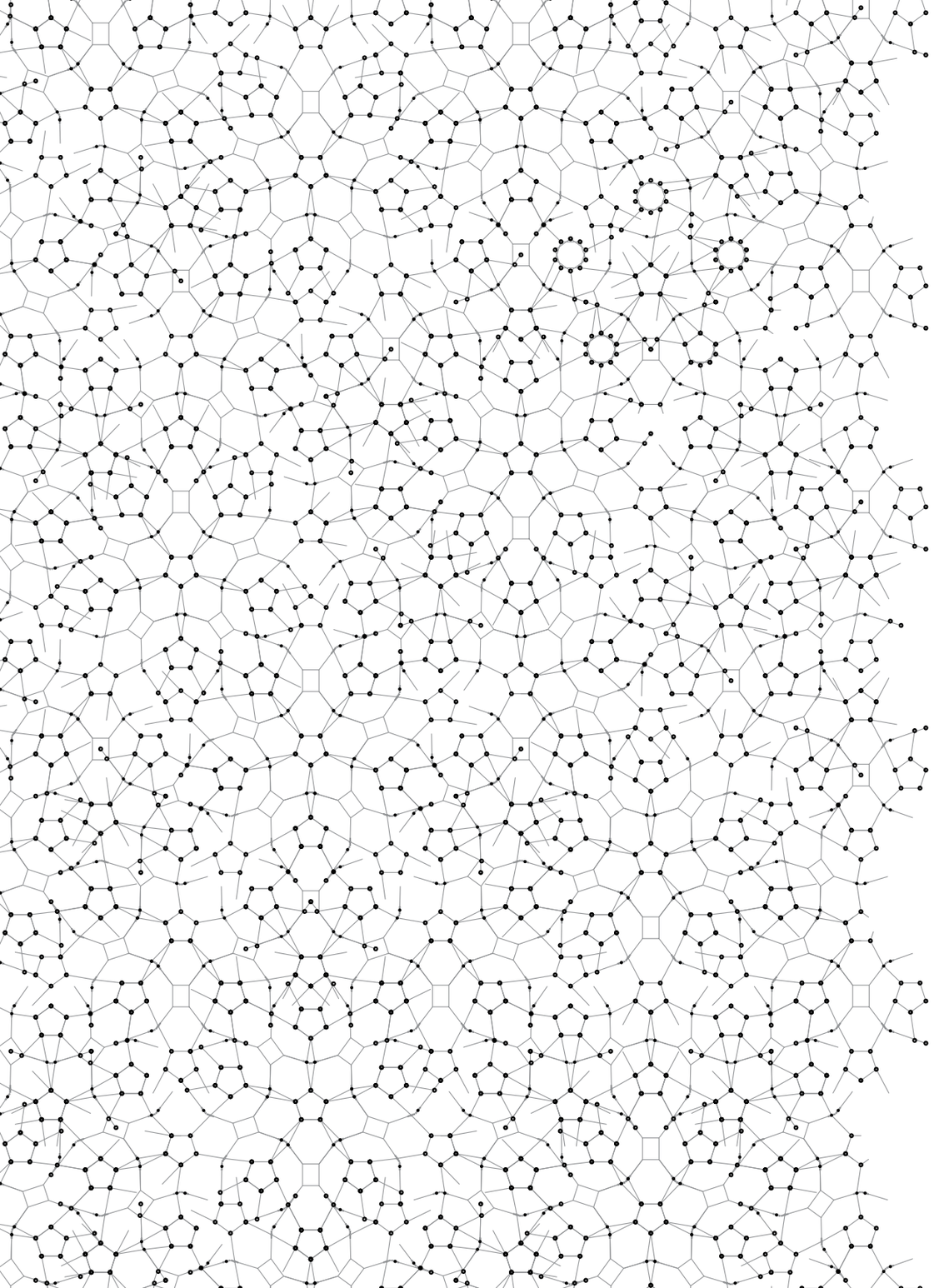
Kinetic Architectures & Geotextile Installations

PHILIP BEESLEY



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Philip Beesley

with

Christine Macy
Andrew Payne
Robert Pepperell
Michael Stacey
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Riverside Architectural Press

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Other publications by Philip Beesley:

Fabrication: Examining the Digital Practice of Architecture
ed. Philip Beesley, Nancy Yen-Wen Chen, and R. Shane Williamson
AIA/ACADIA, 2004
Responsive Architectures: Subtle Technologies
ed. Philip Beesley, Sachiko Hirosue, Jim Ruxton, Marion Tränkle, and Camille Turner
Riverside, 2006
Future Wood
ed. Oliver Neumann and Philip Beesley
Riverside, 2006
Mobile Nation
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Acknowledgments

The projects in this book are collaborations. The contributions of numerous individuals and organizations in the conception and production of this work are gratefully acknowledged. The projects have been made possible by inspired expertise from many different disciplines in design, the arts, engineering and manufacturing. The labour-intensive 'textile' methods used in these projects were made possible by the extraordinary support and encouragement of large groups of contributors. Collectively produced elements from earlier projects have been re-used in later works, building upon earlier contributions. There is a large and constantly evolving set of details and patterns in our practice that preserves and expands a host of details from preceding authors. Physical components are often preserved and adapted, and digital machining data used to guide the digital fabrication production method is copied and re-worked in many cycles. The collective nature of our work makes any question of specific authorship complex, and that question itself is perhaps unnecessary when thinking of the layered accretions gathered here. The works might testify instead to the curious, heterogeneous nature of a collective chorus.

Contributions from the academic communities of the School of Architecture at Cambridge, the Faculty of Engineering at the University of Waterloo and the practice of Philip Beesley Architect Inc. are at the core of this work. The project series began with support from the Canada Council for the Arts in the form of a Prix de Rome in Architecture residency in Rome and dialogue with the Philadelphia artist Warren Seelig, and received generous encouragement from esteemed colleagues from schools and embassies in Italy, England, the United States and Canada. Members of the architectural practices of Diamond and Schmitt Architects Inc., Dunker Associates, and Baird Sampson Neuert Inc. have contributed, and the Gardiner Museum of Ceramic Art, Haystacks Mountain School of Crafts, Harbourfront Centre Craft Studio, London Building Centre, Montreal Museum of Fine Art, Royal Ontario Museum, InterAccess Gallery, Subtle Technologies Festival of Art and Science, Textile Museum of Canada, the University of Toronto Faculty of Architecture, Landscape and Design, NSCAD University, Dalhousie University, and University of Manitoba have supported development at key phases of the work. Numerous individuals and institutions within the Association for Computer-Aided Design in Architecture, the Canadian Design Research Network, London's Digital Fabricators Network, Bartlett School of Architecture and the Architectural Association have provided ongoing discussion and wide-ranging expertise.

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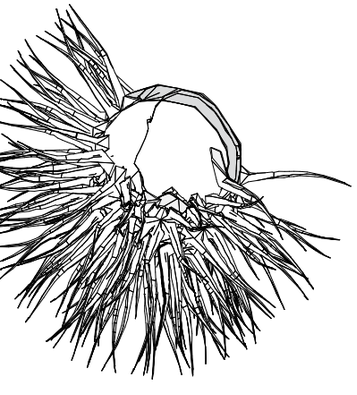
This book was enriched by contributions from authors Jean Gagnon, Eric Haldenby, Christine Macy, Andrew Payne, Robert Pepperell, Michael Stacey, and Charles Stankievech. It was beautifully produced by Eric Bury, editor Leslie Jen and designer Charisma Panchapakesan.

This work has been made possible by the fundamental support of my beloved partner Anne Paxton, my children, and my dear parents.

Philip Beesley Cambridge and Toronto, November 2007

When archaeology inspires design one anticipates work that invokes first principles, moves on a separate plane from the conventional and touches the mythic possibilities of the art of design. Contemporary techniques of fabrication have allowed Philip Beesley and his team to produce a work that appears to have brought into being by ageless ritual or organic process. This wonderful piece refreshes, or, even, restores the fundamental relationship between the built and natural environments. The unfathomable complexity of the elemental repetition is as relentless, ungraspable and inevitable as the natural world, both vast and infinitesimally small. The magical animation of the piece is a Pygmalion bridge between the inanimate and animate. The work holds out the promise that there will one day be an architecture this deep, vivid and alive.

Eric Haldenby Director, Waterloo Architecture Cambridge



Hylozoic Soil *(2007) is the latest in a series of installation works by Philip Beesley that explores interactive geotextiles, reflexive and responsive membranes, networks of actuated objects, and canvases composed of networked systems. In support of Beesley's continuing research in this area, the Daniel Langlois Foundation for Art, Science and Technology played a contributory role in 2002-2003.*

Much of Beesley's work derives from his research of architectural textiles at the Integrated Centre for Visualization, Design and Manufacturing at the University of Waterloo. Exhibitions of his work document the progressive stages of his research and the increasing mastery of his technique, all of which provoke and challenge comprehension by his viewing audience. They are probes into an aesthetic of reception.

But if architecture is a relationship of societies, groups and individuals with their natural and built environments, then Beesley's architecture seems highly relevant. His work pursues the reconciliation of natural and human processes with the artificial world. And, it might be said, 'responsive' environments should also be responsible environments.

These works attempt the embodiment of McLuhan's great idea about one of the effects of electric technology: That in the electric era and for electric humanity, there is a multiplication of centres with no periphery. Rather than an opposition between determinism and free will, the relationship of parts is governed by dynamics involving the organism and its environment.

Jean Gagnon Executive Director, Daniel Langlois Foundation

Contents

... Phosphorences gleam in the moustaches of the seals, shift in the scales of fish. Echini whirl like wheels; ammonites uncoil like cables; oysters make their shell hinges squeak; polypi unfold their tentacles; medusae quiver like balls of crystal suspended; sponges float hither and thither; anemones ejaculate water; wrack and sea-mosses have grown all about.

And all sorts of plants extend themselves into branches, twist themselves into screws, lengthen into points, round themselves out like fans. Gourds take the appearance of breasts; lianas interlace like serpents.

The Dedaims of Babylon, which are trees, bear human heads for fruit; Mandragoras sing – the root Baaras runs through the grass.

—

And now the vegetables are no longer distinguishable from the animals. Polyparies that seem like trees have arms upon their branches. Anthony thinks he sees a caterpillar between two leaves: it is a butterfly that takes flight. He is about to step on a pebble: a grey locust leaps away. One shrub is bedecked with insects that look like petals of roses; fragments of ephemerides form a snowy layer upon the soil.

—

And then the plants become confounded with the stones.

Flints assume the likeness of brains; stalactites of breasts; the flower of iron resembles a figured tapestry.

He sees efflorescences in fragments of ice, imprints of shrubs and shells – yet so that one cannot detect whether they be imprints only, or the things themselves. Diamonds gleam like eyes; metals palpitate.

And all fear has departed from him!

He throws himself down upon the ground, and leaning upon his elbows, watches breathlessly.

—

Insects that have no stomachs persistently eat; withered ferms bloom again and reflower; absent members grow again.

At last he perceives tiny globular masses, no larger than pinheads, with cilia all round them. They are agitated with a vibratite motion.

Gustave Flaubert The Temptation of Saint Anthony

Introduction

Philip Beesley

...Would that I had wings, a carapace, a shell, –that I could breathe out smoke, wield a trunk, –make my body writhe, –divide myself everywhere, –be in everything, –emanate with all the odours, –develop myself like the plants, –low like water, –vibrate like sound–shine like light, –assume all forms –penetrate each atom–descend to the very bottom of matter, –be matter itself!

- Gustave Flaubert, *The Temptation of Saint Anthony*

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During 1995 and 1996, I worked for several months in collaboration with an archaeological team reconstructing a flank of the Palatine, the labyrinthine artificial mountain that overlooks the ancient Forum of Rome. This work focused on ritual deposits at the fortified boundary of the archaic city. The excavations seemed to confirm canonical texts that describe origins of the Eternal City in rituals of sacrifice. During the excavation work I encountered physical traces of mythic history—and the underground became the underworld. The deposits here included building materials, animals, and humans. My work concentrated on traces of a baby that was sacrificed and buried beneath the ancient fortifications. Several years of built and experimental work have developed from this experience.

My compositions since Rome have tended to concentrate on vital, seething qualities built up from intensive repetition of miniature parts.[1] The work tends to be dominated by practical technology while at the same time poetic cadences are latent: blood, soil. The large-scale field structures offer bodily immersion and wide-flung dispersal of perception.

The textiles in these installations have recently taken the form of interlinking matrices of mechanical components and arrays of sensors and actuators that respond to occupants moving within the environment. Lightweight lattice and geodesic organizations form a structural core, employing digitally fabricated lightweight scaffolds that contain distributed networks of sensors and actuators. The structures are designed at multiple scales including custom components, intermediate tessellations composed of component arrays, and general structural systems. The current work focuses on integrating control systems with decentralized responsive intelligence. The work is based on gradual development moving toward applied architectural environments that include manufactured filtering and shading systems.

Reyner Banham cited a turning point early in the 20th century in the 'relationship of men—especially thinking men—and their machines; both were now stripped for action...'[2] I think the kind of Existentialist interpretations that Modernist writers such as Banham have favoured tend to isolate figures from their surrounding 'ground.' It seems to me that Modern critical voices often prefer a stripped void to the richly rendered sentimental environments of the 19th century. My work would doubtless fail those critical readings, because it is emphatically sentimental. In contrast to a modern lineage I find common ground with the heretic scientist Wilhelm Reich in his mid-twentieth century philosophy of *Orgonomy*. Reich described *bions*, vesicles charged with *orgone* life energy representing a transitional stage between non-living and living substance, constantly forming in nature by a process of disintegration of inorganic and organic matter. He said:

> *All plasmatic matter perceives, with or without sensory nerves. The amoeba has no sensory or motor nerves, and still it perceives. Each organ has its own mode of expression, its own specific language, so to speak. Each organ answers to irritation in its own specific way: the heart with change in heart beat, the gland with secretion, the eye with visual impressions and the ear with sound impressions. The specific expressive language of an organ belongs to the organ and is not a function of any 'center in the nervous system'...milliards of organisms functioned for countless thousands of years before there was a brain. The terror of the total convulsion, of involuntary movement and spontaneous excitation is joined to the splitting up of organs and organ sensations. This terror is the real stumbling block...*[3]

Standing in the World

A key term for my pursuit is empathy. My use of this term draws upon aesthetic theory that examines nuanced relationships involving projection and exchange. Combining terms of mechanism and empathy, I hope to develop a stance in an intertwined world that moves beyond closed systems. By drawing upon recent revisionist readings of cultural history, I want to develop a sensitive vocabulary of relationships.[4] In the terms of figure-ground relationships the figures I compose are riddled with the ground.

A brief review of canonical images can illustrate this. One centuries-old attitude that tends to reinforce boundaries is embodied in Lorenzo di Credi's *Annunciation* tempera painting of 1480.[5] The figure of the Archangel Gabriel and Mary stand against an array of landscape and buildings. Their free, relaxed postures are amplified by drapery that swirls around each figure as if caught in the lightest of breezes. The world stretches away behind them, organized by radiant geometry—an inner shell of buildings, with alternating apertures making

1 Implying *hylozoism*: the philosophical conjecture that material things possess life

2 Reyner Banham, *Theory and Design in the First Machine Age*, second ed. (MIT Press/Architectural Press, 1960) p.11. But Banham is arguably a transitional figure whose interest in architectural mechanisms distinguish him from canonical Modern architecture.

3 Wilhelm Reich, 'Orgonomic Functionalism', in *Selected Writings: An Introduction to Orgonomy*, 1960 (Farrar, Straus and Giraux, 1961)

4 Organicism forms the context for this approach. While organicism is sometimes viewed as a late 'Romantic' mode opposed to Modernism (among canonical works are Wilhelm Worringer's Abstraction and Empathy, 1908), this movement can also be seen as an ongoing tradition embedded in the 20th-century and contemporary culture. My views owe much to Christine Macy and Sarah Bonnemaison's book Architecture and Nature: Creating the American Landscape, 2002, and Detlef Mertins' "Bioconstructivisms" essay in Lars Spuybroek's NOX, 2005.

5 Lorenzo di Credi, *Annunciation* (1480)

6 Caspar David Friedrich, *Man and Woman Contemplating the Moon* (1824)

7 School of Fra Angelico, *Madonna and Child* (mid-15th century)

a gridwork filter that opens out to the surrounding; and an outer natural world, manicured in ordered arbours and garden rows. Mary and Gabriel are confident actors here, expressing vivid freedom and mastery. To them, the world is a servant that offers a reliable stage for their own action. This view holds striking similarities to a confident, Modern cosmology of progress.

Caspar David Friedrich's *Man and Woman Contemplating the Moon*[6] embodies an opposite world. Two travellers stand exposed at the edge of a precipice. Around them at the edge of this uncertain space is a turbulent thicket of branches and giant boulders, relics of upheaval in the ground. Heavy clothing pulled tight around them makes dense silhouettes that contrast with glaring light stretching out into the void beyond. Their stark, outward gaze implies great personal resolve, but no certainty. This space contains powers vastly larger than any human domain. However, while Friedrich's pensive atmosphere might seem opposed to di Credi's confident world, the terms of reference that both artists seem to use have some similarity. This Romantic space, like di Credi's, builds upon distinct divisions between nature and culture and between freedom and order.

A third painting takes a different approach, offering a hybrid world in which those distinct elements combine. The anonymous mid-15th-century artist from the school of Fra Angelico, who created the *Madonna and Child*,[7] painted a glittering veil that makes a great sheltering canopy for that scene. In the background and foreground, volatile forces twine together into turbulent clouds that imply the dawn of creation itself. Mother and Child sit sheltered within the veil, their gestures speaking of vulnerable intimacy. The veil is shot through with embroidered patterns in deep relief. The deep red and gold rendering of this textile is almost identical to Mary's golden hair and crimson inner tunic. The outer blue cloak that flows around that inner layer spreads out below, collapsing and funneling out into the great clouds of the nascent world beneath. Above, Mary's inner tunic, golden hair, and encircling halo seem to extend into the brocaded canopy. The veil acts like part of Mary's body, an extended physiology.

The veil in the *Madonna and Child* and Wilhelm Reich's vision are, to me, connected. In similar ways the projects that have developed in this series imply an intertwined world.

Nature

Perfection is a value that seems to often accompany thinking of nature. For example, the eminent nineteenth-century biologist Ernst Haeckel documented radically new dimensions of natural life by arranging species on his illustration pages in glorious, radiant symmetries that gave a picture of confidence in a balanced, perfected universe. Sometimes, when I am in places that are thriving, I feel full of such confidence. I remember the Puskaskqua wilderness on the north shore of Lake Superior where humidity-thickened atmosphere was shot through with hanging moss and butterflies and where the ground was a succulent sponge, layer upon living layer. The living world swept over me there and rendered me tiny. In such a setting, urban anxiety about adulterating nature seemed self-obsessed, adolescent.

A number of my installations have been inserted into natural environments. They work to catch and inject matter, accumulating density and eventually forming a hybrid turf. Like ill-fitting clothes, this work has an uncomfortable relationship with its natural host. The relationship of these object-assemblies contains layers of violence: the violence of a foreign colony imposed on a living host; the forces of dismembering and consuming; the force of will, violating the ethical boundaries that maintain nature as an untouched sanctuary.

The physical assemblies in these projects employ a series of natural laws involving energy flow, nutrient cycling and dynamic balance expressed in distinct functions.[8] For example, the snap-fit of a plastic tongue into a mating socket needs just enough friction to grip its mate while staying flexible enough to avoid collapsing the whole surface. The design approach to sub-units is in pursuit of a balance of refinement and economy. This approach is circumstantial and dominated by quite flexible, practical judgment, far from a picture of perfection. The textile strategies I use make intensive labour for adjusting individual parts impractical. There are tens of thousands of parts, so tooling and fabrication motion used in making each piece is compounded. This requires an economy of means.

The primitive cycles of opening, clamping, filtering and digesting in the artificial assembly are affected by some of the same natural forces that make a coral reef work. Building upon simple motions embedded within individual elements, accumulated actions produce turbulent wave-like reactions. The contemporary philosopher Manuel DeLanda speaks to living systems arising from inert matter in his 1992 essay Nonorganic Life. He describes some elements as

> *...catalysts interacting with various other elements and thereby allowing them to transform each other chemically[. T]hey enable inert matter to explore the space of possible chemical combinations, in a nonconscious search for new machinelike solutions to problems of matter and energy flow. It is as though catalysts were...the Earth's own 'probe heads', its own built-in device for exploration, and indeed, to the extent that autocatalytic loops and hypercycles were part of the machinery involved in the 'discovery' of life, these probe heads allowed physicochemical strata to transform themselves and their milieus into completely new worlds.*[9]

The basic relationship is prosthetic, alien appendages to nature's body. Prosthetics are always accompanied by some tinge of revulsion. An artificial heart causes the host body to recoil and attempt to reject the intruder, no matter how 'good' the addition is for the host's health. New burn technologies involving delicate nutrient-infused lattices that strengthen the skin and allow new skin to grow depend on drugs to mute the rejection impulses that we react with.

These forces are precarious. They may work for the defense of an existing system and the exclusion of new systems. And they may work as catalysts that transform an existing world—opening possibilities of hybrid survival and of extinction. Vertigo.

8 '*...every static law is in fact either a law of falling, the first type, or a law of disintegration, the second type.*' Michel Serres, *The Birth of Physics* (Clinamen Press, 2000) p. 77

9 Manuel DeLanda, *Nonorganic Life, in Incorporations*, ed. Kwinter et al (Zone, 1992)

Burial

I studied a flank of the Palatine Hill with archaeologist Nicola Terrenato and a team working under Andrea Carandini[10] on the excavation and reconstruction of the original foundations of archaic Rome during 1995 and 1996. The focus was a site identified as the Porta Mugonia, one of three original gates to the city dating from its founding in the eight century B.C. The gate is situated on the flank of the Palatine and forms part of a boundary defined by layers of massive tufa boulders and large bastions. Two burial deposits were discovered at the site, one directly beneath the threshold and the other to one side. Both contained traces of the bodies of infants, apparently sacrificed and buried beneath the ancient wall.[11]

Original details of foundation deposits at the fortified boundary of the city[12] were reconstructed by building digital models from a combination of hand drawing and photographs. Site research at a larger scale drew on records gathered from archaeological teams working on excavations across the Palatine Hill. Section drawings were generated showing the topography of the hill stretching from the Roman Forum to the Circus Maximus. The sectional study clarified the original nature of the hill as gentle, rolling agricultural terrain surrounded by marshland. Fortifications were built at the foot of the hill to secure an inner herding area. Dense layers in the following millennium transformed this landscape into a synthetic precipice towering above the Forum.

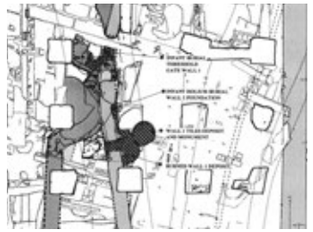
The traces of the buried children appears to confirm many fragments of foundation rituals described by many ancient writers[13] in which 'first fruit' of the first family of the city was sacrificed at the gate, protecting the boundary of the city. Making sacred. A mundus, a little world offered instead of the world around. Beneath the wall at the edge of the city, a pit was dug into the volcanic mud-stone tufa, fitted to the clay dolium vessel enclosing the tiny body. Sifted linings filled in the spaces closing the void between the vessel and the stone. Tiny fragments of the burial remained: a brooch; a tooth. Laid bare. What material could be adequate for covering this place?

Each link of the fabric net received special details. Inside was an anatomy of transparent vessels cushioned by sprung tenons and terminated by serrated hollow needles to puncture and drain. Toward the outside, angled crampons bent back for springing and grasping set up with hair-trigger antennae. Around, a spread of open joints with outflung guides to catch and link with neighbours.

Each of these protozoan links was thin and meager, but by linking and clumping together they made mass and thickness. At first a bare latticework controlled by the geometry of its elements then increasingly formless and growing darker as it ingested decomposing matter. Thicker, and fertile, enveloping the wire implants and making a complete turf. This cover was finally dense, redolent with growth. And within that vital new earth, a convulsion glimmered—a poise telegraphing through from the sprung armature deep within.[14]

10 Andrea Carandini, *La Nascita di Roma: Dei, Lari, Eroi e Uomini all'alba di una civilta* (Giulio Einaudi Editori, 1997)

11 Substitution burial votive, Etruscan c. 5th century BCE



12 Porta Mugonia, showing first and second city fortifications with burial deposits

13 Review of the literature: Joseph Rykwert *The Idea of a Town: The Atnropology of Urban Form in Rome, Italy and the Ancient World* (MIT Press, 1976)

14 Portions adapted from Beesley, *Surface Design Journal* (1998)

Lorenzo Romito, of Rome's *Stalker* collaborative, described this work as:

> *...a look towards the invisible, beyond the din of everyday, where in the silence the voice of the earth is still audible, telling [...] the sacred act of founding. A vase containing the bodies of children is buried under the gateway into the city. It is a warning, only if the traversing of the threshold is understood in its profounder significance – as Romulus killed his brother Remus when he trespassed the torn furrow of Rome's foundation. It is a threshold between inside and outside, between life and death, between man and earth. This was a past of evident differences made distinct by heavy and compact walls like those of the antique cities, constructed by inhabitants who had always heard this warning with sacred fear. Today, where can this threshold be crossed? It seems lost in a city that expands without limits...There is an insect, its belly swollen with blood, there are many others, they join, lose identity and they become one structure, a net, without an inside or an outside, each link a connection and a limit. The net becomes metal, even though it may still be the border of the city it does not enclose like an antique wall, but rather it crosses it, divides the daily spaces from the 'other', the abandoned spaces where things transform without the need of representation, spaces that penetrate into the earth of the city but do not belong to it. [Beesley] reveals his net no longer as a found testimony, but as a forged instrument...an extended territory that allows itself to be traversed without a 'via maestra.'*[17]

Forest

The edges of this consciousness[18] seem, sometimes, distinct. Not distinct as with a hard boundary, but distinct as capable of being lost. The abbot at Wat Pah Nanachat called it *absorbed*. He said that I was slipping.

Earlier he had given a glowing vision. He had spoken to the assembled monks and the smaller group of visitors including myself. The hall where we sat was cocooned in darkness. Layers of shadows within the forest canopy cast in bare moonlight far from village electricity. Accompanied by a chorus of cicadas and bulbuls, he painted the sky as shot through with hovering benign sprite *devas* that cloaked the gathering. Embroidered dissolving cloak, suffused with starlight and punctuated by miniscule points from fireflies and glow-worms.

The surrounding world is benign, he seemed to say. Listening and probing the contours of the surrounding forest. Retracing, leaf by leaf, the fluttering texture. Leaf, hanging moss, vine stems trailing through, spun silk web with carapace, disarticulated wing. Moth fluttering below, dried leaf above wet leaf. The carpet of rustling banyan, oak and plane interspersed with viscous frangipani blossoms. Hard shell of cast cicada skins, viscous soft skin of larvae. Dampened shards beneath the topmost crust, holding slight warmth from earth below. Root tendrils, running through humid mass upward as well as down. Millipede, arcing amidst hundreds of legs moving in chained peristalsis. A colony of slugs, bodies pulsing in glacially slow swaths.

15 *Palatine Burial*, cryptoporticus installation (American Academy Rome, 1996)

16 Detail of *Palatine Burial* installation

17 Lorenzo Romito, *Stalker*, unpublished manuscript trans. Marc Bowditch (1996)

18 The following text documents a departure from a monastery on the northeast border of Thailand in 2004

Beneath the soft bodies of snails, glistening sheen of path exuded: cellulose, digested by microbes, aphids and mites, microbe boiling. In absence of light, a kind of chemical fire that works like acid, eating from within, spreading out into mass. Chorusing pools, each pulling softly into a centre, inter-ripples forming cross-woven agitations working in reverse of light, a rhythm of dissolving. Thickened blanket that arcs outward and down. The glimmering devas now tinged—I had projected gentle smiles into that cloak earlier. Tremulous edges to that, hesitating and then arcing downward into a grimacing smirk. The mouths open: pores set into each successive cellular ring of the corrugated tubules. The sinusoidal arc of each streaming flame combining into a net.

Mouths opening, a generalized hunger, pulling inward. Thickened lips hardened with salt crust, just enough to nip, not yet a bite. Pulling inward, intractable. Rows of mouths each surrounded by protein-braided strands that pull inward and down. Waves of opening and closing that crush by trickling degrees, clamping and pulling forward then clamping again, encircling and closing. Without pause. Irrigated by a bath of gentle acid that flows into the softened parts and riddles into new seams revealed by this massage. Cartilage first, easing into gelatine and then spreading into a brine.

Colonies of mouths populated by grouped tongues that push outward. From within, a flow of darker material extruded into fronds of individual viscous hairs, chorus of excretions, lactic acid in muscles after being emptied, dull tearing, blankness of black sky.

After that first wash of the earth—

Excruciatingly slow spasmodic hiccupping painted within my eyes and skin. Four or five stages, perhaps. Sitting with releases; sitting within a bruise-purple well. Analysis and schemae emerging, ceasing, and re-emerging.

First, sitting during their chants, unbinding releases. Letting go. Uncoiling spine, uncoiling pulse, uncoiling *sankaras*[19] releasing into an upward fluttering vesica flame. Breath stilling then fading, remaining whispers of current, then replacing quiet surges within a thickened meniscus about a foot out from skin pouring upward. Focus: letting go to allow *nimittae*[20] to emerge and in turn let go. Watching.

Upwelling from spine, upper arms, hip-coccyx. Revealing a stuttering turbulence that cascades up my neck, rolling around back of head and temples, releasing with a concentration at fontanel. Waves that breach muscles and spine, lifting them in turn, rolling upwards. Suspending, billowing as they pour outward: am I flying? Am I burning? Am I on the ground?

Not quite a vertigo in the body compass, rather a mixed report of orientation with displaced partial instruments: here I am, Descartes' layers stuttering with great eroded blank spots, like the caterpillar-frothed leaves that make my forest floor. The report is itself displaced: ground seems to be at neck, or perhaps at cheeks; eyes and dome of upper head remaining above, balance below. Or perhaps not split but rather just the boundary I had been calling 'ground' having shifted, post-descent and release, now revealing itself only as a datum. Hovering, like an upper cloud layer, around my sinuses: amphibian. Split eyes, bifocals. Yes, a ground. When I make digital models I use reference planes that intersect at ordinance points.

Orientation in this hybrid ground, though, is washed away in upwellings. Like roaring fire currents that catch tendrils of ash suspended in the campfire, my body is surrounded by others and it floats and lilts and flutters. My whole-being vomits. Choking waves, playing out their chained motion, make spine and arm chains rise in quivering flowing whip motions, flagellae.

How much actual motion? 'Actual' is ironic. But to speak politically, how much motion might others have seen? The lifts were not crystalline. More akin to scholars' rocks: great lumpen bloated rotting masses sloughing off and washing away at hideously revealed cleavage points, like a massive interlaced bog of muck and stinking peat earth which has suddenly found a network of cleavage fissures dissolving through it while at the same time major parts of its masses remain impacted.

There was motion.

There was asymmetric motion.

The cycle of breathing was gone, but another cycle emerged to replace it. Part was familiar: a rising and falling magnetic pulse, contractile following anti-peristaltic valence. The reverse of breathing and ingesting. The reverse of building form by converting air and substance into flesh. Little fluttering motion residues. An elliptical field was revealed by moving eyes sideways to read a different kind of structure. Instead of the matrix narration of down and up, new eyes see the spinal-cord pulse field horizontally with calm centre as a sink and ephemerae at the edges. The shape of this in continual movement like a fire or a lapping shore or a flowing amoeba. The extensions of the bounding membrane are radical. Medusa, quietly seething, flares extend and billow magnitudes further than the diameter of the mass. Looking at that zone, the proportions compound themselves even further, fleeing.

In the centre, unutterable darkness. I am not referring to the centre. I refer to an infinitesimally thickened zone a third of the way out from the centre measured within the main stem, where released energy gives the field a lingering taint of viscosity—just a whisper of a valence, a proto-inclination akin to outer limits of the homeopath's stretched dilution. After compounded upon compounded tincture, when the potential has accelerated beyond absolutes, is there any underlying trace?

Material releases are peripheral. Black holes have a popular face, so this appearance is accompanied by a banner headline on the outer ciliated fringes, with innumerable blinking lights along with hyperbolic graphics.

Calm centre, although 'calm' implies presence. Free from presence. Dark. Light falls into this pool. Black, though, makes silence. Is it a pull? Is something ingesting, or is there a more silent reason? Just collapsing by looking. Falling away.

19 The contemporary Buddhist teacher S. N. Goenka describes the term 'sankara' as a bundled, tension-filled knot with traumatic origins

20 In Buddhist practice, 'nimittae' are hallucinatory states of mental formation embedded within breathing motions

Tangent

I see the light that precedes the dawn just emerge ahead. The unthinkably large dimensions of the Pacific rise and show themselves, stretching across my view and arching across the surface of the sphere, air and cloud and water layers all hovering. I am riding at one layer, hazed. Above is a zone of nearly empty sky, thinned air melting into dark. Shot through with stars. Below is a slowly shifting rumpled skin of condensed white, wrinkling within its skins while great rifts show themselves between huge spiraling streams that arc away across the ocean. The light makes a searing cut now, while it divides and states no thing and thing: earth and sky.

Within the cut is exquisite light, whispers of rose and magenta forming first as inclinations toward hue within silent blue. Purples concentrate and promise: flesh, and knowing. They stand as hungers at the edge of the world. The cloud skins stretch and flex in an increasingly muscular tangle as the light grows. Sheaths of mist, shells of water. The clumping grains are oriented into flow directions, coalescing. Indicators of place, like the morning mist that hovers in the valleys and pits of a country road and plots out the layer of cold and the residue of heated air as I drive through Algonquin Park, or the flickering wind place of northern lights that illuminate the magnetic forces cascading outward from earth-size plates. Indicators but at the same time bodies and flesh themselves: I speak of the world, and I am the world. Is there a difference? Nor am I intending to hold to those shriveled and blooming crusts. Is it possible to speak of mixtures? Is it possible to work with many things?

We are a little lower now. On the horizon, outside this taut body. I turn away to watch the dawn break over the clouds. As I look from front to back, in front and crossing along the arc of the horizon to the rear, I see a shift. In front I see the white of the sun approaching us, turning the deep blue of the sky and melting it into light. The surface of the clouds and earth beneath this rim of light is shaded grey-blue, dark against the sky. As I turn, faint rumples and wrinklings of the sheets of clouds. Along the edge, at no place in particular, I see a new dark emerge. Where does Lucretius's *clinamen* arise precisely?[21] Neither here nor there but at any place. Shifting and sliding, a place of dark. This layer streams back and as I look towards the rear it grows into a distinct layer, a streaming wedge of darkness lifting out from the tangent and becoming a place, raining. I am looking at the shadow of the earth. In front, light. In back, void.

The clouds telegraph the shadow, speaking less dark and more dark and relief and detail. The curve engine, polished ellipse, speaks the shadow too, expanding the edge into a wide fading zone that stretches between gleaming light facing the sun and dark shadow behind, but pulsing and shifting as the airplane rolls in the current, tiny gentle rolling swells, hundredths or perhaps thousandths of a degree of pitch and yaw made visible by this floating compass.

This exquisitely calibrated instrument, measuring the clinamen, speaking of the Medusa cloud.

21 Titus Lucretius Carus (ca. 99 BC–ca. 55 BC), *De Rerum Natura (On the Nature of Things)*. Lucretius treats the *clinamen*, the angle of minimum derivation, as the origin of life. The angle of a tangent to a circle is a clinamen.

Forces

Later, after the releases, I lay in a bowing posture for awhile, forward with head to the ground. A practical and mechanical answer to release. This allowed greater silence. What happened? Released from description. There was an unbounded yes of ceasing, noun fused with verb. Calibration schemae presented themselves as names of things: blood, earth, cognition, fire, community, the operation of forces and results. Simple, underlying patterns: what makes the world, what structures it. I remember thinking about the bow, and the fundaments of earth, and cognition that arose after cessation.

When the others started to leave and walk back along their forest paths, a more gradual surfacing. I found everyone had gone except for two monks, one on the ground and the other ahead sitting like the statues at the front. I was lying sideways, as the learned one recommended. Grasp, elbow, metatarsal, phalange, extend, contract. Eventually I got up. I remember feeling great cheer, although cheer implies someone feeling it. I remember a smile. Sufficiently complete to be able to be free from strength.

Below there were other gales and clouds of visible things, living skins. And the simple voice of the forest, murmuring in every drop of water and rustle of leaf. And, in the dark, alongside murmurs and whispers, the rise and fall of the candle flame that accompanied me as I packed to go.

I remember how a spine sense rose too. I remember listening to some of the voices and those that sat on my shoulders and that which rested behind my neck and further behind in the dark woods. I looked at the candle, and saw that it rose and fell and that I rose and fell with it. I remember listening to the rain drops and the wind. What could I see, and what could I not see? What could I see specifically and precisely? What pictures were inventions and which were real? Amid the pleasure of realization I realized my psychosis: that only some of them were there. Others were not there. I sat with a tissue of murmurs, mixed. I realized that I could not tell the difference. I remember sitting with the rain and listening to the voices, the end of it.

Later, I think of the dark core that replaced breathing after that had disappeared. Instinct pulses located within the nerve field. Riding within panic swells, I saw myself die. Silky soft, that was easy. It was distinct, and full of coarse choices: world, body, others. Rising back up, reconnecting each synapse, naming a fresh mask.

Disintegrating Matter, Animating Fields

Christine Macy

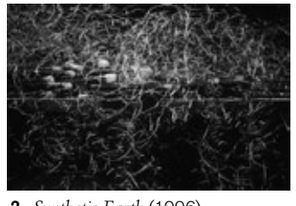
Geometry

Philip Beesley's textile installations are created from multiple individual elements that are assembled into aggregates, fields, surfaces and clouds. The interconnections and calculations required in such assemblies are a matter of geometry. But then measurement is at the root of many textiles; we need only think for example, of the calculation that goes into preparing the harnesses for a loom. Beesley's earliest geotextile installations—*Haystack Veil* (1997) and *Erratics Net* (1998)—were mesh structures spread out over Atlantic coastal landscapes. Rather than stabilizing the earth beneath them as would a conventional geotextile, these installations hovered just above the surface of the ground, catching airborne matter and creating a still zone at the surface of the earth in which fragile plant life might take root. Beesley explains his approach to geometry:

> *I came across the term geotextiles through Warren Seelig, who introduced me to large-scale textiles. My use of the term geotextile was a response to the traumatic idea...that one could stretch a Platonic, homogenizing, world-enclosing, totalizing grid over the earth to control it in one system. I was looking at alternate etymologies of [the word] geometry—in Gaia [earth...and matter [mother], the underlying fertile whole. I loved the idea of geometry having at its root a...life-force, rather than the dry, cutting quality that I associate with the Platonic absolutes. That gave me a certain attitude toward the engineering aspects of geotextiles—using a generative approach rather than a...controlling one. The aspect of geotextiles that I love so much is that they have mutual relationships with living things we implant into the earth that foster other growth.*[1]

Another early project, *Synthetic Earth*[2] (1996)—carried out in collaboration with the glass artist Katherine Gray—offered the possibility that geotextiles might be more than a matrix for fostering plant life; they might even substitute for it as a kind of second nature. In this installation, an array of wax-sealed glass vessels containing 'digestive fluids' were embedded in a dense filigree mesh made of entangled barbed wires that he described as a 'shroud.'[4] This was one of the first of Beesley's installations to explore the relationship between inanimate and biological matter, a theme that he has continued to pursue up to his most recent work, *Hylozoic Soil* (2007). The term comes from the ancient Greeks, who saw the constant motion of inorganic nature as evidence that it was, in some sense, alive. Their word for this was hylozoism: this is the belief that matter is animate and possibly even conscious; and that life is inseparable from matter.

1 Philip Beesley, telephone interview with Sarah Bonnemaison and Ronit Eisenbach (March 4, 2007)



2 *Synthetic Earth* (1996)

Anima

Beesley's textiles do not merely have biological qualities, they have animate qualities—they feed and digest, burrow and push. He elaborates:

> *The particular geotextiles I've been investigating have teeth in them. They're not benign instruments of stewardship; rather, they have their own agenda, they need to feed themselves, they dig into the earth, they push humans away, they need to eat and digest and forge themselves. I'm trying to conceive of a layer of the earth that is not at the service of humans but perhaps can have a mutual relationship with our own occupation.*[5]

An artificial fabric that acts on its desires; this is an uncanny body, as Freud used the term, something familiar yet strange that attracts and repels the viewer simultaneously. According to Ernst Jentsch, who first defined the concept in his essay '*On the Psychology of the Uncanny*' (1906), one has 'doubt as to whether an apparently animate being is really alive; or conversely, whether a lifeless object might be, in fact, animate'[6] In the last century, the sense that people were 'ingenious machines'[7] was well enough established for some philosophers to wonder if human beings were fully alive or were instead, to some degree, automata. The guru G.I. Gurdjieff asked this question. He believed that people trapped within their own subjectivity experience life in a dream state, unconscious of their place in the universe and their potential. He called this a 'waking sleep.' Such people—driven by thoughts, feelings, and actions that are little more than mechanical reactions to external and internal stimuli—squander their life in a search for pleasure and emotional impulses. Instead, Gurdjieff argued, people need to become conscious of their connection to other beings, and their role in creation. This is why he tried to shock his followers, to 'wake them up' from their automatic reactions.[8]

In the same spirit, Beesley wants his textiles to unsettle and disturb their viewers. He describes them as 'carnivorous'. In *Hungry Soil* (2000), he explains that 'protruding hooks and latex bladders equipped with hollow needles imply mechanical operations on drifting organic matter: capture, injection, ingestion.' Like a Venus flytrap, these creations immobilize their prey before slowly incorporating them. We are reminded here of Antonin Artaud, who wished to recreate the thrill of raw experience in his theatre

4 Quotations from Philip Beesley in *Statement* (July 20, 2006) and in *Synthetic Earth* (1996) website project description, www.philipbeesleyarchitect.com

5 Beesley interview (March 4, 2007)

6 Ernst Jentsch, *On the Psychology of the Uncanny* (1906), cited by Sigmund Freud in his essay *The Uncanny* (1919), translated by Alix Strachey (1925)

7 Term taken from Mimi Cazort, Monique Kornell and K. B. Roberts, *The Ingenious Machine of Nature: Four Centuries of Art and Anatomy* (National Gallery of Canada, 1996)

8 For an authoritative account of Gurdjieff's teaching, see P.D. Ouspensky, *In Search of the Miraculous: Fragments of an Unknown Teaching* (Harvest/HBJ Book, 2001)

to shatter a false sense of reality: 'the Theatre of Cruelty has been created in order to restore...a passionate and convulsive conception of life.'[9] The philosopher Gilles Deleuze and the psychoanalyst Félix Guattari also criticized the automatic self in their concept of a 'body without organs,' a term adopted from Artaud:

> *When you will have made him a body without organs, then you will have delivered him from all his automatic reactions and restored him to his true freedom.*[10]

For Deleuze and Guattari, the body without organs is the self freed of automatic habits, traits and tics. It is a body actively realizing its potential in experiences with other beings, 'becoming' itself. It is a body without boundaries, yet one constantly organizing itself into new patterns. Beesley's textiles are precisely such self-organizing entities, growing from their 'encounters' with other bodies, as we see in his description of *Palatine Burial* (1996):

> *At first a bare latticework controlled by the geometry of its elements, [becoming] increasingly formless and growing darker as it ingests decomposing matter. Thicker and fertile, enveloping the implants and making a complete turf.* [11]

The many small elements operating together in a larger network, interacting and interconnected, and growing into one fertile matrix, appears to be a form of symbiogenesis—the merging of separate organisms to form a new organism. This concept is most closely associated with the biologist Lynn Margulis, who believes that mutation and natural selection alone are not sufficient to explain variation in living creatures.[12] Rather, she proposes, millions of years ago single-celled organisms such as bacteria and blue-green algae—that stored their genetic material in single loops rather than in chromosomes in nuclei—existed interdependently and cooperatively. As one such organism engulfed another, both survived and eventually evolved into cells that possess nuclei and organelles, as does most cellular life today. The mitochondria in cells are evidence of this process, since their genetic material is different from that found in cell nuclei. In fact, many sections of the human genome appear to have their origins as bacteria or viruses, and gene mapping has revealed most species to be cross-linked by genetic material that has been transferred from one host to another.

If we read symbiogenesis into Beesley's work, we can conceive of a viewer of his *Implant Matrix* (2006) for example, being incorporated into it. According to Beesley, the matrix is 'capable of mechanical empathy,' reaching out to viewers as 'erotic prey.' He continues, 'The structure responds to human presence with subtle grasping and sucking motions, ingesting organic materials and incorporating them into a new hybrid entity.'[13] The viewer thus ingested might serve a specific function—say, triggering certain internal reactions, or acting as an 'organelle' within the network.

9 Antonin Artaud, *The Theatre of Cruelty, The Theory of the Modern Stage*, ed. Eric Bentley (Penguin, 1968) p. 66

10 Antonin Artaud, *To Have Done with the Judgment of God*, Antonin Artaud Selected Writings ed. Susan Sontag (University of California Press, 1976) p. 571

11 Philip Beesley, 'Orgone Reef,' (cover article) *Architectural Design* vol. 75, no. 4 (July-Aug 2005) p. 52

12 See Lynn Margulis, *Origin of Eukaryotic Cells* (Yale University Press, 1970); Lynn Margulis and Dorion Sagan, *Microcosmos: Four Billion Years of Evolution from Our Microbial Ancestors* (HarperCollins, 1987); Lynn Margulis, *Symbiotic Planet: A New Look at Evolution* (Basic Books, 1998); and Lynn Margulis and Dorion Sagan, *Acquiring Genomes: A Theory of the Origins of Species* (Perseus Books Group, 2002)

13 Philip Beesley, *Implant Matrix* (1996) project description in Philip Beesley Architect (unpublished portfolio of work), no date, p. 8A

Immersion

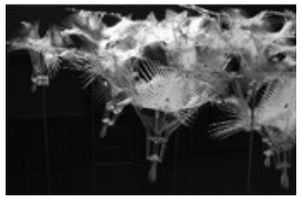
Let us return to Deleuze and Guattari for a moment, to explore their prime example of a 'body without organs'—that is, the earth. 'This body without organs,' they say, 'is permeated by unformed, unstable matters, by flows in all directions, by free intensities or nomadic singularities, by mad or transitory particles.'[14] The idea is that what we experience as solid is actually being constantly created by forces in motion. What we think of as stable or constant (continents, oceans, and clouds; sunlight and energy; biological life) is in fact ceaseless flow. This fluid activity is the body without organs, a state of flux that is always present and acts on matter at all times.

Beesley attempts to provoke the viewer of his works into becoming aware of the flows in which textile and viewer are equally immersed. Since *Gill Array* (2002), Beesley's work has become increasingly technologically sophisticated through digital fabrication techniques that allow him to create units that are precision-cut and cast and intricately interconnected, allowing him to realize the works as sensitive, delicate registers that make the interrelationship between textile, viewer, and environment visible. Inorganic nature works on Beesley's textiles—they deform with gravity and respond to the slightest change in wind or air pressure. They provide a nuanced reading of incidental occurrences in their proximity. They extend outward with feelers and sensors to include the viewer in their ambience—in one interpretation, this could be seen as a generous outward reaching, in another, a hungry or threatening grasping.

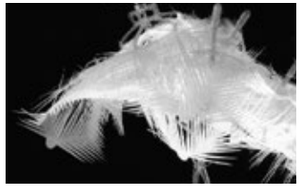
A suite of subsequent projects—*Orgone Reef* [15] (2003), *Orpheus Filter* (2004), *Reflexive Membranes* (2004), *Cybele* (2005), *Implant Matrix*[16] (2006) and *Hylozoic Soil* (2007)—seem alive. If these installations could be said to be conscious, it would not be a centralized consciousness focused in one area (such as a brain), but would instead be distributed throughout the body of the textile, in small loops of information that give minute instructions and react to specific inputs. One element communicates to another, linked by matter and conductive tissue. This advance in his work was the result of a collaboration with researchers at MIT's Media Lab, after which Beesley began to incorporate microprocessors linked to small actuators (mechanical devices such as pumps or vibrators) into his works, enhancing their animate life-like qualities. By adding light and motion sensors to the system, the installations are able to respond to people entering the room, further blurring the boundary between the viewer's sense of self and the textile's 'sense' of the viewer. The result is a decentralized, unsettled and dispersed consciousness. Beesley welcomes the blurring of boundaries that results:

> *One thinker I could point to that has been germinal for me is the psychologist Donald Winnicott. His studies into the formation of the psyche in babies...has produced tantalizing material. Winnicott looks at transitional objects—bits of cloth, a diaper, a toy, clothing, or mummy's breast originally—and how someone relates those things. Before you become an indi-*

14 Gilles Deleuze and Félix Guattari, *A Thousand Plateaus*, translated by Brian Massumi (University of Minnesota Press, 1987) p. 40



15 *Orgone Reef* (2003)



16 *Implant Matrix* (2006)

vidual, those things are...extensions of you. There's a remarkable disintegrity, a delicious immersion, an opening of boundaries that occurs. Winnicott speaks about this kind of thing in the formation of the psyche, how the point is to separate and draw a boundary around yourself, to become self-actualized—in a healthy scenario. But there's a lurking sense in his writing that he actually loves reading that in reverse—of uncoiling and immersing and returning into the earth. That sensibilty of the transitional object—a layer of physical material which has such a potent role in relating to our identities is something that marries very well with my geotextiles. They function like Winnicott's transitional objects: their agenda is to facilitate dissociation, to release, to open the boundaries. Integrity—that is the hardening of boundaries—is a kind of curse. I'm trying to point to disintegrity, or dissociation as offering something vital.[17]

17 Beesley interview, March 4, 2007. For more on Winnicott's concept of the transitional object, see D. W. Winnicott, 'Transitional Objects and Transitional Phenomena,' *The International Journal of Psychoanalysis* vol. 34 (1951) pp. 89–97

Expansion

In writing about his work, Beesley returns time and again to the possibility of consciousness transcending the boundaries of the body. He cites a vivid evocation of this sensation in a text by Roger Caillois:

Then the body separates itself from thought, the individual breaks the boundary of his skin and occupies the other side of his sense. He tries to look at himself from any point whatever in space...And he invents spaces of which he is 'the convulsive possession'...blurring...the frontier between the organism and the milieu...[18]

18 Roger Caillois, *Mimicry and Legendary Psychasthenia*, (1937) translated by John Shepley, in October: the First Decade (MIT Press, 1987)

The hylozoic or life-like qualities of Beesley's textiles are intended to help their viewer blur the distinction between self and other, to step outside of their self, and extend their self-consciousness outwards. Ideally, the viewer would see that they are part of an entire chain of being and of awareness that extends outward in all directions. Beesley touches on Wilhelm Reich's conception of such a vital web, which served as an inspiration for the *Orgone Reef* installation:

The term 'Orgone' was coined by Wilhelm Reich, a psychologist working alongside Freud, to suggest a fertile life force encircling the world. Reich, whose work was tinged by obsession, saw the world as an evolving entity dominated by primordial energies. His visions offer a poignant alternative to the Modern version of progress.[19]

19 Beesley, 'Orgone Reef,' p. 52

Another view was articulated by the Jesuit scientist Pierre Teilhard de Chardin, who saw 'consciousness' arising from the spherical nature of our planet. 'One of the most fundamental characteristics of the cosmic structure,' Chardin says, is 'the roundness of the earth.'[20] Without the involution of matter upon itself...there would never have been the biosphere... In [its] advent and development, life...[is] not only accidentally, but structurally, bound up with the contours and destiny of the terrestrial mass.'[21] According to Teilhard de Chardin, life—spread out in a centripetal extension over the surface of the globe—reaches a 'critical point' with the appearance of humanity.

20 Pierre Teilhard de Chardin, *The Phenomenon of Man*, translated by Bernard Wall, with an introduction by Julian Huxley (Harper & Row, 1959) p. 239

21 Teilhard de Chardin, *Phenomenon of Man*, p. 273

Man discovers that he is nothing else than evolution become conscious of itself, to borrow Julian Huxley's striking expression...Having reached the peak, we can now turn round and, looking downwards, take in the pattern of the whole.[22]

22 Teilhard de Chardin, *Phenomenon of Man*, p. 221

His term for evolution's awareness of itself is the noosphere, from nous, the Greek word for thought. 'Confined to the surface of a sphere, idea will encounter idea, and the result will be an organized web of thought' that envelops the earth—'mankind has…succeeded not only in becoming cosmopolitan, but in stretching a single organized membrane over the earth without breaking it.'[23] For Teilhard de Chardin, this is a spiritual manifestation of the earth's evolution; with the spread of humanity over the surface of the earth, 'we have the beginning of a new age. The earth *gets a new skin*. Better still,' he says, 'it finds its soul.'[24]

23 Teilhard de Chardin, *Phenomenon of Man*, p. 241

Philip Beesley's extraordinary, seductive and emotionally powerful textile installations suggest that such a membrane already exists upon the surface of the earth—intertwining matter, all living creatures and consciousness. His works are his way to allow us to become more aware of it.

24 Teilhard de Chardin, *Phenomenon of Man*, p. 183

Posthumanism and the Challenge of New Ideas

Robert Pepperell

At a time when science and technology are developing at such a rapid pace, it is chastening to be reminded that in the development of metaphysical ideas we have moved little beyond the ancient Greeks. Alfred North Whitehead characterized the European philosophical tradition as 'a series of footnotes to Plato,'[1] implying that on the deep problems—the nature of reality, mind, being and experience—the last two and a half millennia have not brought us much closer to resolution or consensus.

One reason may be that throughout much of the humanist period of history (which can be traced back to Plato's era), we have tended to rely on the same essential beliefs and assumptions about the nature of reality, beliefs and assumptions often regarded as self-evident, foundational and permanent. It has been assumed, to give some examples, that the universe is full of numerous distinct bodies or objects—each demarcated by a boundary at its extremity; that the mind reflects upon a world from which it can be distinguished; that we are each separate from one another and the things in the world around us; that a proposition cannot be both true and false at the same time.

Despite the strength and depth of these beliefs it is surprisingly simple to show, without recourse to occult precepts, perverse reasoning or sleight of hand, that each is erroneous. Such seemingly commonsensical ideas can be invalidated with little more than orthodox scientific knowledge and straightforward descriptions of the phenomena concerned.

Take the belief that we are surrounded by discrete bodies or objects, each having a boundary or edge at its extremity. While at a certain level of engagement with the world it is natural to regard objects around us in this way, a more objective view would recognize that boundaries are in fact arbitrary and contingent, which is to say they can only be determined with relative precision and only at certain levels of viewing resolution. What appears to us at one level of resolution as a sharp edge, say, on a piece of paper, turns out on closer inspection to be an inchoate mass of fibres, becoming ever more formless and indeterminate as we approach subatomic levels of magnification. No finite boundary is ever reached.

Or take the belief that the mind is distinct from the world. One could sustain such a belief only if it were possible to point to either a) any border where the mind stops and world starts, or b) any attribute of the world not encompassed by the mind. The first is clearly impossible, if only for the reasons already discussed, i.e., boundaries cannot be absolutely demarcated. The second is impossible for the reason that nothing can be conceived in the world that does not then become a part of the mind conceiving it. We are forced to acknowledge a fundamental continuity between mind and world, and indeed other minds, a continuity that renders any discussion of their separateness futile.

Or take the belief that we are each individual beings, unique and quite distinct from others and the world around us. This cannot be true for both the reasons just discussed—that boundaries, including the boundaries around our bodies, do not actually exist in the way we ordinarily perceive them to exist, and our supposedly individual minds are in fact widely distributed across a reality containing countless other such minds—but also for many other reasons, including the fact that the genetic material from which we are constructed is overwhelmingly identical in us all, variations between individuals being miniscule. Moreover, the human body is in constant and direct reciprocation with forces around it, including chemical, thermodynamic, kinetic energy, gravitational forces and various forms of radiation. To think of all these as somehow separate or distinct from our own bodies, which are composed themselves of just such energies, makes little sense. The body is a porous, membranous and fluid system in perpetual change and exchange with the environment.

These briefly presented examples are not intended to comprehensively refute the habitual beliefs in question. They are offered merely as signposts to a different way of thinking. But it is by thinking differently, not just by engaging in philosophical arguments, that we can move beyond the ingrained beliefs that have constrained our conception of reality for more than two millennia. If we choose to, we can conceive of reality not as populated by numerous discrete objects but as a variegated plasma of constellated energies, neither solid, liquid nor gas. We can think of the mind not as a quasi-mechanical computation occurring in an internal organ but as an expansive field of experience that both generates and is generated by the reality it conceives. We can think of ourselves not as isolated agents trapped in a dermal shell, but as boundless clusters of activity blurring into space and time.

As we start to conceive reality and ourselves in profoundly different ways, many of the long-standing metaphysical debates recurring through the history of humanist thought begin to evaporate. The problem of whether or not the world exists independently from the mind, for instance, is avoided because the mind and world are now seen as identical. The difficulty of

1 Alfred North Whitehead, *Process and Reality* (Free Press, 1979)

determining where consciousness is located in the brain is sidestepped since consciousness is no longer regarded as a phenomenon solely attributable to the brain. The ethical debates concerning the supposed supremacy of humans and the rights of the individual are effectively defunct when faith in the apotheosis of our species and the existence of individuals is renounced.

Elsewhere I have used the phrase 'the posthuman condition'[2] to signify the collective shift in the way we understand ourselves and the world at this time in history. Posthumanism refers not to the imminent demise of humankind through some technological catastrophe or biological redundancy, but to the period of social and cultural development succeeding humanism. In the posthuman era we no longer regard objects in the world as discrete and bounded, but indeterminate and indefinitely extended. The mind is no longer a central processor but a massively distributed array of sentient correlations. Human beings are no longer unique and pre-eminent in the universe but merely points of reference in an inconceivably large and complex cosmos.

As we try to think in these unfamiliar ways, we struggle to find modes of expression that give shape and meaning to concepts verging on the inconceivable. Coming to terms with our changed condition consists not just in revising customary beliefs but in fully cognizing the implications of what must replace them. The challenge presented by the succession of posthumanism is how we can think in radically different ways from those we are used to.

There is one idea so ingrained in our habitual modes of thought that it seems almost heretical to dispute its validity: the belief that truth and falsity are mutually exclusive. Aristotle famously argued in the *Metaphysics* that something cannot both be and not be. This assertion has become known as the law of non-contradiction—a law so axiomatic it has barely been examined or challenged since its inception. It would seem to be a cardinal case of unthinkability that one could conceive a situation in which a statement was both true and false at the same time, truth and falsity being so clearly incompatible states.

But consider what happens when Man A says to Man B, 'You always contradict me,' and Man B replies, 'No I don't.' In this variation on the classical Liar's Paradox attributed to Zeno of Elea, truth and falsity seem to repel each other like identically charged magnets. If Man A is telling the truth then Man B is lying, and if Man B is telling the truth then Man A is lying. According to classical logic this results in a paradox, a kind of conceptual impasse beyond which we cannot move. Both statements seem reasonable but both cannot apply since they are contradictory. There is, however, an alternative interpretation: that both Man A and Man B are telling the truth and lying at the same time. Rather than struggling for priority, truth and falsity simply exist simultaneously.

By contemporary logical standards, it is by no means absurd to suggest propositions can be both true and false at the same time. There is a branch of (admittedly controversial) logic known as dialetheism that considers paradoxes like the one above and accepts that in certain instances truth and falsity do indeed co-exist. Such 'true contradictions,' as they are sometimes called, are regarded not as aberrations to be dispelled by rational analysis but as valid states in their own right. Take the question of what can we can know about the unknown. Clearly we can know nothing about the unknown, and in knowing this we know something about it—a contradictory state of affairs that is nevertheless perfectly true. (This example is discussed by one of the founders of dialetheism, Graham Priest, in his book *Beyond the Limits of Thought*, 2002).[3]

The idea that contradictions might be embraced rather than neutralized by rational analysis will seem repellent to those wedded to a classical logical framework. But if we look around the world, we soon see how the co-presence of opposing forces underpins many natural processes. Some years ago I saw a television programme demonstrating the Newtonian principle of equal and opposite force. An inflated balloon was attached to a small boat and released onto a pond, the air expelled from the balloon driving against the surrounding atmosphere to propel the craft forward across the water. As I watched this demonstration, I was struck by the fact that the force of the expelled air meeting the resistance of the atmosphere on equal terms resulted in a kind of 'true contradiction'—a mutual antagonism—leading not to a logical abyss but to natural physical motion.

It is easy for us to overlook the essential role contradictory forces play in the makeup of our world. That, for example, our bodies are continually drawn downwards against the floor which presses back against us, and how we're prevented from collapsing into a formless heap by the integrity of our skeletal structure as it resists gravity. At each moment where we see form or motion we are seeing the consequence of opposing forces at play, an elaborate mesh of tensions and pressures holding nature in its delicate balance. The very structure of the atom, long regarded as a fundamental unit of reality, is maintained by the repulsive action of electromagnetic force pushing subatomic particles apart while an opposing strong nuclear force binds them together.

Although it may seem desirable to think of these conflicting pressures as somehow neutralizing in a tension-free resolution—just as it may seem desirable to neutralize contradictions and paradoxes through rational analysis, a task into which countless logicians have thrown themselves—it would be a mistake. What is essential to the structure of reality is that tension is maintained, that opposing forces co-exist in mutual conflict and do not dissolve into conformity. Harmony and equilibrium may appear outwardly as the consequence of this tension, but the underlying incompatibility between forces must remain if form is to be sustained.

An elegant example of structural harmony arising through mutual antagonism can be found in the principle of 'tensegrity,' a sculptural and engineering term describing the building of complex forms using simple elements held in balance by opposing forces. The term is a compound of 'tensional integrity' devised by Buckminster Fuller, but the discovery of the principle was made by one of his former students, the sculptor

2 Robert Pepperell, *The Posthuman Condition: Consciousness Beyond the Brain* (Intellect, 2003)

3 Graham Priest, *Beyond the Limits of Thought* (Oxford University Press, 2002)

Kenneth Snelson. The word now has many meanings, but in its original form it refers to an arrangement of rigid struts held in balance by the tension of cables compressing the structure at key nodal points, something akin to the way a tent is held in shape by rigid poles and taut guy ropes. Crucial to the integrity of the structure is the antagonism between the forces of tension and compression (what Snelson calls 'floating compression'), which arises from a duality of deep significance in the makeup of natural forms, as Snelson himself suggests:

> *When two objects cross one another, two axes are created along the diagonals; one has a right-handed, clockwise helix and the other a left-hand or counter-clockwise helix. This, along with magnetism with its north and south polarities, electrons and positrons, is the very root of binariness. This duality which occurs at every crossing teaches the first lesson about the nature of structure.*[4]

4 Kenneth Snelson
www.kennethsnelson.net/icons/struc.htm

Binaries and dualities are nothing new, and it is not particularly surprising to note the role of tension and compression in the formation of structures. What is different is the way we think about and understand these concepts once we have moved beyond the limitations of the humanist-rationalist paradigm, when we no longer think of opposites (like truth and falsity) as mutually exclusive but as co-existent, when we no longer think of the binary as 'either-or' but 'either-and-or,' not 'on-off' but 'on-and-off' at the same time.

I accept the inherent difficulty, perhaps impossibility, of conceiving a state that is both off and on at the same time, certainly for minds used only to thinking of these states as mutually exclusive. Yet we are surrounded in nature by processes that operate in contradictory ways. The biological membrane—a basic component of all cellular structures and so of life itself—acts in two opposing ways at once: it forms a barrier that separates the contents of the cell from its surroundings, so ensuring its proper function and integrity, and at the same time acts as a conduit for passing organic compounds between the cell and its surroundings, again to ensure its proper function and integrity. The cell membrane both divides and connects, these functions being absolutely vital, but nevertheless contradictory.

The biological membrane, then, can serve as a useful metaphor in helping us to visualize a condition that in other contexts might seem incomprehensible. Just as the membrane both divides and connects, so propositions can be both true and false, conditions can be either and or, states can be both on and off.

Analogies and metaphors can be useful in helping us to visualize difficult-to-grasp ideas, but if we are looking for their contemporary applications we could do worse than look to artists, who frequently inhabit the difficult terrain at the frontiers of human knowledge. Artists will often take on the intellectual challenges thrown up by their age and, most importantly, give those ideas visual form by exploring them in their work. We only need think of the great Renaissance masters' vivid images of the humanist prowess of 15th-century Europe, with its sophisticated optics and geometry, or the Constructivists who created striking plastic manifestations of the revolutionary modernism gripping the early-20th-century imagination. Artists do not necessarily originate new scientific and philosophical ideas, but they are often among the earliest to embrace and respond to them, and certainly among the first to express them in visual form.

The sculptural and architectural works of Philip Beesley stand in this venerable tradition. Many of the symptoms of the posthuman age are evident in Beesley's polysemic constructions, which variously invoke biological tissue, sculpture, textiles, architectural forms, complex geometries, digital replication, and organic systems. They are often startling, almost alien, yet can also seem natural and familiar. They suggest a conception of reality in which living matter is continuous with inert matter, where complexity and simplicity co-exist, where the body permeates beyond the membrane of the skin into the space around it, where each individual element is absorbed into the structure as a whole, where the built environment is an intelligent and conscious extension of the beings that occupy it.

In many ways, Beesley's constructions are sensitive reflections of ideas that are starting to surface in the intellectual landscape of our time. Like many artists before, he makes work that gives visual form to inherently evanescent ideas, ideas rarely expressed beyond the confines of specialist science, mathematics and philosophy, and which by their very nature resist articulation or comprehension. This is not to suggest his works operate didactically or as literal illustrations; they are too diverse and ambivalent for that. Such ideas can only be expressed metaphorically or poetically, which is why art retains such importance in our culture as a pre-eminent vehicle for alluding to new concepts, and why it so often eludes explanation itself. Art, by necessity, can appear abstruse and even repellent because we have yet to catch up with the novel thoughts it synthesizes.

It would be misleading to close this essay without correcting the impression I may have given that the posthuman conception of mind, reality and nature as summarized here actually contains any new or original ideas. Precedents can be found in Hegel, Schopenhauer, Nietzsche, Husserl and many other thinkers who have struggled to overcome the constraints of the European intellectual heritage. But they are most eloquently and explicitly expressed in the eastern tradition, particularly in the many schools of Buddhism and Zen. As I read these ancient texts, which are the products of a very different time and culture to my own, it is strangely reassuring to find the ideas I vainly believed to be my original insights clearly set out by others so long ago. Just as Beesley's work seems both alien and familiar, so it is both comforting and discomforting to realize everything apparently new is already old.

Sewing/Sowing: Cultivating Responsive Geotextiles

Charles Stankievech

In Erilia, to establish the relationships that sustain the city's life, the inhabitants stretch strings from the corners of the houses, white or black or gray or black-and-white according to whether they mark a relationship of blood, of trade, authority, agency…spider webs of intricate relationships seeking a form.

- Italo Calvino

Boxes, Blobs, Branes[1]

As our glass boxes turn into glass blobs, the question must be asked: do current trends in architecture provide better places in which to dwell? Surely the movements of the eye caused by the ripple of folds in the curved surfaces of our 21st-century buildings are a welcome change upon the landscape of urban centres struggling to resist gridlock. For in a world framed more and more by computer screens, it seems only natural to desire buildings that break out of our glass cages. But is switching from straight lines to 'NURB' curves really that radical of a change? From an engineering perspective, perhaps; from a visual perspective, definitely. But do we need a new image on the architectural billboard? In the last hundred or so years, a natural progression in architecture has developed: from the drape of the Statue of Liberty's copper skin to the curtain wall of the Modernist skyscrapers and the dialectical return to the contemporary warped surfaces of glass and new materials.[2] At the core of all three designs one finds the sustained idea of conceptualizing a building as a skeleton with a skin, an idea established in 19th-century sculptural and engineering principles. However, even as these new buildings are stretched, morphed and tessellated, we grow tired of looking at them, but not because of their lack of beauty or craftsmanship. Quite on the contrary, we grow tired of looking at them because we grow tired of *looking*.

The drape of the curtain wall in the 20th century provided engineering feats of elegance and power, giving the world an International Style, but it also created a lack of respect for the *site*, sacrificed to the hegemony of *sight*. Alternatively, a different thread of architecture concerns itself with *topos* (place) and our sensual experience of the site. Instead of working from the *image* of a textile presented by the Statue's copper clothing, a new focus on textile *structures* and membrane *processes* offers a potent path for the future of architecture in the 21st century. Particularly, Philip Beesley's 'geotextiles' lifted from infrastructural uses to architectural possibilities offer an experimental entanglement of body, building and the environment.

The Fall of the Curtain Wall

The curtain wall was part of a transformed aesthetic of architecture, finding its own style not in quotations from the past but from its own function and technical marvels such as the industry of train stations and the spectacle of exhibition spaces. As an engineering technique, the curtain wall relied on a skeletal support structure positioned on the interior of the building, relieving the walls of their normal load-bearing task. Henceforth, the exterior walls could be made of new materials, like glass, and hung from an internal framework of steel or reinforced concrete. Not since the shift with Gothic architecture in the medieval ages had architecture taken such a dramatic step into the light. Literally able to compose glass houses, 20th-century architects created buildings where inside and outside were conflated. The iconic Mies van de Rohe's *Farnsworth House* (1946-50) and Philip Johnson's *Glass House* (1949) with their floor-to-ceiling walls of glass attempted to foster a value of transparency where the boundary between environment and dweller became visually erased with the use of new materials. But this exclusively visual act of joining inside and outside through the technique of framing the landscape can further segregate the other senses and their experience of the outside. That is, the act of the inhabitant taking in the view of the exterior often negates the feeling of outdoor climate, smells and sounds. Ironically, the implementation of glass boundaries heightens the separation between the body and the natural environment. The dweller (or shall we say spectator) scans the vista as a pilot[3] would through his cockpit's canopy or a driver[4] would through the windshield speeding down the expressway, surveying the landscape with the utmost of ease and comfort: 'it is worth returning to the curious fact that pure vision is *pure kinesthesis*, best described as a form of flight.'[5] Here, the glass envelope functions properly when the surface reflects narcissistically from the exterior and acts invisibly from the interior, containing the air at about room temperature.[6] Ocular illusions of transcendence materialized under the bell jar.

The World is Flesh

In a world growing more and more *virtual*, the drive to interface with information grows stronger, reinforced through a feedback loop.[7] Clothing with embedded computers, sensors controlling room atmosphere, noise-cancelling headphones, the consolidation of audio-visual communication/entertainment/information

management into mobile PDAs (personal digital assistants) are some of the commodities mediating the everyday world. Most designers are attempting to capitalize on this exploded area of the market by creating 'faster, lighter, stronger' interfaces not concerned with the senses but with ergonomic design—something quite different. However, some designers are urging us to reflect and reconsider our built spaces as sites which offer more than just an amplification of visual information. Juhani Pallasmaa's classic text *The Eyes of the Skin: Architecture and the Senses*, first published in the mid-1990s during the boom of digital architecture, offers an argument for an architecture concerned with the 'polyphony of the senses' (to use the words of Bachelard).[8] Stemming from a philosophy of phenomenology and an embodied architectural practice, Pallasmaa builds upon Merleau-Ponty's conceptualization where the 'world is flesh.'

There are many faces to phenomenology, some heavily reliant on Kantian schematics of the subject, where an internal Cartesian/Kantian manifold synthesizes space and time within the mind of the subject. In contrast, other practices of phenomenology offer an understanding of reality where the world, the body and the mind are not distinct entities and are perhaps even false categories in themselves. However, it is important to note these complications of categories are not the deconstructionist complication of binaries. As important as language and the symbolic order are in shaping reality, we are dealing with a reality that is not a spectrum (along which binaries compete) but multiple, mutually inclusive dimensions. A topological extension or critique of phenomenology combined with recent observations in politics and proprioception offers an architecture where the floors and walls fluctuate dynamically. This floor or horizon would be what Merleau-Ponty called the *chiasm*—the intertwining—a concept that challenges typical notions of objectivity and subjectivity.[9] At the *chiasm*, intentionality is diffused and the 'production of subjectivity' finds itself immersed in the flesh of the world, oscillating between 'the visible and the invisible.' As Merleau-Ponty hazards, 'Where are we to put the limit between the body and the world, since the world is flesh?'[10]

One strand of architecture sharing Merleau-Ponty's observations spans the 20th century—in the work of Frank Lloyd Wright, Alvar Aalto, Steven Holl, Peter Zumthor, Paulo Mendes da Rocha, Tadao Ando, and many others. Unlike the buildings driven by new materials for high performance and 'supercharged digital design,' the work of these architects seeks a holistic experience. The experience of walking through such a building is about engaging all the senses. This is not to say that technological advances and the implementation of new technology is a morally deficient gesture. To the contrary, the now everyday technology of central heating makes humble houses a place of comfort and welcome during the cold season. But a well designed window that lights a space dynamically according to different times of the day is just as effective a modulator of space as is the virtual window of a video screen displaying real-time data.[11] The issue is how to create dwellings and spaces that integrate necessary information technologies with our sensory needs and psychological desires—and for some, spiritual ways. In fact, the ability to ingeniously intertwine all of these needs is more than a curiosity, it is an essential task in the upcoming century—one not easily undertaken nor fulfilled. However, as Brian Massumi questions:

> *Practices of architecture allied with experimental art…can be twisted away from addressing pre-existing forms and functions toward operating directly as technologies of emergent experience…Imagine if these were to become infrastructural to architectural engineering…Could architecture build on the ability of digital technologies to connect and interface different spheres of activity on the same operational plane, to new effect?*[12]

One would hope that a hybrid architecture can emerge, borrowing from the sensual experiences of phenomenological architecture while also borrowing from the radicalism of experimental architecture.

The idea for a hybrid architecture echoes Le Corbusier's desire in the later phase of his work, where he hoped to enter 'the phase of natural harmony of the *deuxième ère machiniste* [the second machine age] in which the industrial superstructure and the rural base would achieve a happy equilibrium.'[13] This philosophy manifested itself in a small house he built in India during the early 1950s which included a grid concrete structure as well as several vernacular climate control characteristics such as a turf roof. A second renewal is necessary, not for the machine age but for the information age. The infatuation with the speed of information and our continual seduction by new fabrication techniques must be kept in check with processes of proven architecture that works with the senses. A long history already exists building physical interfaces for the senses—not in research labs but in the age-old fields of furniture design and architecture. Presently, the older idea of *balancing* industrial and rural needs to transform into the *entanglement* of information and senses: not a static building envelope of concrete and grass, but a dynamic canopy of fibres and gardens. Of course, as Aalto points out, 'one has to exercise tact when approaching nature, that life has to be cultivated carefully—but [by] using technology.'[14] If our subjectivity is immersed in the world and there is fundamentally a lack of clear distinction between the production of subjectivity and the building of the environment, we must be conscious of our investment in our built spaces, realising (as is now the norm in ecological practices) that care for the environment means care for the self and vice versa.

The Garden Called Subjectivity

For many, architecture is the extension of man's psyche into the natural environment. For through his tooling of the land he creates a built space meeting his needs and fulfilling his desires. In turn, the architecture he fashions, fashions him. Pallasmaa, however, sees things differently: 'Architecture is essentially an extension of nature into the man-made realm, providing the ground or perception and the horizon of experiencing and understanding the world.'[15] When constructing a multi-sensory experience it is important to view architecture as an extension of nature, not as an extension of man. Establishing this 'ground' creates a fundamentally different workflow.

At the birth of architecture, this distinction was irrelevant because of the effect of humans on the environment, but with the massive change towards the destruction of our climate, the fabric of our existence is in jeopardy. This is not just to draw attention to 'ecological' concerns but also to the flatness of our everyday relation with buildings and cities which seem in constant disavowal of the senses. Of the several tactics by which to salvage our world and therefore influence our interaction with it, the use and production of green spaces plays an elemental part...in particular the garden in its various shapes and sizes.

The garden provides a rich and sensual experience: the visual pleasure of landscape design, the smell of flowers, the sound of water flowing from a fountain, the touch of intimacy in hidden alcoves and grottos, and the taste of fruit from harvest. Of course, the benefits extend beyond the limits of the classic five senses. Gardens also provide a communion between species (human and other), a quiet place to reflect, an open space to play, and an investment in time. The garden functions at a pace normally forgotten about in today's computer age: the time of seasons, the time of light, the time that expects patience.

The garden need not only fulfill mythological functions of creation, falling from grace and other fantasies. What about the gardens of today? The need for parks and gardens in urban centres is on the rise as we realize that the life of a city is intimately connected to its green spaces. Take Manhattan and London as two examples of metropolises that still sustain a high quality of life despite their scale. As the cities around the world dramatically swell in upcoming years, these two will maintain a certain desire for habitation due to their allocation of public green space—and not just for the psychology of recreation.

In addition to the master plans of urban parks, individuals and organizations are privately fulfilling the need for small paradises in the landscape of parking lots. Two strategies of urban gardening are in practice today, with two different results. The community garden is a practice where a group of people share a plot of land in the city centre divided into subplots, each with a small garden. This tradition allows people in apartment buildings (vertical urbanism) to maintain a garden without having direct access to a personal yard (horizontal urbanism). The result is a community of people sowing, tending, and harvesting not only vegetation but stories and relationships—qualitative information.[16] The other urban gardening practice, and an idea gaining popularity, is the roof garden. While often the opposite in social spirit to the community garden, the roof garden, which is mostly private, can still function as part of a larger green concern: 'The benefits of green roofs are many: longer roof lifespan, greater sound insulation, reduced heating and cooling system needs, and a cutback in storm water runoff. Green roofs decrease carbon dioxide and increase oxygen in cities, making them cooler in the process and reversing the so-called *urban heat island effect*.'[17] Thus, two important characteristics can be gleaned from contemporary gardens: 1) community gardens foster a patchwork community and provide the locus and means of cultivating social information structured on organic processes, and 2) roof gardens elevate the garden from street level and integrate its biological attributes into urban architecture to create hybrid canopies. It is these two attributes which I argue should be the guiding principles of the gardens of the future, a future which will hopefully find a way to cultivate social information while integrating its means biotechnically into the infrastructure of architectural engineering. In this way, we will be intimately connected with the two main external forces shaping the production of our subjectivity: our social sphere and our built environment.

Gardens of Tomorrow

What will the gardens of tomorrow be like? One would hope that the traditional practice of tilling topsoil, planting seeds and tending to the growth of plants will always retain a certain simplicity, but this does not mean new gardening techniques and uses for gardens should not be explored. Philip Beesley's sculptural work, starting with the *Chthonian Projects*, pursue such a branch by meditating on the present function and future possibilities of geotextiles. Already used industrially and established in infrastructural development ranging from toxic waste containment to soil erosion prevention, the geotextile is a hidden presence in much of the current landscape. Embedded into the surface layer of the earth, a geotextile can provide separation, filtration, drainage, reinforcement and/or protection, depending on its specific product design. Essentially the effectiveness of the geotextile resides in its ability to integrate into the landscape in a seamless manner. Once the fabric is implemented, the surrounding vegetation grows in, around and through the material, creating an entangled intermeshing of natural and technological. The integration between synthetic fibres and organic rhizomes allow for a hybrid fabric that offers renewed life to environments that would otherwise be devastated by the human footprint. In psychoanalytic terms, the geotextile attempts to treat trauma—be it a chemical spill, erosion, infrastructure impact and so on.

Some of Beesley's first geotextiles are earthworks establishing his initial discourse with the earth's surface as a reaction to his archaeological finds during his Prix de Rome research. Traumatized by his discovery at the Palatine Hill—that the literal foundation of Roman civilization, and thus the resulting Western civilization, is built upon child sacrifice—Beesley developed a coping strategy of reburying that which he uncovered:

> *I began to respond to the Porta Mugonia excavations by conceiving a textile cover used for reburial of the archaeological site. The structure was conceived as a hybrid burial shroud, constituted as artificial living turf akin to the massive Republican and Imperial accretions of the Palatine Hill itself. Palatine Burial was a fabric soil, a spreading geotextile reinforcing the soil and fostering new growth.'* [18]

In a sense, all of Beesley's geotextiles are re-enactments of this reconciliatory burial, a hope to rebuild the social fabric and create spaces with a renewed sense of growth. For with a burial, the body literally and ultimately breaks down the final barrier between the flesh of the human and the flesh of the world. Ashes to ashes, dust to dust, the microscopic enmeshes to create the fertile soil for new life.

Loosened from the industrial confines of geotextile functionality, the early works *Haystack Veil* and *Erratics Net* are earthworks utilizing repetitive geometric meshes on a large scale and capitalizing on the vast scope of territory covered by the sculptural fabric. After these two projects, which feel like gestural sketches, Beesley's methodology switches from fieldwork to laboratory research: a movement from earthworks to gallery space, from site-specific to non-sites (Robert Smithson). In practice, the use of real soil is replaced with implied soil, in exchange for a complexi-fication of the geometric structural meshwork and the integration of distributed processing networks that control responsive articulations. The first evolution of the work occurs at this stage: Beesley models the flow of information processing on the flow of organic growth.[19] The geotextile moves from static fabric to dynamic membrane. The digestive machine of organic soil decomposing bodies is here supplanted by sensors tracking the 'erotic prey' of the gallery visitor.

But unlike the (x,y,z) matrix used in computer vision to analyze the motion and location of subjects within its surveyed territory,[20] the geotextiles of Beesley are not woven textiles with a warp and weft, they are not grid structures or lattices. They are more analogous to the structure of felt with their 'entanglement of the...microscales of the fibers.'[21] Installations like *Implant Matrix* and *Hylozoic Soil* are architectural textiles of knotted processes including topological meshes akin to Klein bottles and digital information networks sensing human presence. Organic structural design, distributed processing and dynamic relations are what make up the architectures of the future and which are really the extension of ideas from the past found in Victor Horta's Art Nouveau designs or Alvar Aalto's philosophy:

> *Nature, biology, is formally rich and luxuriant. It can with the same structure, the same intermeshing, and the same principles in its cells' inner structure, achieve a billion combinations, each of which represents a high level of form. Man's life belongs to the same family. The things surrounding him are hardly fetishes and allegories with a mystical eternal value. They are rather cells and tissues, living beings also, building elements of which human life is put together. They cannot be treated differently from biology's other elements or otherwise they run the risk of not fitting into the system; they become inhuman.*[22]

But what about that which is not even physical? It is fine for these architects to relate different physical entities, but what about the recent introduction of digital technologies? Deleuze and Guattari's description of a nomad art seems to continue the same line of thought:

> *It is inorganic, yet alive, and all the more alive for being inorganic. It is distinguished both from the geometrical and the organic. It raises 'mechanical' relations to the level of intuition. Heads (even a human being's when it is not a face) unravel and coil into ribbons in a continuous process; mouths curl in spirals. Hair, clothes...This streaming, spiralling, zigzagging, snaking, feverish line of variation liberates a power of life that human beings had rectified and organisms had confined, and which matter now expresses as the trait, flow or impulse traversing it. If everything is alive, it is not because everything is organic or organized but on the contrary, because the organism is a diversion of life. In short, the life in question is inorganic, germinal, and intensive, a powerful life without organs, a body that is all the more alive for having no organs, everything that passes between organisms ('once the natural barriers of organic movement have been overthrown, there are no more limits').*[23]

Hylozoic Soil attempts this very overthrowing, a search not for the 'inhuman' of Aalto, but the living 'inorganic' of Deleuze and Guattari. The connection between the interface and the user, or the building and one who moves through it, is not at the level of thought, it is at the proprioceptive level where natural eye jitter (nystagmus) happens to twitch in sequence with the memory alloy of a whisker in *Implant Matrix*. And thus begins a feedback loop between the analog and the digital, the haptic and the optic, Euclidean and non-Euclidean space, between inside and outside.

Another important shift in Beesley's research develops in the later geotextiles where the elevation of the work is raised from the ground into the air. *Haystack Veil* was dispersed along the ground like a normal geotextile, but as we move into the later pieces such as *Reflexive Membranes*, *Implant Matrix* and *Hylozoic Soil*, the work is suspended, taking on a multidimensional form closer to the microfibre structure of felt than a lattice woven fabric. This subtle change in position from underfoot to overhead suggests the possible future use of geotextiles and gardens not only on the ground in parks, but as integrated hybrid landscapes in the verticality of the urban situation. Imagine the future of buildings where our skyscrapers are not reflective skins of glass and metal but flowing surfaces with geotextiles; not only skyscrapers composed of woven carbon fibre structures able to twist and respond to the torque of environmental conditions but geotextile canopies able to sculpt the psychological and emotional responses of the client.[24] As the field of high-performance textiles finds implementation in functional infrastructure, medicine and architectural design, the need shifts beyond seeing if new materials can perform from an engineering perspective to learning how to utilize networks of information and structural textiles as an effective means of creating an increase in the qualitative feeling of our environments.

Situated at the prototype stage, the art exhibitions of Beesley's installations serve as a 'laboratory for built work.' In the same vein as the seminal 1976 exhibition *The Idea as Model*, Beesley's architectural models are not about representation empowered by the Lilliputian effect of contrasting scale between client and toy building.[25] Instead of a model anchoring the narrative fantasy of a proposed project, the idea-model functions as a conceptual tool with its own aesthetic principles. In this way, we can see these highly artificial experiments as thought processes speculating on 'what the surface of a building could be like.'[26] If all of this seems far fetched, Beesley's geotextiles share an imagination similar to Archigram's *Plug in City* or Yves Klein's experiments towards an *Air Architecture*—projects that influenced our infrastructure and thinking more than perhaps fabrication and construction.[27] Then again, in the near future, that Art Nouveau pattern moving on the wall might not be a hallucination—the wall might actually be moving. Without conscious thought, it just might be a Beesley topiary shifting to offer protection from an ozone-piercing sun.

Notes

1 *Brane* has 3 important functions within the scope of this essay: 1. *memBrane*: 'a pliable sheetlike structure acting as a boundary, lining, or partition in an organism,' 2. *Brain*: intelligent processing network, 3. *Brane*: in theoretical physics defined as 'an extended object with any given number of dimensions, of which strings in string theory are examples with one dimension. Our universe is a 3-brane' (Oxford Dictionary).

2 Hal Foster compares Gehry buildings to the Statue: 'For all the futurism of the computer-assisted designs of architects like Gehry, his structures are often akin to the Statue of Liberty, with a separate skin hung over a hidden armature and with exterior surfaces that rarely match up with interior spaces' 'The ABC of Contemporary Design' *October* Vol. 100 (Spring 2002): p. 191-199. Anthony Vidler on the interior similarities of Greg Lynn and the Statue: "The 'inside' of architecture, then, to return to an early theme of Lynn, would not be shaped by occupation or by any other attribute than its profoundly residual character—like the fortuitous insides produced, say, by the external necessity to fashion a shape like that of the Statue of Liberty." *Warped Space: Art, Architecture and Anxiety in Modern Culture* (Cambridge, Massachusetts: MIT Press, 2000). Philip Beesley and Sean Hanna compares Foster and Partners' Swiss Re Headquarters to the Statue: 'Lighter,' *Extreme Textiles: Designing for High Performance*, ed. Matilda McQuaid (Indianapolis, IN: Princeton Architectural Press, 2004)

3 Norman Foster

4 Diller + Scofidio

5 Brian Massumi, *Parables of the Virtual: Movement, Affect, Sensation* (London: Duke UP, 2002) p.148

6 Were the vectors of sightlines reversed in glass architecture, we would run into the nightmare of Jeremy Bentham's Panopticon: trapped in a reflective cage of self-analysis, exacerbated by the paranoia of being watched by the unknown. See Dan Graham's work ranging from his glass pavilions to his theoretical *Cinema* based on the phenomenon of one-way mirrors.

7 An overused word defined in multiple ways, I would define the virtual as the obsessive accumulation of information combined with the speed of its access and transfer, creating overdetermined clouds of possibility

8 Juhani Pallasmaa, *Eyes of the Skin: Architecture and the Senses* (London: Academy Editions, 1996) p. 41

9 It is at Merleau-Ponty's 'crossing over' that the desires of normally opposed viewpoints like Massumi and Pallasmaa find common ground—despite their disagreements about phenomenology. While Massumi is suspicious of the moral connotations embedded in the writing of Pallasmaa (rooted in Heidegger and the organicism of Frank Lloyd Wright's value of 'integrity'), contextualized in the face of Modernism's corporate glass boxes, Wright's attempt to design buildings based on their interior function with resulting exterior appearance is the precursor to Greg Lynn's 'inside' of architecture with its 'residual' character (or Lars Spuybroek's *Deep Surface*). The shared concern is not moral but ethical, a formal strategy to keep open the space for growth in the field of design. Whether this manifests itself in 1930s architectural revolution or new millennial revolution, the point is that they are architectures of the same revolution—one a temporal rotation later. Of course, Pallasmaa desires to create a sense of the home (*heimlich*) while Massumi desires the unhomely (*unheimlich*). Nevertheless, both strategies are tactics to dissolve subjectivity into space, into architecture apropos the senses: while Pallasmaa hopes to define one's subjectivity through pleasure and immersion into comfort, Massumi wishes to complicate and challenge one's subjectivity through disorientation and augmentation. Perhaps it is most productive to locate the two thinkers' similarities by referring to two specific buildings: Pallasmaa's acclamation of Wright and Massumi's championing of Spuybroek. Wright's *Fallingwater* (1935-9) and Spuybroek's *H2O Expo* (1994-7) both attempt to create the form and atmosphere of their buildings from the flow of water. Their differences are not in idea but merely in their stylistic contexts (International Style versus digital) and the technologies available at the time. Neither building is less experimental if taken in the context of its construction.

10 Maurice Merleau-Ponty, *Basic Writings*, ed. Thomas Baldwin (Routledge, 2004) p. 255

11 The artists James Turrell and Robert Irwin provide striking examples where the relation between architecture and a window can be poignantly affective

12 Massumi, p.192

13 William J. R. Curtis, *Modern Architecture Since 1900*, 3rd ed. (NY: Phaidon, 1966) p. 425

14 Quoted in Richard Weston, *Alvar Aalto* (NY: Phaidon, 1995) p. 100

15 Pallasmaa, p. 41. Here again we see the classic divide between a Cartesian engagement with the world (*res extensa*) versus a more 'bottom-up' approach.

16 A recent practice of guerrilla gardening in public spaces normally left unattended is another example of urban gardening. With this strategy, the in-between places of meridians, tree wells, back alleys and other 'no man's land are reappropriated and beautified: from no man's land to nomadic gardens.

17 Christian Werthmann, *Green Roof: A Case Study* (NY: Princeton Architectural Press, forthcoming)

18 Philip Beesley, *Chthonian Projects* lecture (July 31, 2006)

19 For an interesting example of a visual version of organic information processing, see Benjamin Fry's *Organic Information Design*, M.Sc. Thesis (MIT Media Lab, 2000), and his project *Valence*

20 While the computer screen is 2D, and thus explains an X, Y matrix, colour space is a depth in computer graphics, Z. Spatial location is represented by raster location (the line of video), but the colour value is represented by a third coordinate (often a string of RGBA values). This system shares the fundamental idea of colour space as depth in a 2D field sketched out at the turn of the 20th century in the works of the De Stijls, especially the 4D experiments of avant-garde architect Theo Van Doesburg.

21 Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (Minneapolis, MN: Minnesota Press, 1987) p. 475-6

22 Quoted in Weston, p. 100

23 Deleuze and Guattari, p. 498-9

24 Beesley co-authors an essay with Sean Hanna in the exhibition catalogue *Extreme Textiles*. The overall exhibition and book explores architectural implementations of textiles, focusing on the engineering marvels of recent advancements in technology. In contrast to this line of research, Beesley's art exhibitions provide the opportunity for a more sensual exploration of technotextiles. *Extreme Textiles: Designing for High Performance*, ed. Matilda McQuaid (Indianapolis, IN: Princeton Architectural Press, 2004). For a proposal of carbon fibre structures reinforced with resin, see the overview of Peter Testa Carbon Tower, p. 110-118

25 Though an interesting observation could be made between the structural and material similarity between Beesley's clear plastic modular architectures and Jim Henson's clear sugar-crystal architectures built by the *Fraggle Rock Doozers* as well as other pedagogical toys popular in the 1980s such as the clear snap-fit *Capsela* equipped with small motors, gears and other mechanics illustrating basic physics principles.

26 Philip Beesley, 'Orgone Reef,' *Architectural Design* vol. 75, no. 4 (July/Aug 2005)

27 For Archigram, see especially the textile graphic on the cover of *Archigram* no. 7 and Chapter 3: 'Beyond Architecture: Indeterminacy, Systems and the Dissolution of Buildings' in Simon Sadlers *Archigram: Architecture Without Architecture* (Cambridge, Massachusetts: MIT Press, 2005) p. 92. For Yves Klein, see Peter Noever and François Perrin's Yves Klein: Air Architecture (Ostfildern, Germany: Hatje Cantz, 2004). This is not to undermine Beesley's keen interest in present-day modes of fabrication: see his publication *Fabrication: Examining the Digital Practice of Architecture*, eds. Philip Beesley, Nancy Cheng and Shane Williamson (Cambridge, Ontario: University of Waterloo School of Architecture Press, 2004). I mainly wish to draw attention to his installations as part of the more imaginative aspect of his multifaceted practice.

Surface: Between Structure and Sense

Andrew Payne

Since 1996, Philip Beesley has been producing membrane works whose material and semiotic performance is ambiguously situated between the realms of architecture and art. This equivocation of architectural and artistic vocations places these works in a very recognizable tradition of modernist and post-modernist artifactual production, one that would include Max Bill and Gerrit Rietveld, Gordon Matta Clark, and Diller Scofidio + Renfro. How might we begin to describe what is specific to Beesley's own testing of the threshold separating architecture from art? I imagine that specificity to be of a piece with Beesley's tireless posing of a question perhaps more immediately germane to the former discipline, but nevertheless not without implication for the latter: how should the world, meaning our world, this world in which natural and artificial systems are co-implicated to the point of indifferentiation—how should this world be surfaced? What is especially distinctive about Beesley's response to that question is its interrogation of a set of oppositions that underpin our familiar relationship to the object realm. Earth and world, horizon and ground, object and milieu, organism and mechanism, surface and depth, skin and vessel, technical instrument and symbolic cipher-all come up for question in the membrane structures Beesley has produced in the last decade and change. If Beesley's earlier works bear a more recognizable relationship to structure and materials research currently being conducted in both architecture and the newly emerging discipline of design semantics,[1] the more recent work, marked by a vertical reorientation of the geotextile membrane, exacerbates the semiotic enigmas already lurking in this earlier work, progressively transferring the interest in surface as a locus of structure (and therefore virtual habitability) to an interest in surface as a locus of sense (with all by way of affective investment that term implies.) This interest in the surface as a locus of sense, and more especially in the new role played by surfaces in the technological reorganization of the human sensorium, marks a point of affinity between these works and a number of contemporary architectural and artistic practices.[2]

1 In his *On the Essential Contexts of Artefacts or on the Proposition that 'Design is making sense of Things'*, Victor Margolin and Richard Buchanan, 'The Idea of Design: A Design Issues Reader' (Cambridge, Mass.: M.I.T. Presss, 1995) p. 57, Klaus Klippendorf describes product semantics, a variant of the term design semantics, as 'a study of the symbolic qualities of man-made forms in the cognitive and social context of their use and the application of the knowledge gained to objects of industrial design.' He further identifies this study as organized around four contextual matrices: the ecological, the generative, the sociolinguistic, and the operational. The aptness of this definition and associated taxonomy not only in application to Beesley's membrane works but indeed to a significant number of contemporary art practices suggests an unprecedented confluence between post-vanguardist experimental art practice and contemporary industrial product research, one that remains largely untheorized.

2 For a discussion of some of these practices, see my *Surfacing the New Sensorium*, Praxis 9: Expanding Surface, Fall, 2007, p. 5-13.

'All Art is Cosmological'

I have suggested that these works put in question the distinction between technical device and symbolic cypher. But just what sort of symbolic operation do these works perform? Let me begin with the early works, for indeed the semiotic import of these works shifts over time, a shift marked by their reorientation along a vertical axis. Were I to describe the symbolic operation that these early works perform according to the terms of traditional rhetoric, I would say that they are synecdoches, What I mean by this is that they represent so many microcosms, so many models or schematizations of a larger universe in which we might imagine them nested.[3]

Of course, the theory of the microcosm has a distinguished career in architecture, from Vitruvian to Modular Man and beyond. Having said that, the microcosmic substitution of part for whole becomes problematic with the modern conception of a universe unremittingly extended. After Giordano Bruno, the movement from cosmos to model is also a movement from infinite magnitude to finite presentation, precisely the trajectory that, since Kant, we associate with the sublime. Henceforth, the operation of cosmic synecdoche therefore necessarily refers to an absent or impossible totality.

Recent discussions in architecture suggest that this disruption of classical cosmology has the effect of relieving architecture of the burden of motivating its compositional strategies according to microcosmic schemas, freeing it to organize the massing of built form in a strictly *partes extra partes* fashion. For instance, Stan Allen, citing the Great Mosque at Cordoba as a prescient counter-example to the classical logic of the microcosm, argues that:

> *Parts are not fragments of wholes, but simply parts. Unlike the idea of a closed unity enforced in western classical architecture, the structure can be added without substantial morphological transformation. Field configurations are inherently expandable; the possibility of incremental growth is anticipated in the mathematical relations of the parts.*[4]

Translating this additive logic into the terms of classical rhetoric, it would seem that the compositional logic that comes into ascendance with the passing of classical cosmology is not a logic of synecdoche, but of metonymy, the association of elements in the absence of any global figure that would predetermine the terms of their association. I do not wish to diminish the relevance of Allen's argument in application to any number of contemporary architectural practices. However, appeal to the logic of metonymy, of purely *partes extra partes* construction, leaves unanswered a number of fundamental questions relating to our post-classical condition. How, in the absence of any totalizing gestalt, do these parts ever

3 On the fundamentally tropological status of cosmic models see Max Black, *Models and Metaphors* (Ithaca: Cornell University Press, 1962); Mary B. Hesse, *Models and Analogies in Science* (Notre Dame: University of Notre Dame Press, 1966); Fernand Hallyn, *The Poetic Structure of the World: Copernicus and Kepler*, trans. Donald M. Leslie (New York: Zone Books, 1993).

4 Stan Allen, *Field Conditions*, 'Points+Lines: Diagrams and Projects for the City' (New York: Princeton Architectural Press, 1999) p. 94.

become intelligible as parts? And of what precisely is it that they now serve as parts? It is arguably in response to just these sorts of questions that the French psychoanalyst Jacques Lacan describes the production, alongside the concatenation of signifiers according to the logic of metonymy, of a catachretic signifying effect in which the function of the part is not to associate with other contiguous parts, but rather to stand in for the whole insofar as it is always missing or impossible. Here each part, and precisely in order to be intelligible as part, serves as microcosm of an otherwise unpresentable, because infinite, whole, so that the coherence of the whole is then a function of the nesting of the unpresentable within the presentation, the infinite whole within the finite part, each time out.[5] I believe that Jean Luc Nancy clarifies the interest of this conception of the founding metaphor as a catachretic synecdoche for any consideration of Beesley's work when he remarks that:

> *All art is cosmological, since the productive technique of spacing always produces the world, an ordering of the world, the world in part or as a whole, but always and each time the whole in each part. The world is only ever the infinite reference of each one of these points to all others, and what we call a work of art is, each time, a singular, monadic, and nomadic concretion of the cosmos.*[6]

This begs the question: what sort of universe is it that these works model or concretize, however imperfectly or sublimely? In responding to that question, I find myself reaching for Gilles Deleuze's phrase: 'the plane of immanence'. It seems to me to provide a characterization, not less apt for being literal, of the cosmos that these works body forth in miniature and the relations between both part and part and part and absconded whole that this cosmos implies. By that I mean that the propagation of identical or nearly identical parts in a planar configuration is strictly correlative to that logic of equivalence amongst singulars that immanent organization implies. Hence the plane of immanence is a plane first of all because the horizontal distribution of parts effectively levels any hierarchy that would have ordered them according to some system of ascending and descending values, some chain of being.[7]

Now Beesley is very precise concerning the construction of his planes, which unlike Deleuze's are not abstract but concrete. Recalling another theorist who was not averse to discovering cosmic significance in the most minor details of construction, Gottfried Semper, Beesley tells us that they are textile skins.[8] By this we may understand that their surface continuity is produced through an iterative process involving the imbrication of finely scaled elements possessed of a minimal degree of thickness in such a way that the continuity of the resulting fabric is structurally dependent on the no less finely scaled spaces that keeps these elements in a state of interacting difference, the space of their warp and weft. This is a flatland, but a flatland whose surface has a certain porosity and minimal thickness.

5 For Lacan, the movement of signification is twofold. In the first instance it implies a catachretic substitution of something for nothing, a substitution thanks to which, on Lacan's account, the passage from nonsense to sense is made possible. This is the axis of signification that Lacan identifies with metaphor, but which I describe as catachretic synecdoche, so as to emphasis the relation of part to impossible or absent whole implicit in this operation. In the second instance, there is a substitution of this second signifier for this first, founding one. This is the axis of signification Lacan identifies with metonymy. See, for instance, Lacan's discussion of metaphor in *The Instance of the Letter in the Unconscious, or Reason since Freud*, 'Ecrits', trans. Bruce Fink (New York: W. W. Norton & Company, 2006) p. 412-444.

6 Jean Luc Nancy. *The Technique of the Present: On On Kawara*, 'The Ground of the Image', trans. Jeff Fort (New York: Fordham University Press, 2005).

7 It is in precisely with respect to this non-hierarchical distribution that a certain limited affinity obtains between the symbolic operation at play here and the forms of *extra partes* organization described by Allen.

8 Gottfried Semper (1803-1879) was a German architect and art historian. In his *The Four Elements of Architecture*, he presented a theory of the development of the tectonic arts polarized around the distinction between the earthwork and the textile wall.

Unearthing Semper

The description of the architectural membrane as a textile suggests Gottfried Semper. But must we not see in the horizontal extensions of the membrane in Beesley's early works a subversion of the Semperian distinction between chthonic and textile arts? The earth as fundamental datum, exemplar of the fated giveness of things, is suppressed in works like *Soil*, *Hungry Soil*, *Haystack Veil*, and *Synthetic Earth*, literally swept under the carpet, as are the implications that go with working, through excavation, that heaviest and most intractable of the natural elements. All the rich associations that attach to the earthwork are here suppressed in favor of a strategy in which the *mundus* is drained of its gravity and becomes merely a surface among others. Here we are encouraged to imagine a future in which a single geotextile swath would outfit all of creation, encouraged to imagine that swath being rolled across lawns and over pavement, up walls and over roofs, somewhat in the manner of Borges' map in which the difference between virtual model and mundane original is eclipsed. The earth, deep with years, is in these works suppressed in favor of a ground conceived as susceptible to the same covering strategies employed in the vertical partitioning of space. Just as the carpetwall has served to keep the threat emerging on a predatory horizon at bay, so these eco-mats serve to keep the underworld, with its chthonic energies, at a distance. But the interesting thing is that they do this precisely by simulating, in the shallow lattices that their horizontal extension reveals in section, something like the sedimentations of matter over time thanks to which an earth ever first accumulated. Like I said, these flatlands have a certain thickness, a thickness in which stuff accumulates, the residuum of spent time. These are seedbeds for the cultivation of inanimate or barely animate matter. It is the simulation that is of interest here, the simultaneous replication and replacement of an original earth, the transformation of its immemorial giveness into the product of an act of artifice.

So much for the early works. As the series develops, we can observe a vertical reorientation of the membrane thanks to which it starts to perform not as carpet but as wall or canopy. Now the membranes stand before or loom over us, sometimes outfitted with pseudopods evincing effects of mechanical empathy. With this change of orientation I would say that their role as structural support begins to give way to a new role in which the membrane serves as façade or mask. In these works, the surface no longer holds us up, however notionally, at a distance from the earth; rather, the differentiated surface holds us in its gaze. I wonder whether we have not passed at this point from the model to the enigma.

From the Model to the Engima

The later works gaze, and in some instances even gesture, back at us, as though *we* were for *them*. It is at this point that the construction and deployment of these membranes definitively leaves the domain of the

research artifact and enters the territory of the work of art, more precisely, the territory occupied by sculpture in what Rosalind Krauss has described as its 'expanded field'.[9] As I have observed, it is also at this point that the work shifts semiotic modes, from the model to the enigma, and the pretext of structural and materials research gives way to a more psychoanalytically inspired exploration of the relationship between surface and affect. If my intuition is correct, then the later work, of which *Implant Matrix* may serve as the exemplar, provokes two questions. Firstly: how is our understanding of these objects enriched by interpreting them as sculptural installations? Secondly and conversely: how is our sense of the possibilities available to a sculptural object/field enriched by our encounters with these membranes?

One way to begin to address these questions would be to situate Beesley's skin objects in relation to the primary objects of literalist artists like Robert Smithson and Donald Judd. If that seems to me a place to begin, it is because the work of Smithson and Judd represents in my view a fundamental rupture or displacement in the status of the art object, one that their chief ideological adversary, Michael Fried, was prescient in appreciating, if not generous in assessing.[10] For reasons that I will clarify below, it seems to me that we are still living in the aftermath of that rupture, still experiencing the work of art according to something like the terms of the displacement it effected. With that in mind, let me briefly recall the terms of Fried's argument concerning 'literalism,' so as then to clarify what I imagine to be its relevance to contemporary artistic practice as a whole, but to Beesley's practice most specifically.

On Fried's account, the rupture initiated by Judd and Smithson comes down to erasing the distinction between our experience of the art object as object and our experience of it as art. For Fried, the distinction between our experience of an object *qua* object and our experience of a work of art is important because it prevents us from misguidedly employing aesthetic criteria in the second instance that are in fact felicitously applied only in the first. An example, indeed the prime example, of such misguided judgment is the judgment of a work of art as 'interesting'. Hence to Judd's remark that it is not necessary that an art object be beautiful, if it is interesting, Fried responds that for the modern artist and his critic, neither beautiful nor interesting will do; the work—which is not, but is magically invested in, the object—must be 'good'. Now if we follow Fried, not to be good, but merely interesting, or, at least, merely interesting in the way that Judd and Smithson are merely interesting, is to be guilty of two, apparently antithetical, crimes of taste: 'literalism' and 'theatricality'.

Literalism is what Judd espouses when he says, a propos of a work by Lee Bountecou, that 'the blackhole does not allude to a blackhole, it is one.' It implies that the work presents no content exterior to its presentation of itself in the viewer's intuition of it, including that content that Fried, following his mentor Clement Greenberg, would associate with medium specificity: the content of painting is the history of painting, the content of sculpture is the history of sculpture, etc. The second charge, theatricality, apparently antithetical to but in fact connate with the first, begins from the perspective that what is characteristic of objects of everyday experience, as against objects of art, concerns their always being embedded in a situation that determines their significance for a subject. It follows that, for Fried, *pace* Judd, to liberate our judgments of an object from the aesthetic conventions and values associated with the various artistic media (painting, sculpture, etc.), is by no means to restore the object to some ontological degree zero, to encounter that object in its 'raw' state, but rather to restore it to the same worldly situation from which aesthetic convention had initially rescued it, a situation that is, as Fried is careful to point out, entirely determined by the intentional framework of the subject that commands it. If literalist art is theatrical for Fried, it is therefore because human life is theatrical in the sense that our encounters with objects are predetermined by the intentional framework that orients our being in the world, with the result that objects seem to anticipate and welcome that framework and the interests it implies. For Fried, then, the miracle of the work of modern art is the miracle of an object whose interest cannot be entirely reduced or correlated to the situation of a subject. And for Fried, it is the frame or *parergon* that insures that the work of art remains unassimilated to that objective situation. As Walter Benn Michaels puts it in a recent discussion of Fried's argument in 'Art and Objecthood':

> *The frame turns the object into a representation and, making the beholder's experience of everything outside the frame irrelevant, makes his experience as such (which is to say his experience of everything but the representation) irrelevant… The removal of the frame turns the representation back into an object… and makes the beholder's experience of the object identical to his experience as such.*[11]

So what Fried calls literalism is *par excellence* an art of the situation, but of the situation insofar as it is commanded by the intentional framework of a subject. The literalism of the primary object insists on the subject as always already there commanding a situation outside of which the object evinces neither interest nor sense. In other words, literalism is the art object on the way to art environment, another way of saying architecture.

Now I take it as patent that today art labours under the sign of what Fried calls the literal, which is to say the theatrical. It is for this reason that the most consequential mode of artistic production today involves not the production of objects, but of milieux, installable environments. Today there is barely any art, let alone art object; it has been replaced by something called culture, a something we will know by the fact that it spreads out over everything like a scenographic syrup. Today, in this world awash in culture, there exists little or no concern to distinguish the experience of an everyday object from the experience of an object

9 Rosalind Krauss, *Sculpture in the Expanded Field*, 'The Originality of the Avant-Garde and Other Modernist Myths' (Cambridge: The MIT Press, 1986) p. 276-290

10 Michael Fried, *Art and Objecthood*, in 'Art and Objecthood: Essays and Reviews' (Chicago: University of Chicago Press, 1998) p. 148-172

11 Walter Benn Michaels, *The Shape of the Signifier: 1967 to the End of History* (Princeton, New Jersey: Princeton University Press, 2007)

whose objectivity has been suppressed in the interest of having it stand as a concrete schema for the resolution of the formal aporiae implicit in an expressive medium or symbolic form, this being, more or less, the definition of art that sustained the post-War consensus, at least in the North American context. Today, owing less to a shift of aesthetic preference than to a fundamental torsion in our manner of ontologizing sense, the integrity of these media and their power to convey cultural authority is severely diminished. Today, *pace* Fried, it is not the object but the affect it provokes when placed in its situation that counts. For better or for worse, perhaps for better *and* for worse, we live in the age of the work of art as rainbow, as cabinet of wonders, as perceptual marvel or special effect. For instance, the colour works of Olafur Eliasson, so representative of the spirit of our time, are not the least bit interested in separating aesthetic experience from an investigation of quotidian experience; indeed, they are precisely interested in using art as the means of transforming everyday experience into a form of experimental conduct.[12] The specific forms of intellectualization and idealization of experience implicit in the various theorizations of aesthetic judgment from Alexander Baumgarten to Fried have little or no role to play in this experiment, which is focused on those modalities of experience suppressed by the act of intuitive construction. What is more, whereas the intellectualization of optical experience that characterized the artistic canons of high modernism tended to advocate, if only implicitly, on behalf of a suppression of the other senses (so that 'medium specificity' comes to imply a kind of Taylorization of the sensorium), the postmodern *Gesamtkunstwerk* makes a direct, that is to say, at once literal and theatrical, appeal to the senses in their lived variety and connection. I think we can identify this new tendency, which spans the distinction between art and architecture, by the following features, not all of which are necessarily apparent in every work manifesting this tendency: an interest in the informational and simulacral potentials of technologically invested surfaces; a studied displacement of the sensorial regimes that organized the subject/object nexus under conditions of modernity; the post- or ultra-modern revival of the *Gesamtkunstwerk* in the guise of an immersive milieu; the expansion of art and architecture's sensorial spectrum to include non-optical stimuli; and the neo-constructivist conception of art as an organizer of novel forms of conduct conceived according to game-like critieria.

Is this not the context in which Beesley's more recent works install themselves? These works are unabashedly 'interesting,' and in precisely Fried's sense of the term. Not only do they engage their surroundings, they all but assimilate themselves to them. What is more, just as the literalist object, by virtue of its scale, shape, and position, exercises on Fried's account something like the charismatic attraction evinced by human others, thereby destroying the frame that shields the work of art from its environment, so these works, employing post-literalist strategies, construct a kind of eerie simulacrum of the inter-subjective encounter,

12 For a relevant discussion of this work by Eliasson himself. see Olafur Eliason, *Some Ideas About Colour*, eds. An Te Liu and Andrew Payne, 'Errata: The Cultural Productivity of Accidents, Errors, and Unforeseen Events', *PUBLIC 33*, Fall 2006, p. 50-57

one in which the object/milieu gestures by turns seductively and ominously to the viewer/occupant. The walls have ears is an anxious-making statement; how much more anxious-making, then, when these same walls sprout pseudopods whose sucking and grasping motions beckon to our presence.

Beesley's reorientation of his geo-mats along a vertical axis and his decision to outfit them with what can only be described as mechanical empathy indicators suggest that these membrane structures, in their later iterations, move away from the field of structural and materials research strictly speaking and into the domain of art. This displacement would be unthinkable in the absence of a contemporary re-conception of art as a practice that eschews any adherence to medium- or even discipline-specific conventions in the name of re-forging the link between experience and experiment implicit in the etymology of these terms.

From Flat Stock to Three-Dimensional Immersion

Michael Stacey

The wellspring that courses through Philip Beesley's work is landscape and humankind's relationship to the land, the interaction of people and the earth. His interests arise equally from the collective consciousness of humanity and a situated response to a found landscape. His work is a very humane response to the contemporary condition of ecology, and he seeks to progress beyond an abstract Modernism to something richer and more productive. In *Art and Industry* (1934), Herbert Read thought that art could be divided into two distinct types: humanistic art and abstract art. He defines humanistic art as that, 'which is concerned with expression in plastic form ideals and emotions.'[1] Using Read's definition, Philip Beesley's series of installations from *Haystack Veil* (1998) to *Hylozoic Soil* (2007) are clearly examples of humanistic art. Read also observed that 'The man who makes potentially, or partially, is an artist the moment the things he makes express feelings and invite response.'[2] Therefore, it is appropriate to consider Philip Beesley as both an artist and an architect, by training and based on his body of work.

Aspects of Beesley's work are rooted in the vastness of the Canadian landscape. *Erratics Net* (1998) responds to the glacier-scoured rocky landscape of Nova Scotia, and Beesley speaks eloquently of standing on this granite outcrop and being able to experience a connection with the earth and the millennia (about 5,000 million years) since the formation of this crystalline igneous rock. Beesley is also responding to humankind's actions on the Canadian landscape—the destruction caused by the extraction or the pollution of the landscape by heavy industry, which has been evocatively depicted by Edward Burtynsky. *Orgone Reef* (2004), exhibited as part of the *Digital Fabricators*[3] exhibition, can be read as an experimental geotextile, which by deploying artificial and natural processes, has the capability of creating a new landscape. A hybrid ecology implicitly capable of healing the earth; healing the scars of industry and capitalism as William Morris had longed for. There is a romantic quality to Beesley's work but it would be wrong to view it as utopian. Nor is it a dystopic warning to humankind, as penned by Canadian novelist Margaret Atwood in *Oryx and Crake* (2003), in which she writes:

> *On the eastern horizon there's a greyish haze, lit now with a rosy, deadly glow. Strange how that colour still seems tender. The offshore towers stand out in dark silhouette against it, rising improbably out of the ink and blue lagoon. The shrieks of the birds that nest out there and the distant ocean grinding against the ersatz reefs of rusted car parts and jumbled bricks and assorted rubble sound almost like holiday traffic.*[4]

The installation *Hylozoic Soil* invites the viewer or participant to reconsider his or her relationship to nature and to the near future of human ecology. The installation is immersive in its visual provocation; it is biomimetic, romantic, dreamy, inventive, and an exemplar of spatial poetry. Yet Beesley's work goes beyond biomimicry, seeking a synthesis between nature and artifice. Central to this train of thought is the desire to harmonize artificial and natural processes, and to expose similarities in the act of creation in the human mind and nature. The influence of the brilliant Scottish scientist D'Arcy Wentworth Thompson is clear from the organic geometry used in many of the installations, and can be evidenced by Beesley's organization of a conference—along with Sarah Bonnemaison—at the University of Waterloo in the fall of 2001. The conference took its title from Thompson's seminal book *On Growth and Form* (1917), and Beesley has taken more from Thompson than a mere interest in the mathematics and geometry of living organisms. In fact, he opened the conference proceedings with the following quotation from *On Growth and Form*: 'Matter as such produces nothing, changes nothing, does nothing…[it] can never act as matter alone, but only as seats of energy and as centres of force.'[5]

His time in Italy as winner of the Prix de Rome in 1995-6 appears to have been a formative experience: working with an archaeologist, he recorded ritual burials of ancient Rome. He drew inspiration from this underworld, and one of his Chthonian projects 'evokes a collective memory of innumerable voices from history.'[6] In Rome, the layers of culture, power, history and architecture are evident to virtually all visitors of that majestic city. Possibly one of Beesley's talents is the ability to make such qualities available in any given space and often in the non-programmed, non-referential space of a gallery.

1 Herbert Read, *Art and Industry* (Indiana University Press Edition, 1961) p. 36

2 Herbert Read, *Art and Industry*, p.13

3 Michael Stacey, ed. *Digital Fabricators*, (Riverside Press, 2004)

4 Margaret Atwood, *Oryx and Crake* (Bloomsbury, 2003)

5 D'Arcy Wentworth Thompson, *On Growth and Form* (Cambridge University Press, 1917)

6 Philip Beesley, *Chtonian Projects* lecture (July 31, 2006)

7 *The Girl with No Door on Her Mouth* (2002)

Digital Fabrication

Beesley is a pioneer of digital fabrication. Digital design has the potential of returning architecture to the centre of the constructive process. It also offers the potential for the architect to become a direct fabricator or digital craftsman to drive manufacturing from his or her computer desktop. This provides both opportunity and responsibility to the architectural profession. The laser-cut Mylar screen of the set for the opera—*The Girl With No Door On Her Mouth*—which was designed in collaboration with Dereck Revington and staged in 2002—is an early example of direct digital fabrication, using the facilities of the Integrated Centre for Visualization, Design and Manufacturing [ICVDM] at the University of Waterloo.[7] Philip Beesley's body of work encompasses many collaborators, and he seems to apply the principle clearly articulated by the Japanese industrial designer Sori Yanagi: 'Design is not something achieved by an individual working alone. If three put their heads together, goes a Japanese proverb, the wisdom of Manjusri Bodhisattva can be theirs. A designer cannot have too many gifted collaborators.'[8]

8 Sori Yanagi, *Sori Yanagi Designs* (Sezon Museum of Art, 1998)

Not Driven by Technology

Although the installations *Orpheus Filter*, *Orgone Reef* and *Hylozoic Soil* are examples of digital fabrication, unlike many contemporary interactive installations they are not driven by a fascination with technology alone. The installations are generated from a depth of thought on the human condition and our collective potential influenced by the psychoanalysts Donald W. Winnicott and Wilhelm Reich and the writings of Jesuit theologian Pierre Teilhard de Chardin. 'Making architecture may be considered a conscious endeavour to imagine and investigate the physical and psychological aspects of human experience.'[9]

9 Bob Shiel, ed. "Design Through Making," *Architectural Design* Vol. 75 No. 4 (2005)

Hylozoic Soil is a lightweight architecture, which is informed by the inventive work of Frei Otto and Felix Candella, where a minimum of material is used to create the maximum impact. In the hands of some architects, this becomes a reductive process and a very 'wooden' or limited architecture results. Often this is the result of a lack of investment or input into the base components of the architecture and an obsession with standardization, which is now technologically obsolete.[10] What Beesley achieves is much more like great jazz music. Jazz is in essence prefabricated, the melody is composed, the structure agreed and the nature of ornamentation of each instrument is known. The band is well rehearsed. The improvisation of the musicians is what brings this form of prefabrication to life. What is required to make great jazz is skill, commitment and inventiveness. Within his installations, Beesley demonstrates all of these qualities—composition, structure and ornamentation. It is his knowledge of materials and how they will perform in space that creates the improvisation, even before any

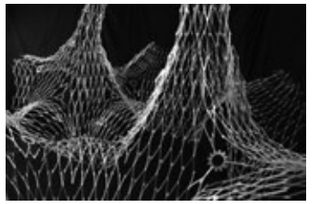
10 Mass production never truly applied to architecture despite the extensive rhetoric surrounding 20th-century architecture, and today we have the means to produce bespoke components without significant costs.

active interactive technology is introduced. *Orpheus Filter*, unlike *Orgone Reef* and *Hylozoic Soil*, was responsive to its environment only through its component parts.

A new element within *Hylozoic Soil* is an expanded space-lattice mesh, which is capable of taking compression as well as tension. This is formed from dual tetrahedrons, composed of two identical chevron-shaped wishbones that snap into each other. The interactivity within the installations has developed from *Orgone Reef*, which introduced proximity whiskers. For *Hylozoic Soil*, Beesley is using 'Arduino' distributed microprocessors and arrays of narrow-band proximity sensors.[11]

Although not driven by technology, Beesley demonstrates his considerable understanding of the means and methods he is using and specifically the machinery—the laser cutters. About 100 years after Frank Lloyd Wright's lecture entitled *The Art and Craft of the Machine*, Beesley appears to be delivering the mastery of the machine that Wright called for.

> *In this day and generation we must recognize that this transforming force whose outward sign and symbol is the thing of brass and steel we call a machine, is now grown to the point that the artist must take it up, no longer protest. Genius must dominate the work of the contrivance it has created. The plain duty is relentlessly marked out for the artist in this, the Machine Age. He cannot set it aside, although these involved an adjustment to cherished gods, perplexing and painful in the extreme, and though the fires of long-honoured ideals shall go down to ashes. They will reappear, phoenix-like, with new life and purpose.*[12]



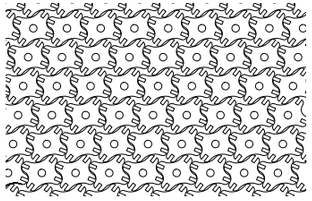
11 Expanded space-lattice mesh and component parts of *Hylozoic Soil*

12 Quoted from Frank Lloyd Wright's lecture *The Art and Craft of the Machine by Herbert Read in Art and Industry*. Read dates this lecture as 1904 and this specific quote is not included in the text of Wright's 1901 lecture *The Art and Craft of the Machine in Rethinking Technology: A Reader in Architectural Theory*, edited by William W. Braham and Jonathan Hale (Routledge 2007)

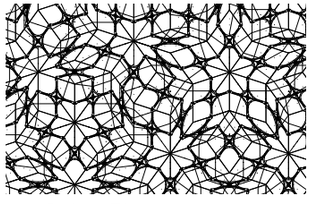
From Flat Stock to Three-Dimensional Immersion

In the introduction to *Component Design* (2001), I placed an emphasis on components that are fully three-dimensional, techniques such as superplastic aluminum which can produce doubly curved components or metal castings which offer a freedom in form-making once the constraints of the metal and process have been understood. The tectonic skill demonstrated by Beesley in *Orpheus Filter* I find fascinating. He has taken one process, laser cutting, and basically two materials, acrylic and Mylar, and produced an inventive and immersive three-dimensional installation. Cutting from flat stock sheets, he has used a minimum of material with a minimum of waste. The minimization of waste is produced by using a carefully considered packing geometry.[13]

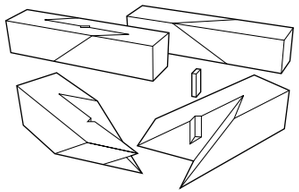
The fabric comprises a dense array of interlinking components, making an intricate three-dimensional structure. The array is organized in a cohesive structure using shifting patterns of non-repeating geometry, a Penrose tessellation. This is generated by deploying alternating rhombic structural units and corresponding decagonal membrane tiles.[14]



13 *Orpheus Filter* cut sheet



14 *Orpheus Filter* Penrose tessellation geometry



15 Miyajima-tsugi, halved oblique scarf joint

16 *Lattice Archipelogics* (courtesy of Servo)

17 Ben van Berkel and Caroline Boss, *UN Studio: Design Models* (Thames and Hudson, 2006) p. 14

The structure is laser-cut 3mm acrylic and the resilience of this material, which was invented in 1933, is used to produce snap-fit connections and sprung sliding connections. Although some components serve solely as connectors, the parts are cut to facilitate connectivity. To this armature of acrylic, leaf-like membranes of translucent Mylar are fixed. Thus, the drafting film on which architects in an earlier era—the late-20th century—produced their working drawings is transmutated into a metaphor of future life. The inventiveness of the snap-fit details, although based on the flexibility of acrylic, remind me of the geometrical sophistication of Japanese joinery as beautifully set out in the Art of Japanese Joinery by Kiyosi Seike.[15] Appropriately, the complete installation is greater than the sum of its parts, but what wonderful parts. Each component has a distinct and interesting form and a unique role to play. *Orpheus Filter* reveals Beesley's interest in the classical—in the perfection of the geometric order and in the romantic—in its evocation of sources of energy, and in its provocation of the human psyche.

In terms of tectonic intent, it is revealing to compare *Orpheus Filter* with *Lattice Archipelogics* designed by Ulrika Karlsson of Servo. This interactive installation was also illustrated in the *Digital Fabricators* exhibition. The base component or cell of *Lattice Archipelogics* was rapid prototyped using stereo lithography on which a silicone mould was formed; the cells were then cast in polyurethane. The cells are joined together with a standard connector selected from a catalogue. Although *Lattice Archipelogics* and *Orpheus Filter* have typological similarities, they are tectonic opposites. Components assembled from flat stock compared to cast components, integral jointing compared to standard junctions, and thus the spatial outcomes differ significantly.[16]

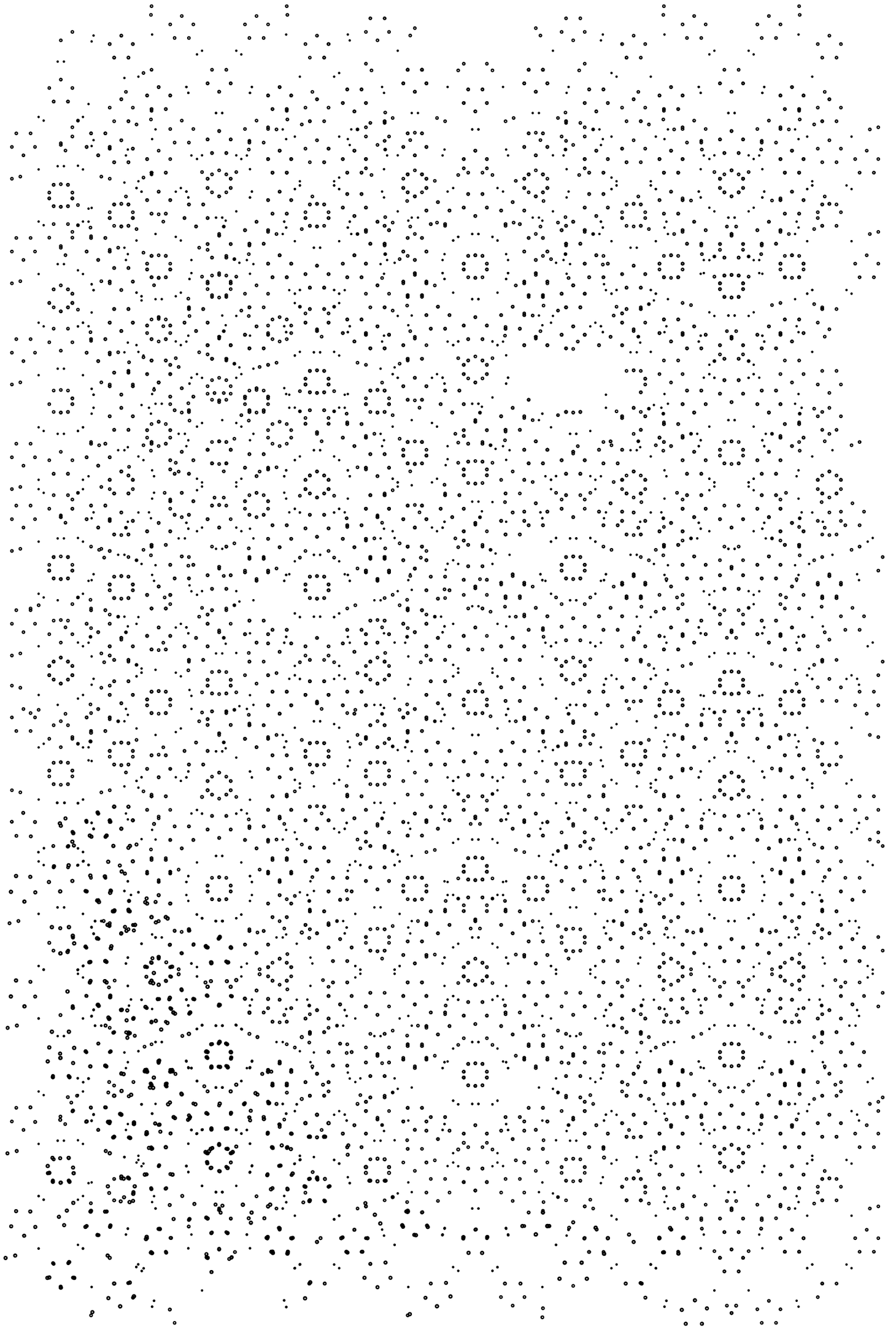
Although based on digital design and digital fabrication, Beesley's work is not an example of smooth surface architecture nor is it the architecture of no space or non-inhabitation. Many digitally inspired architects seek simply a means of achieving the rendered surface of the virtual form at full scale, without consideration of how it can be built or how the means of construction can inform the expressive quality of the architecture. This atectonic obsession with form is both neo-Beaux Arts and postmodern architecture in digital form—as flat as *Vanna Venturi House*, the house Robert Venturi built for his mother in 1962. This is surface-driven architecture where form is in danger of dominating all other content. Another criticism of some digital architects is that they are inward-looking, effectively only talking to themselves like a closed order of monks. Ben van Berkel and Caroline Boss (2006) suggest that there is too much obscuring rhetoric, and 'digital design techniques are taught and exercised in a hermetic way that is impossible to sustain in actual practice.'[17] This criticism should not be applied to Beesley's work for at least two reasons: he is interested in more than the technology, and he is committed to the public

realization of his art and architecture, be it a new installation or a new building for the *Niagara Credit Union* (2004).[18] Herbert Read states, 'A building may be constructed according to definite canons of proportion, as the Parthenon seems to have been constructed, or it may seek a freer harmony of asymmetrical balance, an infinite counterpoint of lines and planes determined by the aesthetic sensibility of the constructor.'[19] Although written in 1934, Read could well be writing about *Hylozoic Soil*.

Beesley's work shows that art, architecture and craft can be totally cerebral. Individuation does not need the direct contact of the human hand. Knowledge, skill and invention, however, are essential in the creative process. This is an architecture that is more than conceptual—the ideas go beyond this realm and become physically immersive.

18 *Niagara Credit Union* by Philip Beesley Architect (2004)

19 Herbert Read, *Art and Industry*, p. 81



Haystack Veil

1997 - Deer Isle, Maine
Haystacks Mountain School of Crafts

with Warren Seelig *and* Student Collaborators

Haystack Veil was a large-scale textile covering a moss and lichen covered shorecliff alongside the North Atlantic Ocean. The project was developed as a collaboration with a group of textile students working with Philadelphia artists Warren Seelig and Philip Beesley at the Haystacks Mountain School for the Crafts in Maine. Thirty thousand scrap alder sapling twigs were cut and bundled into a knit veil that covered a quarter acre at a deeply wooded periphery of the school. The material was formed into a lattice structure made of a network of repeating tripods.

The planted feet of each tripod stood toe to toe, creating a continuous geodesic framework that accommodated multiple distortions and interruptions of rock crevices and forest falls. Malleable spiral-tie wire connectors were used to create resilient tripod joints with expanding and contracting angles. Fibres connected the upper vertices of each tripod and made a continuous triangulated grid. This upper layer was created by bunding long, thin twig strands to create continuous strands. Self-leveling saddles created by extensions of the tripod arms above their collar-joints guided the location of these strands. This tri-axial grid acted as a distilled, curvilinear echo of the reticulated forest topography lying beneath.

The skin was left in place for several years and accumulated animal warrens within tangled overgrowth and compost layers, while sustaining erosions from large-mammal movement.

Facing page

1 Installation view

Overleaf

2 Detail view, lattice edge at shorecliff

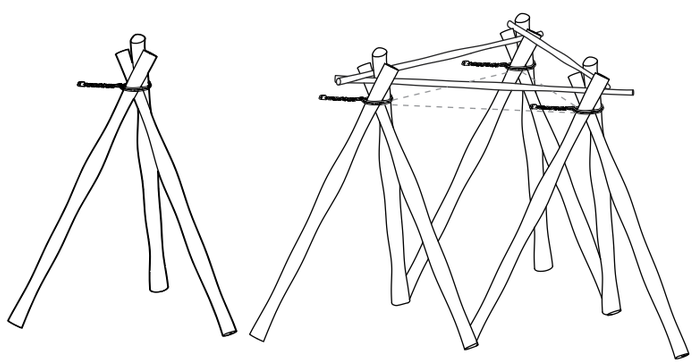
3 Detail view, tripods and triaxial top layer

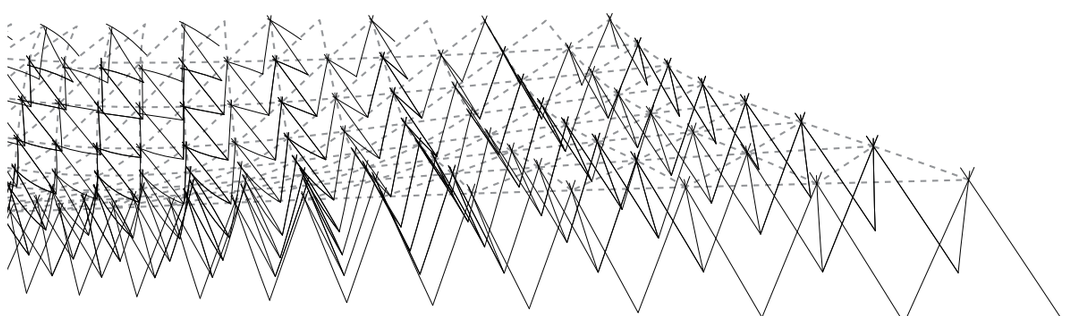
4 Diagram, tripod units

5 Diagram showing space-lattice structural system

Overleaf

6 General view showing forest floor





Erratics Net

1998 - Peggy's Cove, Nova Scotia

Erratics Net is an interlinked wire fabric mounted on a glacier-scoured shorecliff near Peggy's Cove, Nova Scotia. A soil reinforcing mesh was developed for this shore, a wide-spread net anchoring into the rock surface. Layers of new strata floating just above the surface of the land are developed within the foam-like filigree of this textile installation. The artificial reef encourages turf growth by means of a myriad of hooked clips catching wind-blown plant matter, holding and amassing a matted matrix serving as synthetic soil. The net is made with wire joints clamped by sliding flexible tubes that lock each link to its neighbour. The textile system is organized in a pillowed form of alternating peaks and valleys, with outward-facing barbs catching new material and inward barbs anchoring beneath. These details hold the net just above the bare rock and make a shallow film of still, sheltered air that allows delicate growth to emerge.

The first stage of this installation was developed during a course in experimental structures at Daltech Department of Architecture, 1998. A second stage was developed in collaboration with Waterloo architect Caroline Munk in the fall of that year. The second state responded to times of deep fog where the air stills and the ground is soaked in vapour. In response, the net was expanded into multiple layers, each outward facing peak within matrix layers in turn serving as the foot for an inward facing valley of the next layer. A foam-like cellular lattice results, a filigree extending throughout the thickened atmosphere. The natural growth encouraged by this armature is froth-like and fills space with minimal mass. The material is marked by regular thickened intervals making a porous stratified border alternating with expanded, open layers. A striated penumbra emerges, an aura floating outward from the land. The project pursues dissociated space, an absorption into ether.

Facing page

1 View showing first phase geotextile at ocean shore

Overleaf

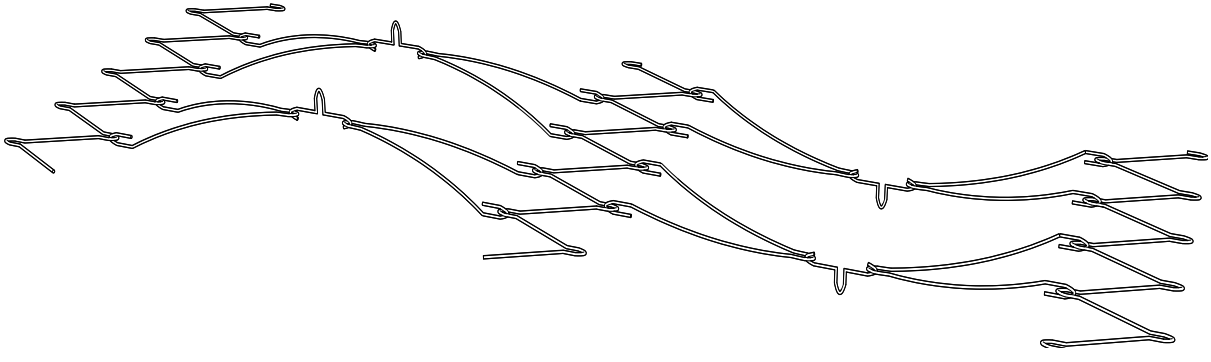
2 Detail of second phase

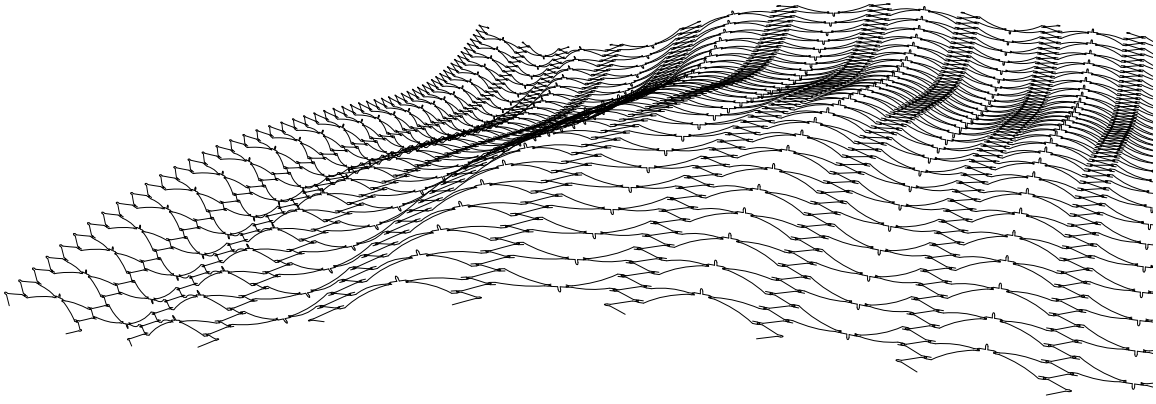
3 View of first phase with glacial erratics

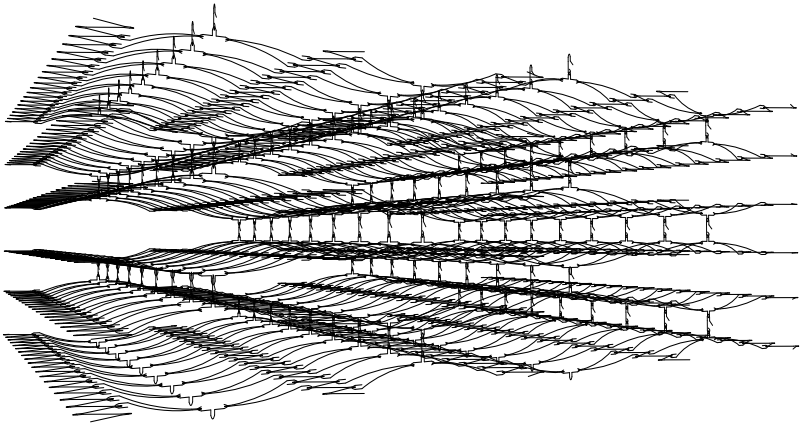
Facing page

4 View showing first phase geotextile at ocean shore

5 Model view showing geotextile weave elements







6 Detail view of second phase

7 Model of second phase textile system showing pillowed structure

Facing page

8 First phase view

9 Model of first phase textile system showing laminar structure

Overleaf

10 Second phase perspective view

Hungry Soil

2000 - Toronto, Ontario
Roma XX Exhibition, BCE Place Galleria

Hungry Soil is conceived as a cousin of benign geotextiles that would shelter and accelerate plant growth. Captured large-scale organic matter fertilizes the system.

Thin-gauge spring-wire is bent into wishbone-shaped units that interlink to make an octohedral space-truss. Expansion of the skeleton truss yields a foam-like mesh spanning large volumes with minimal mass. Slide-lock details accompanied by simple compression-collars formed from biodegradable polymer tubing provide a universal system. Clips integrated in the wire skeleton provide attachment points for collection bladder-needles and twin barb-traps. These active elements saturate the mesh in a dense three-dimensional array. A lurking quality results.

The system was derived from the artificial skin replacement system for burn therapy developed by Toronto's Apotex Industries.[1] In that system, a biodegradable gauze is seeded by gel capsules coated with human skin cells engineered for replicaton and bathed in nutrient solutions. Regenerated skin grows over the affected area, and the scaffold that holds the seed elements is eventually dissolved and absorbed. *Hungry Soil* envisions a similar approach to landscape regeneration. Springing barbed details encouraging accretive massing and clumping, a slow process of ingestion. Protruding hooks and latex bladders equipped with hollow needles imply mechanical operations on drifting organic matter: capture, injection, ingestion.

The work was conceived during a time of personal study of the Kindertransport, organized transport of Jewish children from Germany to the United Kingdom in 1938-9. Details of the Soil work relate to blood and earth imagery, and levels of mechanical repetition raised questions of exchanges between imperial organizations.

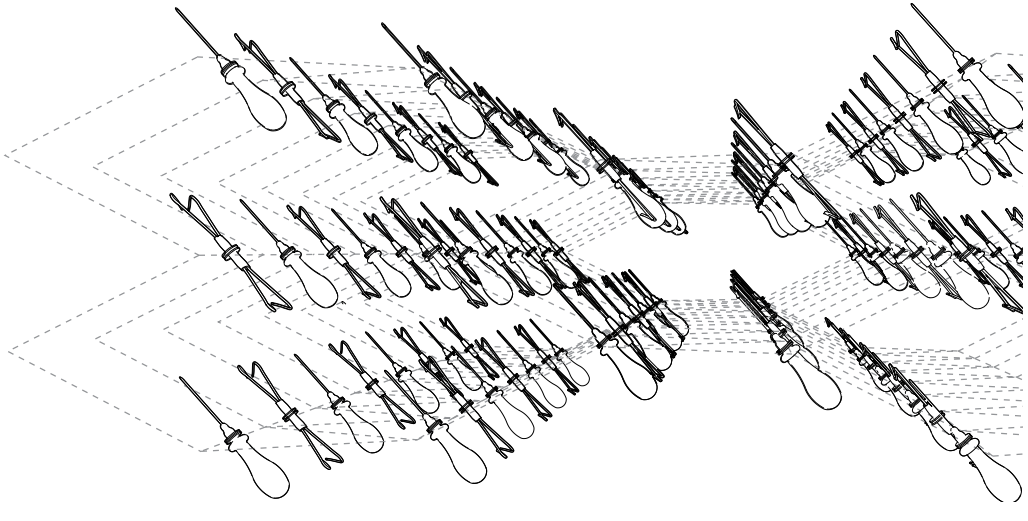
1 Apotex Skin Replacement Therapy, *On Growth and Form: Textiles and the Engineering of Nature*, ed. Philip Beesley, Rachel MacHenry & Evelyn von Michalofski, The Museum for Textiles (Toronto, 1998)

Facing page

2 Detail, perspective view showing bladder and clamp matrix, stainless steel wire scaffold, and vertical wall implants

Overleaf

3 Front view



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4 Detail, collection bladders

5 Perspective model, showing pillowed matrix

Above

6 Detail, double clamp units on scaffold

Orgone Reef

2003 - Winnipeg, Manitoba

Orgone Reef is an artificial reef that could support a living skin. The project is a hybrid geotextile, a new class of materials used for reinforcing landscapes and buildings. The details of this structure are designed to catch and hold the things they contact, accumulating a thick, porous mass. The project functions with aggression, clamping and cutting into neighbours, draining and digesting the things contacted and converting this material into fertile soil. The structure would help a scarified landscape heal and grow new layers.

Several kinds of rhombic pyramidal structural tiles make this textile, connected by vinyl links that allow flexing and shifts in local relationships. The interlinking system creates a billowing space-truss that alternately arches upward and hangs in catenaries, adapting to locations of intermittent suspended supports. A primary tile, repeated[1] hundreds of times within the topography,[2] includes a pyramidal skeleton that supports a deeply serrated mylar filter configured to provide one-way trapping flows within a fluid medium. Fronds of adjacent tile filters intermesh, yielding a coarse felted membrane.

Cutting patterns are designed to release embedded stresses within roll-formed mylar, producing oriented curling of frond-rows within the filter material. Curled elements are arranged in opposing pairs, producing passive mouth-like pores that encourage passage in one direction while resisting reverse passage. This hybrid osmotic function is employed as a design principle at varying scales within the installation. Motions telegraphing through the matrix allow this system to function as a distributed pump acting upon the environment.

1 The mechanical repetition of elements contrasts to strategies used in previous installations. Previously, complexity was generated through combinations of densely repeating grid-arrays.

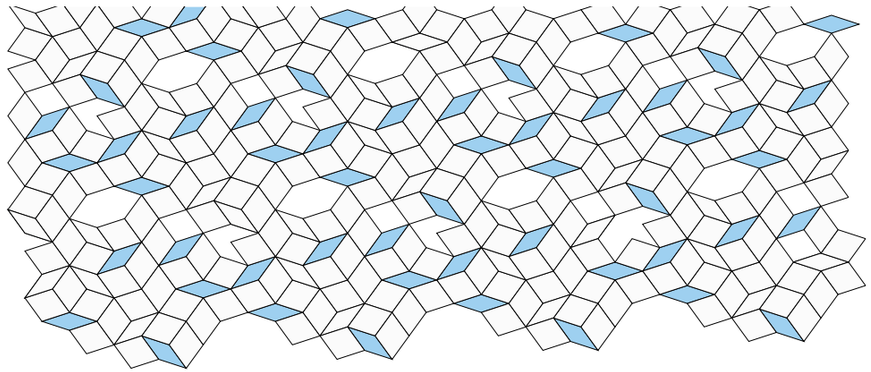
2 An interlinking Penrose geometry is used to organize the hybrid fabric. The tiling is comprised of two rhombi, one with angles of 36 and 144 degrees and one with angles of 72 and 108 degrees, yielding a quasiperiodic system free from general symmetry.

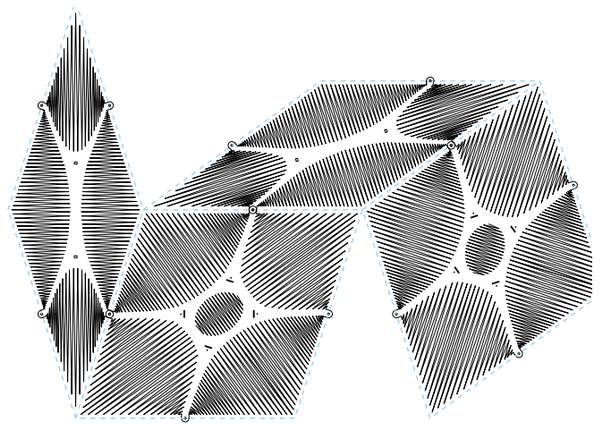
Facing page

3 Detail view showing top side of rhombic filter units

Overleaf

4 View of geotextile field



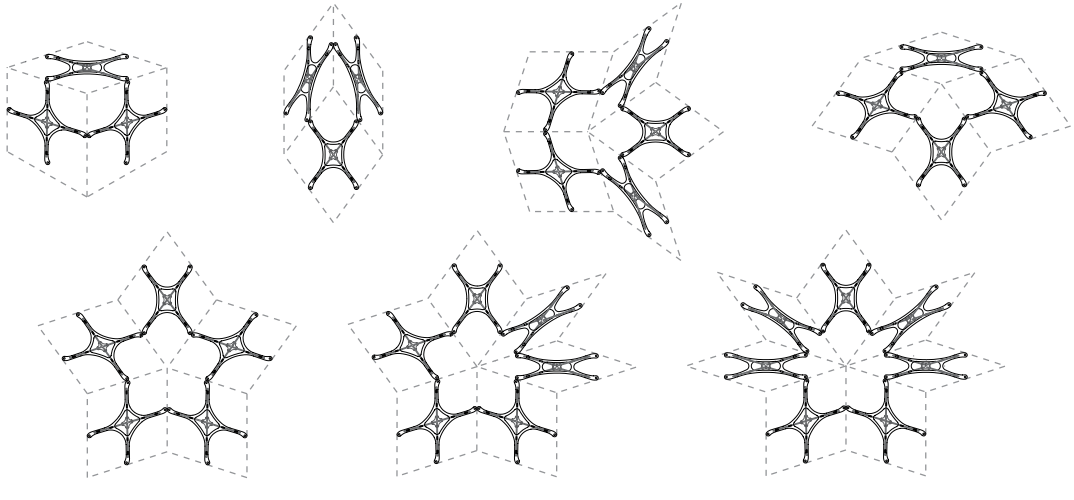


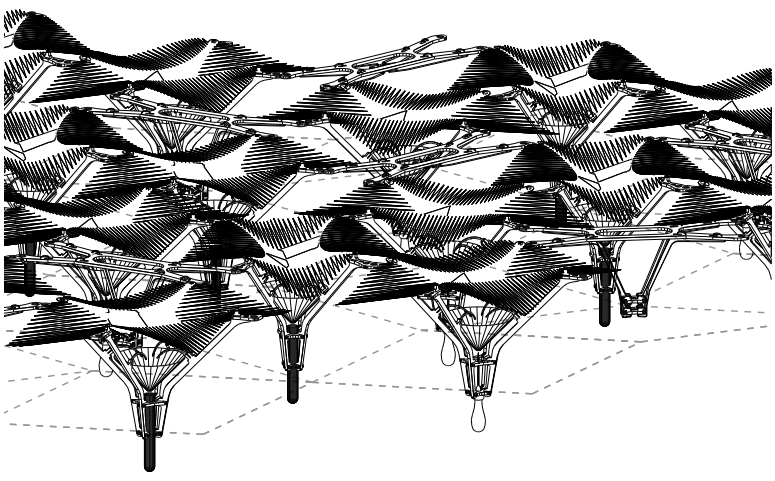
5 View of filter field from below

6 Plan diagram showing filter position options

Facing page

7 Penrose tessellation ordinance system





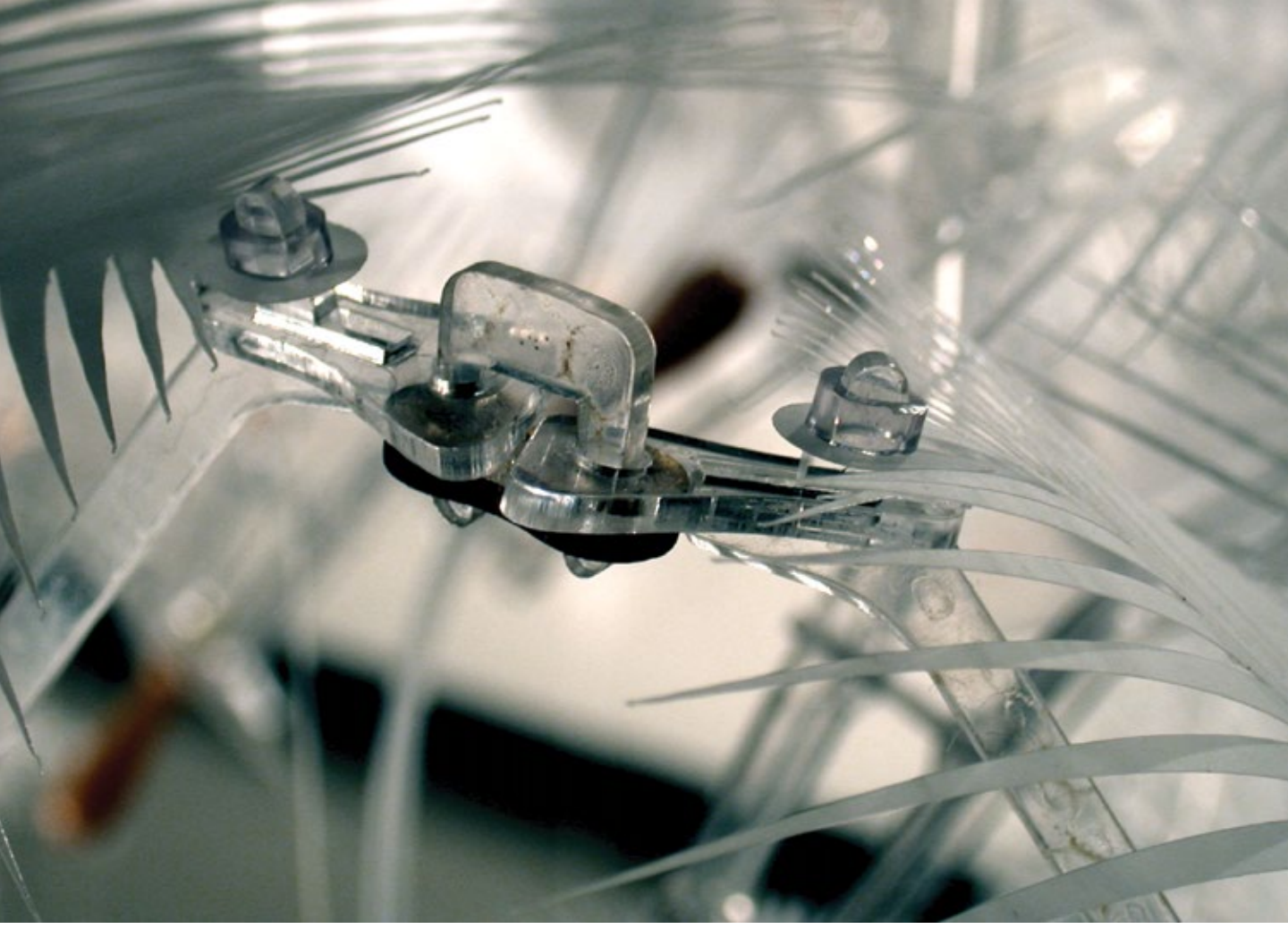
8 Detail view of filter units showing bladders and collection vessels

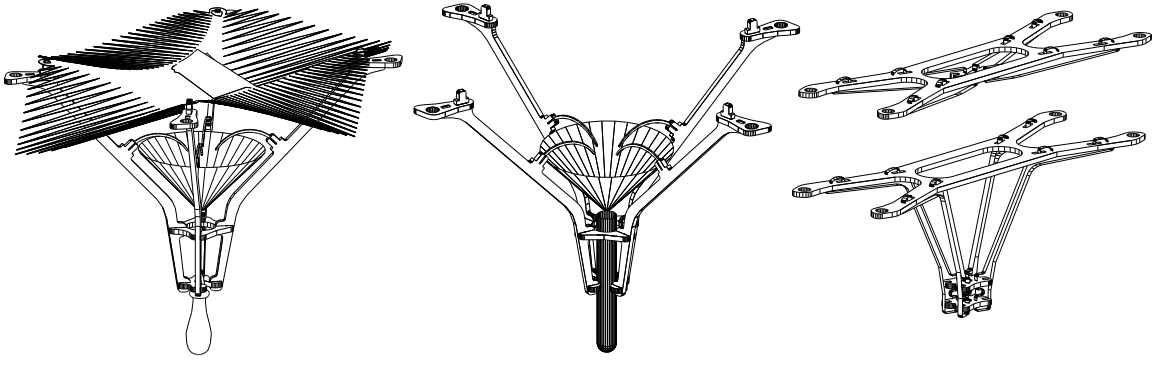
9 Model view showing section of assembled membrane

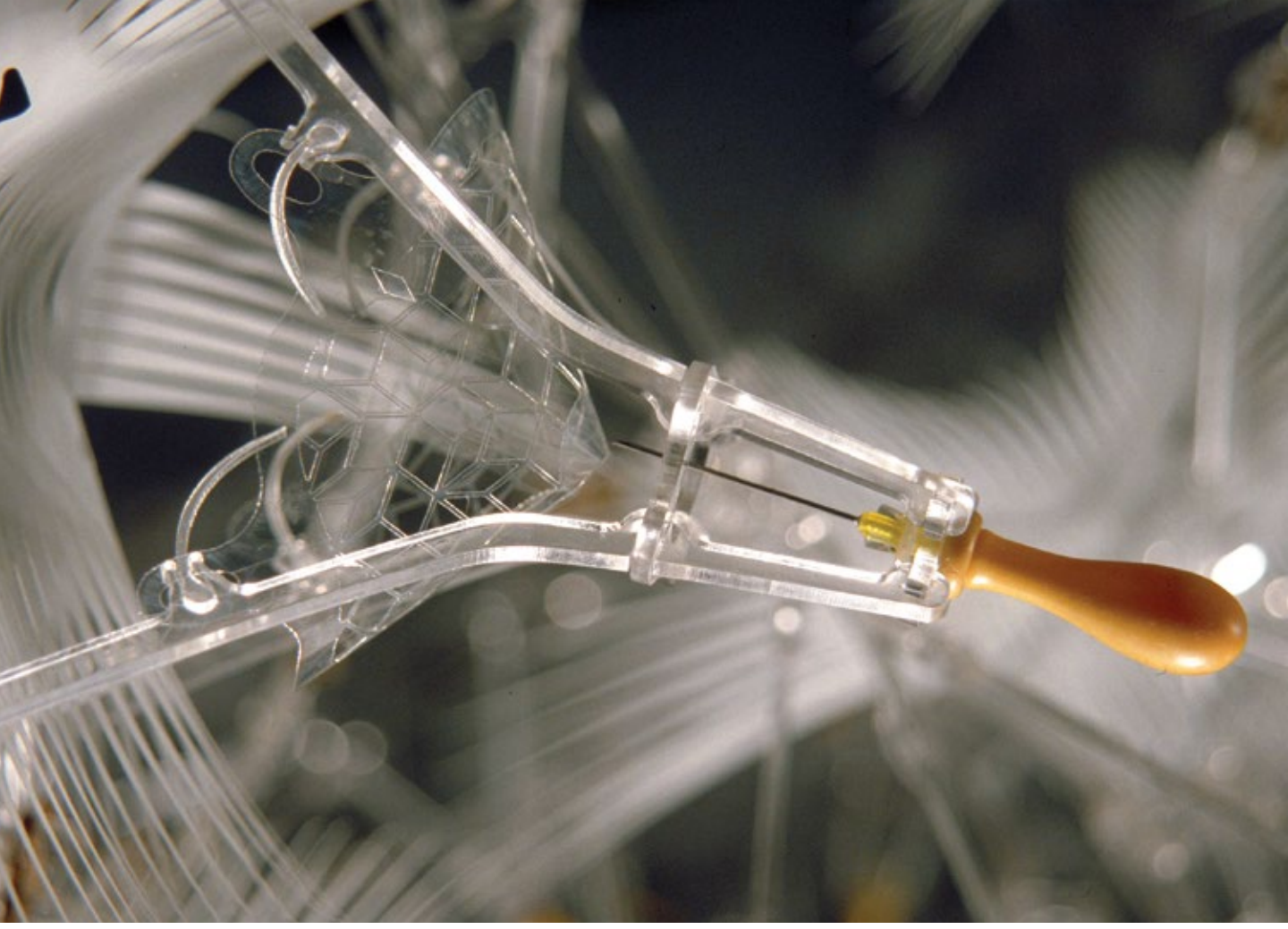
Facing page

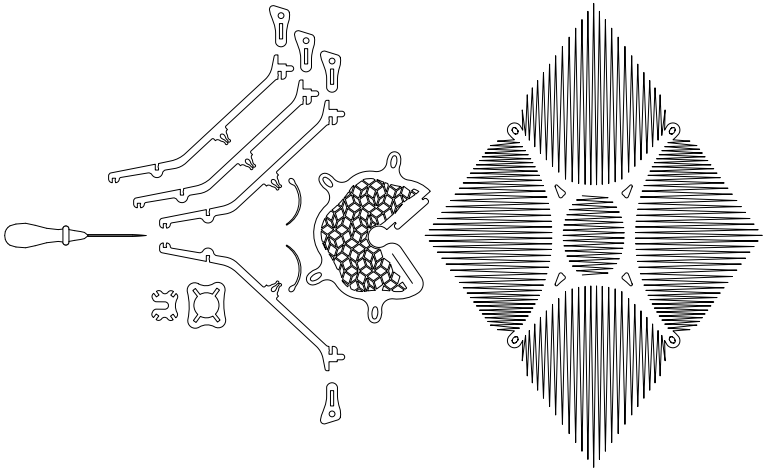
10 Detail view of collection units

11 Plan diagrams showing Penrose tessellation variations









12 Detail of barbed collection nest and bladder

13 Assembly view of collection unit unfolded elements

Facing page

14 Detail view of collection unit arm junctions

15 Model views showing collection unit, plasma receptacle and structural rhomboids

Overleaf

16 View of geotextile edge

Orpheus Filter

May 2004 - Birmingham Interbuild/RIBA Pavilion
June-July 2004 - London Building Centre Gallery

Orpheus Filter is a vertically-oriented suspended geotextile equipped with layers of miniature valves and clamping mechanisms. A minimal amount of raw material is expanded to form a porous network. Cupped filters and valve forms in this collection array derive from selective warping of flat-sheet fabrications. One-way passive valve details induce transfers through the assembly.

The *Orpheus* system is organized in two layers of rhombic elements, one involving fixed arrays of pyramidal skeleton units that form a space-truss, and the other involving overlapping membrane tiles connected by press-fit clips. The membrane layer rides over the surface of the truss and the combined layers function as an epidermis between interior and exterior environments. Individual rhombic elements follow the assembly criteria of a Penrose tessellation, producing a densely massed crystalline membrane capable of sustaining advanced erosion while maintaining structural integrity In this geometry each rhomboid-shaped tile element can take any of ten possible fixed planar orientations, allowing informal assembly akin to self-generation in natural growth patterns.

Patterns of junction holes for matching adjacent membranes were generated based on the factorial of the array geometry. This layout provides openings for most possible orientations between elements. Self-orienting junctions for connecting tiles are included in the system that provide elastic snap-fit closures and leveling guides. Clips are inserted through openings that align through multiple tiles.

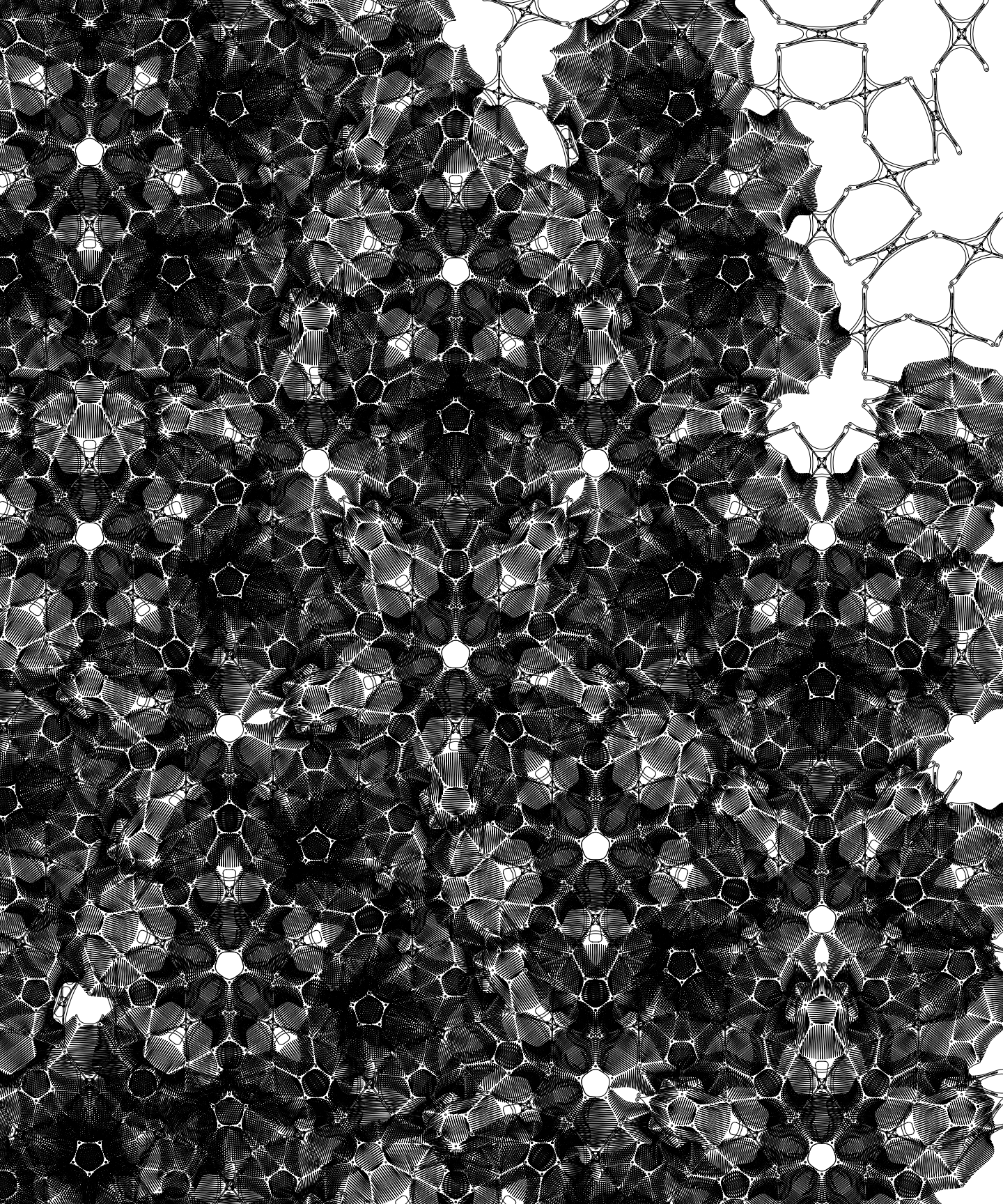
Fluid collection and anchoring details extend the function of the membrane. Collection is handled by clamping needles fitted with gill-like lures that shelter just beneath the soft surface of the felted filter layers. The collection elements are connected through hollow spacer-struts to expandable bladders. Anchoring barbs at opposing outlying layers are formed from toughened polymer, detailed for penetrative burrowing.

Facing page

1 Drawing of felted filter tiles laid over structural skeleton

Overleaf

2 Elevation view of *Orpheus Filter*



3 Detail, bladder field

4 Filter field ordinance system

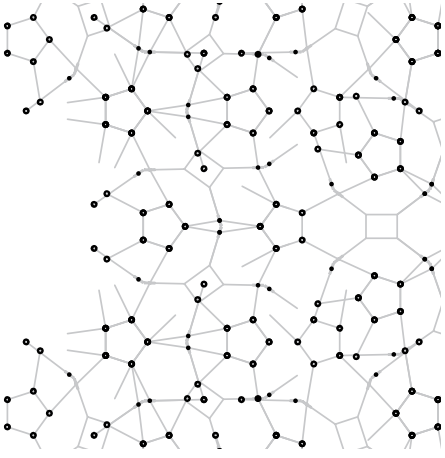
5 Bladder skeleton ordinance system

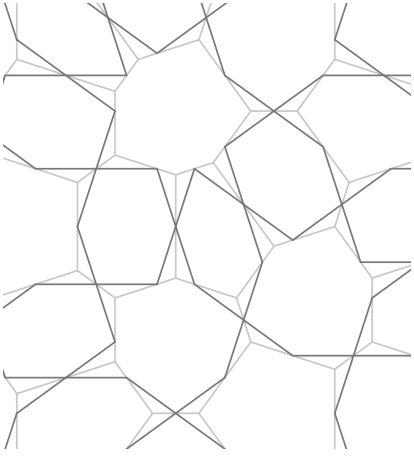
Facing page

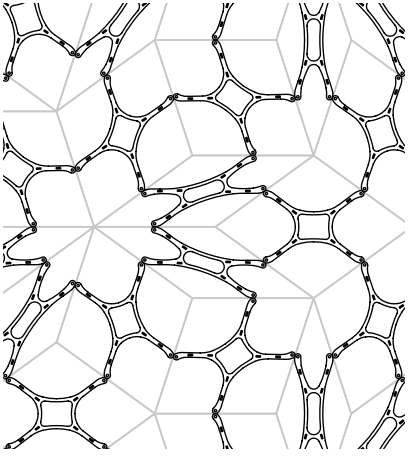
6 Filter field detail

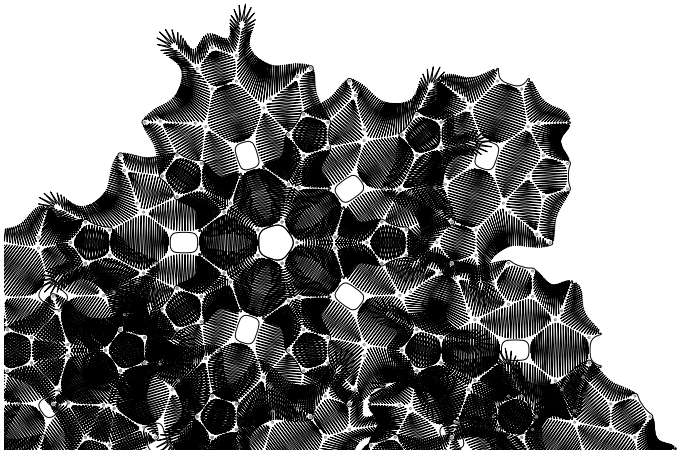
7 Bladder skeleton typical layout

8 Drawing showing developed filter field



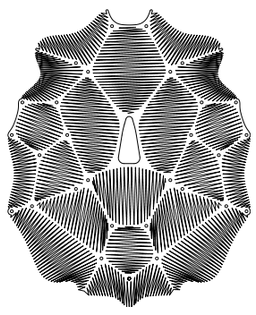


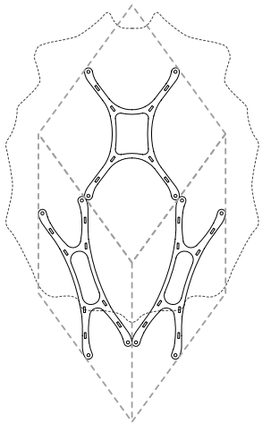


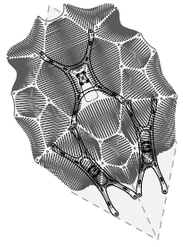


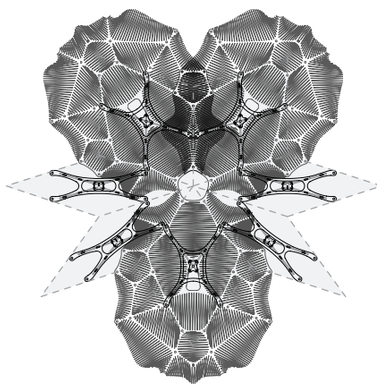
9 Detail of filter layer showing connectors and pores

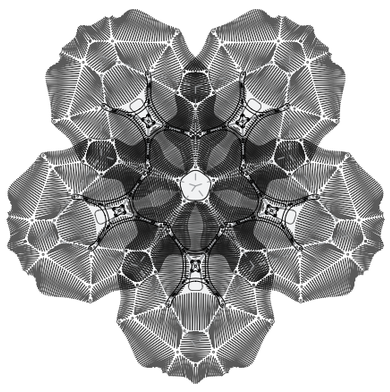
10 Pore and skeleton typical configurations

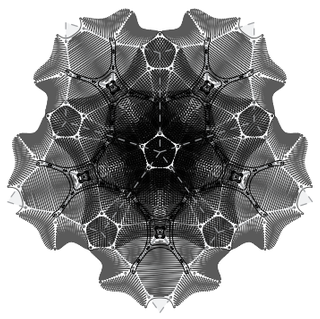


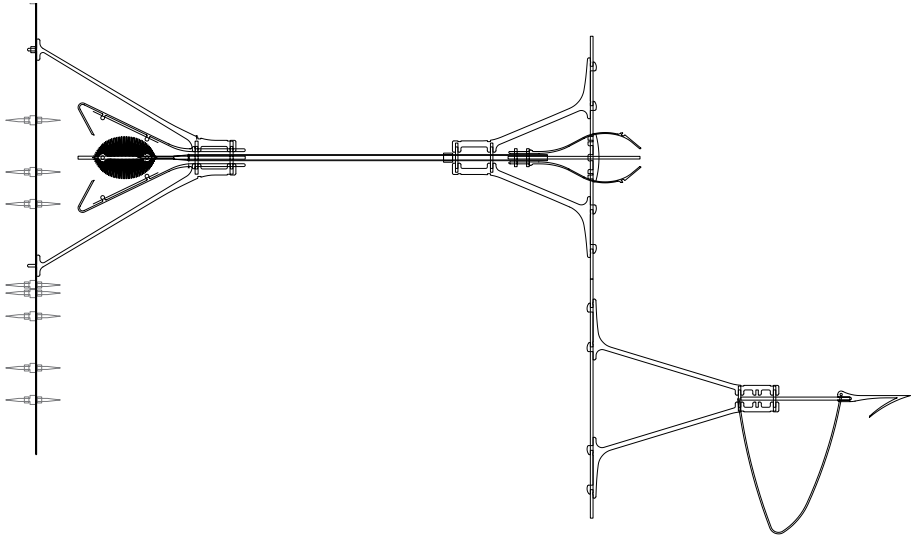


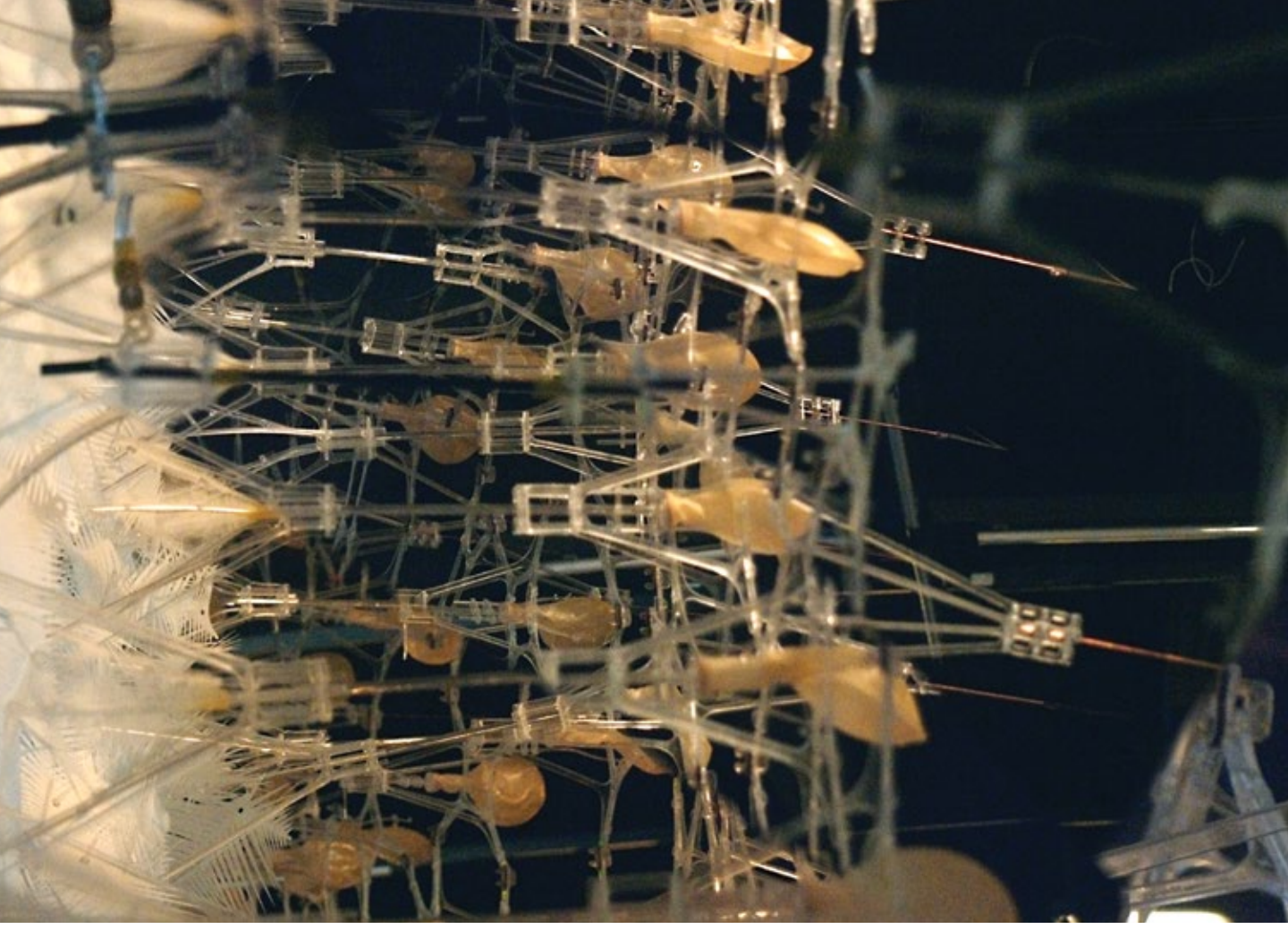


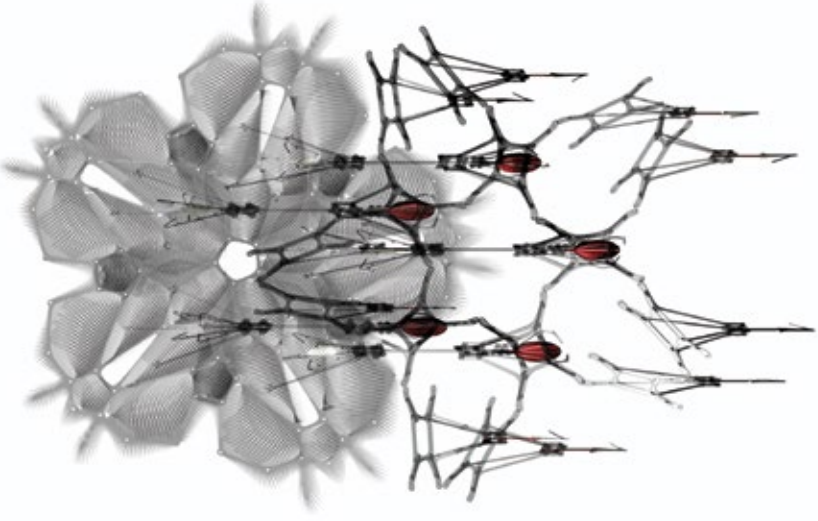












11 Interstitial view showing bladder and anchor units behind filter layer

12 Digital model view of typical filter cluster

Facing page

13 Filter tile detail

14 System drawing showing filter layer, trap needle unit, collection bladder unit, and barbed anchor unit

15 Detail, clamping needle with lures

16 Unfolded view showing clamping needle element profiles

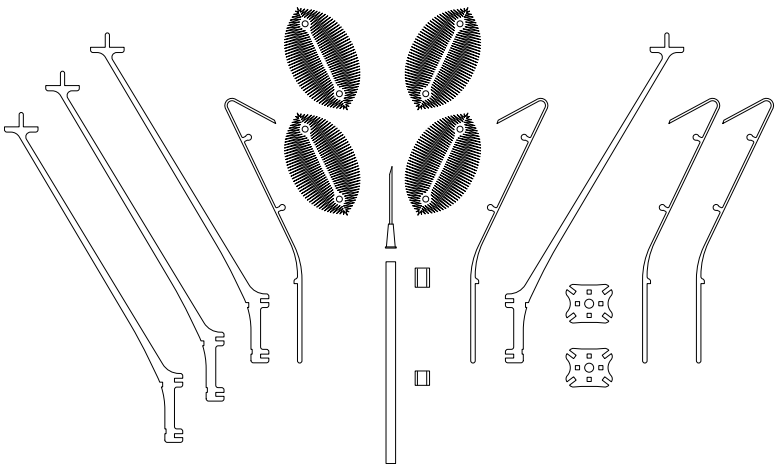
Facing page

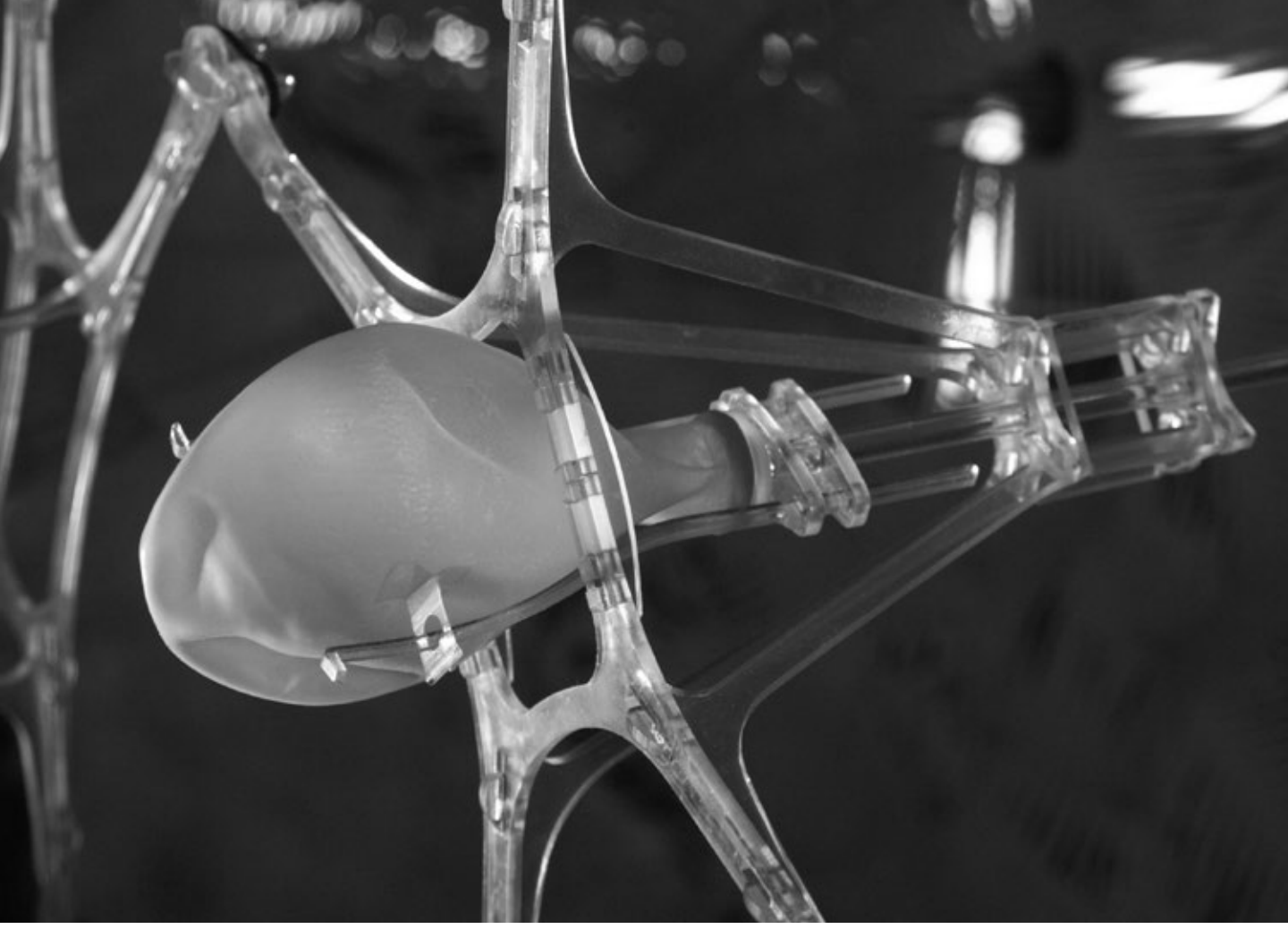
17 Bladder unit

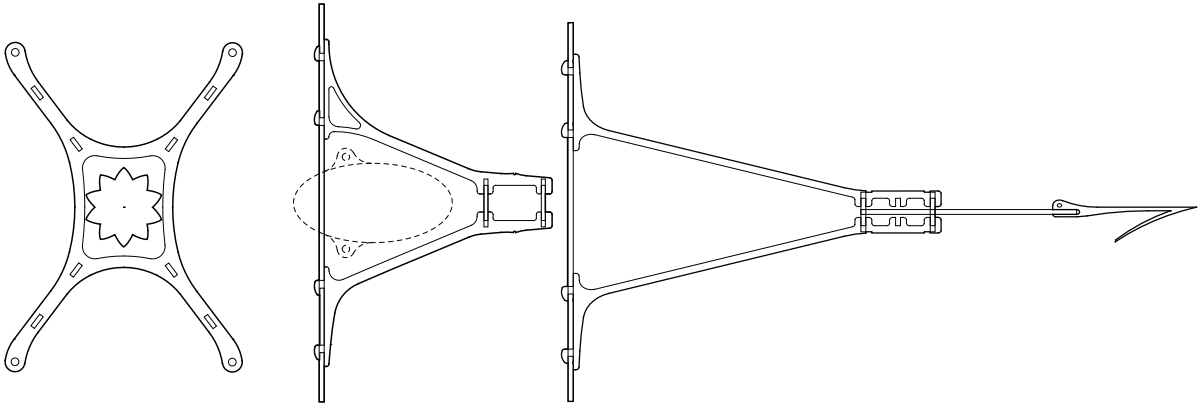
18 Bladder unit plan and side view, barbed anchor unit side view

Overleaf

19 View of bladder and barbed anchors







Reflexive Membranes

2004 - Cambridge, Ontario
Riverside Gallery

with Steven Wood

The *Reflexive Membranes* installation integrates elements from the *Orgone Reef* system with arrays of sensors and lightweight actuators. Microprocessor nodes in the upper layer of this assembly control clusters of sensing whiskers suspended from a lower layer. When proximity is sensed, oscillating waves transmit throughout the assembly. This motion produces a peristaltic pumping motion that propels air and suspended materials through the filter.

A Penrose tesselation guides the upper structural skeleton. Billowing distortions result from interruptions and varying alignments of hanging elements. Suspended below this layer are second space-truss layers, connected to the upper skeleton by sliding spacers fitted with hemispherical rare-earth magnetic joints capable of handling strong kinetic forces and varying junction angles. Active whisker elements are fitted within pyramidal rhobic tiles located within these lower levels. Wound music-wire whiskers are fitted to direct-current motor follicles and are configured to provide capacitance sensing. When an occupant comes in contact with a whisker, a change in electrical resistance is transmitted to local microprocessor boards,[1] initiating a reaction sequence where chains of whiskers operate. Whiskers responds with spasmodic flagellation, stirring surrounding fluid and propelling material through the filter.

Secondary tiles carry barb-trap mechanisms connected by polyethylene tubes to bladder reservoirs. The traps are charged with elastic centrifugal springs configured as opposing sets of 'savionus' rotors.[2] Clamping barbs, a meshwork cone-shaped deposit scaffold and a latex gland fed by a hollow needle are positioned below this filter, for digestion of organic masses that might accumulate over long periods. A different type of tile supports vertically stacked projections of deeply reticulated membranes whose barbed fronds encourage clumping and aggregation. These elements create additional strata that expand filtering and deposit functions.

1 Custom microprocessor boards designed by Steven Wood/Ikoro, based on the *Art Interface Device* project by InterAccess Gallery, Toronto

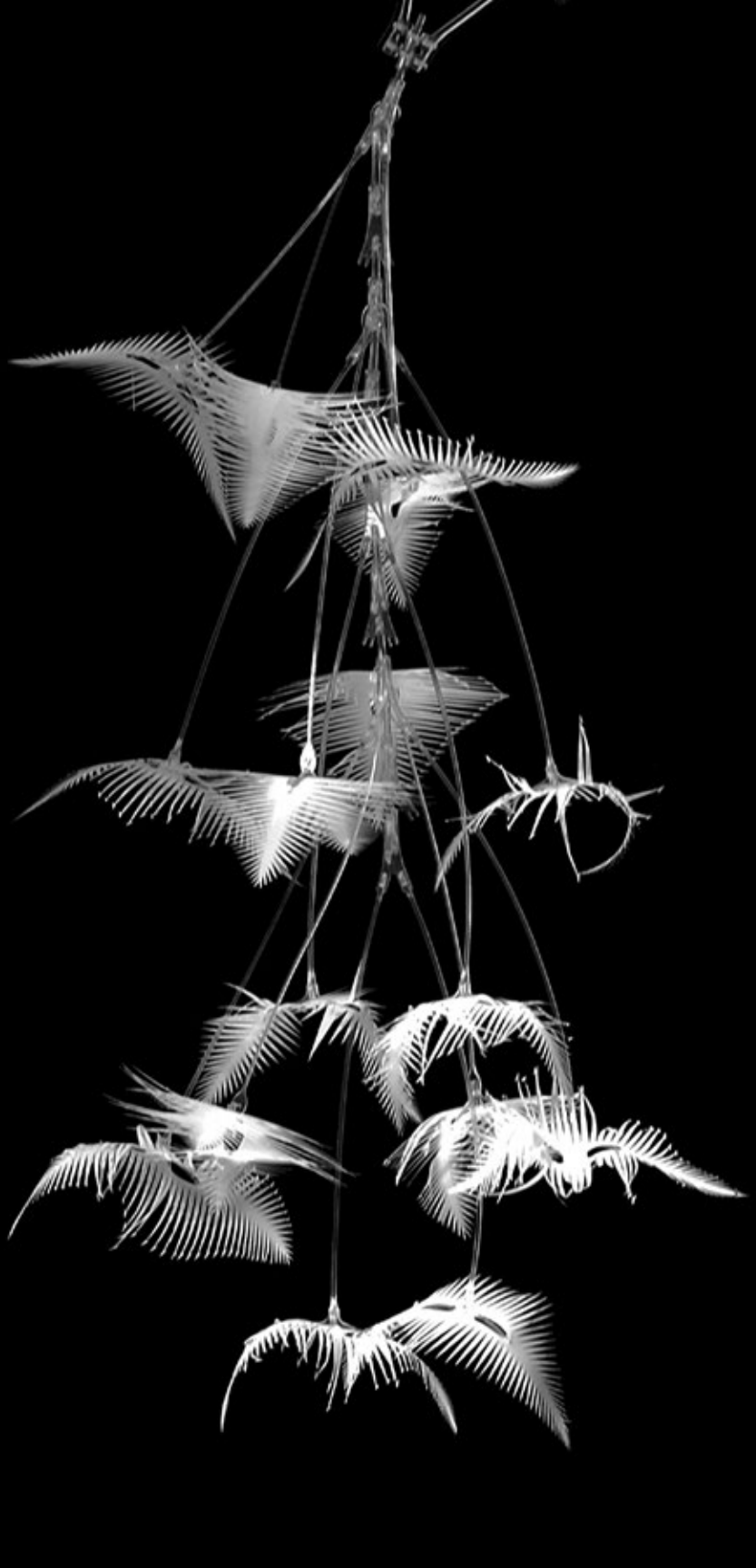
2 Savionus rotors are wind turbines consisting of opposing curved surfaces arranged to rotate around an axis. Spines in the barbed traps are powered by contact with solid bodies. Motion would be incremental, reflecting intermittent contact. The opposing pair permits general movement of the trap while collecting closing forces within its mechanism.

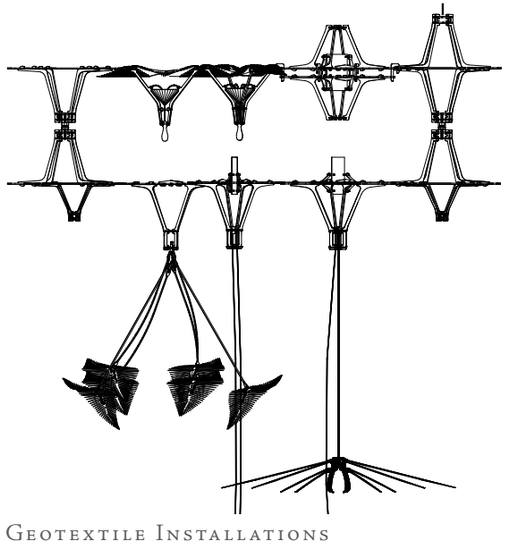
Facing page

3 Detail burr unit

Overleaf

4 Elevation view showing upper membrane layer with lower-level trap and whisker units



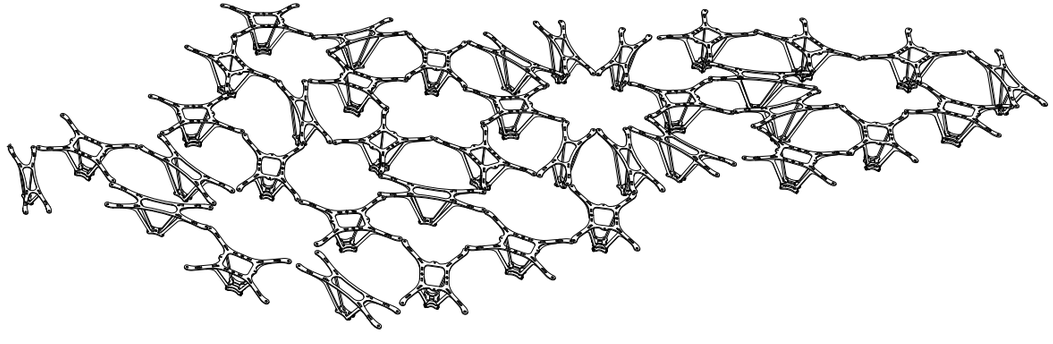


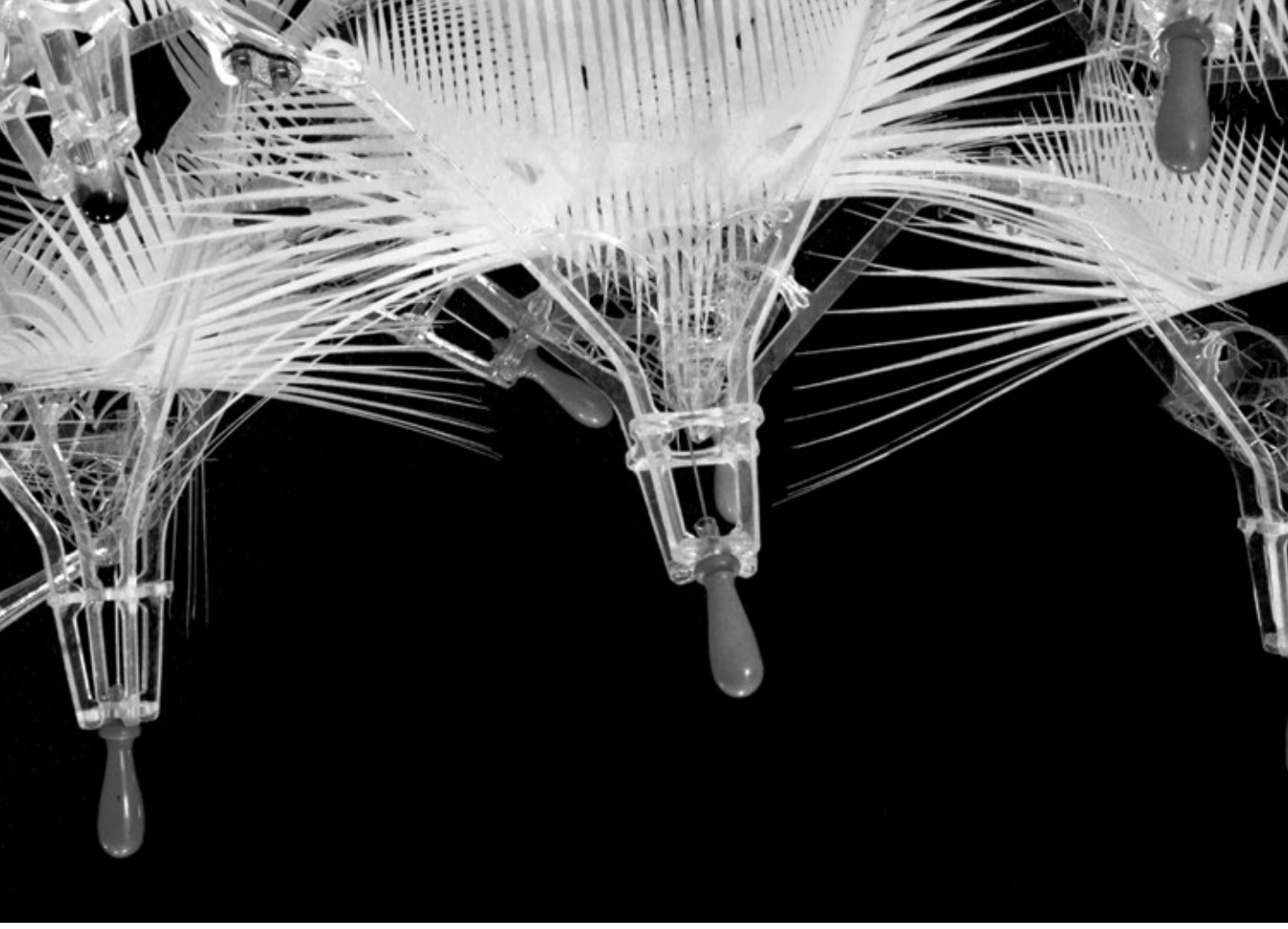
5 View of interstitial layer between upper membrane and lower filtering layer

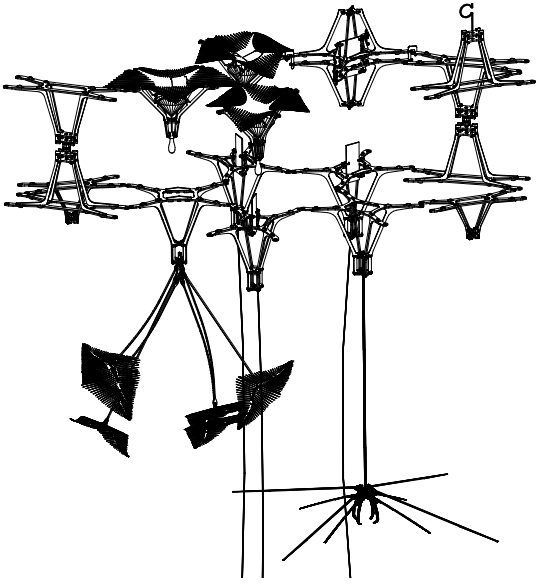
6 Elevation view of filter elements: upper structural units, lower whisker, burr, and trap elements

Facing page

7 Model view of upper structural skeleton showing rhombic tessellation







8 Filter units with bladder collectors

9 Model view of upper and lower membrane systems

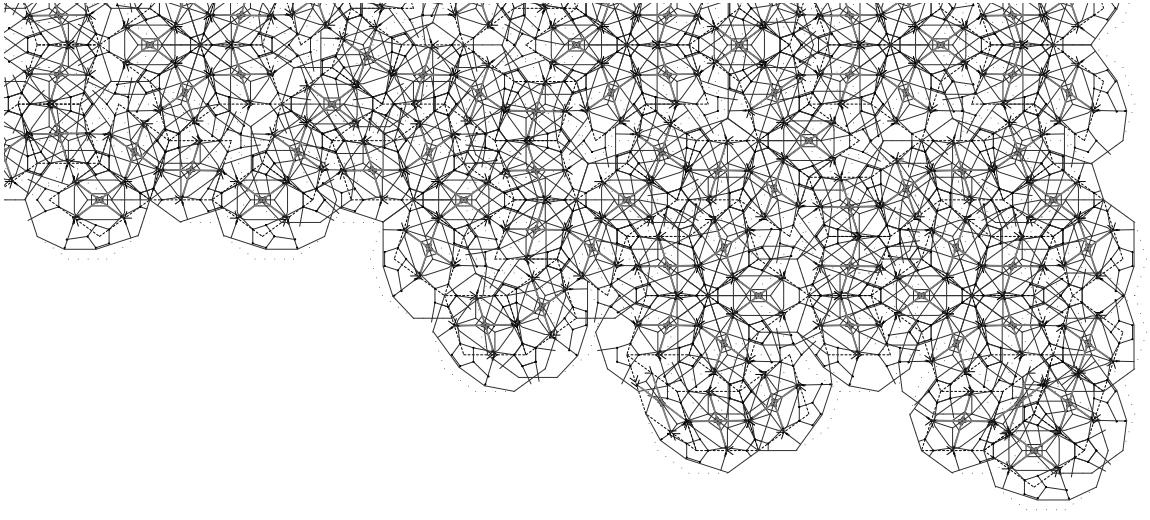
Facing page

10 Detail view of Savionus rotor trap

11 Diagram showing Penrose tessellation system guiding upper rhombic skeleton ordinance

Overleaf

12 Detail view of upper skeleton with microprocessor, and lower whisker colony



Cybele

2005 - Cambridge, Ontario

Cybele is a self-assembling framework made of delicate laser cut components connected and oriented by miniature rare-earth magnets. A barbed cellulose membrane covers the structure. The membranes ride upon individual snap-fit acrylic frames and create a continuous topography. The rhombic tesselation of this system is reinforced by intertwined felting created by intermeshing of the serrated cellulose material. Through flex and movement in the system the system knits itself together.

Tiles are supported by a precarious scaffold akin to a tangled forest canopy whose structure is concentrated at upper and lower levels. Upper spring-clip wire mounts are configured for insertion into quarter-points of the cellulose tiles. Lower tripod sets include paired needle-stakes that work in concert with a lead counterweight encouraging free rotation prior to settling into final orientation. These details encourage jostling, flexible negotiation between tiles and support formation of densely interwoven felt in the upper layer.

Each tile carries a brace of suspended elongated bladders. Funnel-shaped openings for each bladder are oriented upward, for drainage and collection. Salts prime the bladders, anticipating dilution and exchange.

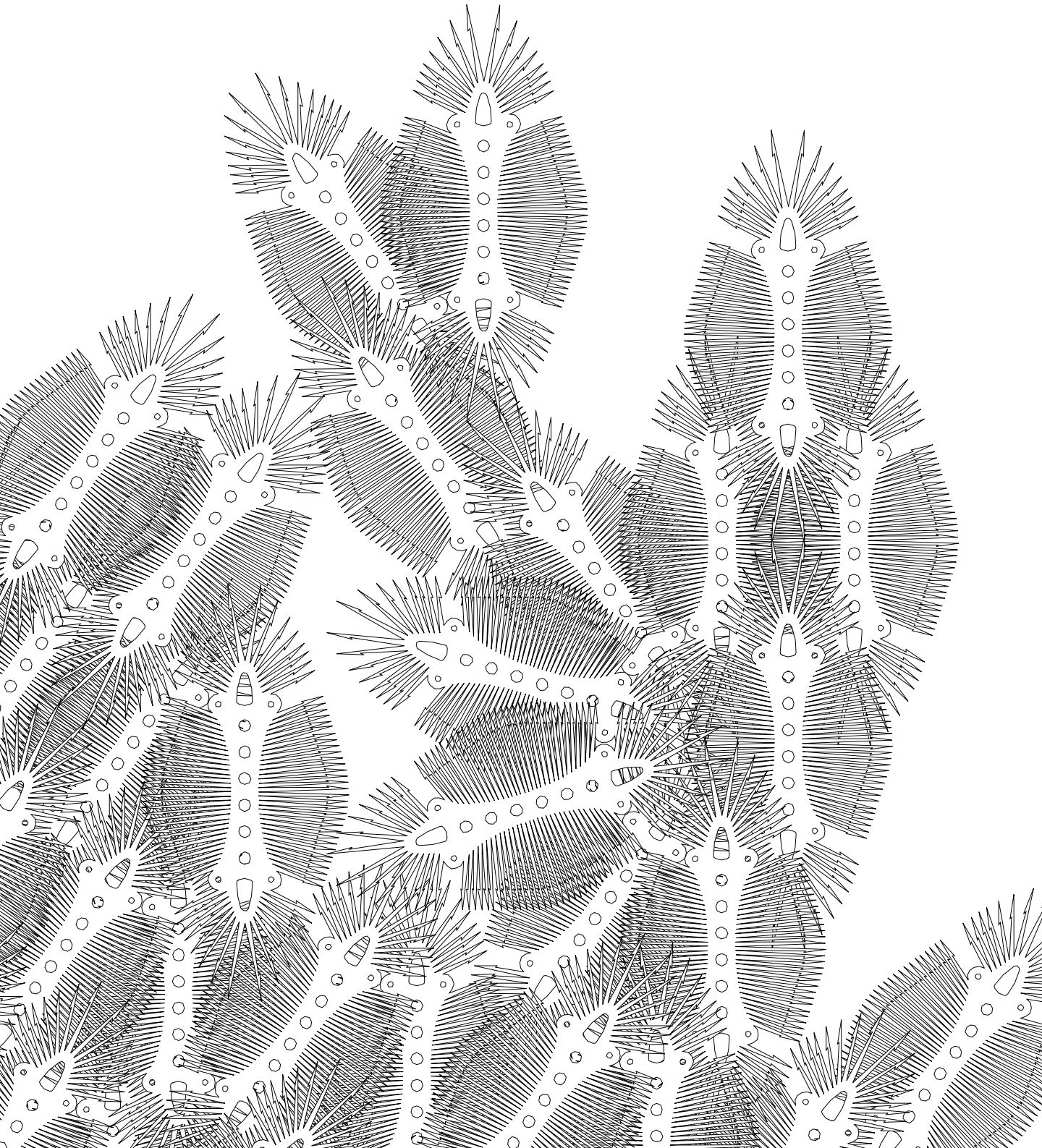
The sculpture was installed at the University of Waterloo, 2005.

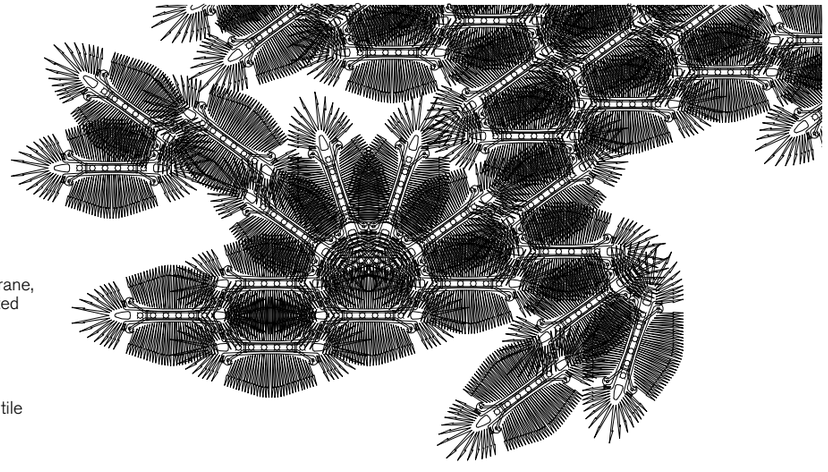
Facing page

1 Plan detail showing felted cellulose membrane tiles

Overleaf

2 Front view



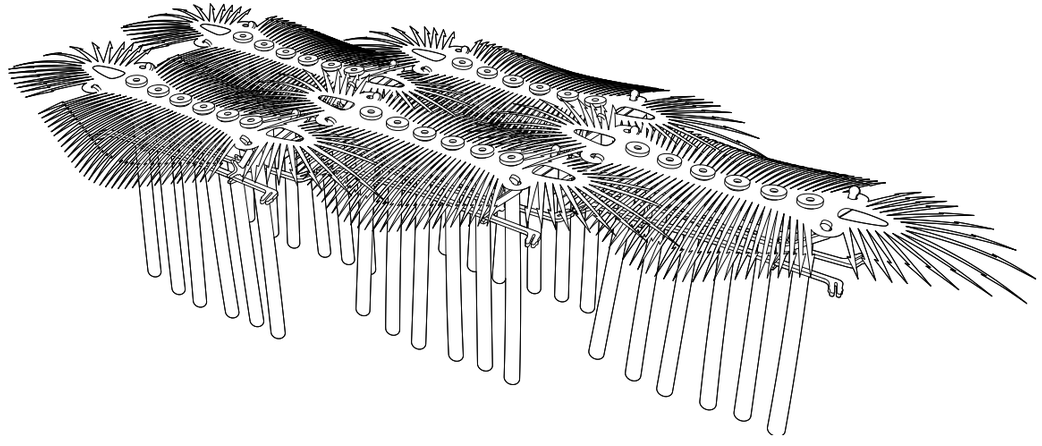


3 Detail view of cellulose membrane, with bladder openings and felted cellulose fronds

4 Plan diagram

Facing page

5 Model view showing cellulose tile and bladder units



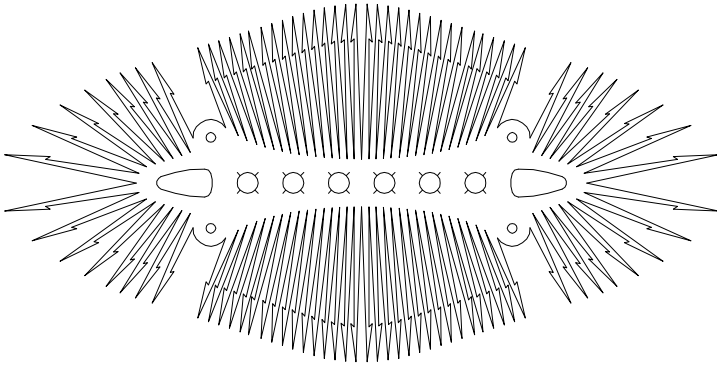
6 Underside showing bladder arrays

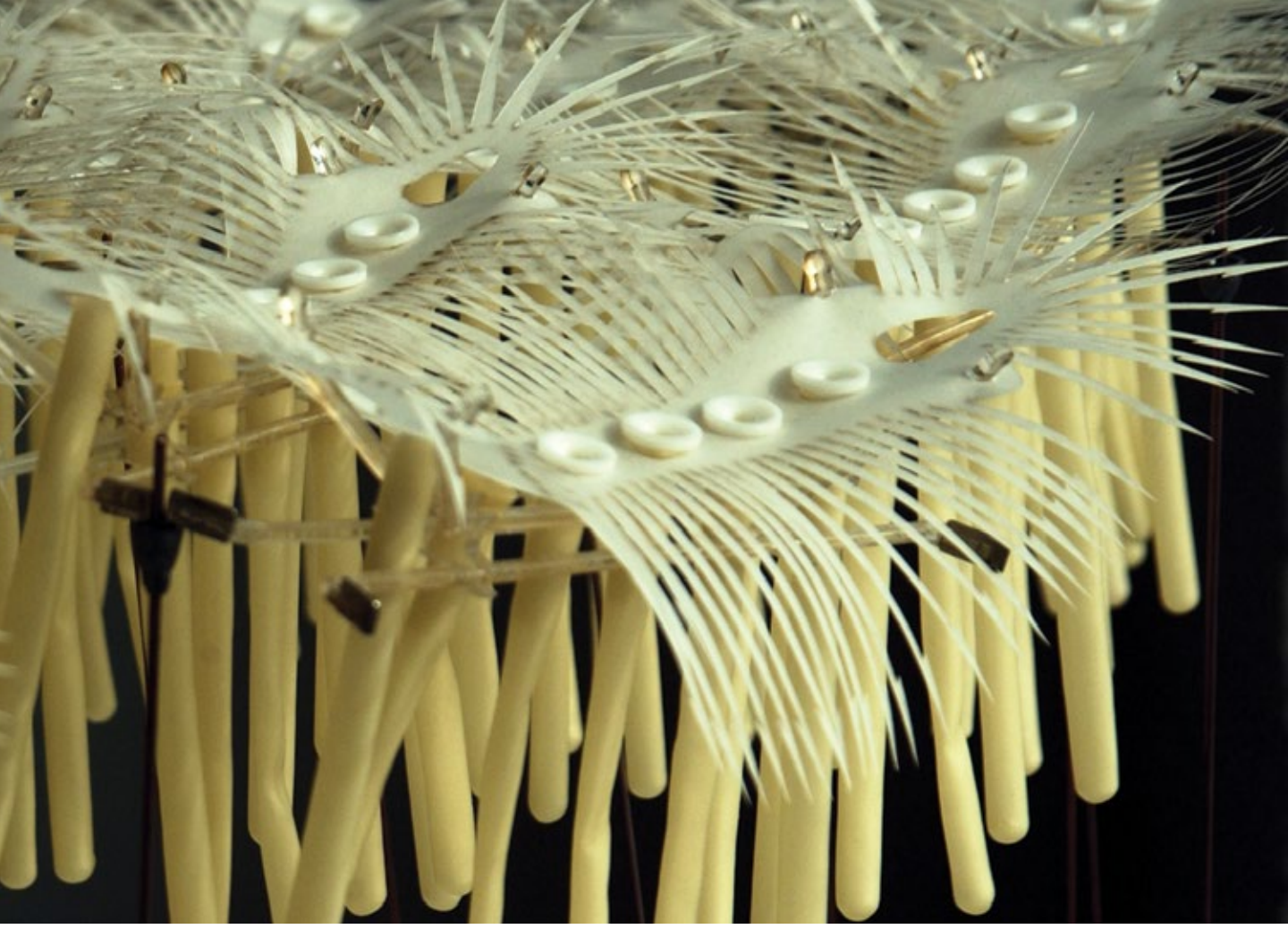
7 Plan detail of cellulose tile

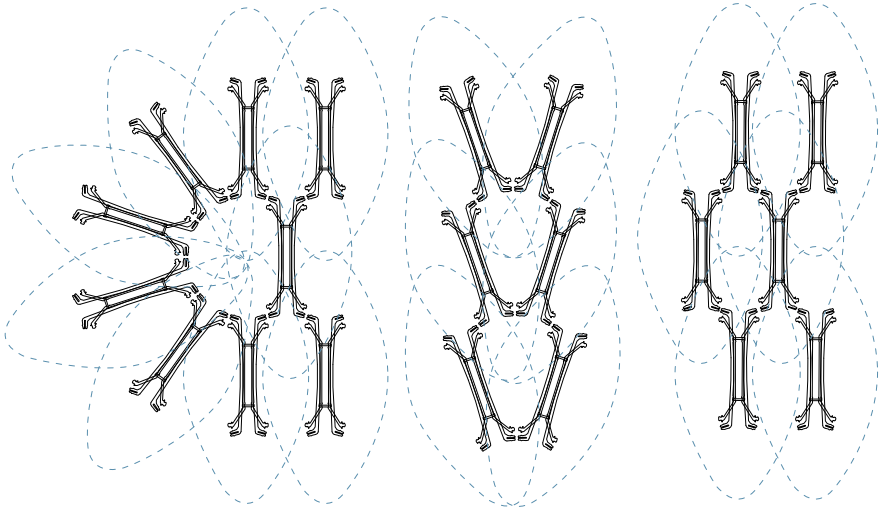
Facing page

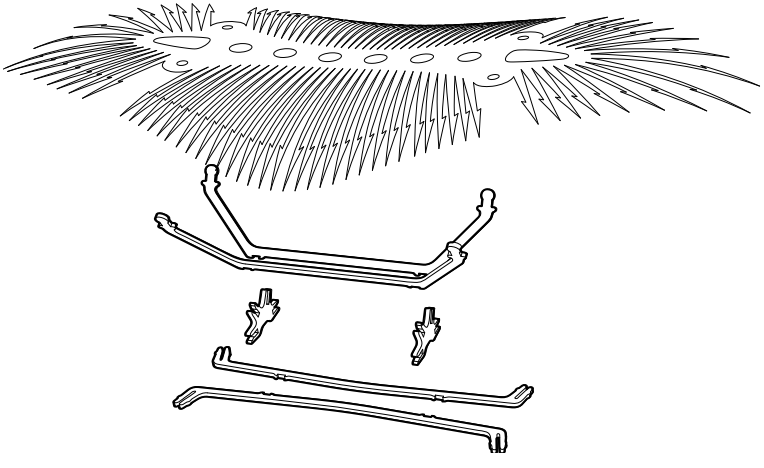
8 Detail of upper side of cellulose tiles

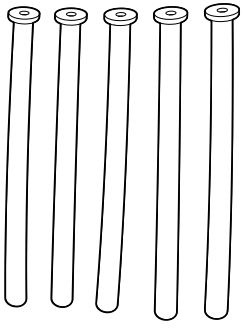
9 Plan details showing alternate tessellation systems

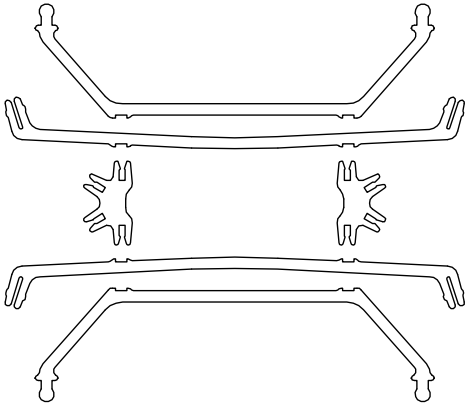












10 Detail of support feet showing sharpened bipod and lead

11 Plan detail showing structural sled component profiles

Facing page

12 General view of underside

13 Isometric model view showing structural sled cellulose tile and bladders

Implant Matrix

2005 - Toronto, Ontario
InterAccess Gallery

with Will Elsworthy,
Steven Wood *and* Rob Gorbet

Implant Matrix was a diffused cloud of interlinked elements that accumulated to make a building skin. A lightweight polymer skeleton was cloaked with a quilted mylar tilework fitted with layers of miniature valves and clamping mechanisms. Distributed microprocessors, arrays of whisker-sensors and shape-memory alloy actuators provided a networked control system for the matrix. These elements were arranged in chained, rolling swells that made subtle grasping and sucking motions. The composite motion created billowing 'peristaltic' pumping that filtered humidified air and collected organic matter within the matrix surface.

The skeleton was formed from hundreds of slender rhombic cells laser-cut from acrylic sheet. This matrix contained a regular array organized as a planar diagrid. At intervals, an additional tile was introduced and created points of three-dimensional hemispherical swelling. These nodes offered compressive shell strength that allowed them to act as toughened gussets within the membrane system, providing points of concentrated structural connection for the assembly as a whole. Additional distortions and fissures in junctions between assembled tilework sections resulted from a collaborative assembly method coordinated among numerous builders.

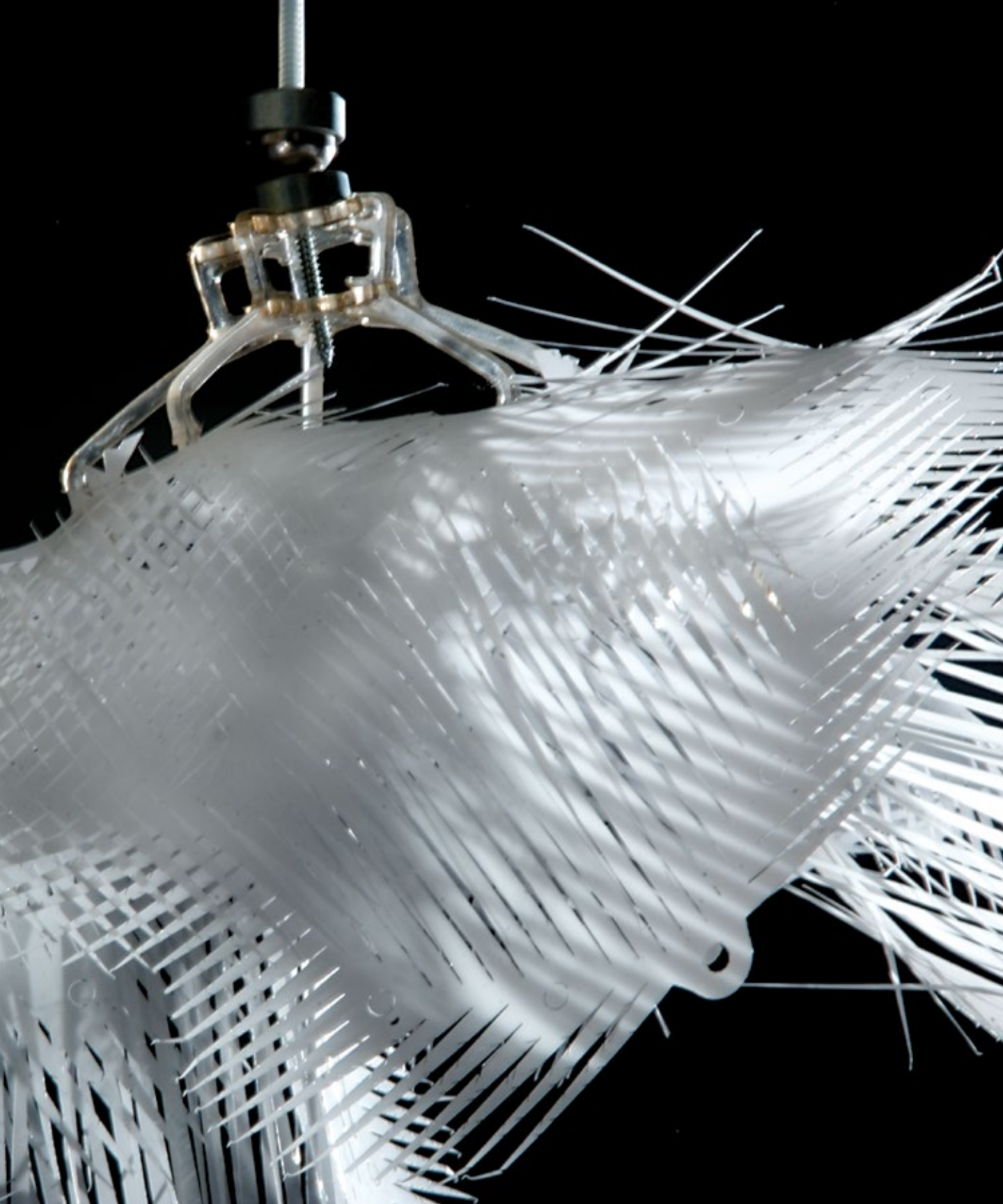
The cells contain flat profile struts with integrated snap-fit tabs and slots that accommodated transverse stiffeners and junction plates. Each cell contained a meshwork membrane pump unit powered by shape-memory wire actuators. These membrane pumps were composed from thin mylar sheets and contained hinged mouth details that functioned in a similar manner to folded paper mechanisms in pop-up books. Long ciliated fringes containing miniature barbed hooks extended the outer surfaces of these filter membranes and encouraged tangling with adjacent units, making a continuous felted surface.

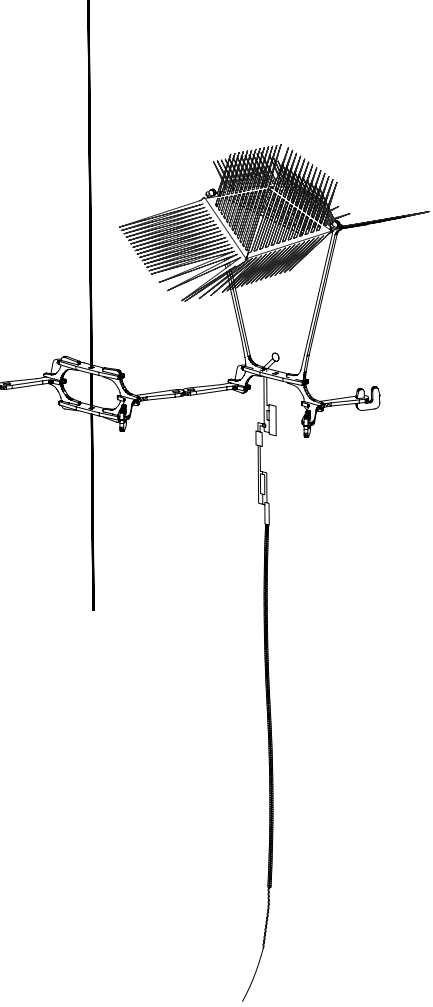
Facing page

1 Detail of lower membrane magnetic suspension joint

Overleaf

2 Lower level filter strata populated by spring traps, whiskers and bladder needles





A second filter layer was suspended below the skeleton, attached by spacer-struts containing variable-angle hemispherical rare-earth magnetic joints. Quilted mylar tiles derived from the *Orpheus Filter* system were used for this installation. Similar to the *Orpheus Filter* system, a quasiperiodic Penrose tessellation organized these tiles, and a universal geometry of junction holes permitted rotation and layering of the units. A thicket of activated whiskers was mounted within this layer. Fields of secondary glands and collection pores populated the surfaces of the filter. Injector glands contained silicone bladders fitted with long probes for passage of salt deposits into trapped host bodies. Small trapping pores were set to operate with suspended hair triggers hanging alongside the whisker systems. Extended feet for these elements used detailing akin to legs on a water spider, distributing weight and riding on the meniscus of the filter surface.

The whiskers responded to touch with convulsive contractions that were powered by shape-memory actuators pulling along the axis of the wound music-wire whisker cores. When viewers touched a whisker, changes in electrical resistance were sensed by capacitance sensing circuits within subcontrol circuits connected to main node controllers. These controllers would respond with actuation signals that would initiate sequences of opening and closing mouths within local clusters of membrane pumps. Additionally, the controllers emitted communication signals to adjacent nodes in neighbouring pump colonies that initiated secondary responses. Ripples of movement resulted from this sequence of signals.

The main control boards used simple Peripheral Interface Controller 'PIC' microprocessor hardware. Each board controlled several dozen actuator and sensor elements in parallel chains, and a communication system using modular connectors and twisted-pair circuitry provided communication functions for coordinated responses through the entire installation.

3 Actuated breathing pore, spacer unit and sensing whisker

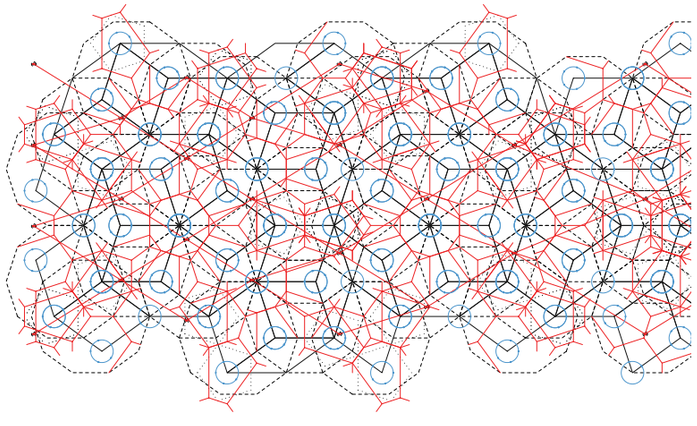
Facing page
4 View below filter layer showing whisker colony

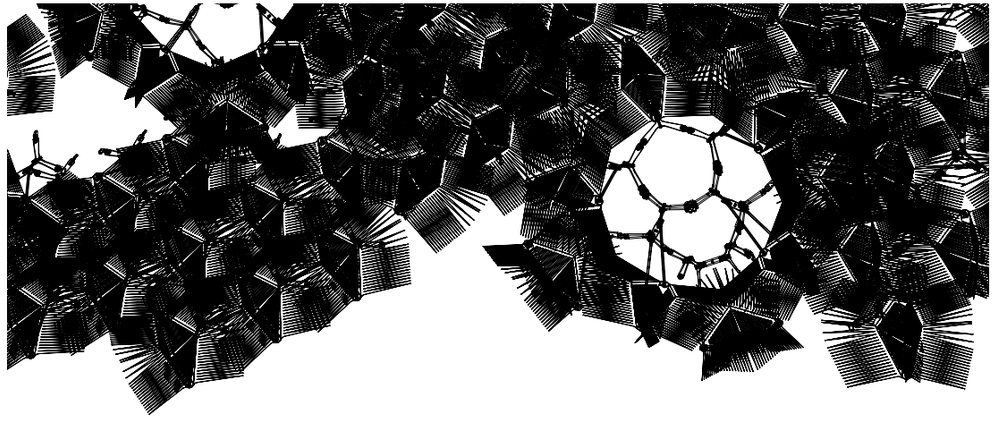
Overleaf
5 View showing actuated breathing pore strata above, filter layer below

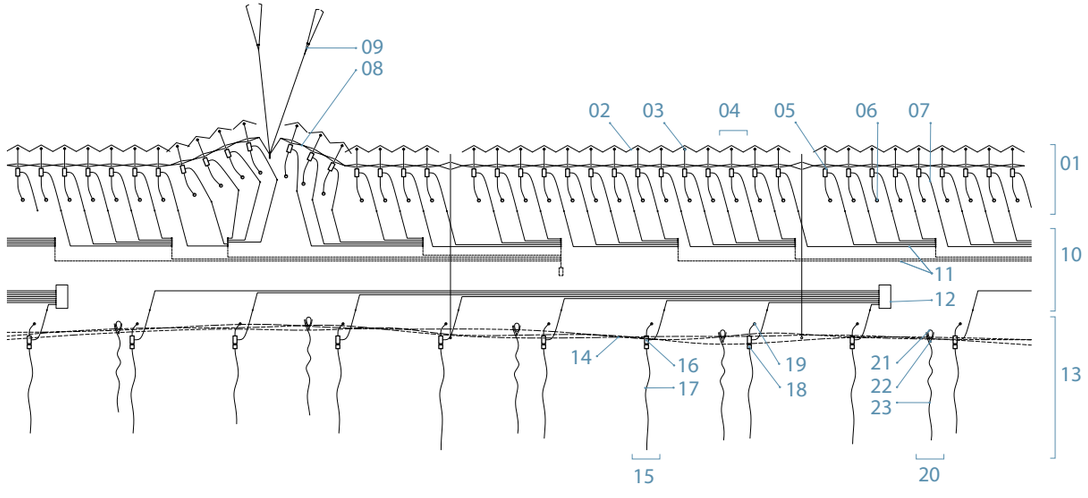
6 General view

7 Penrose tessellation ordinance system for filter layer

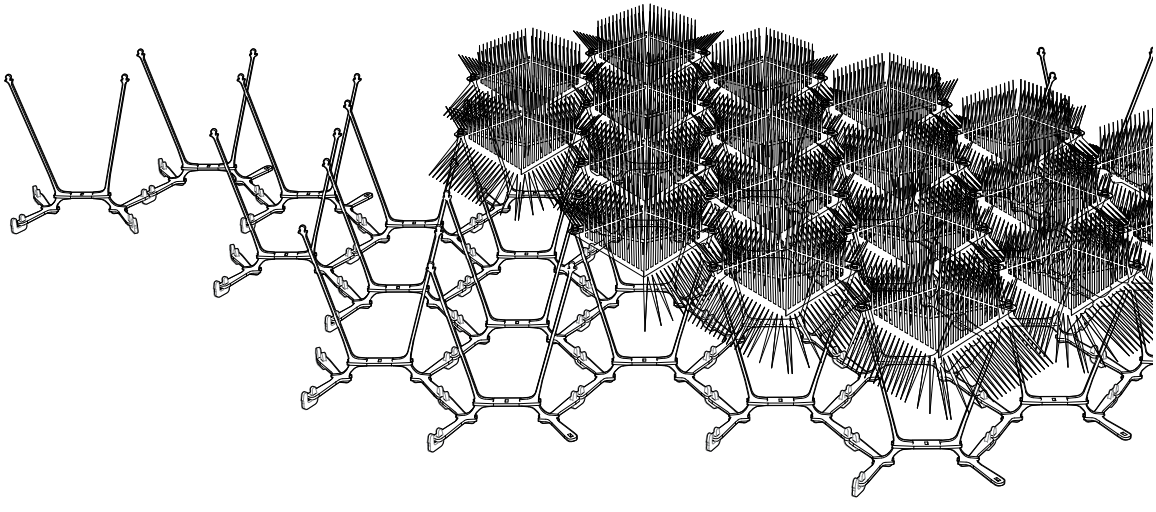
Facing page
8 Plan view of actuated breathing pore layer

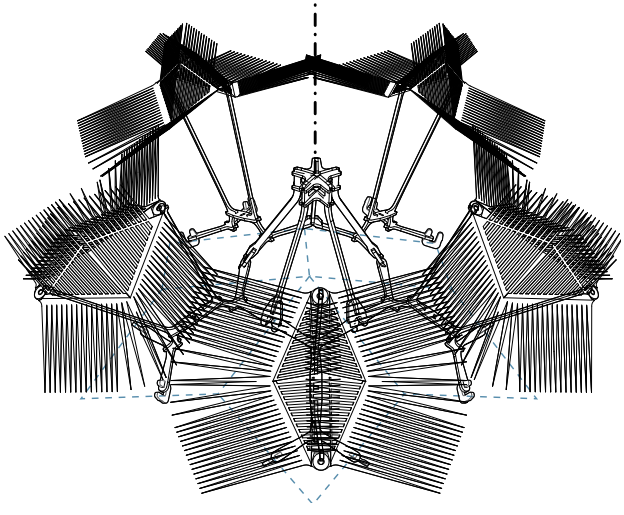






01 **Structural Matrix**
02 Activated 'Pores'
03 Shape Memory Alloy (SMA) Wire
04 SMA Actuator Circuit
05 Controller Board
06 Light Sensor
07 Power Supply
08 Hemispherical Structural Node
09 Attachment Clamp
10 **Network Matrix**
11 Actuator Power Delivery
12 Sensor Control System
13 **Filter Matrix**
14 Filter Mesh
15 Sensors
16 Sensor Circuit
17 Capacitance Sensor/Actuator 'Whisker'
18 Speed Control Motor
19 Light Emitting Diode
20 Nutrient Packs
21 Nutrient Reservoir
22 Excretion Mechanism
23 Trigger





9 Breathing pores

10 Hemispherical pentagon node with structural junction

Facing page

11 Spring traps and whiskers below filter later

12 Model view showing rhombic breathing pore tessellation

13 Filter layer with LED signallers and collection bladders

14 Unfolded breathing pore element profiles

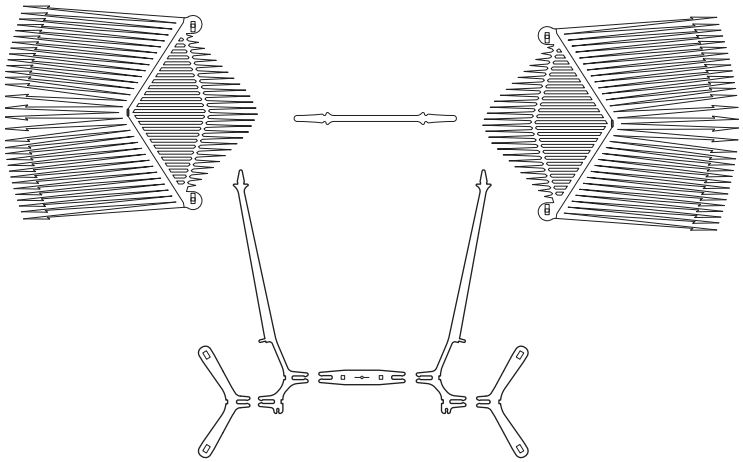
Facing page

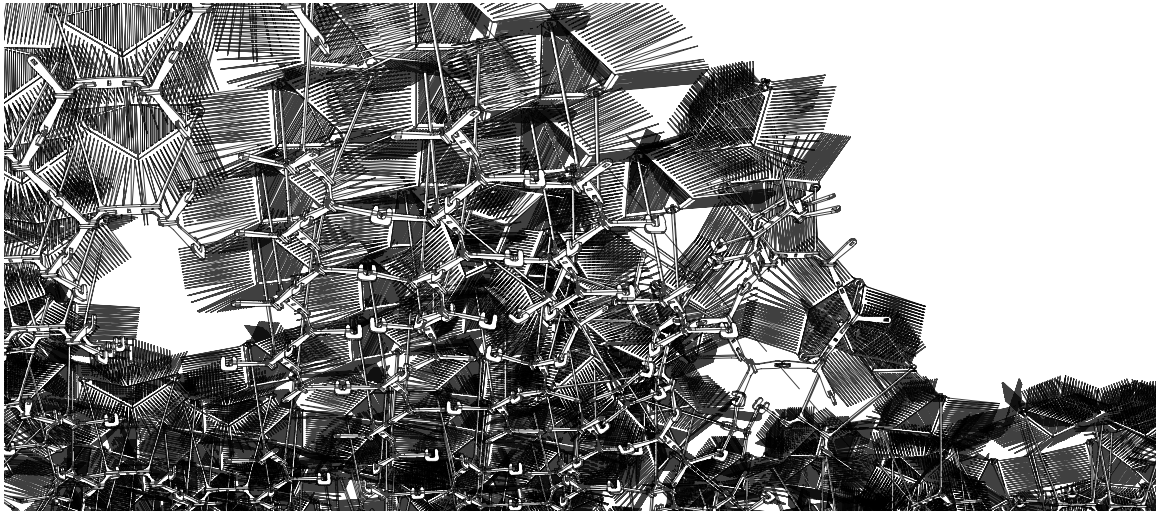
15 PIC microprocessor

16 Model view showing breathing pore layer

Overleaf

17 View of breathing layer above and filter stratum below





Hylozoic Soil

2007 - Montreal Museum of Fine Arts, Quebec

Hylozoic Soil offers patterns of motion by mechanical components that respond to occupants' movement within the environment. The microprocessor-controlled system includes *Arduino*[1] hardware extended by new control boards, shape-memory alloy actuators and space sensors arranged in a distributed interactive system. Lightweight lattice and geodesic organizations form a structural core, employing digitally fabricated lightweight scaffolds that house distributed networks of sensors and actuators. The structures are designed at multiple scales including custom components, intermediate tessellations composed of component arrays, and general structural systems. The work focuses on integrating control systems with decentralized responsive intelligence. The work is based on a program of gradual development moving from individual figures composed of complex hybrid organisms toward immersive architectural environments that include lightweight interior-linings and exterior shading and filtering assemblies.

Occupants move within the *Hylozoic Soil* structure as they would through a dense thicket within a forest. Microprocessor-controlled sensors embedded within the environment signal the presence of occupants, and motion ripples through the system in response, pulling trickles of air through the mesh and drawing stray organic matter through arrays of filters.

The structural core of *Hylozoic Soil* is a flexible meshwork assembled from small acrylic chevron-shaped tiles that clip together in tetrahedral forms. These units are arrayed into a resilient, self-bracing diagonally organized space-truss. Curving and expanding this truss work creates a flexible grid-shell topology. Columnar elements extend out from this membrane, reaching upward and downward to

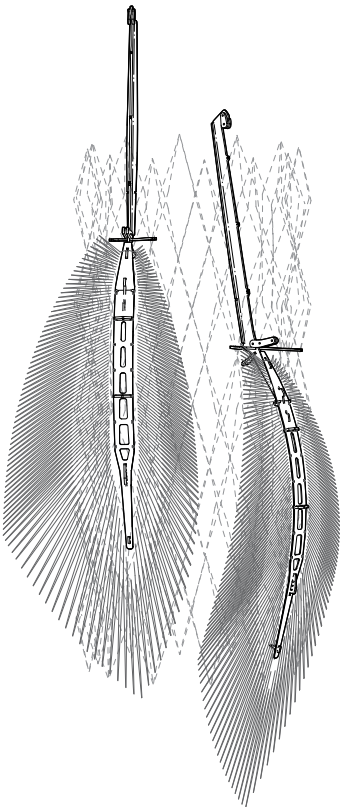
1 Arduino is an open-source microprocessing platform, named after a medieval king of Italy www.arduino.cc

Facing page

2 Detail view of breathing column with diagrid mesh and breathing pores

Overleaf

3 View of populated and unpopulated breathing columns



4 Model view of breathing pores

create tapering suspension and mounting points. Fitted into this flexible structure are hundreds of small mechanisms that function in ways akin to pores and hair follicles within the skin of an organism.

'Breathing' pores are composed of thin sheets shaped into outward-branching serrated membranes, each containing flexible acrylic tongue stiffeners fitted with monofilament tendons. The tendons pull along the surface of each tongue, producing upward curling motions that sweep through the surrounding air. 'Kissing' pores are a cousin of this mechanism. These use a similar mechanics fitted with a fleshy latex lash and offer cupping, pulling motions. A second kind of 'swallowing' pore occurs in a triangular layout that creates a dense series of openings running throughout the meshwork. These openings contain pivoting arms in triangular arrays that push out radially against the surrounding mesh, producing expanding and contracting movements. Light-emitting diodes are fitted within lower surfaces of these elements, configured to pulse in synchronization with swallowing motions. 'Whisker' wound-wire pendants are arranged in dense colonies within this environment, supported by acrylic outriggers with rotating bearings. Tensile mounts for the whiskers encourage cascades of rippling, spinning motion that amplify swelling waves of motion within the mesh structure.

Processing for this system is based on Arduino, an open-source platform that was designed to make tools for software-controlled interactivity accessible to non-specialists. The palm-sized Arduino microcontroller board can read sensors, make simple decisions, and control devices. In *Hylozoic Soil*, each board is paired with a custom 'daughter board' that provides extended functions including communication, high-current outputs, and configuration switches. The distributed system consists of 38 controller boards, all with identical hardware. Specialized functions are assigned by software setups in groups of boards, and one board assumes a supervisory role for the entire system. Individual boards all 'talk' on the bus controller's receive lines, and listen to the controller's instructions on the parallel send lines. Information is transferred from board to board via the controller.

Several levels of behavior are programmed into the sculpture in order to encourage coordinated spatial behaviour to emerge. Software is organized into local behavior affecting isolated groups of devices, coordinated behavior between neighboring groups, and global behavior running throughout the whole system. Each board produces its own response to local sensor activity and listens for messages from neighbouring boards, identified by means of an address map of the devices within the installation, encoded into the software. The bus controller has information about sensor activity from all of the individual boards and is able to control a third level of 'global' behaviour with this information.

Simplicity and economy are prevailing qualities that have guided design of the system, supporting massive repetition and efficient mass-manufacturing of the assemblies. Consumption of materials is reduced

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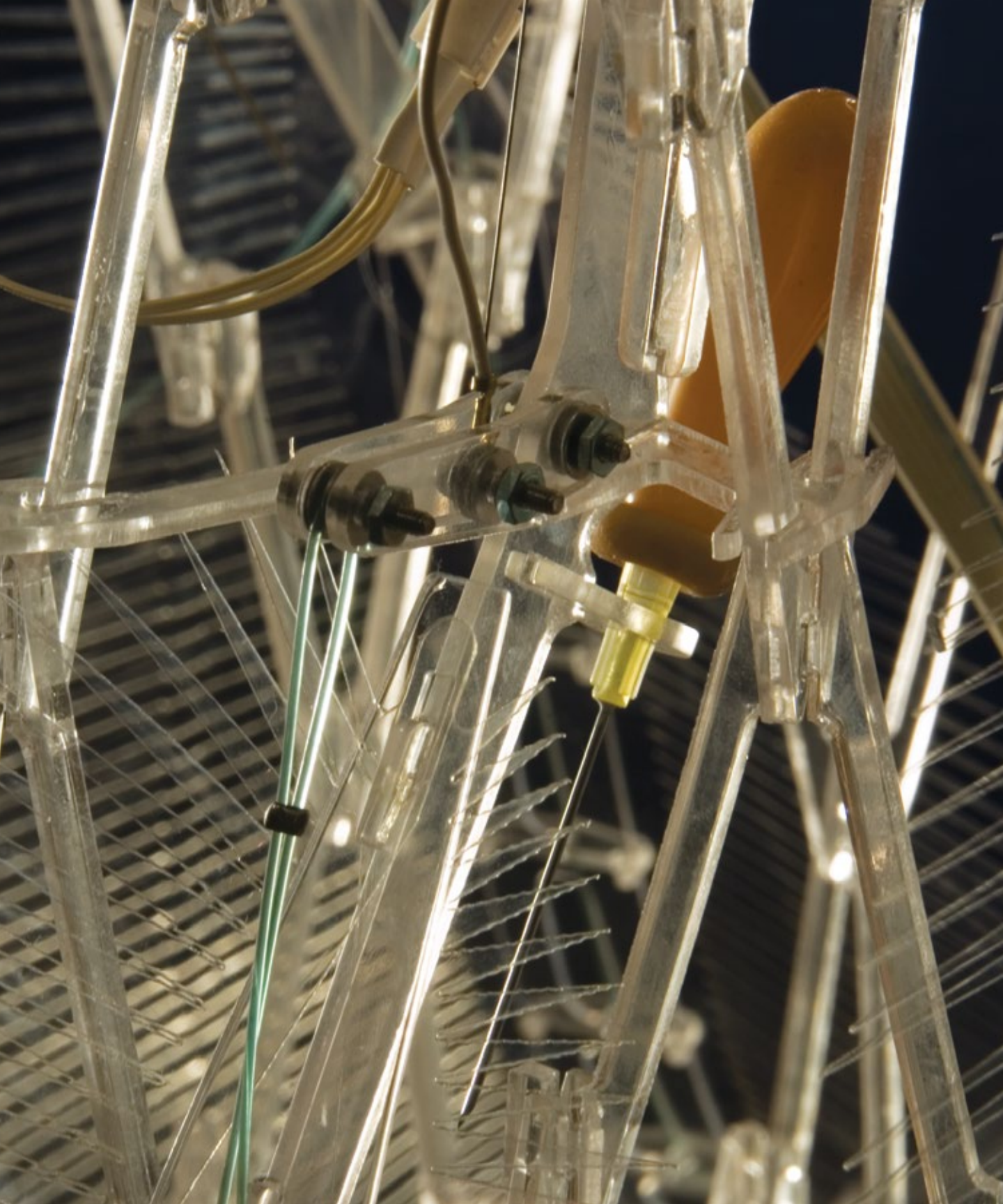
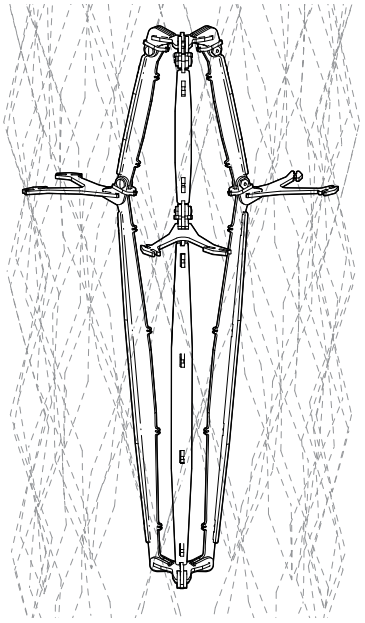
5 Detail showing shape memory alloy and lever junction with monofilament; gland-needle behind





6 Model view of swallowing mesh actuator

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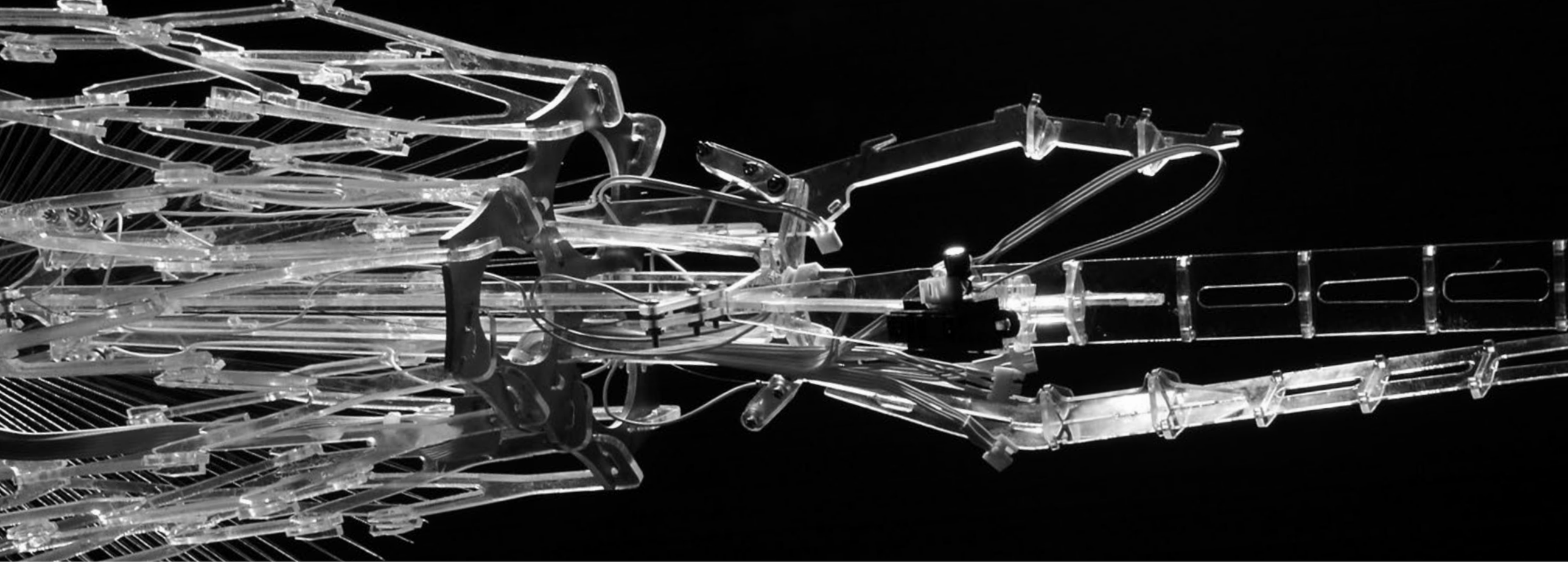
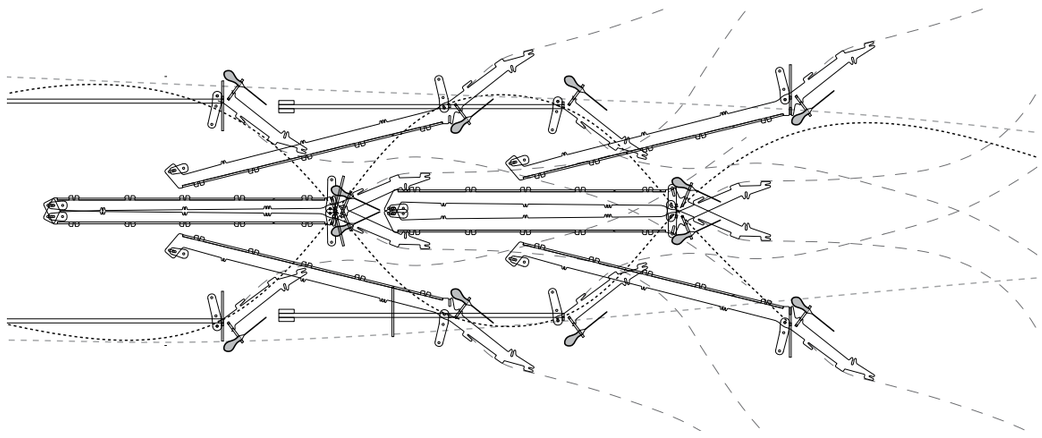
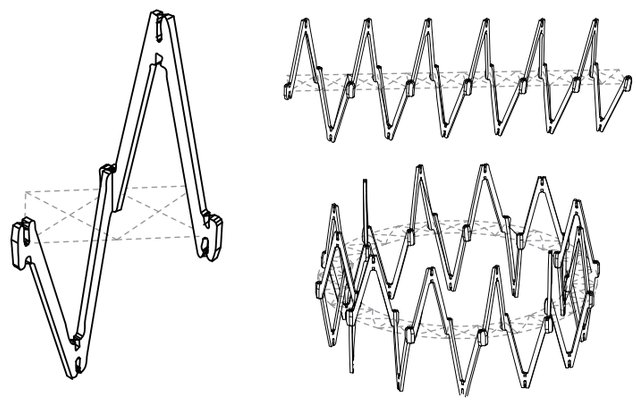
7 Detail showing Arduino microprocessor and custom daughterboard

to a radical minimum by employing optimized form-finding design methods. Strategies include use of efficient tensile forces and textile systems in mesh and shell forms and derivation of three-dimensional forms from thin, two-dimensional sheets of material. Space-filling tessellations and nested components derived from sheet goods contribute to this hybrid economy. Some eight cubic feet of acrylic polymer, fifty pounds of copper wire, aluminum sheet and handfuls of specialized alloys are expended, while the expanded space formed from these materials occupies some eight thousand cubic feet.

Similarly, the control system offers complexity in its behaviour while avoiding large centralized computing. The distributed arrays of inexpensive miniature microprocessors achieve coherent behaviours through their distributed communication network. The intensive repetition of small information packets in the communication network and mass-manufacture of miniature physical components in the physical sculpture are similar in their approach, offering a heterogeneous whole.







8 Diagrid column foot showing milled aluminum termination plate, with kissing pore extension

9 Acrylic chevron snap-fit base units with sub-assembly variations

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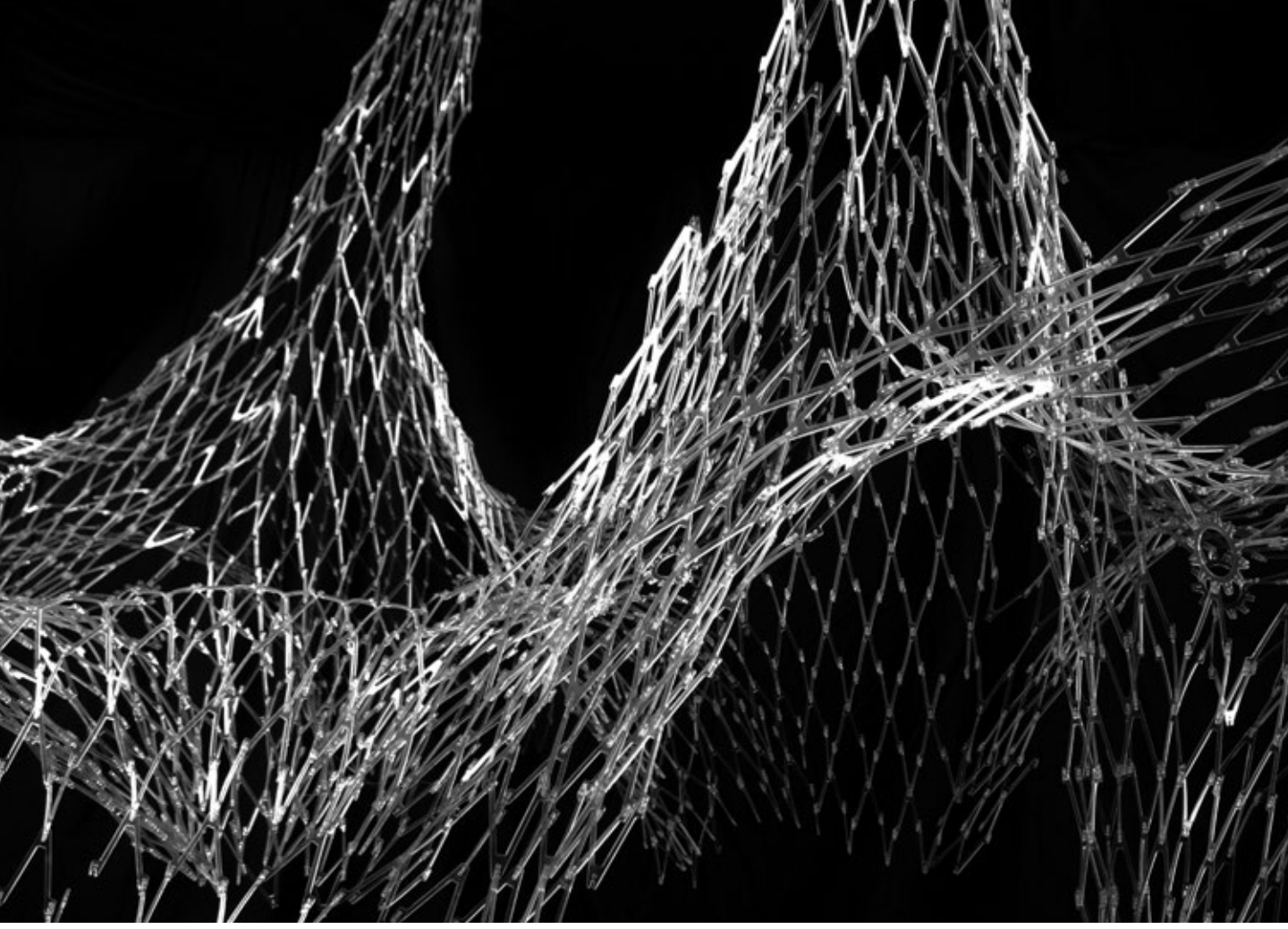
10 Layout of breathing pore actuator arms within column assembly



11 Core diagrid mesh typology

12 Mesh vaulting formed in interstices between core units

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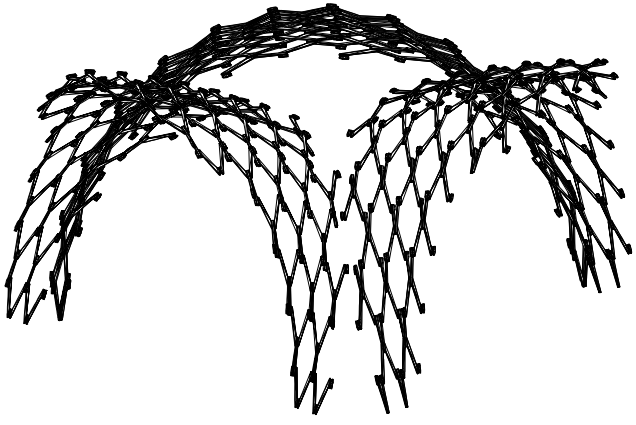
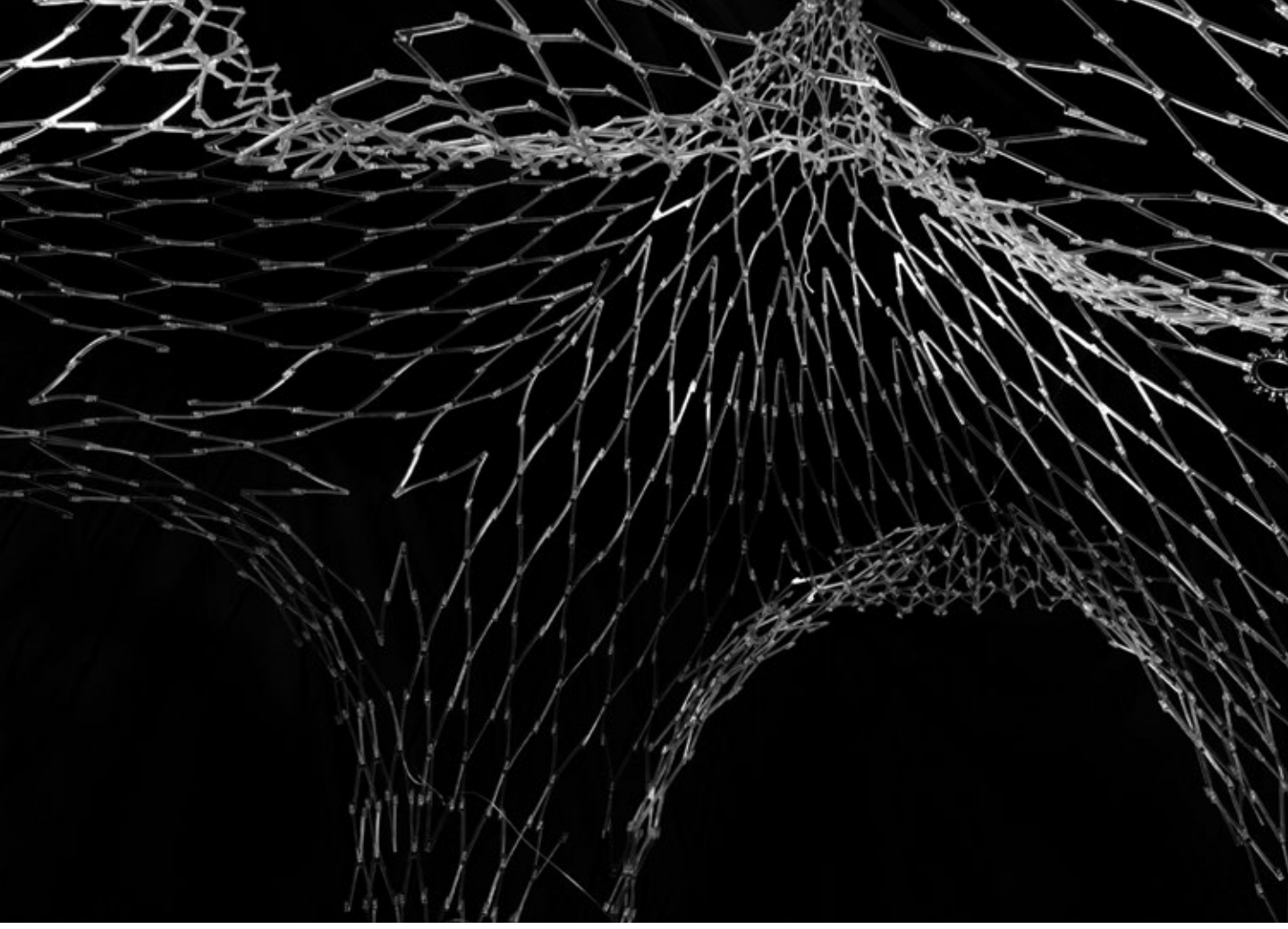
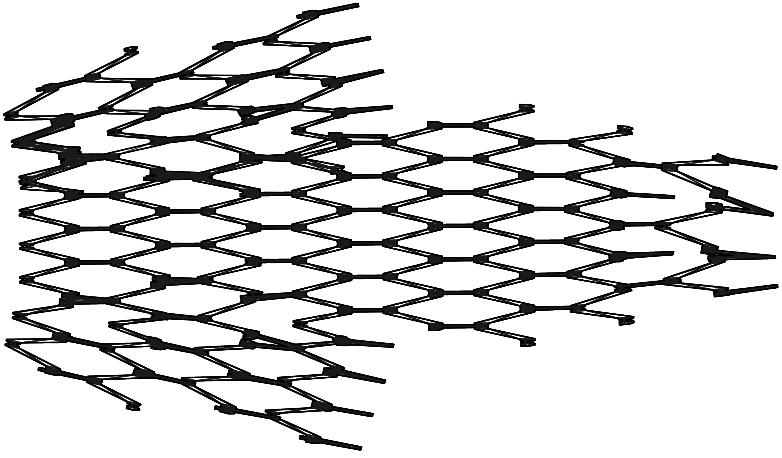
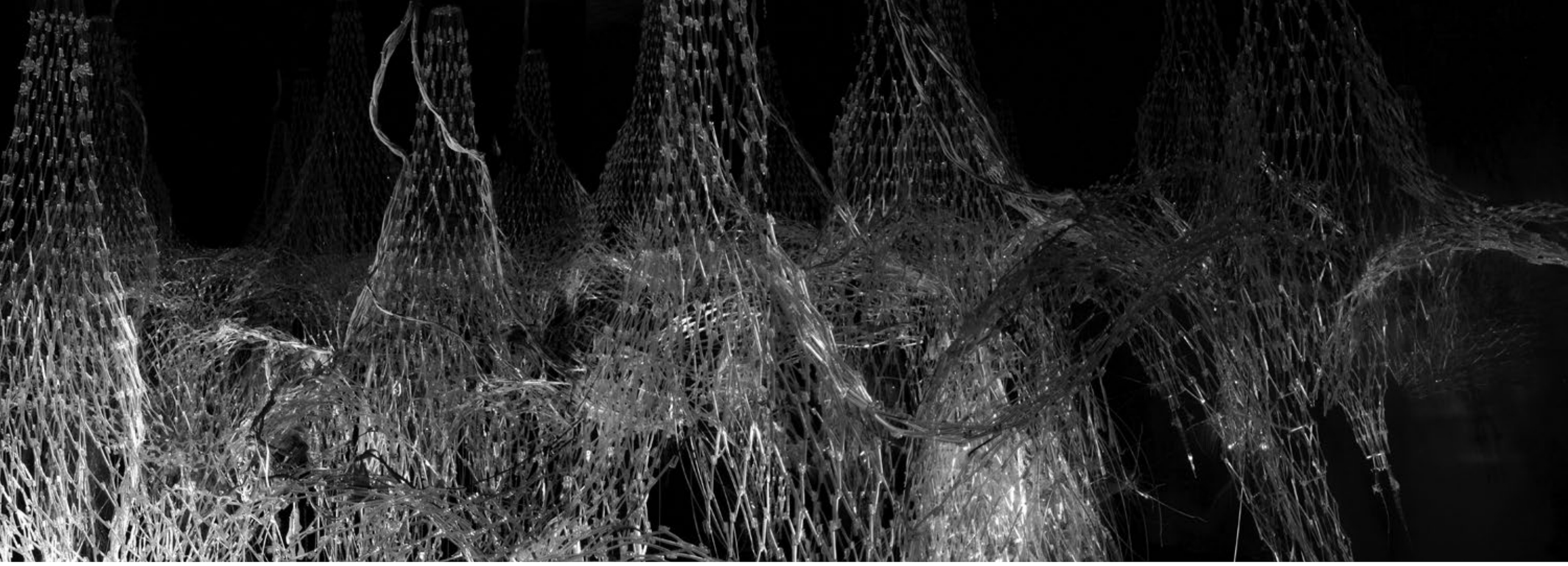
13 Core diagrid unit showing bifurcations and triangular tangent formations

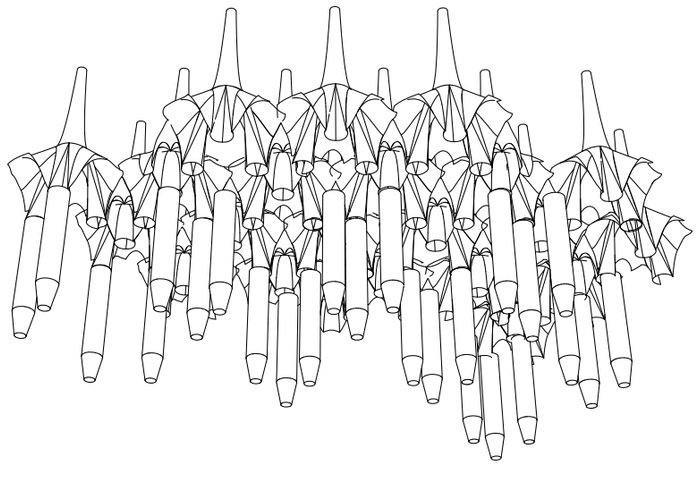
14 Core diagrid sub-assembly, unfolded











15 Diagrid mesh typology

16 Mesh 'lily' array with breathing columns below

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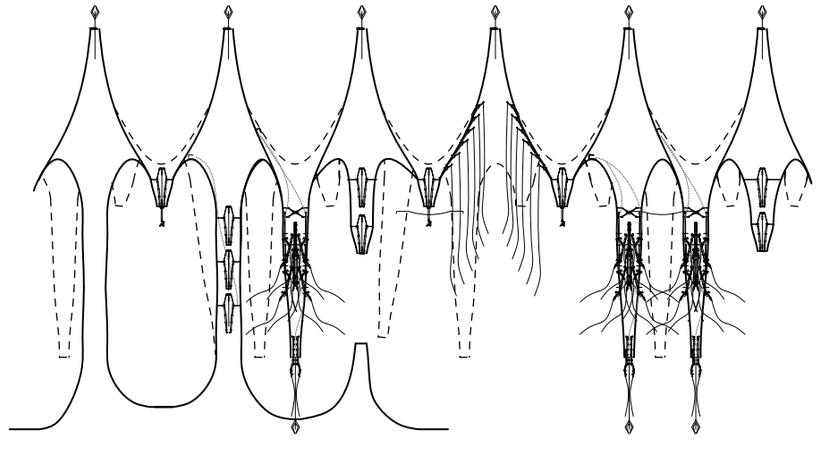
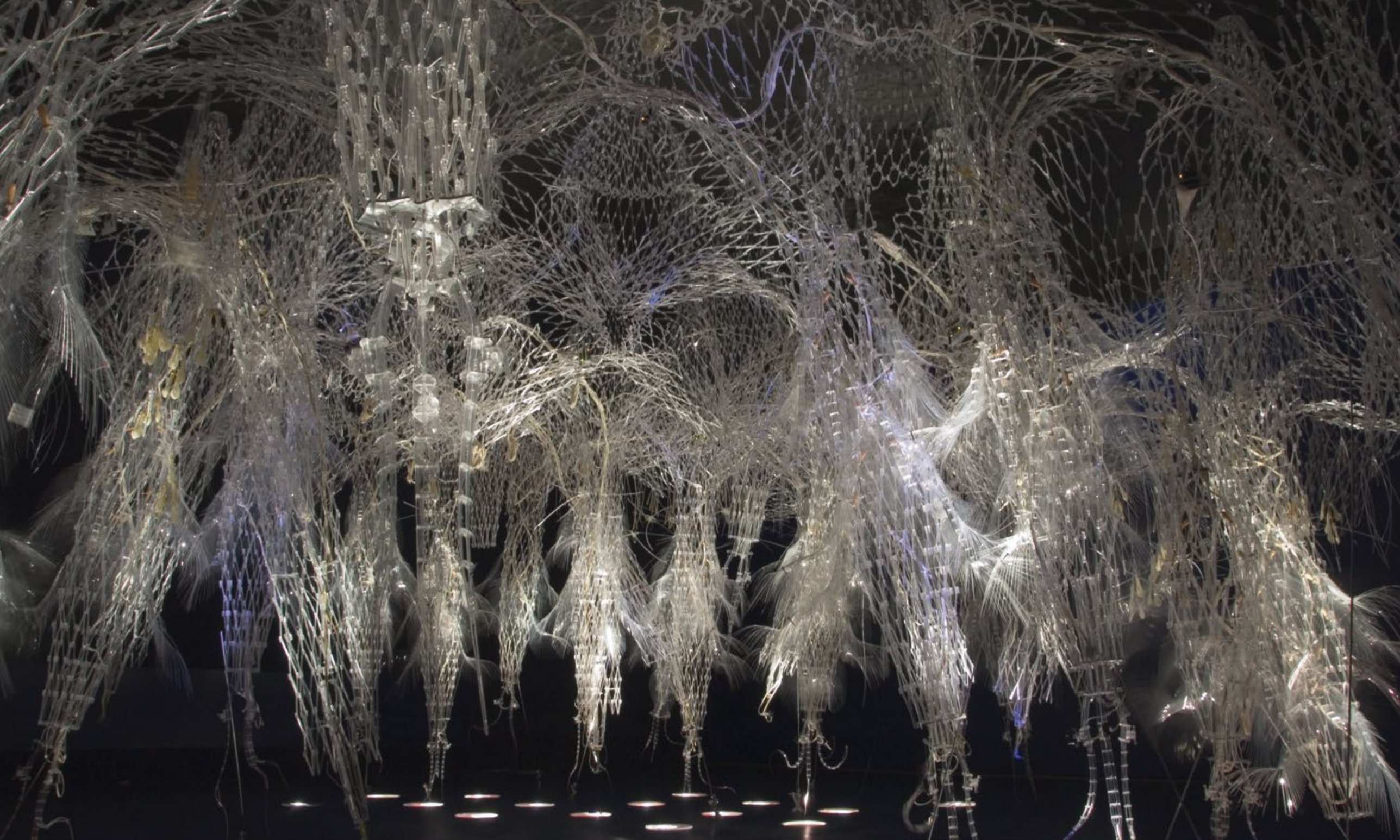
17 Section view showing breathing columns, whisker node and swallowing pore units





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Biographies

Philip Beesley

Philip Beesley maintains an experimental practice that combines sculpture with public buildings, exhibitry and work for the stage. He is an associate professor in the School of Architecture, University of Waterloo, and practices architecture in Toronto. He was educated in visual art at Queen's University, in technology at Humber College, and in architecture at the University of Toronto. He was a member of art and performance collaboratives *Open Series* and *Studio Six/Kataraque* in Kingston and the *George Meteskey Ensemble* in New York. Periods of study were undertaken in Rome at the Vatican and the American Academy and in New York with the Wooster Group. Prior to beginning his practice he apprenticed in instrument making and in lighting design.

His focus on textile structures began in exchanges with members of the Toronto craft community and the Textile Museum of Canada during the 1990s. Exchanges with Philadelphia artist Warren Seelig from 1995 to 1998 introduced geotextiles as a class of engineering structures, reinforced by dialogues with Kenneth Snelson and Chuck Hoberman in 1998. At the University of Waterloo School of Architecture, Thoman Seebohm supported a focus on computational modeling during the late 1990s and was co-founder of the Integrated Centre for Visualization, Design and Manufacturing in 2001. Interactive systems were introduced by Diane Willow at the Haystack Mountain School of Crafts in 2002. Jim Ruxton, Steven Wood, and Robert Gorbet have been primary collaborators during 2003-7 in support of electronics and digital control systems.

Distinctions for his work include the Prix de Rome in Architecture (Canada), a Governor-General's award, and two Dora Mavor Moore Awards.

Publications include *Fabrication: Examining the Digital Practice of Architecture* (AIA/ACADIA 2004), *Responsive Architectures: Subtle Technologies* (Riverside, 2006), *Future Wood* (Riverside, 2006), *Mobile Nation* (Riverside, 2007), and *On Growth And Form: Organic Architecture and Beyond* (TUNS Press 2007).

www.philipbeesley.com

Christine Macy

Christine Macy is a professor of architecture at Dalhousie University in Canada. Her research work focuses on the representation of cultural identity in architecture, civic infrastructure, and ephemeral architecture. A graduate of UC Berkeley and MIT, Macy practiced for a number of years before establishing Filum in 1990, a research-based design office focusing on the form-finding and fabrication of ephemeral and tensile structures. A frequent contributor to Canadian Architect, her books include *Architecture and Nature: creating the American Landscape* (Routledge 2003) which received the Alice Davis Hitchcock Award from the Society of Architectural Historians in 2005; and the forthcoming *Festival Architecture* (Routledge 2007), and *Dams* (Norton 2008).

Andrew Payne

Andrew Payne has a PhD in English from the University of Toronto, where he is now an assistant professor in the Faculty of Architecture, Landscape, and Design and Director of the Architectural Studies Program. He is a former editor of the cultural publications *Impulse and Public*, and his writings have appeared in magazines and journals such as *Parachute*, *C*, *Praxis*, and *Princeton Pamphlet Architecture*.

Robert Pepperell

Robert Pepperell is an artist and writer. Trained at the Slade School of Art, he has exhibited widely and published many articles and books, including *The Posthuman Condition* (2003), *The Postdigital Membrane* (2000), and *Screen Consciousness* (2006), in collaboration with Michael Punt). He is a member of the Association for the Scientific Study of Consciousness, The British Psychological Society, a Fellow of the Royal Society of Arts, an Associate Editor with the journal Leonardo, and a Reader in Fine Arts at University of Wales Institute Cardiff, where he is also Head of Fine Arts.

Michael Stacey

Michael Stacey's professional life combines practice, research, writing and teaching. In 1987 he co-founded Brookes Stacey Randall Architects and in 2004 he established a new practice: Michael Stacey Architects. His commitment to design excellence has been recognised by numerous awards, which range from Civic Trust Awards, Bureau International du Beton Manufacture Award and Royal Fine Art Commission Building of the Year Award, Jeux D'Esprit. Key projects include: East Corydon Station, Thames Water Tower, Wembley Gateway Urban Regeneration Masterplan, Enschede Integrated Transport Interchange, Art House in Chelsea, Expertex Textile Centrum and Ballingdon Bridge. Product design for the building industry includes the invention of the Aspect 2 integrated composite cladding system, which is manufactured and marketed by Corus. He is also the author of a wide range of publications and articles including *Component Design* (2001). Michael Stacey is Chair in Architecture at the University of Nottingham and Research Professor at University of Waterloo, Ontario. Themes within his research include: digital fabrication, form finding in architecture, offsite manufacture, facade design and procurement, emergent materials and sustainability. His interest in digital design has led to the foundation of the Digital Fabricators Research Group, which focuses on the use of digital design tools in the making of architecture.

Charles Stankievech

Charles Stankievech works in the constellation of art, architecture and theory. Balancing philosophical questioning with explorations of materiality, his work combines a subtle play between the history of ideas and the history of technologies. His work has been exhibited internationally—from Venice to New York to Vancouver—and recent writing has appeared in Leonardo Music Journal (MIT Press), Responsive Architectures, and On Site Review. Stankievech currently splits his time between Montreal and Dawson City, Yukon, where he is developing the KIAC School of Visual Arts. For other projects and writings visit: www.stankievech.net

‘The glass-like fragility of this artificial forest, built of an intricate lattice of small transparent acrylic tiles, is visually breathtaking. Its frond extremities arch uncannily towards those who venture into its midst, reaching out to stroke and be stroked like the feather or fur or hair of some mysterious animal. In keeping with Beesley’s own description, his enchanted environment complies with the laws and cycles that determine the millennial assembly of a coral reef, with its cycles of opening, clamping, filtering and digesting. Capacitance-sensing whiskers and shape-memory alloy actuators create a diffuse peristaltic pumping motion, luring visitors in to the eery shimmering depths of a forest of light . . .

In keeping with the tradition of biologist artist Ernst Haeckel’s Riddle of the Universe (1899), which traced actions of organic and inorganic nature alike back to natural causes and laws, Beesley’s Hylozoic Soil stands as a magically moving contemporary symbol of our aptitude for empathy and the creative projection of living systems.’

Jury, VIDA 11.0, Fundacion Telefonica

Philip Beesley teaches at the School of Architecture, University of Waterloo and practices architecture in parallel with digital media art. Beesley’s work focuses on immersive digitally fabricated lightweight ‘geotextile’ structures. Recent projects feature interactive kinetic systems using dense arrays of microprocessors, sensors and actuator systems. These environments pursue distributed emotional consciousness combining synthetic and living systems.

Selected to represent Canada at the 2010 Venice Biennale in Architecture, Beesley’s work is widely published and exhibited, and has been distinguished by awards including VIDA 11.0, FEIDAD, and the Prix de Rome in Architecture (Canada). He was educated in visual art at Queen’s University, in technology at Humber College, and in architecture at the University of Toronto.

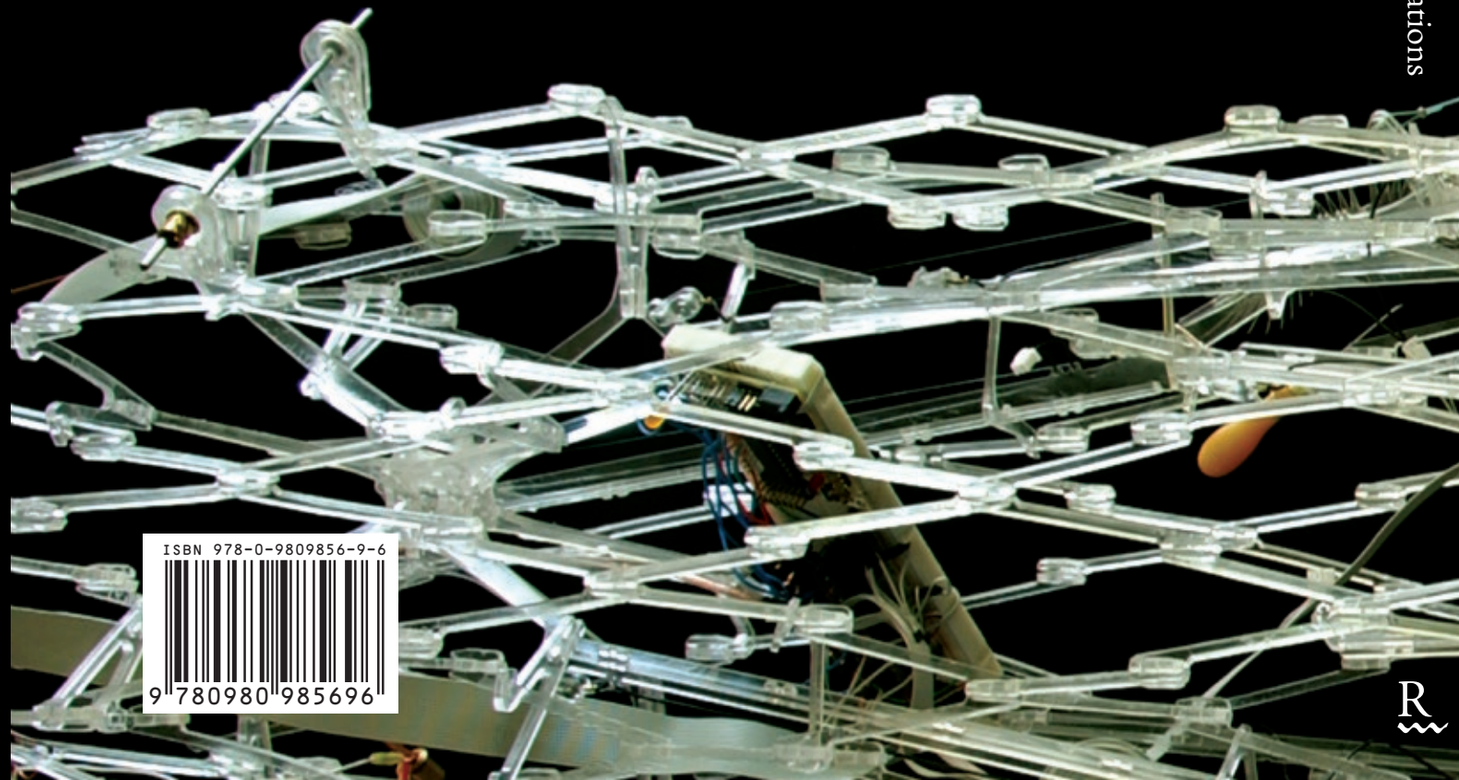
www.philipbeesley.com

Kinetic Architectures & Geotextile Installations

This book documents projects developed by Philip Beesley and collaborators from 1995 through 2007. The collection includes architectural sculptures located in natural sites, and exhibition installations that integrate kinetic components and interactive systems.

With contributions by Jean Gagnon, Eric Haldenby, Christine Macy, Andrew Payne, Robert Pepperell, Michael Stacey and Charles Stankievech.

Riverside Architectural Press



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