UWE Bristol | University of the West of England

Crafting A Nature-Inspired Future

A Co-design Workshop Bridging Academia and Industry

20th September 2024, Design Museum, London

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Agenda

Welcome and Introduction

Nature and Architecture

Dr Lidia Badarnah

Keynote Presentations:

Climate Change: Have We Got This Right?

Wolf Mangelsdorf, Buro Happold

Beauty through Ingenuity: Learning from Nature to Shape Our Built Environment

Camila Rock De Luigi, Grimshaw Architects

Forging a biometic future

Ehab Sayed, BIOHM

Structural Modelling and Biomimicry

Daniel Piker, Foster and Partners

Workshops: A 3-step innovation Process:

Dr Lidia Badarnah, UWE
facilitated by Abigail Hird, Defankle Innovation

Step 1: Principles and Concepts
Step 2: Challenges and Barriers
Step 3: Mapping and Opportunities

Conclusion: What Next?

Welcome and Introduction

Nature has developed sophisticated strategies to adapt and thrive, providing a wellspring of inspiration for adaptive and regenerative architecture. This workshop gathered academics, architects, engineers, strategists, and innovators eager to explore the power of biomimicry.

Overlooking the trees of Holland Park, the event aimed to facilitate knowledge sharing and dissemination, bridge industry and academia, and foster innovation, sustainable collaboration, and funding.

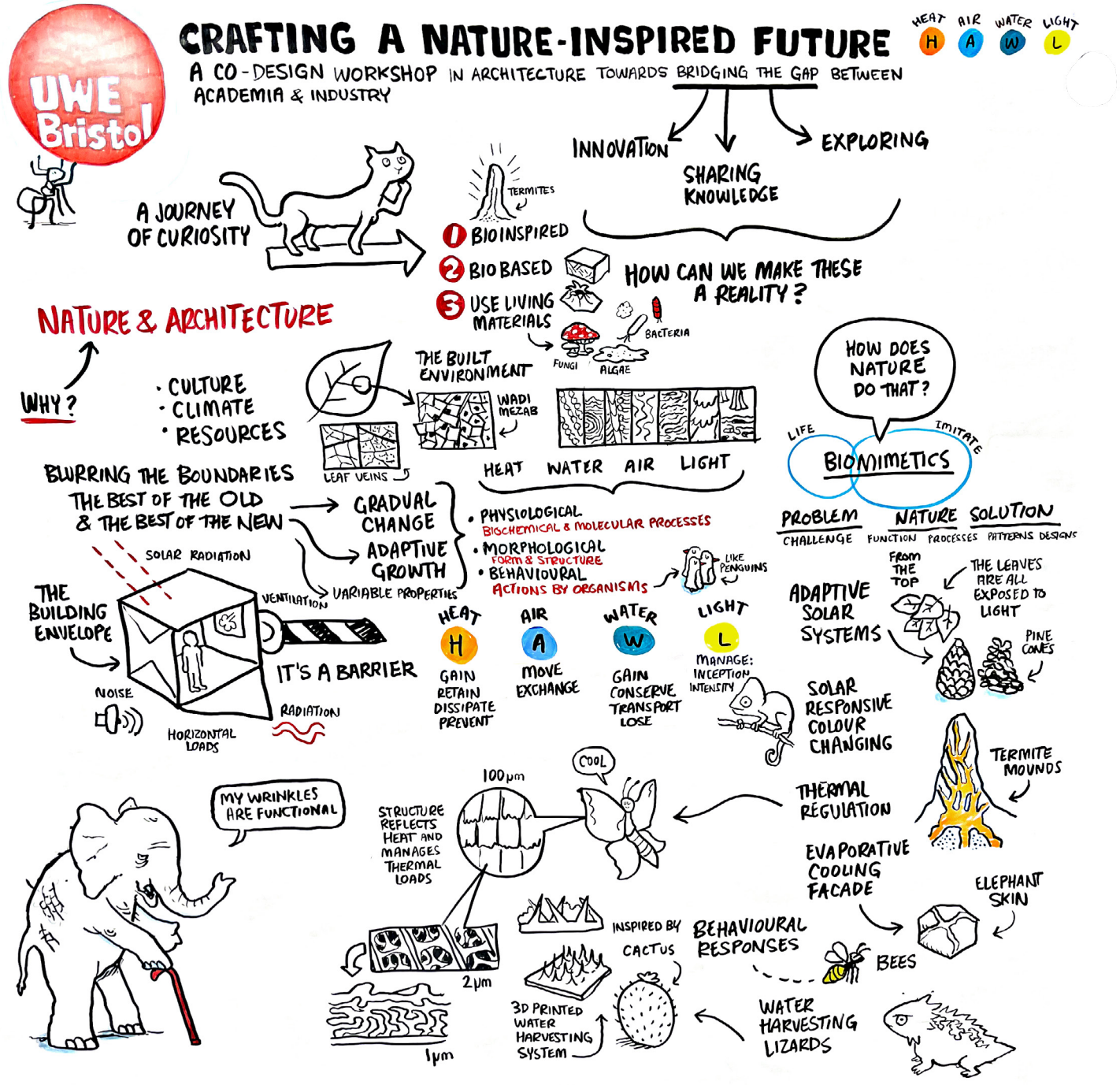
As participants arrived, passing beneath the dramatic paraboloid roof of the atrium, an atmosphere of anticipation permeated the venue.

"I hope this will be a journey of curiosity and inspiration."

An inspiring assembly of professionals, including academics, architects, strategists, and engineers.

Nature and Architecture

Dr Lidia Badarnah



Lidia opened with some background to biomimicry and architecture, explaining that nature can elevate architecture in diverse ways: designs can be biobased, bioinspired, or incorporate living materials.

The development of energy-efficient designs has never been more essential, and thankfully, advancements in additive manufacturing, material properties, and computational tools have opened avenues for adaptive solutions that push the boundaries of design.

"The best of the old and the best of the new."

Biomimetics can be approached in two ways: one begins with a challenge and seeks solutions from nature, while the other starts with nature's designs and examines their applications.

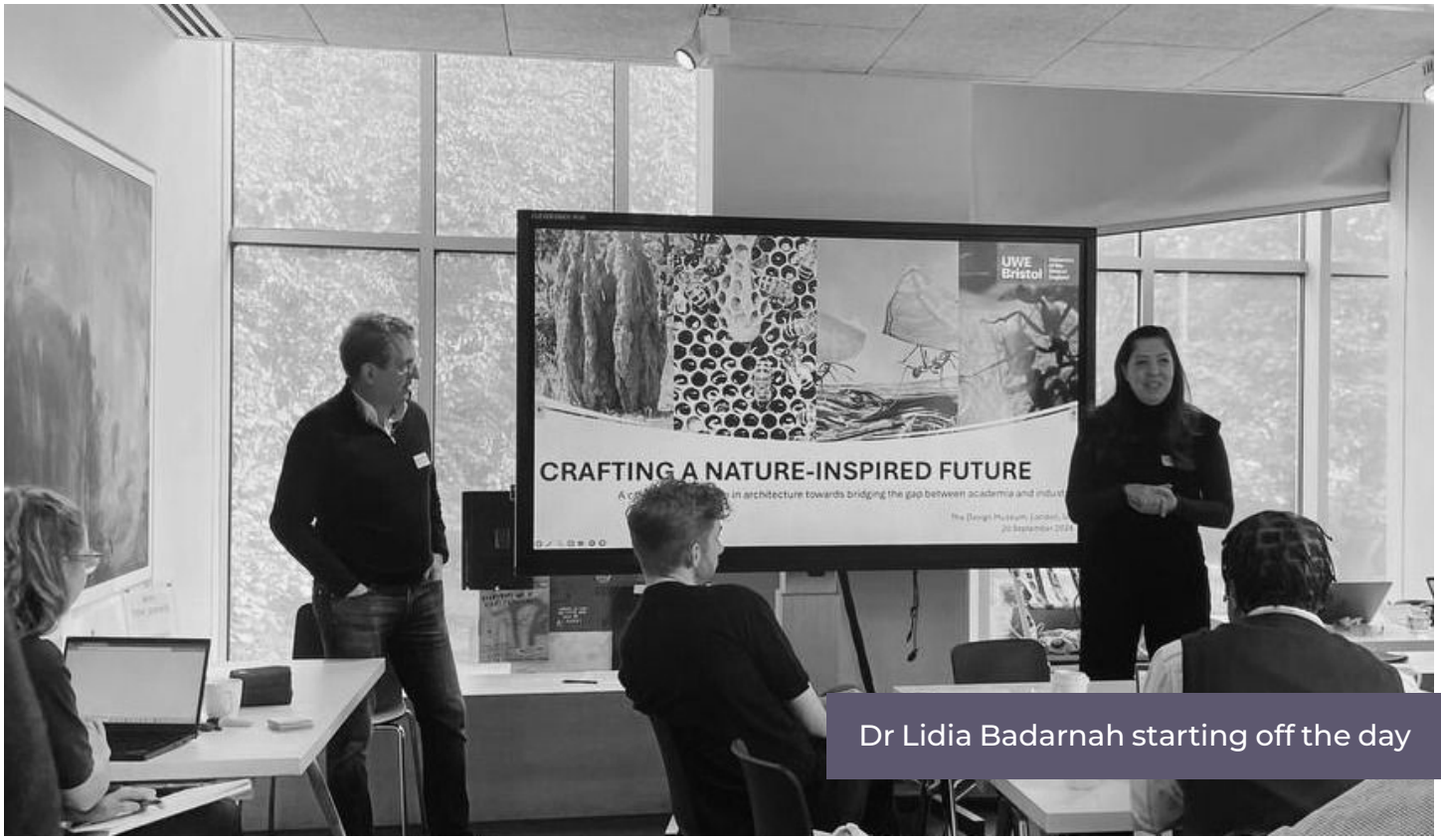
In closing, Lidia presented examples of biomimetic architecture corresponding to the following four categories:

Heat: Termite mounds use natural convection to maintain optimal temperatures. Inspired by this, passive cooling systems use natural ventilation techniques to optimise indoor temperatures.

Air: Structures can emulate the ventilation strategies of mounds, burrows, and nests to create pressure gradients and enhance air circulation.

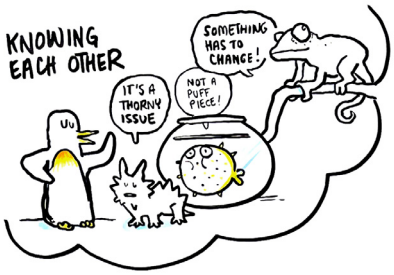
Water: Water harvesting systems, such as 3D-printed fog collectors are modelled after cacti.

Light: Designs inspired by the silver ragwort demonstrate how light can be scattered and filtered, controlling sunlight penetration while reducing heat.



Dr Lidia Badarnah starting off the day

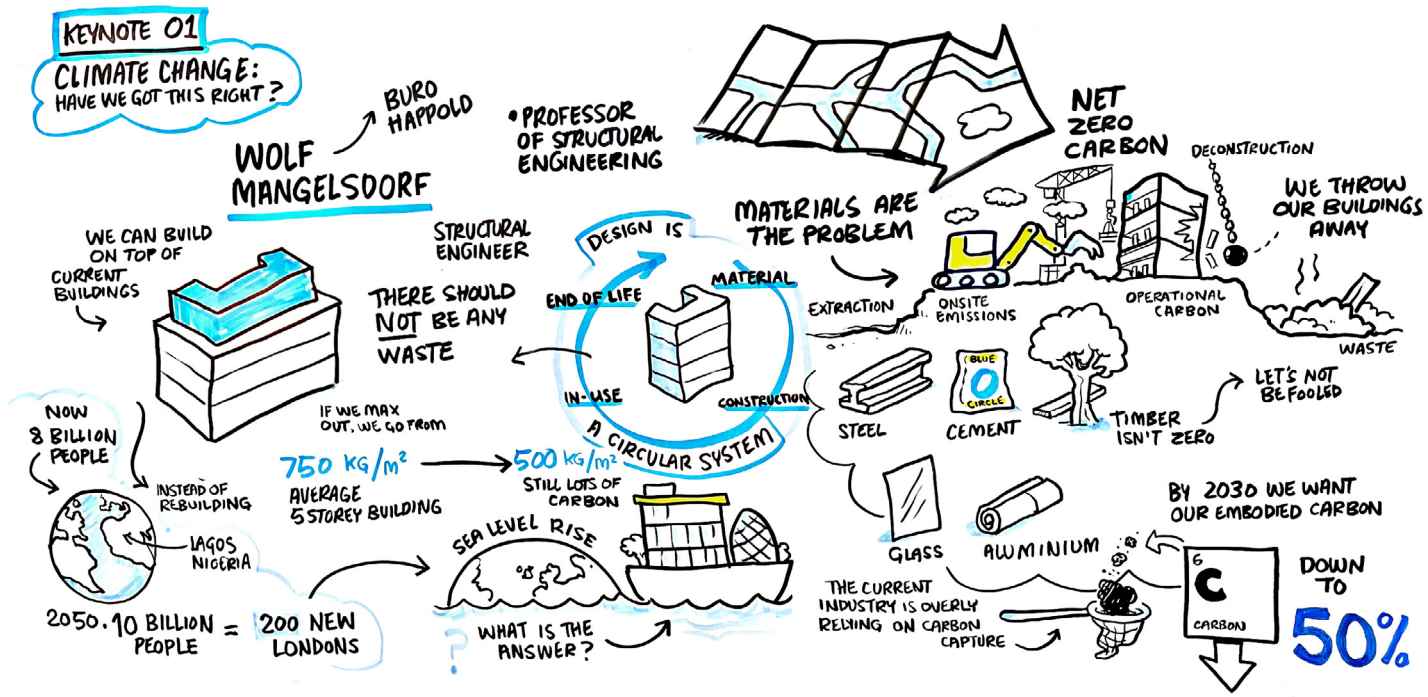
Keynote Presentations



After a short icebreaker, the workshop featured four keynote speakers, each of whom shared how nature guides their work and their thinking on the built environment.

Climate Change: Have We Got This Right?

Wolf Mangelsdorf, Buro Happold



Wolf outlined the ambitious sustainability targets set by Buro Happold as they aim for net zero and a 50% reduction in embodied carbon intensity by 2030.

Materials significantly contribute to emissions throughout their life cycles, from their extraction to disposal.

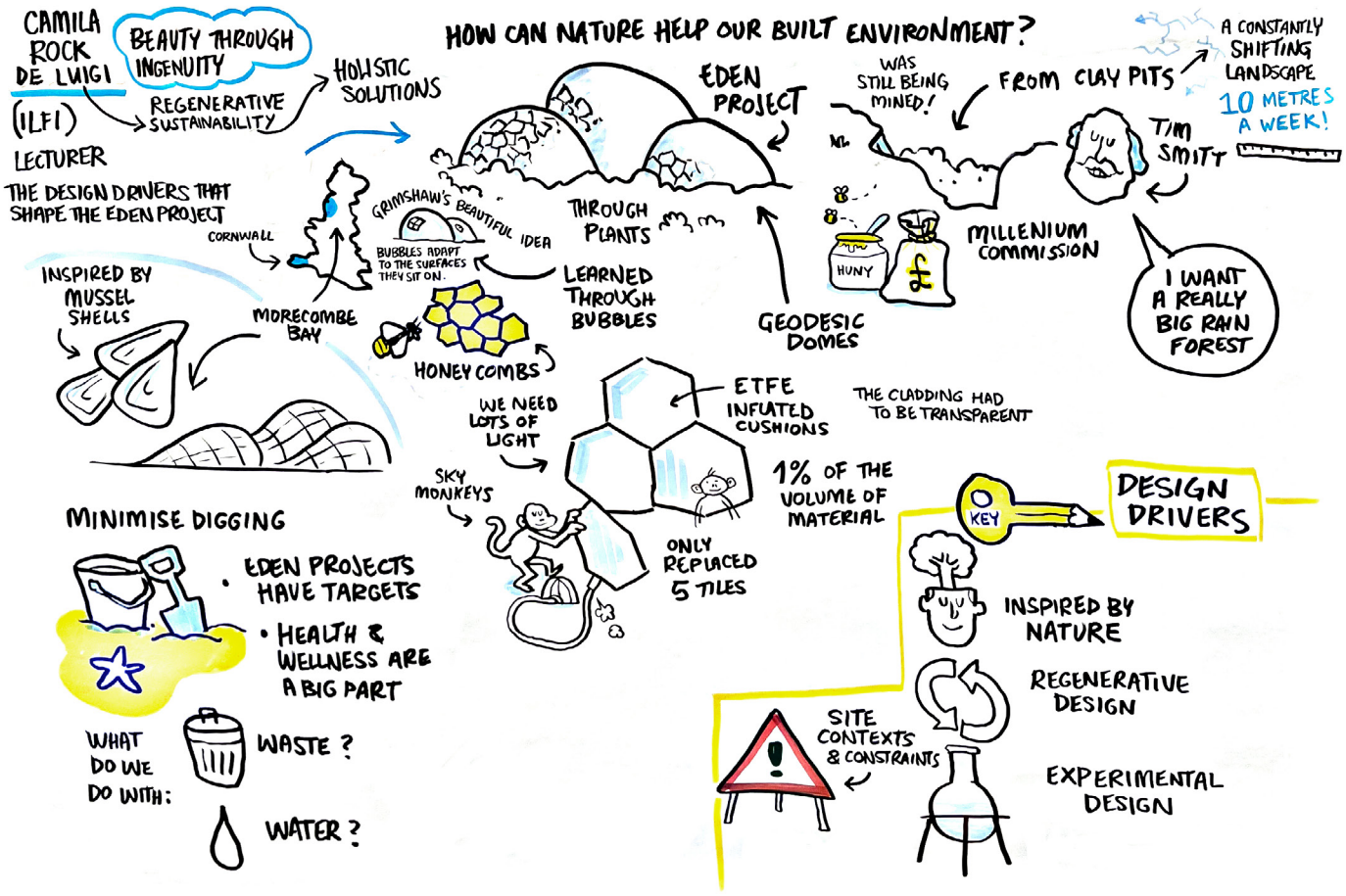
"Research has to happen at the material level."

With the global population projected to reach nearly 10 billion by 2050, we'll need to construct approximately 200 'new Londons' over the next few decades.

The need for climate-resilient architecture is clear, but must we really stick to the tired formula of concrete draped in greenery? Or can we produce more creative, boundary-pushing approaches?

Beauty through Ingenuity: Learning from Nature to Shape Our Built Environment

Camila Rock De Luigi, Grimshaw Architects



Camila shared elegant examples of how nature's designs informed the Eden Project in Cornwall and Morecambe.

She recounted the initial challenges faced during the Eden Project Cornwall's design in 1998, particularly securing funding while the clay pit site was still being mined.

> *"It was a chicken and egg situation."*

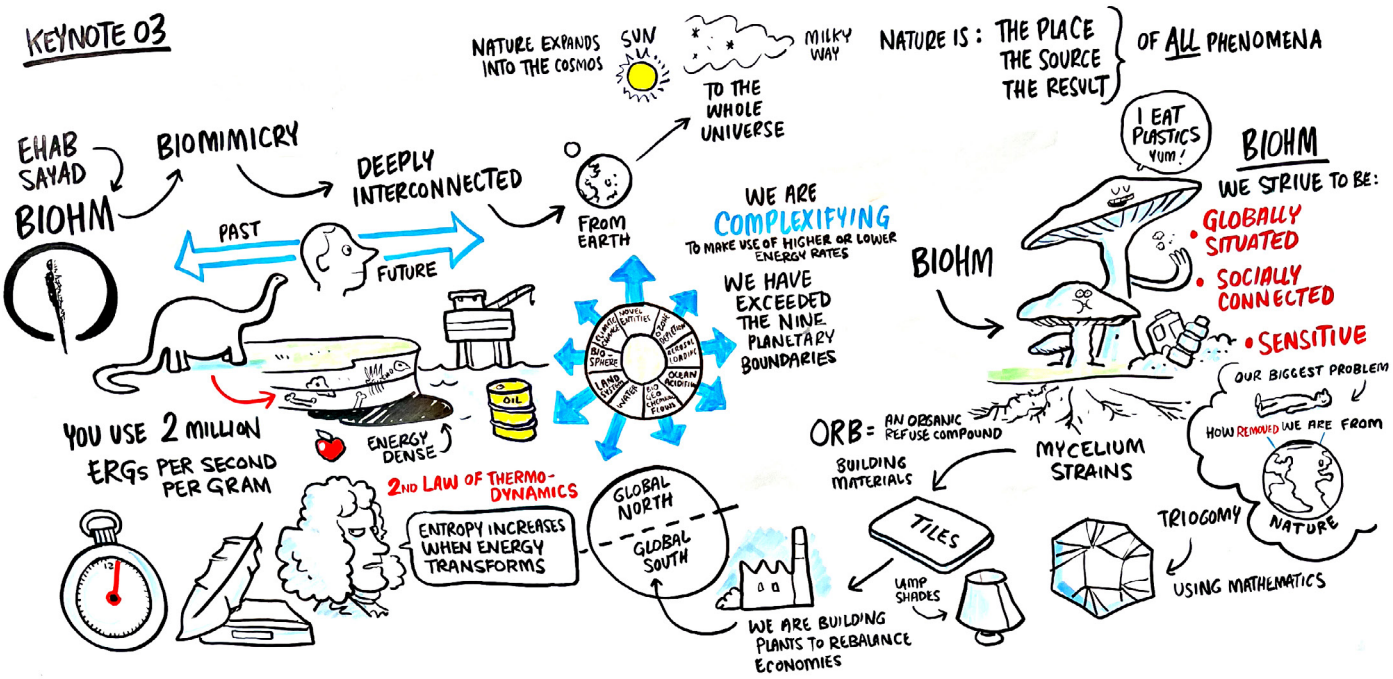
They studied soap bubbles, which naturally conform to the surfaces they settle on, regardless of their shape. This led to the creation of the 'lean-to' Biome structures that adjust to an ever-changing landscape.

The project also drew on geodesic forms found in honeycombs. To enhance transparency and light, they used inflated cushions made from lightweight, high-strength polymer. While admittedly plastic, this material allowed for air-filled pillows, minimising the use of steel.

The key design drivers were inspiration from nature, regenerative practices, experimental approaches, and an understanding of site contexts and constraints.

Forging a Biomimetic Future

Ehab Sayed, BIOHM



With some big-picture thinking, Ehab urged us to rethink our relationship with nature on a grand scale.

Observing nature's evolution reveals how it adapts to varying energy rates, with systems complexifying to resolve problems, continually embodying a higher level of intelligence.

> *"We choose what we adapt to."*

Consequently, humans are maladapted to natural systems, having become overly attuned to cultural systems instead. We create things detached from the systems around us.

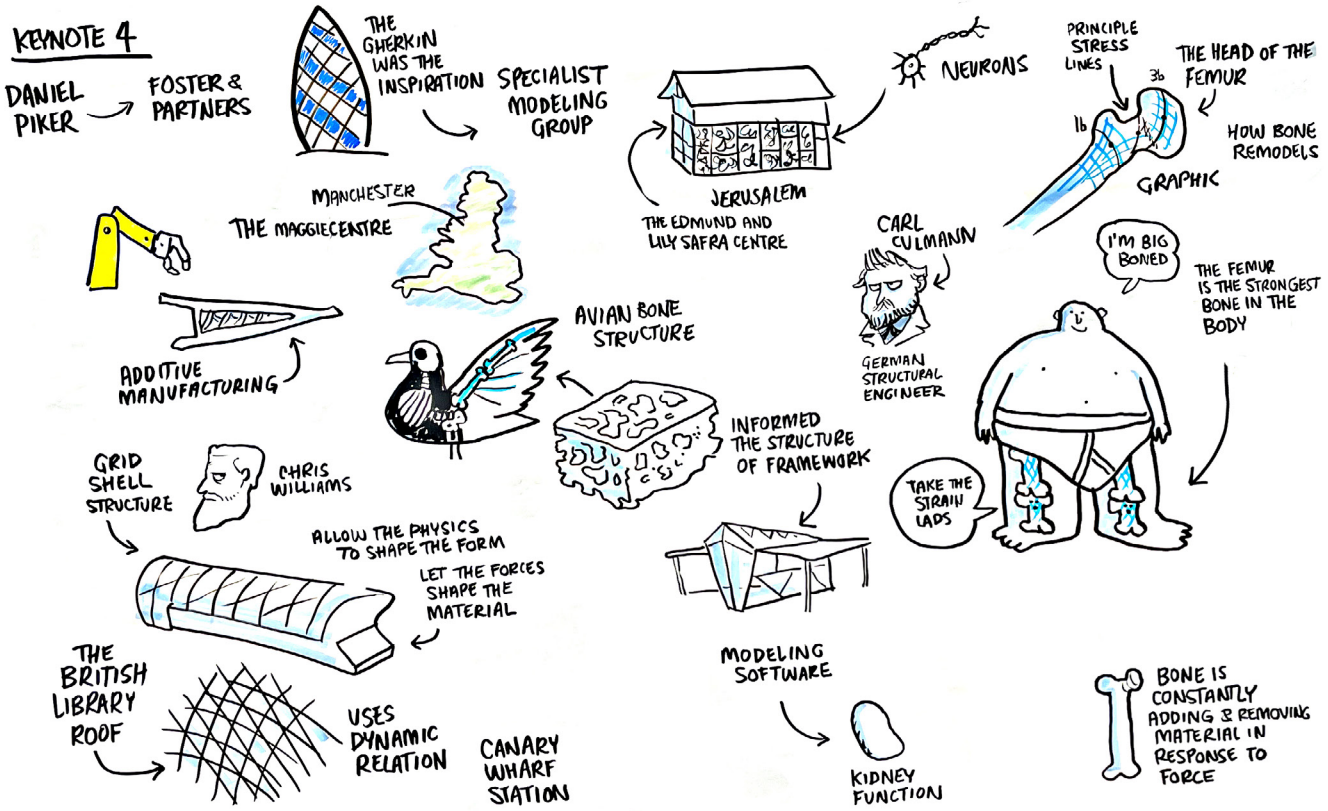
> *"Our problems are the ripples of the society we have built."*

At BIOHM, Ehab explained, the focus is on solutions that are globally situated, socially connected, and sensitive to the cybernetics and energetics of their environments. He shared innovative examples of their work, including targeting toxins by passing waste through a series of cocktails and selling the byproducts as additives.

Concluding, Ehab noted the core issue: our biggest challenge lies in how removed we've become from natural systems in our decision-making. We need to be biomimetic in how we think about problems.

Structural Modelling and Biomimicry

Daniel Piker, Foster and Partners



Daniel delved into structural modelling, showing how nature can guide innovative design. He began with the striking example of the Safra Brain Research Center in Jerusalem, complete with intricate reproductions of 19th-century medical illustrations.

As he explained, bones are perfect models for efficient design—they constantly adapt, adding or removing material based on stress; bones embody the ‘waste not, want not’ philosophy. Daniel highlighted the pioneering work of engineer Karl Cullmann, inspired by the femur for his crane designs. Cullmann studied principal stress lines—trajectories of internal forces—which reveal how bones efficiently support off-centre loads, offering clues for optimal structural topology.

At Foster and Partners, these principles were applied when designing Maggie’s Centre in Manchester to create an efficient lattice structure.

Daniel also touched on a collaboration with the European Space Agency, where they developed a weight-bearing dome for lunar bases inspired by lightweight bird bones.

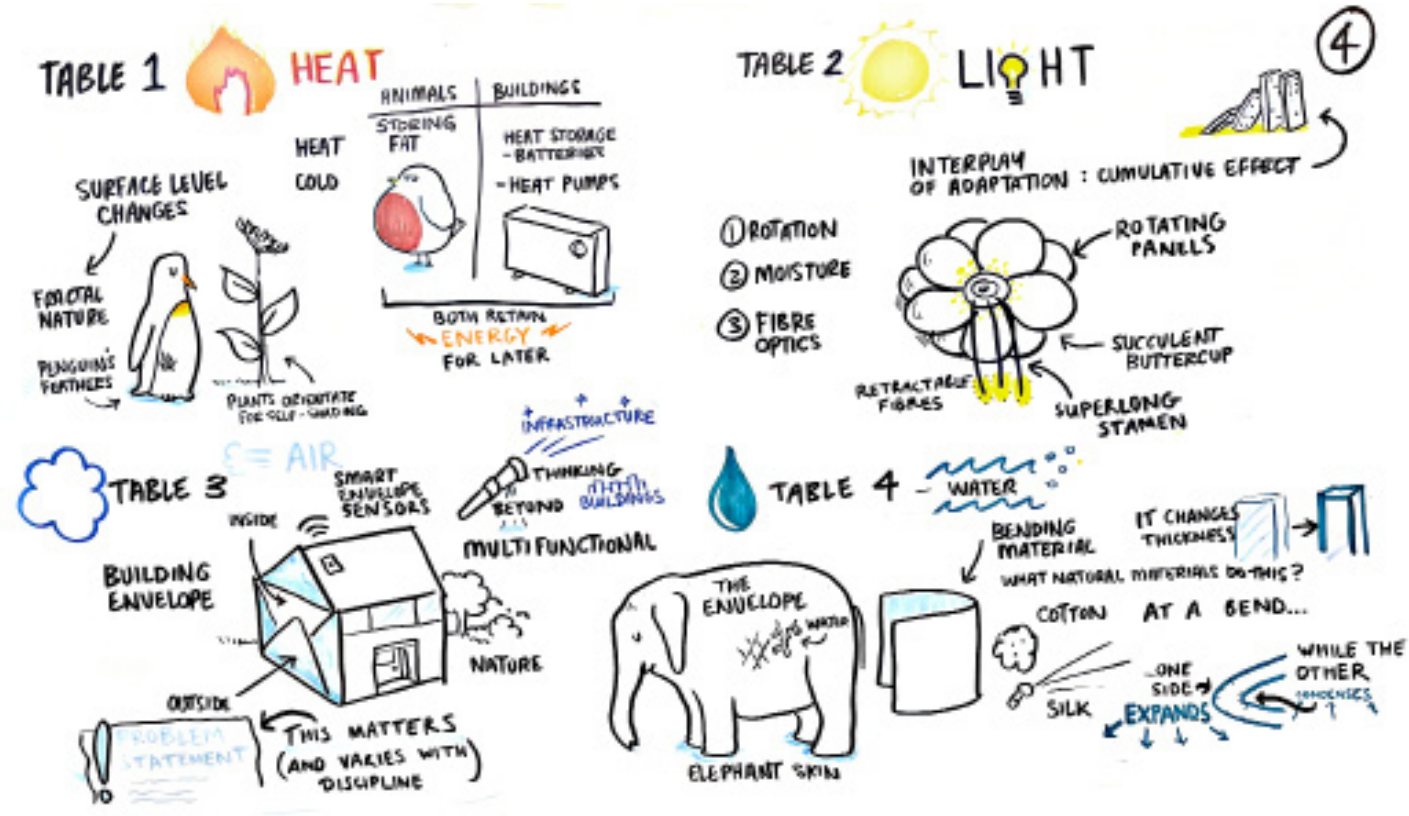
Workshops: A 3-Step Innovation Process

Dr Lidia Badarnah, UWE and Abigail Hird, Defankle Innovation

After the keynotes, it was time to move from dissemination to the innovation and collaboration part of the day, led by facilitator Abigail Hird.

Step 1: Principles and Concepts

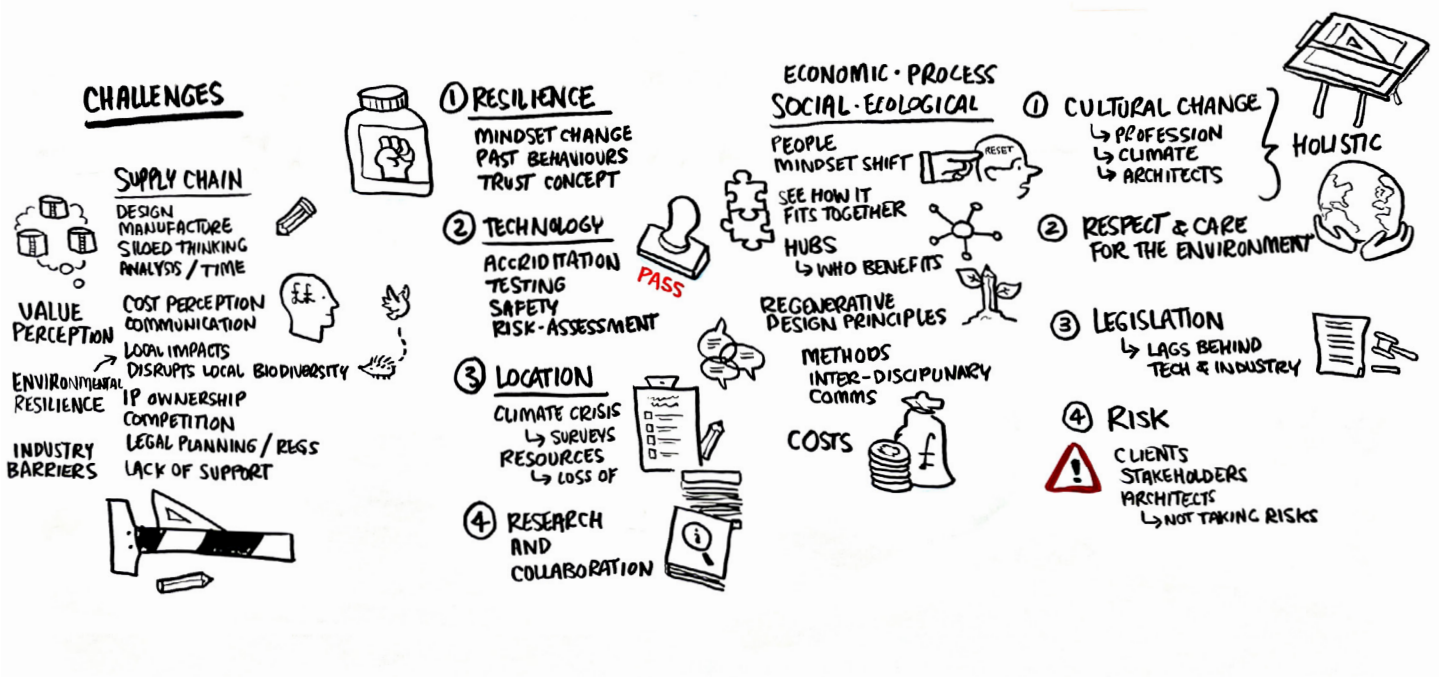
First, participants engaged in a brainstorming session, using the 'Rapid 8s' technique. Attendees generated eight design ideas. They then selected their favourite and developed eight variations before collaborating to create a 'mega concept.'



- One group considered adaptations to light, proposing a buttercup-inspired design featuring a superlong stamen with retractable fibres.
- Another group suggested heat pumps that capture solar energy for later use, inspired by plants' self-shading strategies and animal energy storage.
- A third group focused on water. They explored facades that change thickness and clarity, proposing a folding mechanism using fabrics like silk or cotton to create dynamic surfaces.
- Lastly, the group examining air thought beyond the building scale, discussing smart envelope sensors for infrastructure that interact with people and the environment.

Step 2: Challenges and Barriers

Next, participants examined the root challenges and barriers to realising their top ideas. What is likely to hinder biomimicry projects?



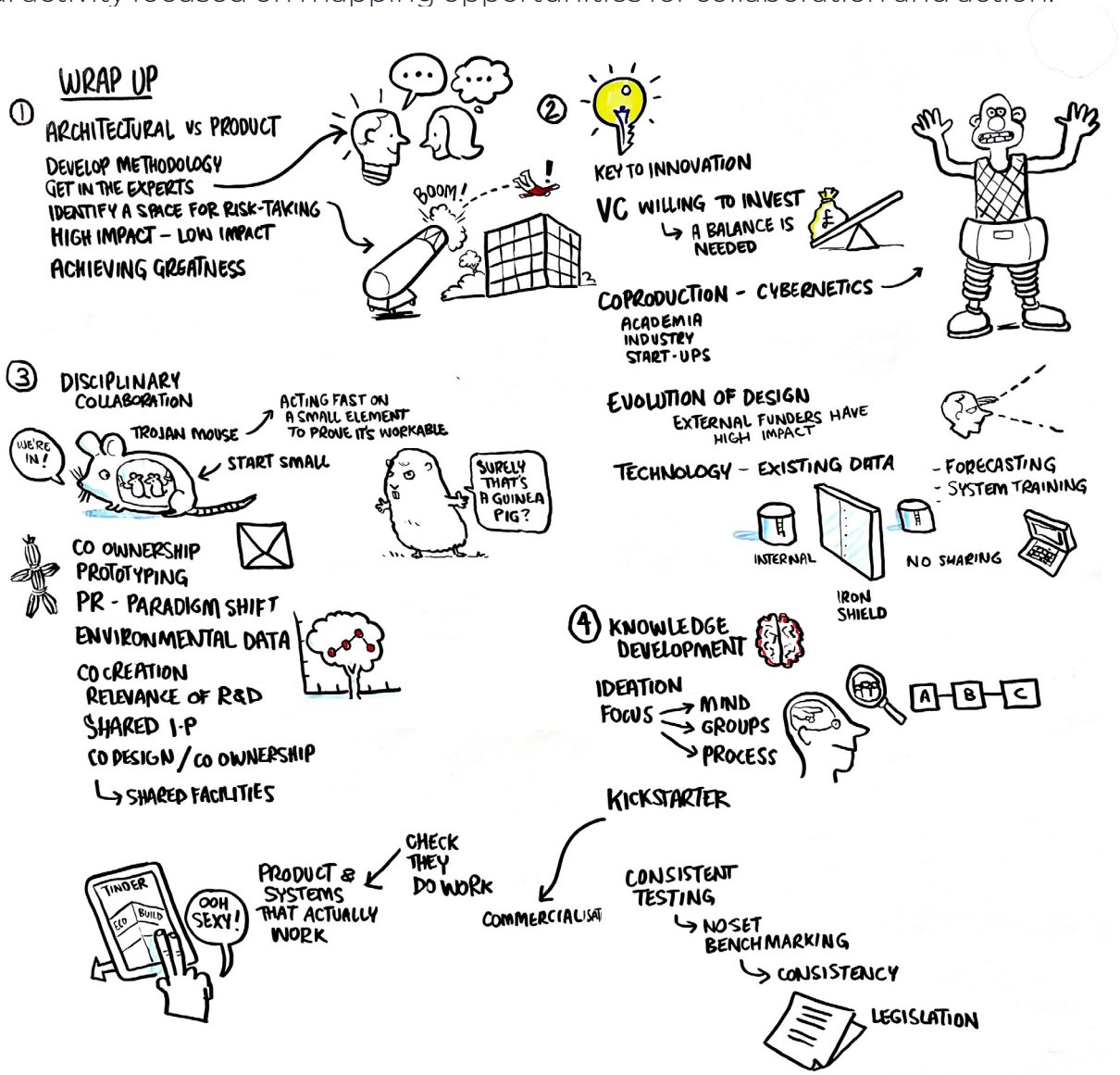
- Supply chain challenges emerged as significant obstacles, particularly regarding siloed operations in construction.
- Value perception was another crucial issue, with resistance to change.
- Environmental considerations took centre stage, emphasising the need to prioritise local biodiversity.
- Discussions highlighted systemic barriers, including intellectual property ownership and regulatory constraints, which impede progress.
- Lastly, there is a pressing need to build trust in technology through rigorous accreditation and risk assessments.

"Legislation lags behind advancement."

The group workshops

Step 3: Mapping and Opportunities

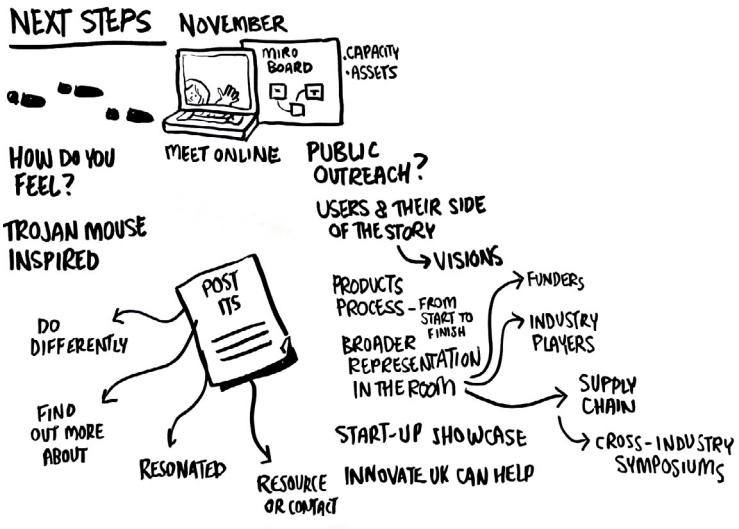
The final activity focused on mapping opportunities for collaboration and action.



- Participants called for a safe space where risky ideas could be explored. A favoured concept was the “Trojan mouse” approach, which encourages acting quickly on a small element to demonstrate feasibility.
- There’s an opportunity to create clear methodology and practical guidance.
- Participants recognised that new contracts and ownership models might be necessary to alleviate risks.
- Discussion also mentioned collaborating with academia, industry, startups, and facilitators.
  - An intriguing idea emerged for a Tinder-like platform to connect academics with industry needs.
  - Participants agreed that debate will be needed, ensuring that values such as care, respect, and empathy remain at the forefront.

“We need to debate, but who do we bring in and when?”

Conclusion: What Next?



The engagement and passion demonstrated by participants exceeded expectations, marking the workshop as a resounding success.

The next step will be online in November 2024, where the focus will be on transforming ideas into tangible actions and possibly opening doors to opportunities like the Curiosity Award or a future symposium. This collaboration is poised to embark on an exciting journey toward a nature-inspired future.

Dr. Lidia Badarnah organised this workshop and secured its funding, supported by a dedicated team from the University of the West of England; a big thank you goes to Sigita Žīgure, Sophie Laggan, Sara Jalali, Fatemeh Zare, and Rebecca Lashley. Special thanks are also due to Abigail Hird from Defankle Innovation for her expert facilitation, and our funders, AHRC-IAA, for supporting this initiative.

Some of the team with the captured illustrations

Captured by We Are Cognitive: A Visual Thinking Agency

We Are Cognitive are a creative agency known for our pioneering work in explainer videos and simplifying complex ideas. We love transforming complicated concepts into simple visual narratives through storytelling, illustration, and animation.

It was a pleasure to be involved in this pioneering, idea-sparking workshop and learn about biomimicry in the built environment. Using Scribing and Visual Capture, we synthesised the key ideas and conversations, creating a visual record of the day as it unfolded. Scribing strives to make abstract concepts more tangible, aid memory retention, and foster greater understanding and collaboration among participants.

We hope these colourful visuals capture the essence of the day and help keep the valuable learnings alive as this partnership flourishes into the future.

Find out more: www.wearecognitive.com

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