07 Terra Colonies: Executing Nature's Versatality

Interview with: Mohnish Siripurapu

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Abstract: The interview explores the integration of biomimicry in architecture, emphasizing nature as a guide for sustainable design. It discusses the role of terracotta in passive cooling, highlighting its hydrophilic and thermal properties as a natural alternative to mechanical cooling systems. The conversation underscores the importance of interdisciplinary collaboration, merging science, technology, and craftsmanship to translate natural efficiency into functional design. Challenges such as cost perception, scalability, and aligning natural principles with human-made materials are addressed. The discussion also reflects on the impact of digital tools, parametric design, and the evolving role of architects in creating sustainable, human-centric spaces.

Survival is a gifted skill all the species on the planet possess. Cacti, for example, is built to survive in the deserts. Drawing inspiration from the cactus, a symbol of remarkable resilience, "cooling cacti"- a cactus with terracotta instead of thorns was designed by Ant Studio, an architectural firm based in Noida, New Delhi. "Like a cactus that thrives in harsh desert conditions, our installation embodies the marriage of art and sustainability. The "cooling cacti" aims to ring the bell of Climate Change, while at the same time suggesting that the solution is rooted in our traditional systems". This installation uses the phenomenon of direct evaporative cooling to lower the temperature of the surrounding air. Water is poured over the terracotta tiles, arranged in a cactus-like shape, soaked by the porous and hydrophilic material. The water then evaporates from the surface of the tiles, taking away the latent heat and creating a cooling effect. The surface temperature is also reduced, enhancing the cooling performance.

Nature: in its complexity, in equilibrium :

Nature comes in its complex shape and form. Forms in nature are self-sufficient and stable. Larger part of these nature inspired designs comes with analysing these natural systems and integrating the principles into designs. The studio quotes- "when you notice the natural environment, you would realise that everything is linked with each other, and it is all working in a seemingly perfect balance and harmony. And yet, nothing really is perfect in nature; it's raw and inorganic. The same is true with integrating natural systems in design: it is about understanding and trying to achieve balance, while at the same time leaving room for imperfection to thrive".

Nature, along with its vast source of design inspirations and ideas, is a library of versatile materials. As nature is in equilibrium, the materials possess qualities such as unmatched strength, adaptability and embodies the ability to withstand stress and recovery. Ant studio has been particularly fascinated with terracotta. It comes from earth and is available in abundance. The designer explains- "as

per functionality, terracotta's hydrophilic nature helps manage moisture effectively, while its low emissivity ensures optimal thermal performance. Beyond functionality, it aligns with our biophilic philosophy, connecting spaces to nature. Its vast availability makes it sustainable, while its earthy aesthetics blend seamlessly into the environments we design. In every way, terracotta is a collaborator in bringing vision to life.

Sustainability, the rising need for all of us to think of every choice and the impact on society, environment and the future generators to come; it becomes extremely important to have certain ethical considerations and choices. The designer quotes- "in our projects, we ensure that every decision - whether about materials, processes or impact - is thoughtful. Locally sourced, renewable materials like terracotta reduce environmental impact and even have the potential to support local communities. Energy - efficient systems and passive design strategies help lower operational footprints, while careful site planning minimises disruptions to natural ecosystems. Sustainability is about balancing environmental, social and ethical considerations."

Design thinking: a rendezvous with trust

Design, just like other fields, intersects with ideas and theories of various fields and expertise. The larger umbrella of nature inspired designs, requires thorough, comprehensive and detailed research. This might not always be restricted to the fields in designs but often extend to various disciplines. Here comes the crucial role of the interdisciplinary collaborations and how they play a vital role in the successful implementation of such designs. To this, Ant studio quotes - "biomimicry in design sits at the intersection of nature, science, and technology, requiring insights from diverse fields. By working with diverse disciplines such as engineers, artisans, and energy consultants, we ensure every aspect of the project - from form to functionality - is well-rounded. Engineering helps translate natural principles into structural solutions, artisans bring craftsmanship aligning with our vision, while energy analysis guides the overall design to help us make informed decisions backed by data. This blend of expertise fosters innovation, solves challenges and ensures that biomimetic principles are effectively implemented." The designer, having worked in the engineering world, says that - "by binding biophilia with culling- edge technology, we are able to leverage natural processes such as shading and ventilation and mimic ones like evapotranspiration. Each design undergoes multiple iterations, balancing the artistry of nature with the precision of engineering."

Design is an extensive process. From design inspirations and ideas, to translation and fulfilling the client's requirements, design undergoes lots of changes and the designers deal with multi-faceted challenges. When it comes to nature inspired designs, the designer shares key challenges faced. He says - "one perpetual challenge we face is shifting the perspective from cost to value when discussing various ideas in a project. Often, the financial aspect overshadows discussions, with potential customers viewing it as an expense rather than an investment. Our approach has been to emphasise the long-term impact of various elements and strategies we propose, helping stakeholders see the bigger picture. For instance, we recently worked with a client sceptical about the initial investment in sustainable energy solutions. By presenting a detailed ROI (Return on Investment) analysis, including reduced energy costs and enhanced operational performance, we demonstrated how their upfront expenditure would translate into measurable gains. This expenditure reaffirmed the importance of transparent communication and data-backed insights in earning trust and building lasting relationships." He also mentioned challenges of aligning natural efficiency with human-made materials, and scaling solutions. The team approaches these hurdles through hands-on workflows and interdisciplinary brainstorming, where in every obstacle becomes an opportunity to innovate.

A future in precision: algorithmic manipulations for innovation

This age marks the beginning of the digital era. With advancement of digital tools and softwares aiding designs, the approach to nature inspired designs and parametric design are altered and influenced by them. The designer's approach to this comes from experience weighing both the pros and cons of the interventions of the digital tools. He says - "even the simplest natural processes often have hidden complexities that can be challenging to resolve manually. Addressing these issues would demand significant time and effort, often involving repetitive tasks. Digital tools and software streamline this process, automating repetitive tasks and enabling us to focus on refining designs. Parametric modelling tools allow us to replicate intricate natural patterns with precision, while simulation software evaluates performance metrics like airflow or thermal efficiency. This efficiency not only saves time but also enhances the overall design process, resulting in more refined and effective outcomes".

Design has consequences. it impacts how society grows and adapts to changes for years ahead. Nature inspired designs play a vital role

in shaping that future. When asked to comment on the pedagogical aspects of this discipline, the designer quotes - "The future of architecture lies in blending technology with ecological and human-centric principles. Biomimicry inspires sustainable, adaptive designs by emulating natures' strategies, while parametric design expands possibilities with precision and complexity. However, these tools enhance creativity but cannot replace the architect's role in shaping spaces with cultural sensitivity, institution, and meaning. Architectural education must adapt, balancing technical proficiency with critical thinking and contextual understanding. Ultimately, architecture must remain a human endeavour. While technology drives innovation, the architect's role in addressing emotional and cultural needs ensures spaces resonate on a deeper level. By combining technological advancements with empathy and sustainability, the discipline can shape a future where architecture is both innovative and profoundly human".

The Protagonist, after nature

Architect Mohnish Siripurapu, the founder of the studio advises young learners and architects to observe nature closely. He says it is the ultimate design manual, which offers solutions perfected over billions of years, and yet they keep evolving. From the self-cooling mechanisms of termite mounds to the structural efficiency of a honeycomb, every natural system holds a lesson in resilience efficiency and adaptability. Take time to study ecosystems, materials and processes to uncover the underlying principles that make these systems thrive. He also suggests that at the same time, it should be helpful if we master digital tools early. Parametric design software like rhino and grasshopper allow us to translate the complexity of nature into scalable, functional designs with precision. These tools enable iterative workflows, where we can tweak and test designs efficiently, avoiding the manual repetition that can stifle creativity. Simulation software helps predict performance metrics such as energy efficiency, structural stability and acoustic behaviour, ensuring our biomimetic concepts work seamlessly in real - world conditions. Ultimately, digital tools don't just simplify the process, they amplify our capacity to innovate.

Personal journey and experiences play a vital role in shaping how a designer approaches various ideas and processes. Role models, buildings and incidents shape the way we think and have a great influence on our design decisions. Similar is with "The Dumbledore" of Ant studio: Mohnish Siripurapu.

When Monish began his practice, he envisioned it as a space for unrestrained experimentation—beyond the boundaries of architecture alone. From a young age, his aptitude for math and coding set the foundation for his analytical approach, and during his bachelor's studies, he was captivated by the innovative forms emerging in the West. For him, architecture became a means to push the boundaries of imagination and craft transformative spaces. In his initial years, form-finding was at the core of his work. He relished exploring spatial experiences and challenging conventional design norms, treating architecture as a mathematical and computational puzzle. One of the first masters to profoundly influence him was Santiago Calatrava, whose work he found poetic. He admired the harmony of sculptural forms, structural ingenuity, and movement in Calatrava's projects, which resonated deeply with his architectural pursuits. His understanding of architecture expanded further with Antonio Gaudi's work. Gaudi's unique approach profoundly impacted Monish, reshaping his understanding of organic forms and the seamless integration of nature into architecture.

In 2015, he pursued a postgraduate diploma in Spain, immersing himself in the land that nurtured both Gaudi and Calatrava. This experience allowed him to explore their projects firsthand, solidifying their influence on his evolving design philosophy. Geoffrey Bawa became another defining figure in his journey. During a transformative trip to Sri Lanka, he experienced Bawa's projects, which masterfully brought nature into built environments and celebrated unbuilt spaces. The harmony of architecture and landscape, along with the beauty of in-between spaces, deeply resonated with him and reshaped his perspective on design. For Monish, Calatrava, Gaudi, and Bawa represent three architects from different generations who redefined architecture through their distinct interpretations of nature. They taught him to see beyond forms, appreciate the value of the unbuilt, and find meaning in the spaces that exist in between. These lessons continue to inspire his work, blending imagination, structure, and nature in pursuit of extraordinary architectural experiences.

Mohnish Siripurapu

Monish Siripurapu is an Architect and 'Antrepreneur', founder of Ant Studio, an innovative architectural practice dwelling in the intersection of Art, Nature and Technology, part of AD100 2024 and carving its name with experiments in the field of sustainability and computational design technology. He is also the founder of CoolAnt, a sustainability think tank innovating Climate-Responsive Building Envelopes through nature-based energy efficient cooling solutions.

CoolAnt has received national and international recognition for its work. The startup's pitch was recently aired on season 3 of Shark Tank India. Their low-carbon cooling systems have won them the National Energy Efficiency Innovation Award (NEEIA), by the Bureau of Energy Efficiency (BEE), felicitated by President Droupadi Murmu in 2023. CoolAnt has also won the Asia Pacific Low Carbon Footprint Challenge, the Clean Energy Challenge by 'What Design Can Do', and was funded by the UN Environment Programme (UNEP).

Monish is a TEDx speaker and has also presented his work at the TMK knowledge forum at the G20 summit at Bali, Science Museum London, Google's Anthropocene, UCL Bartlett, CEDIM Mexico, IAAC Barcelona, Construction symposium Ekaterinburg in Russia etc. amongst others. His team has presented their Research in conferences like UIA Copenhagen, CATE and ENERGISE. He was a keynote speaker at the World Environment Day New Delhi, 2018 and has also lectured and exhibited his work in various IIT's and IIM's in the country. His works have been published across well renowned platforms such as History Channel, CNN, World Economic Forum, Architectural Digest, Inhabitat, and ArchDaily.