

Foreward: Input Output: Performative Materials.

By Philip Beesley

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PERFORMATIVE MATERIALS IN ARCHITECTURE AND DESIGN

RASHIDA NG
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Performative Materials in Architecture and Design

Edited by
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Foreword

[T]he cosmological point of reference for architecture has shifted from the human to the non-human: from the Vitruvian man, inscribed in a circle and a square as the guarantor of universal validity, to the tangled web of creatures and environments within which humanity lives a promiscuous life.

Detlef Mertins, 2010¹

Immanent, dynamic, and open: the qualities offered by the voices in this volume are marked by a striking optimism about the expanded powers of performance-based architecture. It could be argued that the 'responsive' functions and design tools of new architecture are fraught with critical problems. New generative and parametric design practices increasingly offer potent methods for manipulating the environment, reminding us of paroxysmic debates over eugenics and behavior programming in past decades. However, if the taboo of acknowledging the myriad mechanical natures of humanity seems to be relaxing, perhaps it is because these increased powers of manipulation also carry increased sensitivity in measuring the impacts of what we do and what we make. The voices in this book speak with confidence. Rather than a commanding center, the sensitive qualities spoken here imply a liminal, involved position within the natural world.

When the ancient Roman philosopher and poet Lucretius watched motes of dust quivering and darting within the sunbeams of his window, he saw atoms at play. Rolling and wavering, the dust spoke of decay and loss, and a vague, shaded shift of life arising—the semiquaver of living seeds. Lucretius followed earlier Greek thinkers in seeing life arising from the chaos-borne quickening of air, water, and stone. Oscillation is implicit in this way of seeing the world, an oscillation that constantly opens boundaries between the part and the whole.

Lucretius implied a kind of *contingent* life energy in his meditation: his motes of dust boil out into higher order forms that register in perception only for an instant before unfurling back out into dissolved surrounding space. Is it possible to inhabit this material state of flux between the figure and the ground? This ancient idea resonates with strands of generative 'bottom-up' thinking that has gained momentum in the early part of our new century. Can this kind of vital milieu be constructed, making a kind of fertile soil for new architecture?

It is tempting to draw parallels with a twentieth-century generation. When Buckminster Fuller proposed his 'operating panel for Spaceship Earth' beside the United Nations, he

envisioned networked global markets and enlightened individual human agency as a social and political fundament, while B. F. Skinner's brand of behaviorist psychology² attempted to engineer a complete society of happy, productive subjects. Perhaps most poignantly, Teilhard de Chardin³ projected a 'prodigious affinity' that would take on a global scale. Within the wide range of these sources a collective manifesto was implied, aspiring to the creation of high-performance architectures that emulated complex systems and positioned humankind as the ultimate arbiter of the built and natural environments.

If this preceding generation offers a fundamental conception of the world as a transcending, integrated whole, the voices now gathered seem to lead away from such unified visions. Phil Ayres, Martin Tamke and Mette Ramsgard Thomsen pose practical, concrete questions—"what are the protocols by which these designs can be understood, and into what scales of architectural production can they be turned?" Rashida Ng offers a key by evoking a shared ethical foundation for these projects. In her compelling introduction, she comments that the "evolution of these technologies ... foreshadows more deliberate and reciprocal relationships between materials and their proximate contexts ... [M]aterials do not simply exist within dynamic environments, but more accurately act as integral contributors to living ecological systems."

The component meshworks of some of these new conceptions seem deliberately weak and fragile, designed to share and shed their forces. Like the fine-grained intermeshed structures of a woven textile, systems gain resilience and strength by densely combining a diversity of elements. Temperature, human occupation, and environmental cycles all work directly on these sensitive components; the materials soak up that influence, distorting and transforming.

Kinds of performance described by these authors seem to move progressively closer to definitions of life. First we may see a receiving function, akin to the way a gauze veil might float around the person wearing it. In the same way that the draping function of a textile can be described as having a particular "hand," structural meshworks may float and move in response to their surroundings, flexing in reaction to physical contact with viewers and local movements of air. Next might be an active, mechanical response where components operate in kinetic patterns, suggesting a combination of electrically driven mechanisms and artificial intelligence. Martina Decker suggests that "smart materials might enable us to create a whole new generation of responsive architectures that were not possible before, an architecture akin to homeostasis in living organisms, wherein a complex system of control mechanisms reacts to local changes in the environment."

Indeed, chemically active building materials are now being conceived, supported by a new generation of material science that permits designers to access molecular structures. Surfaces addressed by electrical charges permit kinetic functions independent from the historical structures of gears and motors; fluid circulation systems operate by depositing delicate layers of material, building up felted skins that seemingly prefer reticulation and turn away from the minimum surface exposures of reductive crystal forms. These "performative" materials maximize interchange with the atmosphere and with their occupants.

They are not, after all, environments that readily increase human power and domain. Instead, one becomes aware of subtle impacts: air, moving around the body, perhaps charges in surrounding magnetic fields that one disturbs as they pass. Perhaps by offering material turbulence as a primary design quality, these works move away from seeking permanence and durability, instead celebrating their ephemerality. These strategies, seemingly rooted in an exquisitely deliberate weakness, increase the potency of this emerging architecture.

Philip Beesley

Notes

- 1 Mertins, Detlef, *Preface to Hylozoic Ground: Liminal Responsive Architectures*, Cambridge, Riverside Architectural Press, 2010.
- 2 Skinner, B.F., *Reflections on Behaviorism and Society*, Englewood Cliffs, New Jersey, Prentice-Hall, 1978.
- 3 deChardin, Teilhard. *Hymn of the Universe*, London, Harper and Row, 1965.



Hylozoic Ground is an immersive interactive environment exhibited at the Venice Biennale in 2010. Tens of thousands of lightweight digitally fabricated components were fitted with microprocessors and proximity sensors that react to human presence. This responsive environment (interwoven with chemistry) functions like a giant lung that breathes in and out around its occupants. (©PBAI, Photo: Pierre Charron)

Hylozoic Ground

2007–2012

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Hylozoic Ground is a collaborative hybrid artwork. The project's title refers to hylozoism, the ancient belief that all matter has life. The work features an interactive geotextile mesh that senses human occupants and responds with caressing and swallowing movement, in peristaltic waves within distributed fields of lightweight pores. The viewer enters beneath an animated canopy interspersed with a dense field of meshwork columns, populated by breathing pore elements and meshed proximity sensors that track occupant movements throughout the space. Filtering layers offer subtle qualities of hovering and gently vibrating fields, capturing the subtle air movements created by occupants.

Hylozoic Ground fuses textile-based sculpture, synthetic biology, and distributed interactive computing and mechanics. Throughout the environment, adjacent elements communicate with one another, spreading occupant signals in waves of emotive kinetic reactions. Processing for this system is based on Arduino—an open source platform that was designed to make tools for software-controlled interactivity accessible to nonspecialists. Several levels of distributed behavior are programmed into the sculpture in order to encourage a coordinated spatial behavior to emerge. Also embedded within the meshwork, engineered protocells are arranged in a series of flasks with a circulation system that helps maintain and regulate the environment. Chemicals within this artificial system are then able to capture carbon and build delicate miniature structural scaffolds.

A chief objective of *Hylozoic Ground* is to explore a new role for architectural environments by transforming portions of static buildings into dynamic responsive generative surfaces and equipping them with near-living “metabolic” (chemically active) functions. These living chemical exchanges are conceived as the first stages of self-renewing functions that might take root within this architecture. A parallel objective is to establish sensitive, renewed relationships for human occupants interconnected with their surrounding environment. A viewer's relationship with *Hylozoic Ground* is gentle. The work is an empathic organism that interacts and suggests the sensation of an architecture that might begin to know and care about its occupants.

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Project Collaborators: Hayley Isaacs, Martin Hanczyc, Pernilla Ohrstedt.

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