

# **Ubiquitous Planting and Green Bricks: towards symbiotic, evolving spaces**

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First bloom, India, 2005

Marble Quarry, Italy, 1993

This is a moment of simultaneous attraction and repulsion. Every time a building gets created, a natural landscape is destroyed and a sterile signature left behind.

## **Proposal**

The research proposes the design of a green, intelligent, modular and structural 'brick' which has specific native plants or seeds *integrated* with it. The "plant tile or skin" would act like a "living brick" that could be integrated with the built form, thereby triggering diverse greens within a city. This would gradually transform the city's infrastructure into a productive, healthy, edible and playful fabric. Few crucial questions driving the research are: how can we learn from nature to design more resilient and responsive systems? How can we embed this 'brick' with living technologies to perform certain functions? Could every 'tile' be treated like an insulated green house which accumulates solar energy? Could the constituent material act like a nutrient? How would such a close and continuous spatial association with plants affect our outlook? Would it create a paradigm shift in our relationship? The thrust of this research and thereby this proposal is to use technology and advances in material science to explore the relation between architecture, ecology and computation by redefining our understanding of the quintessential building block: the brick.

## **Introduction**

Plants are the centre of the web of life. The growth of urban centres around the globe has had a critical impact on ecology. City dwellers have become increasingly disconnected and removed from the natural environment. In recent years there has been a growing interest and public movement to bring ecology out of the bush and into the urban and suburban environments where most people spend their time.

Some of the questions at the core of this research are:

- How can we effectively use technology to reconnect humans and ecology?
- How can we create pulsating, hygienic, life giving 'skins' around us and how can they improve our environment?
- How can we systematically address the challenges being faced by cities globally?

- As per recent statistics, 73 million humans are born every year. Can we give birth to 73 million plants? This proposal is the result of the author's ongoing research and interest in urban gardening and biomimetics. The search for integration has taken him from the Hortus Botanicus in Amsterdam through to the urban sprawl of New Delhi and finally to the rainforests of the Gurukula Botanical Sanctuary in south India. One of the most crucial insights of this journey has been that "growth" in cities is inevitable especially in developing countries. The momentum is such that instead of asking people to slow down, we must find ways in which we can contribute to this "growth" in a responsible way. An effective green shift, can happen at the market level through new product solutions, which respond to this. By 'integrating' plants, with a cities infrastructure we can create an enormous positive impact and shift the way architecture is perceived.

## Growth

Infrastructure would classify as a key "growth" symbol within a city. The intent of this research is to create a *green tipping point* through the design and practical use of green "bricks", thereby creating ubiquitous green clusters within a city. The vision goes beyond manicured lawns, horticultural imports, bonsai's and golf parks. The proposal strives to bring back native plants at the core of our daily life by integrating them with the built form and other symbols of 'growth' within a city.



Illustration A- Green Brick  
The illustration above is not representative of the final product

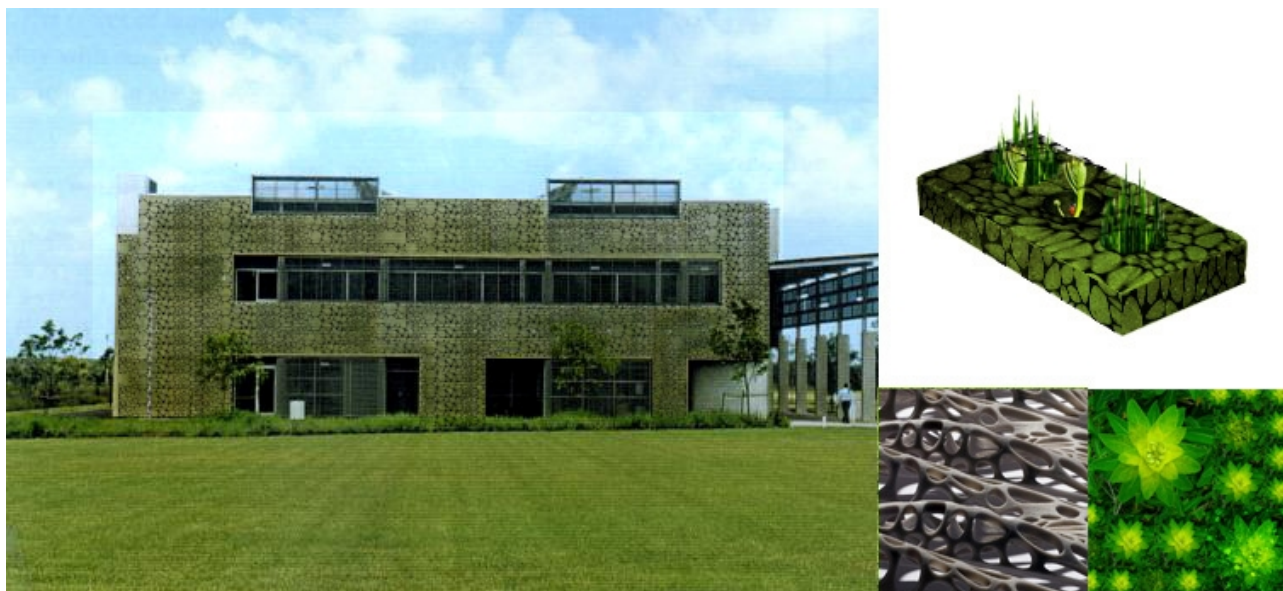


Illustration B- Green Brick  
The illustration above is not representative of the final product

People could buy the 'green brick' off the shelf and use it as a substitute for conventional bricks or concrete blocks. This could be integrated with curtain walls, acoustic panels or glass blocks and become an integral part of the building structure. Over time, cities would be associated with the plants they give life to. Barren walls, commonly seen in cities today, would turn into fertile green communities.

The choice of plants could be adapted to address pressing challenges within a city:

- The bricks could become a source of nutrition, vitamins and herbal medicine (Leucus aspera cures bronchitis and asthma, Lia Indica cures ulcers, amaranthus is used by dentists). Each home could become an independent seed bank, a space for abundant biological exploration and a living, evolving

bio-archive.

- The integral plants could pre-date on pests and act as repellents for termites (Lantana is a pest repellent)
- They could create a green cushion which would act as an acoustic buffer apart from generating fragrance to counter foul smell which is common in numerous Indian cities (e.g. We could integrate epiphyllum oxypetalum, commonly known as 'queen of the night' with the tile)
- They could act also as green filters creating healthy micro climates in urban realms
- Reducing the urban heat island effect with these bricks is another possibility.

Numerous other benefits could result from such integration. The specific choice of these plants would create new urban identities. The process could strive to fuse local variables with global aspects of construction and need for structural performance. Local nurseries and gardeners could play a crucial role along with input from established botanical resources. The final product solution could draw from the intrinsic qualities of natural structures and result in a series of systemic solutions suitable for different regions and climates. This would be an opportunity to explore and possibly redefine the idea of a single unit or building block.

There are many threads worth exploring. For example: How would the mental construct of an inert 'brick' change with the integration of a life form? Would this integral approach be visible and tangible to the naked eye? What would be the most efficient and appropriate form and material? Can it be inspired by an abalone shell? Or could it be in the form of a sphere or a wafer ! What would the texture feel like? Would the surface texture collect water from early morning fog similar to the hydrophilic bumps on the tenebrionid desert beetles in Namib desert or would it be inspired by the directional corrugations on shark skin? What would constitute its parts and what would be the whole ? Could we use a cradle to cradle approach by reusing industrial waste as the material or creating an organic composite which supplies nutrients to the plant? Can we fuse fabrics and metals using shape deposition manufacturing(SDM) technique to create a material which is both structure and facade? Would it evolve such that the plant develops an internal self-regulation method? Would this become a precise craft or still hold the uncertainties of living forms? How can we design and build a platform for 'growth'? How can it be based on an inclusive, symbiotic model? Would it be an envelope or a skin supplying nutrition to the embedded plant? Would it resemble a lattice or a live tissue! Could it become a breeding ground for more life forms and increase biodiversity? How would it incorporate the growth of roots and branches? Would every single unit turn into a possible nest? Or would every element be treated like a small insulated green house which accumulates sun's energy? How would such a close and continuous spatial association with an emergent growth behaviour affect our outlook? Would we understand and respect other life forms better?

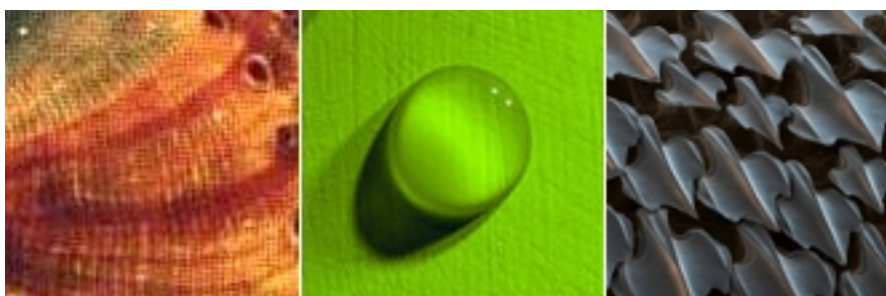


Illustration C - Textures inspired by abalone shell, lotus leaves and shark skin  
The illustration above is not representative of the final texture



Illustration D - Green Brick inspired by seed balling  
The illustration above is not representative of the final product

With the knowledge that diversity and resilience has been crucial for human evolution, would this process lead to a more synthesized urban community? Will it lead to a new language of design hybrids which balance static elements within a dynamic composition? Would these skins become crucial ingredients of built forms which grow and transform? Could this change the way we perceive architecture today, making it fluid, unbound and constantly evolving: a new language for spatial semantics? Could we learn aspects of integration and emergent behaviour from indigenous vernacular construction methods! Would this green approach further inform and transform other mass produced objects? Could the skins of cars, trains, ships and planes have embedded greens to neutralise their impact on the environment? Could evolutionary computation and new manufacturing technologies simulate such ecosystems for us to 'see' and 'play'? These are just some of the threads worth exploring in this project.

### **A Green Hope**

The message here is of an integral, symbiotic and technology driven vision which creates a practical design for the future. The author hopes to explore further and develop this product in the form of interdisciplinary research which draws upon the fields of biomimetics, smart materials and evolving responsive environments under the larger purview of architecture, computation and ecology.

### REFERENCES:

- Thompson, D. (2000). *On Growth and Form*. Cambridge, United Kingdom. Press Syndicate Of The University Of Cambridge.
- Wigginton, M., Harris, J. (2002). *Intelligent Skins*. Woburn, MA. Reed Educational and Professional Publishing Ltd.
- Holmgren, D. (2002). *Permaculture - Principles and Pathways Beyond Sustainability*. Australia: Holmgren Design Services.
- Haeckel, E. (2005). *Art Forms from the Ocean*. Munich, Berlin, London, New York. Prestel.
- Mueller, T. (April, 2008). *Biomimetics - design by nature*. New York. National Geographic Publishing Group.
- Ferre, A., Hwang, I., Sakamoto, T., Tetas, A., Kubo, M., & Prat, R. *Verb Natures: Architectural Boogazine*. Actar's Boogazine.

### GLOSSARY:

1. **Permaculture:** Permaculture is a holistic design response to a world of declining energy and resource availability with emphasis on design processes drawn from nature. Through an integrated, interdependent, evolving, multidimensional and creative approach, it manifests itself as a system of gardening; as a worldwide network of individuals and groups, and as a sustainable culture.
2. **Heat Island Effect:** The term "heat island" refers to urban air and surface temperatures that are higher than nearby rural areas. Heat islands form as cities replace natural land cover with pavement, buildings, and other infrastructure. The effect is further increased in areas with tall buildings and narrow streets
3. **Seed Balling:** A simple and effective method for re-vegetation of degraded landscapes, particularly in semi arid areas using seed balls.