it would be somewhat "forced" to consider ancient wisdom as part of contemporary biomimicry** science from a technical, practical, and anthropological perspective.

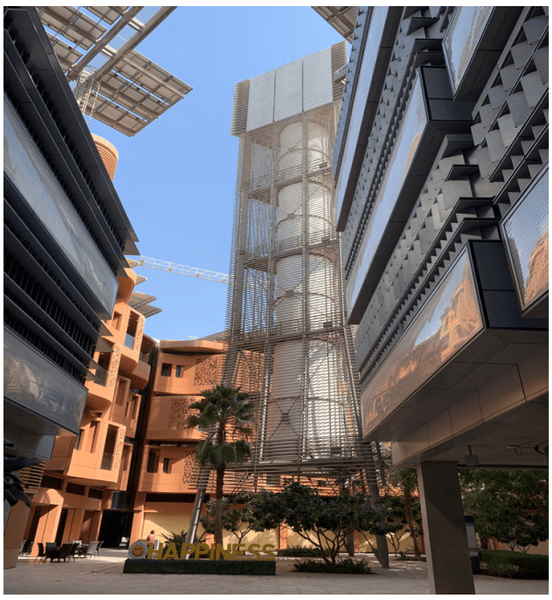
- **So the question arises: is biomimicry a new term for ancient wisdom?**

We must address the differences between **biomimicry, bio-utilization, biomorphism,** and **bioinspiration** to respond to this question.

Bio-utilization: using biological material or living organisms in a design or technology, like using trees as a material (wood) or mud as glue (bahareque). While one of the most distinctive aspects of biomimicry is the study and emulation of functional strategies to create sustainable solutions that embody the (re)connection concept and the *ethos* behind it, ancient wisdom is

pure knowledge, know-how, engineering. We should be aware of simplifying it and framing it under the contemporary concept of biomimicry.

On the other hand, **biomorphism** "refers to designs that visually resemble elements from life (they "look like" nature), whereas **biomimetic** designs focus on function (they "work like" nature)."

Example 1: **Masdar City (UAE)**	***Example 2:*** **Sharma Springs (Bali)**
	

For instance, ***Example 2*** is a house with a shape of a leaf. It visually resembles a leaf of a tree and has "natural shapes." It also enters the field of **bio-utilization** since it's made from bamboo. But it may not be an example of biomimicry because the overall building may not "work like nature." Instead, ***Example 1*** is a building in Dubai with a natural cooling system that works like a cloud, spreading tiny drops of water all day long and promoting naturally cool indoor temperatures.

Finally, **bio-inspired** designs are commonly misunderstood as biomimicry, but **bio-inspiration is much more related to bio-morphism**. Designing products that are *inspired* by nature may look "beautiful," but "looking like" nature or looking "beautiful" is not a reliable indicator of biomimetic design. According to the Biomimicry Institute: **"a biomimetic design might or might not look anything like the organisms that inspired it. Rather, the important indicator is function"**.

According to Sanabria, indigenous engineering or ancient wisdom is indeed part of biomimicry, but the contexts and the reasons are entirely different. While biomimicry was born to solve humanity's challenges, ancient wisdom and Latin American constructions with bahareque emerged from the natural dynamics of rural and non-globalized societies.

Whether it is Biomimicry or not, **Latin American ancient wisdom applied to buildings, engineering, and architecture carries intrinsic and unprecedented importance** in a moment where not one or two but hundreds and thousands of alternatives are urgently needed.

Links and Contact Information

Biomimicry Institute

https://biomimicry.org/what-is-biomimicry/

CHRISTOPHER BROSSE

Political scientist. Currently specialized in the field of Upcycling. During the last years, he has been exploring Circular Economy, Lateral Thinking, and Creativity.

LUCAS SÁNCHEZ M.

Lucas works in arts for social change-related projects and as an artist/musician. His background is in Political Science, Music, and Holistic Science.

Humanity is facing four essential survival challenges (4Revs) — or bottlenecks — which we must overcome to enable the continued flourishing of life on Earth: Food, water, resources, and climate change/energy (details below). These four areas will require revolutionary innovation and, at the same time, provide a treasure trove of new opportunities.

4Revs is a unique, co-creative ecosystem that aims to help humanity solve these four survival challenges in one generation – between 2020-2050.

Thank you for partnering with us.