Biomimicry in Architecture

INSPIRED BY TERMITES

Chloé
Ostermann

What is biomimcry?

An ode to nature

The process of mimicking natural systems and models to solve complex human problems in all fields including:

engineering
materials science
fashion
architecture
...

Daily uses for biomimicry

Japanese bullet train's conical nose is inspired by the beak of the kingfisher bird and its ability to pierce through water with hardly any surface disruption

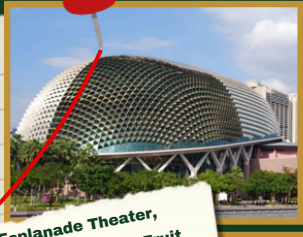
Famous Chinese carpenter Lu Ban was inspired by the lily leaf to create the chinese wind umbrella in 507 BCE

Nature has spent millenia evolving to solve some of the same problems our society struggles with today. Nature has all of the qualifications and experience to be our greatest mentor in sustainable designs as long as it stays alive and diverse.

BIOMIMICRY IN ARCHITECTURE

Did you know the foundation of the Eiffel Tower was actually inspired by the network of small tubes that reinforce our femur bone?

Besides structural designs, architects also mimic unique patterns in nature



Esplanade Theater, Singapore x Durian Fruit

THE MOST SUSTAINABLE AND EXPERIENCED ARCHITECT IS NATURE

What else in nature could help us solve architectural challenges?

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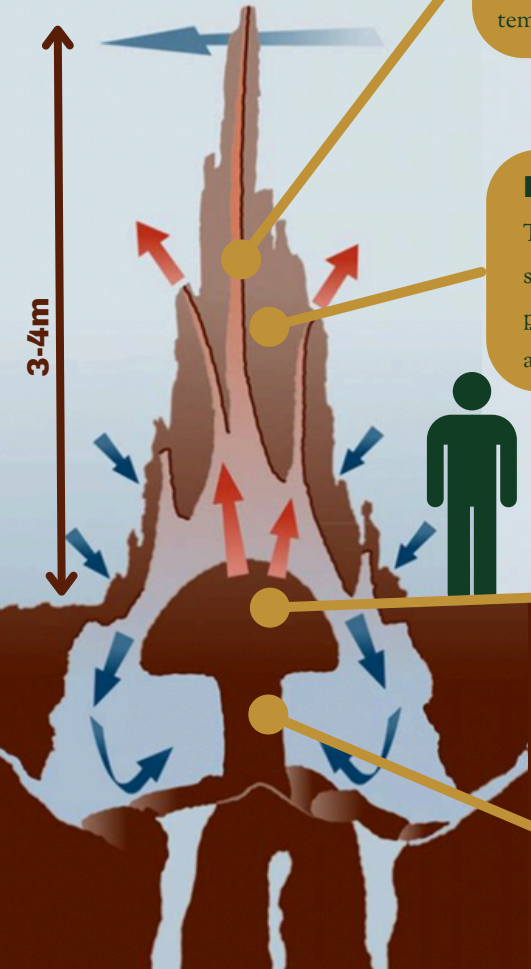
The Termitary

Despite their blindness, termites excel as farmers and architects. They have perfected their massive nests to be incredibly self regulating at a constant 30°C (86°F) despite outside temperature fluctuations going from 40°C to less than 0°C.

The circulation of warm air within the nest facilitates a self-sustaining exchange of CO_2 with the atmosphere to provide ventilation



Central Chimney

A network of tunnels connect to a central chimney that allows for air circulation that regulates temperature and humidity inside the nest

Foundation

The nest itself is constructed using a mixture of soil, termite saliva and dung. This material creates a porous exterior that allows for additional air flow and quick rainwater drainage

Fungal Gardens

In return for the wood stores brought by termites, fungus growth offers nutritious food for them to eat

Cooling Cellar

Thin plates of dirt that absorb ground water and regulate the termitary's temperature

The Termitary inspired building

Translating the innovations of termites to a human context

Eastgate Center

Harare, Zimbabwe, 1996, Mick Pierce

Zimbabwean Architect Mick Pierce was inspired by the natural ventilation of the termitary to create the first rendition of this nest in human terms. He aspires to create a living breathing structure that mimicks the flexibilty and adaptivity of the termite nest.

"This was an attempt to design a building based on the metaphor of a living system more like a termitary. An ecosystem not a 'machine for living in'."
-Mick Pierce

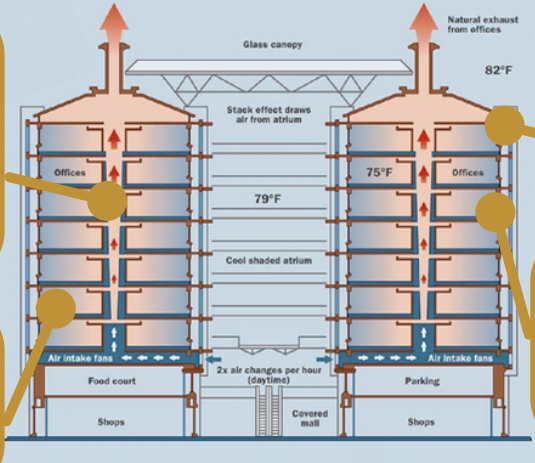
$30M
Construction fee

Central Chimney

Evacuates rising heat and improves stack effect (natural tendency of warm air to rise and cold air to fall)

Voided Concrete Floors

hollowed floors conduct cool air



Solar Panels

Solar energy powers hot water heater

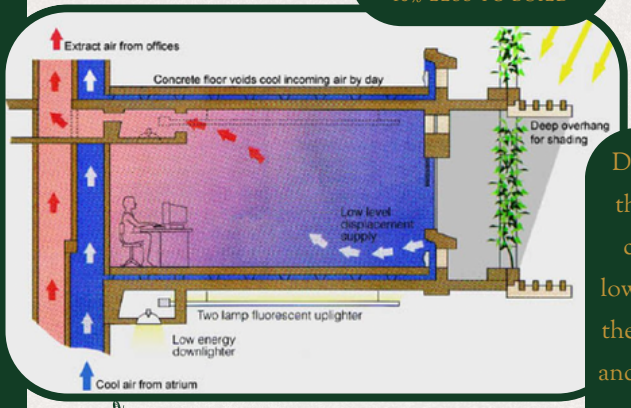
Overhang and planting

provide natural shade for side facing the sun

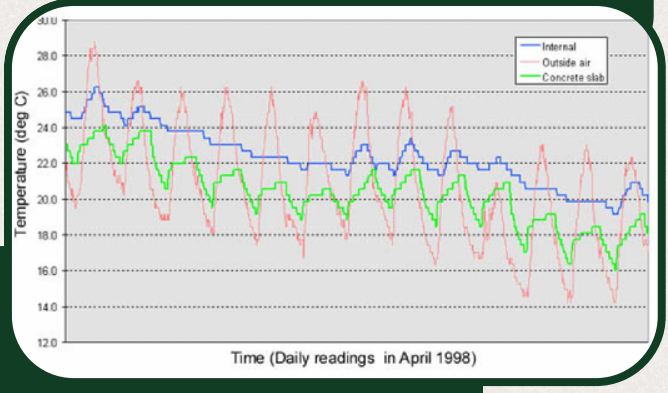
"The building is also a breathing system based on the principle of gas diffusion through a membrane we call osmosis"
"an ecosystem not a machine for living in."

A Closer look inside...

EASTGATE CONSUMES LESS THAN 50% OF THE ENERGY USED IN CONVENTIONALLY AIR CONDITIONED BUILDINGS AND COST 10% LESS TO BUILD



During the night, cool air flows through the space between the ceiling and the floor above to lower the room's temperature. As the air warms up, it is then drawn and released upwards through the main chimney during the day.



By utilizing night cooling, thermal storage, and convective air currents, Pierce created a building that maintains a consistent indoor temperature. The indoor temperature stays stable between a comfortable 25°C and 20°C, despite significant fluctuations in the outdoor temperature.

Areas of improvement for this design are mainly in the buildings temperature control center that takes advantage of intense outdoor temperature changes to better flush out accumulated hot air. More reseatch is also possible for improving the heat transfer between the air and the voided concrete flooring

INTO THE FUTURE OF ARCHITECTURE

1. After the success of the Eastgate bioinspired design, Mick Pierce designed his second termitary inspired design, Melbourne's Council House 2 (CH_2) which became the first building in Australia to receive 6 stars in Australia's Green Star environmental accreditation. It's innovative design features wooden slats on the side of the walls that automatically pivot according to the placement of the sun.

II. Harvard researchers are drawing inspiration from marine sponges' glassy skeletons to design stronger and taller buildings. The sea animal's reinforced square lattice offers a higher strength to weight ratio than conventional architectural foundations.

III. Milanese architect Stefano Boeri designs "Vertical Forests" buildings with a massive diversity of trees and plants embedded throughout the structure to create micro-climates and absorb urban pollution.

IV. The Beijing National Aquatics Center in China, known as the Water Cube, has an innovative exterior made of ETFE pillows inspired by soap bubbles. This design allows for natural sunlight, heat insulation, cost reduction, and sustainability.

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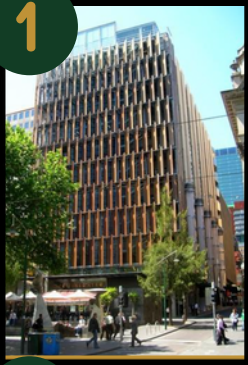

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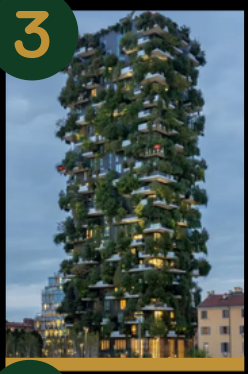

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"SUSTAINABLE ARCHITECTURE MUST SATISFY THE NEEDS OF PRESENT USERS WITHOUT DIMINISHING THE PROSPECTS OF FUTURE GENERATIONS. IT MUST ALSO BE EMBEDDED IN ITS NATURAL AND SOCIAL ENVIRONMENT." —MICK PIERCE

HOW DO WE ENSURE RESEARCH DONE ON NATURE IS DONE WITHOUT PERTURBING THE ENVIRONMENT?

THINK CRITICALLY

COMMUNITY INVOLVEMENT IN CONSTRUCTION PROJECTS IS VITAL FOR ENVIRONMENTAL JUSTICE. ENGAGING LOCALS ENSURES TRANSPARENCY, SUSTAINABILITY, AND INCLUSIVITY. THIS FOSTERS EQUITY, ENVIRONMENTAL RESPONSIBILITY, AND SOCIAL COHESION.

BIOMIMICRY SHOULD BE TREATED AS A COLLABORATION WITH NATURE. HOW CAN WE LEARN FROM NATURE WITHOUT RESPECTING IT AND PRESERVING IT? CREDITING NATURE WHERE IT IS DUE IS CRUCIAL FOR OUR SOCIETY TO REALIZE HOW PRECIOUS NATURE IS.

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