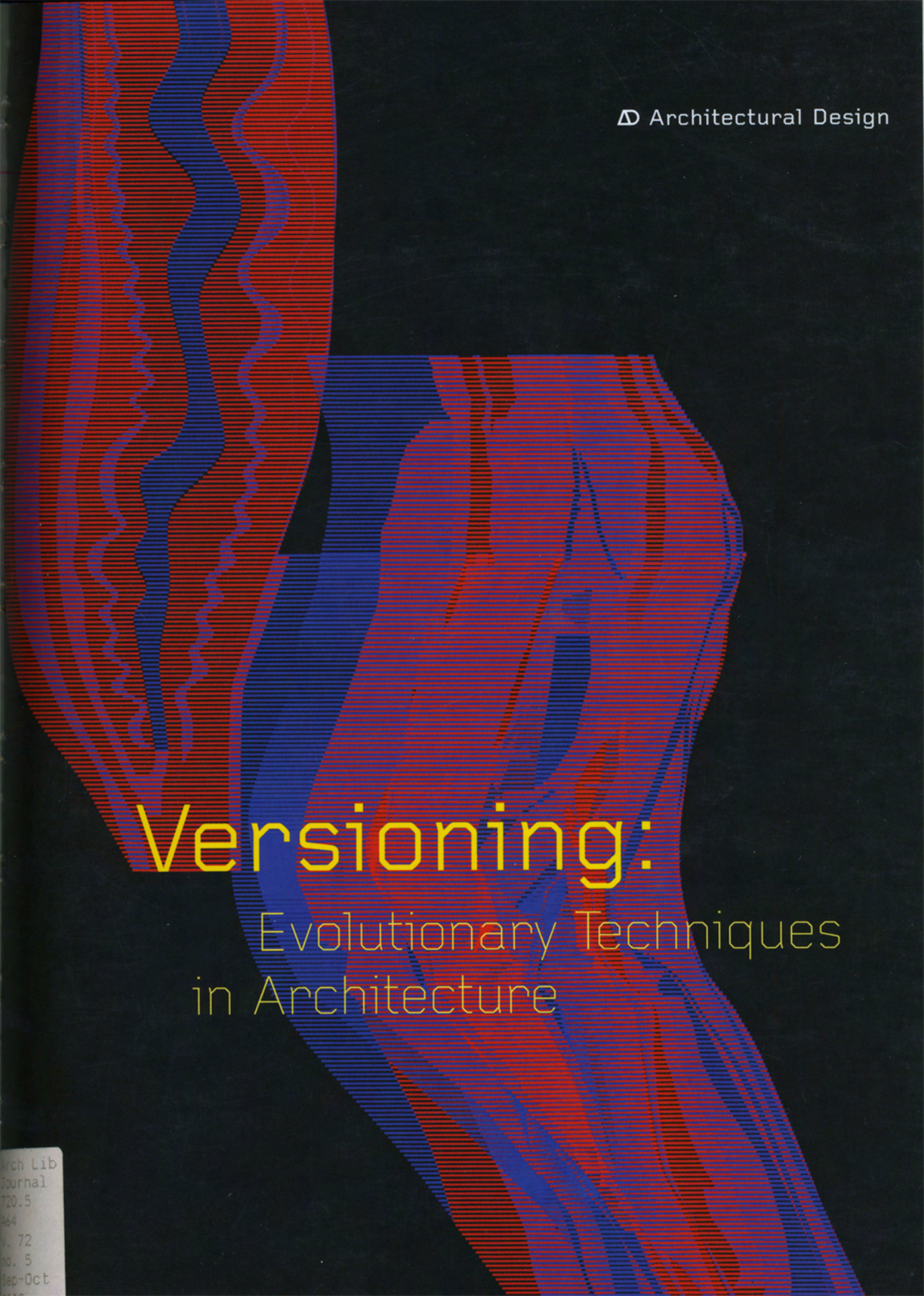
Architectural Design



Versioning:

Evolutionary Techniques in Architecture

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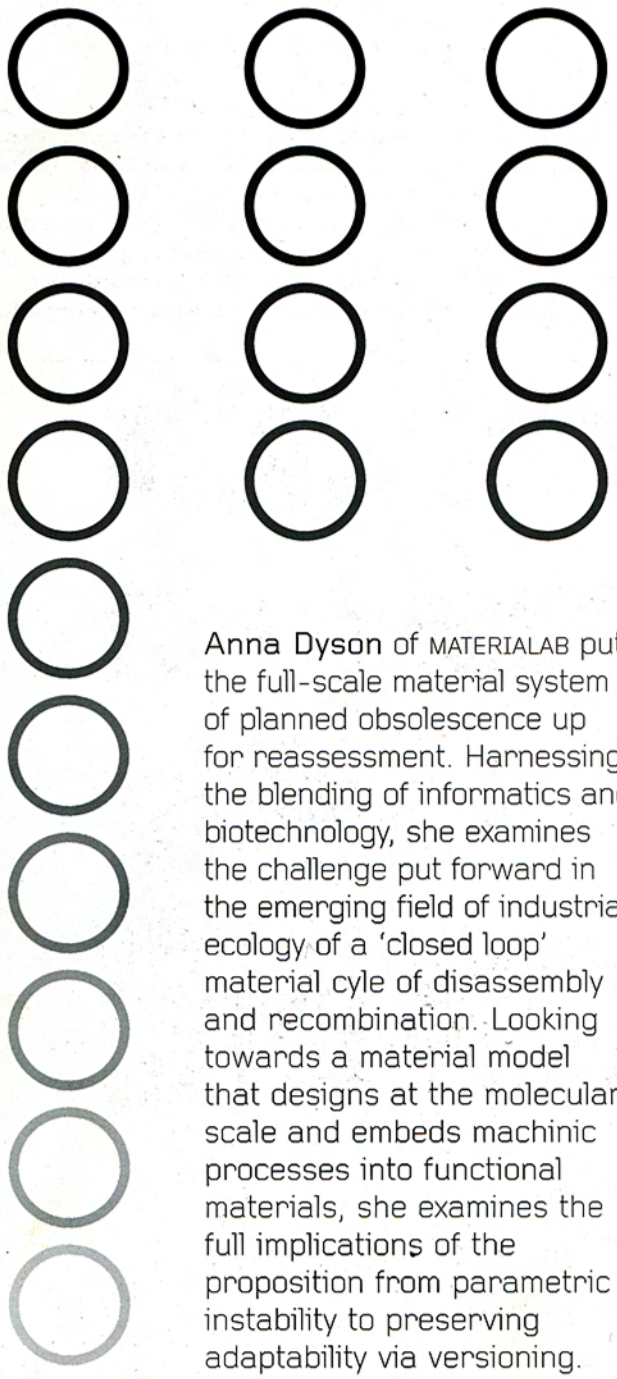
Recombinant Assemblies



Anna Dyson of MATERIALAB puts the full-scale material system of planned obsolescence up for reassessment. Harnessing the blending of informatics and biotechnology, she examines the challenge put forward in the emerging field of industrial ecology of a 'closed loop' material cyle of disassembly and recombination. Looking towards a material model that designs at the molecular scale and embeds machinic processes into functional materials, she examines the full implications of the proposition from parametric instability to preserving adaptability via versioning.

I mistrust all systematizers and I avoid them. The will to a system is a lack of integrity
— Friedrich Nietzsche, 1888[1]

Biotechnology:[2] Tactics for Intensive Accumulation

The current context for technological innovation has catalysed the powerful blending of informatics with biotechnology, the latest development in a long series of disproportionately capitalised bases for knowledge production. Throughout modernity, these industrial bases have become increasingly divested of connection to cohesively negotiated goals for material culture. Yet the latest events carry the potential to destabilise some of the values that have spurred their own development. In her arguments on behalf of the cyborgian reinvention of nature, Haraway posits a difficult but compelling argument in her abiding suspicion that 'biology' is an 'accumulation strategy' that may be 'more kind than alien', 'more strange than capital'.[3] Yet, the fact that the current massive extinctions of difference in existing life forms actually coincides with the astonishingly strenuous efforts of the biotech industrial complex to crack the 'codes' for animate existence, has become a popular emblematic irony.

Meanwhile, within the design community, along with much of the ongoing fascination with complexity theory and its tenuous coexistence with rampant experiments in computer-generated biomorphic form, there has been surprisingly little viable discussion of the information contained within these alleged datascapes (as biologists maintain that successful body designs and behaviours must be critically high in information content). Propelled by the codified boundaries of the software, they often still reflect modern paradigms of technology that have tended to treat available information with objectivity, with the expected ability to process and repattern data into a coherent problem set whereby any complicating information is comfortably reduced or removed to afford maximum legibility or literalness.

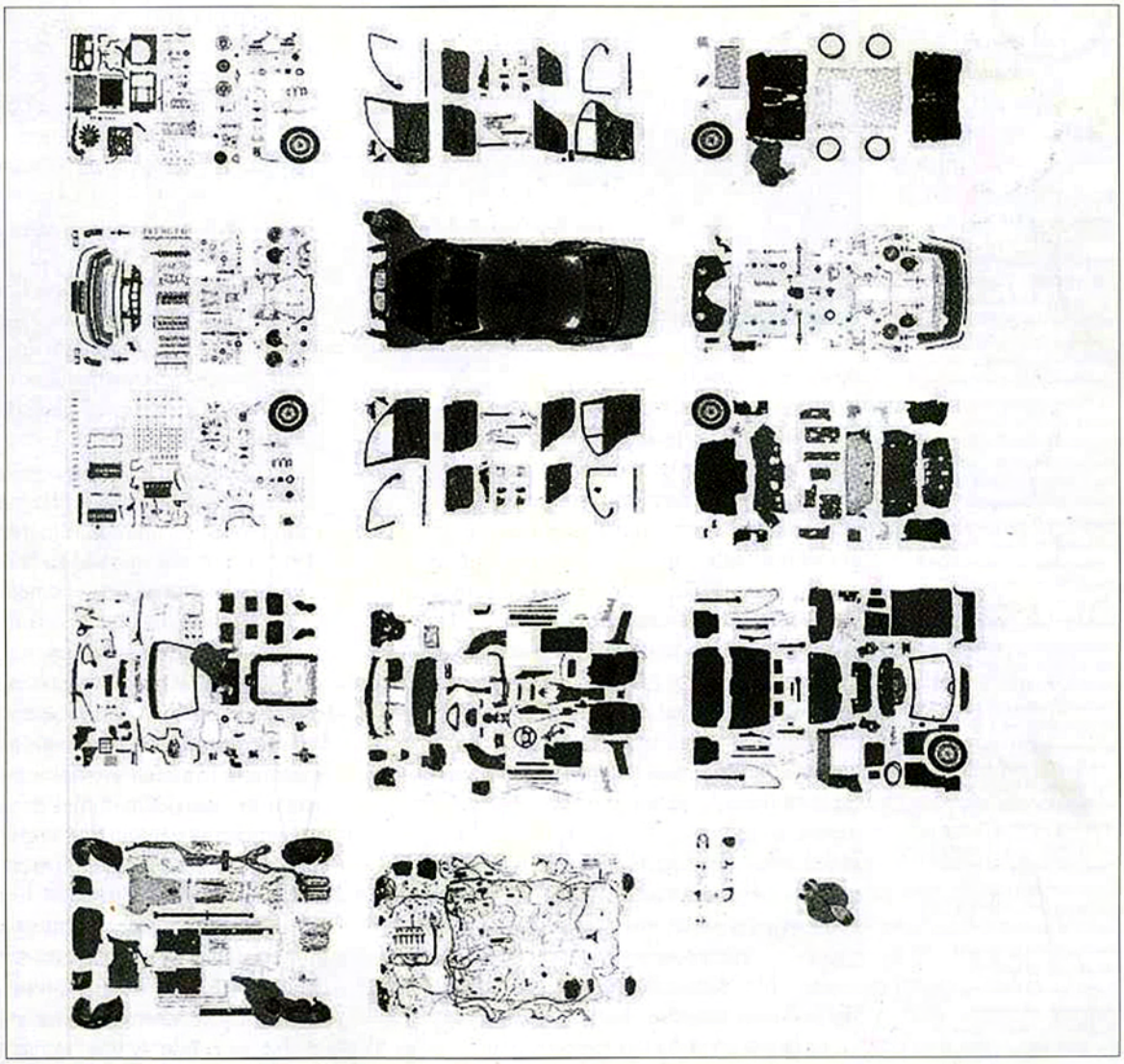
This ultimately homogenised smoothing could not be further from a biotic condition but is, rather, concurrent with other vestigial modalities of mechanisation, whereby the will to master technology in a linear and reductive sense seems to become all the more urgent the more technology threatens to slip from control. So what exactly characterises the relationship between ecological crisis and the objectifying modes of mechanical paradigms that are still deeply embedded in our most contemporary design processes? They are both functions of a material culture with disproportionately extended knowledge bases that resist the intensive cross infection of lateral (informally cohesive) information

flows. In response to truly complex ecological criteria within design, what would it take to effectively innovate bioadaptive assemblies whereby multiple and codeterminate codifying procedures in computing could be a means for mitigating automatic objectivity?

Unlike the simplistically theocratic tone that undermines much popular environmental rhetoric, the daunting logistical mobilisation required to effect such an alternative mode of production suggests a complex engagement of communities and specialists in a context of information intensification.[4] Within the broader context, it has never been an attractive enough suggestion that a viable solution to the current global crisis could be to rein in the present expenditures and make do with less, to limit the exploitation of resources in an economic structure that only privileges such a dynamic. Nor does it work to emphatically call for the redistribution of energy flows without sufficient deliberation of alternative modes that could create more distributed prosperity. The primary catalyst for change will always be opportunity, even (or especially) if it is qualified by ethical-aesthetic aspiration.

Among the strange possibilities emerging from the biotech revolution is the potential for a radical alteration of trajectories for material production and gestation: shifting from the present throughput economy to a closed-loop (metabolic) material cycle, in which the intensification of value within that cycle becomes a strategy for accumulation.

However, if we are to attempt to engage complexity at the scale of ecology, which is a theoretically infinite series of interdependent scales, then our fantasies of control or completed cartographies will give way to a different procedural posture of multiple but situated cartographies, a series of partial engagements. These processes are not necessarily indeterminate, but embody locally codeterminate decision-making which,



Right
Car parts, BMW. Research into recycling and reassembly is moving towards the next sports car, in line to be designed for disassembly in 20 minutes ...

Right
The baidarka kayak, which meshes small pieces of bone into a wooden superstructure in the strategic zones requiring maximum flexibility, makes an interesting performative comparison with the most 'high-tech' carbon-fibre composite models. For all its apparent flexibility, the carbon-fibre craft is a homogeneous structural solution that exhibits none of the localised adaptive resilience that the ancient prototype exhibits. The latter's combination of hardness and flexibility, due to micro-insertions of specialised material within a composite, reflects the current challenge for the development of 3-D templating. Free-form manufacturing has allowed us to build complex 3-D prototypes from the ground up, one layer at a time. But one of the keys to bioperformance is the micro-compositing of more than one material. Two or more must be employed (for example, a layer of chalk separated by a layer of proteins) as natural systems blur boundaries at multiple scales within composite structures to facilitate symbiotic performance behaviour, as well as possibilities for adaptive recombination.

through intrinsic acknowledgement of its partiality, remains tractable and pliant. How ironic that the various computer-aided processes that we engage to gain 'vertical' control over the means of production are also those that may simultaneously allow for the relinquishing of singular subjectivities. How then to design within, manage and communicate a complex data-rich context, whereby partial and problematic criteria must not be excluded in an evolving process? Do we have to give up 'control' to gain real power: the power to adapt?

From a Throughput Economy to a Closed-Loop Material Cycle

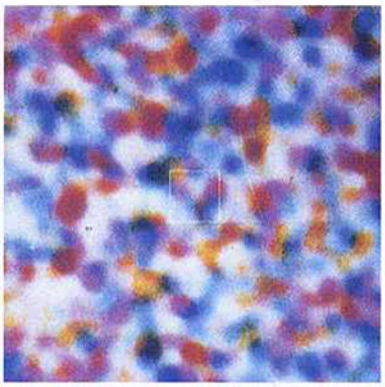
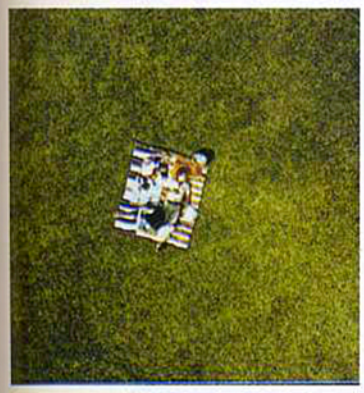
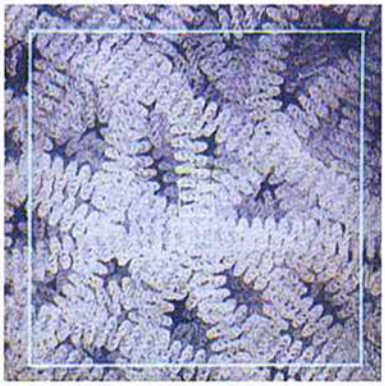
It may be difficult enough to imagine the practised development of such situated maps within a negotiated design process. Even more daunting is the notion of full-scale material implementation open to reassessment; that is, designed for disassembly and recombination. Yet that is exactly the challenge currently being undertaken by the nascent international movement of industrial ecology – a development of recoded social imperatives which mandate a programmatic shift away from the linear throughput economy of materials (extract, heat, beat, treat and discard) to a cyclical one (designed for reuse within the same or complementary manufacturing processes).

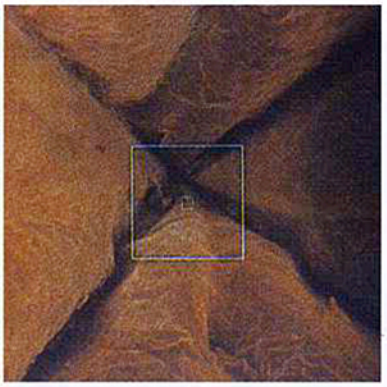
In a closed-loop material cycle, in contrast to a throughput economy, one is obliged to engage rather than objectify material because the considerations of its immediate manipulability and expendability must be stretched to include its continued participation in another economy. The process therefore becomes responsive to mutating contexts not necessarily dictated or, for that matter, even anticipated. This leads us to the current crux of emerging development: degrees of adaptability must be designed into multiple scales of the material itself.[5] If our economy of planned obsolescence can give way to an even more 'productive' paradigm of biotechnology as a strategy for accumulation, then we have to forego our arrogant assumptions that our current technologies are 'beyond control' because they are somehow so advanced, and instead recognise the socially reductive barbarism of their singularly linear extensions, which resemble much more closely the immature first-phase growth of an opportunistic ecosystem.

Ecosystems can be divided into four temporal phases: type 1 is opportunistic, rapid growth, non-diverse and migrating – a meadow full of weeds after a fire; types 2 and 3 work towards complexification and diversity; type 4 is a mature, fully diverse self-sufficient system with no waste and only solar energy imported - a redwood forest. The kinds of closed-loop recombinant assemblies that are suggested by emerging industrial ecology will not be possible without material biological responsiveness embedded into multiple scales, both physically and temporally. The staggering complexity of such a designed condition at least necessitates a shift from regarding individual materials or assemblies on their own terms, instead considering them continuously as a function of multiple mutating conditions.

Growing Material

Intelligent materials epitomise the radical transformation shaking our technological foundations from a mechanical paradigm privileging structural materials like steel that guarantee operational 'stability' towards a model that embeds machinic processes into functional materials that are designed at the molecular scale to transform themselves in response to various stimuli. From within a mechanistic value structure that sought to exploit and process materials for strictly objective purposes, any change in a material's properties (its elasticity or volume) was typically seen as a problem to be controlled or eliminated. Clearly this has not always been the case.



Above
Charles and Ray Eames were atypical of most modern practices that chose not to fully implicate themselves in the innovation of manufacturing. The visionary Eames collaborative was inclusive of a vast array of elements that they considered intrinsic to design, and it is no coincidence that their later avid examinations into interscalar phenomena, from the cosmological to the nanospheric, in their films on the *Powers of Ten*, was prescient of some of the most important aspects of current material innovation: the cross-referencing and cross-pollination of behavioural data from multiple scales for the design of composite material systems.

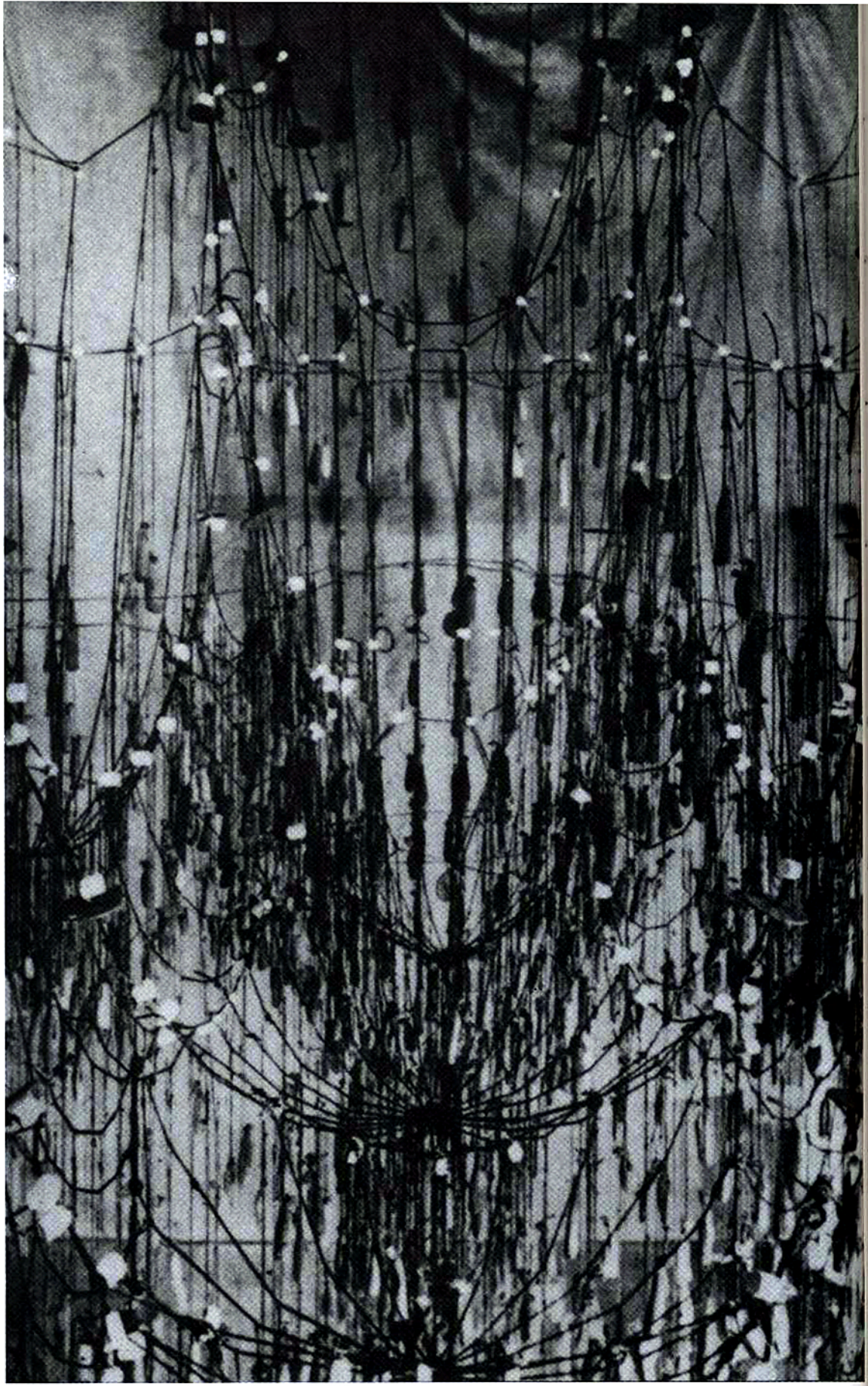
Indigenous and vernacular technologies are replete with examples of sophisticated techniques for harnessing the dynamic behaviour of natural materials, usually woven into composites that exploit the synergistic capabilities of hybrid structures, such as the baidarka kayaks fabricated by the Aleut for millennia.

It is difficult to imagine the effect of the emerging biotech revolution on our exchange economy if we were able to catalyse the self-assembly of strong, light composite skins, resilient 'ceramic' shells or super-high-strength structural 'silk' without the use of high heat, poisonous chemicals or the extraction of large amounts of nonrenewable resources. Instead of the mimicry of biomorphic form, this development is rather about imitating the self-assembling manufacturing process itself; for example how organisms manage to grow crystals and then form them into structures that work. Even in many of the applications within our present throughput economy, where one would imagine dumb structural materials to suffice, in a cyclical material economy, certain degrees of adaptability or imbedded intelligence may prove to be more viable.[6] The widespread social anxiety associated with the advent of genetic engineering could be mitigated by focusing on the real hope that cell-culturing holds for finding more benign ways of manufacturing which eliminate noxious chemical by-products and high energy fluxes.[7] In fact, this anxiety itself may productively restrain the kind of gleeful technophilia that typically accompanies major innovation and thereby exempts it from the kind of critical scrutiny so important to its socially conscious implementation.

But the fundamental questions still lie with the shifting of our collective subjectivities due to new material possibilities: namely, whether or not sentient qualities in our environment will sensitise us to the revealing capacity that technology could have in our lives, and allow us to shift our focus from the elusive attainment of 'control' and 'stability' toward attempted compatibility with natural phenomena that are fundamentally in flux. This shift requires the emergence of a locally catalytic socioeconomic meshwork, one that is galvanised by a tipping point in the perception of valued opportunities from extensive material economies to intensive parametric loops. It has become a truism that ecological imperatives will dissolve the functional and operative boundaries between disciplines because of the complex interdependencies of these conditions, yet if architectural practice is to participate in this innovation, then it will have to insinuate much stronger bonds with the developed vertical engines of technological innovation, both academic and corporate/industrial.

Parametric Instability: 'What if the Balloon Bursts?'

Working within a socially parametric mode in design, a criterion, or programmatic desire, that may initially be considered as independent is expressed through other functions. In a sense, we have always been implicitly doing this within any design process that is given to trade-off decision-making that is highly partial. It has almost become a technophilic cliché that the interactive promise of multiple computational mapping in the design process could render explicit those parametric forces that were previously subsumed into conventional typologies, or later on into the singular subjectivities of late-20th-century design. That is, situated cartographies of programmatic intention could become a means not just for legibly sharing subjectivity

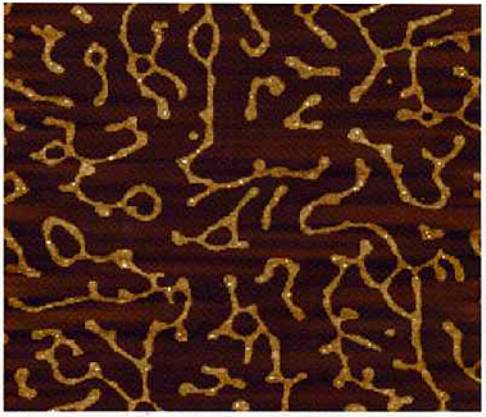


Right
Antonio Gaudi: Inverted Model for Sagrada Familia, Barcelona

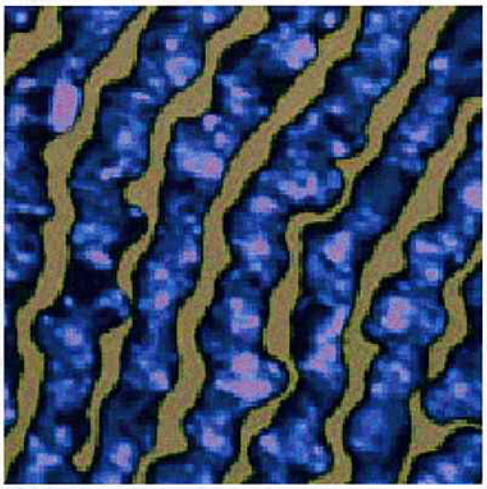
The search for a design framework that could allow for a simultaneous reading of complex or reverberant data informing the process of making has many important precursors to the computer. It is probably not coincidental that the term 'organic' has been variously associated with them, although unfortunately the label has often been understood in a formal or resultant sense, rather than in a procedural or generative one. Gaudi's hanging model transfers unanticipated feedback response throughout the tensile structure, in an attempt at a simultaneous performance model that could reveal complex reverberant behaviours as the lines of tension are registered and later 'trapped' into an inverted compressive matrix at the building scale. The expensive and time-consuming experiments were unfortunately not given to imitation because the information was deployed to singularly drive the design process, one that excluded most other criteria from the generation of form. Ironically, although his process does question the legitimacy of the subjective gesture it does not subvert the totalising system, that in itself is singularly subjective.

Opposite
In the development of next generation technologies, a contemporary version of the *Powers of Ten* would have included not just the imaging of phenomena at previously unimagined scales, but the actual design of material at multiple scales, beginning with the nanometer scale, where self-assembly is emerging as a powerful bottom-up method of fabrication. Although intelligent materials are invariably associated with the expense of 'high value added' items, in combination with 'dumb' structural materials they present the possibility for sentient environments whereby the ever tighter coupling between sensing and actuating functions can embed environmentally responsive behaviour into multiple integrated facets of designed environments.

Transmission electron micrograph of self-assembled hybrid nanostructure (organic polymer and metals).



Pattern of interparticle interactions in self-assembled nanocrystals.



The hybrid self-assembly, zooming into silver nanowires.

Resonant image, Manhattan, New York.

within the design process, but also for tracing potentially conflicting criteria that – pre-computing – seemed too cumbersome to reconcile without reductively excluding important information. Reminiscent of McLuhan's initially comic claims for the global electronic extension of social interaction,[8] it only becomes a clichéd expectation because the project has not yet been pursued to an effective enough scale or degree, and will require intensive and distributed accumulation across localised knowledge bases before profound shifts are catalysed.

Because all programmatic aspects, whether material, contextual or economic, have values that are fixed as well as those that are pliant or mutable, they can be characterised as variables within certain parameters. Therefore, if there is enough information that can be cross-referenced through these variables, reverberant relationships between multiple datasets can be actualised into fluctuating cartographies. As Haraway has maintained, 'although figures do not have to be representational or mimetic, they do have to be tropic, that is, they cannot be literal and must involve at least some kind of displacement that can be a means for troubling identification and certainties (stabilities)'. Although we are often loathe to account for the metaphorical aspects of our cognitive processes in design, all language, including mathematics, but especially figural language, is made up of tropes, 'constituted by bumps that make us swerve from literal-mindedness'.[9]

Versioning: Preserving Adaptability

In techniques of versioning, displacement is inherent to the procedural stance, whereby iteration is a means for revealing and supporting variance rather than for the fixing of identities. As techniques of versioning are applied in material practice across the various specialities contributing to the building process, the maps are both instruments and signifiers of spatialisation, as they situate multiple requirements with often mutually conflicting intentions. Unfortunately, although nascent, there has not been thus far nearly enough supported research or attention focused on the means through which mapping processes in computing can productively cross-pollinate programmatic content. Again, the architectural discipline's partially self-imposed exile

from the substantial funding engines for technological innovation exacerbate the degree to which computational processes are given to the fetishistic adoption of mapping processes from other disciplines, rather than in a dialogic relationship of collaboration. The demands of heterogeneous and apparently conflicting criteria present an opportunity for the negotiation of possibilities in which the tendency towards fetishising the manipulation of a particular cartographic or material technique is mitigated by problematising information. Fetishism belongs to a world without tropes, to a literal-mindedness in the interpretation of cartographic output. 'Non-fetishized maps index cartographies of struggle or more broadly, cartographies of non-innocent practice, where everything does not always have to be a struggle'.[10]

'Does "Real" matter?' – Search for the Authentic: Material Intelligence and Behaviours

The notion of authenticity might seem like a quaint throwback to the many cyclic periods of resistance to the technological transformation of architecture throughout the modern era, but there is nothing nostalgic about Ruskinesque piety in the face of the emerging biotech revolution. In fact, it seems compellingly relevant in a way that has far less to do with resistance to homogenising effects than to the renewed possibility of a kind of collective versioning of the body that in the Gothic was catalysed by lateral information flows. It was the incredibly sensitive feedback loop in the transmission of information through the building process that allowed for subtle changes and modifications to be made from one bay to the next within the same building. Admittedly, as Félix Guattari warns us, any reading of the past is inevitably overcoded by our references to the present, and our capitalist subjectivity, with its pious implications for master artisans of the Middle Ages who built the cathedrals, remains obscure to us.[11] We are impaired from even recognising our need to signify something of our own condition through our characterisation of a historical context that seems fundamentally distinct from our own.

And yet, in the face of the current problem of the collective loss of creative control over the building process, which is an extremely real one, how do we regain just measurement of productive innovation without resorting to the reductive patterning and massive information losses present in much experimental contemporary architecture? How do we effect a contemporary version of the lateral information flows that would exist with a more (cohesive) sensitive collaboration, without falling into utopian rhetoric? Multiple pressures seem to suggest that the time is ripe for the demise of the relationship between the celebrity architect and the rampant material poverty of current (American) architecture that doesn't even participate in the economy of the stage set which it most resembles.

Robocops of Globalism

Regardless of new technical opportunities emerging in our economy of making, for a meaningful shift in our economy, the 'backyards' in the processes of production, the endless dumping grounds for the transnational entities that have enjoyed 'productive' status under current throughput material economies, have to be folded into a newly liable equation. As we acknowledge the troublesome homogenising forces of the 'globalisation of the world' as a semiotic-material production of some forms of life rather than others',[12] do we have a choice but to accept the increasingly legible interdependency of this condition as a potentially productive catalyst? Can it become the lens that reveals the ramifying effects of our organising structures more transparently, thereby rendering them inescapably open to critical dialogue?

The potential for fascistic forces dominating any such material reorganisation is daunting, save for the fact that universal theories and ideologies become less and less tenable when they are projected into a closed loop.[13] The 'other' becomes 'another'. Thus, the parametric diagram begins to work at all scales, global and local, microscopic and macroscopic. This diagram only becomes terrifying if one imagines this emerging body politic becoming the kind of completed or holistic body hallucinated within a totalising systemic theory before its imminent collapse, including the McLuhanesque electric mysticism of the 'Age of Aquarius', before many of its proponents moved on with the business of thoroughly capitalising on practically every aspect of mass-mediated existence.

It's no coincidence that the voices of the last few decades who have decisively claimed that architecture has no place in the formation of public political debate on such issues are also often proponents of the kind of pyramid model for architectural practice whereby all forms of dialogue are effectively morphed in service of the singular signatory gesture.[14] While it seems clear that the heroic brush stroke has a limited contribution to make to the arena of deep sociomaterial innovation, must architecture be for ever banned from participation in the metanarrative through the public quarantine imposed by the exclusive behaviour of a few figureheads? ⌂

Notes

1. Friedrich Nietzsche, The Twilight of the Idols, in *The Portable Nietzsche*, Viking Press (New York), 1954.
2. Throughout this article, biotechnology is used in the widest sense of the term, encompassing technologies that harness biological information for the invention of new material systems.
3. Donna Haraway, *Modest Witness@Second Millennium*, Routledge (London and New York), 1996, p 10.
4. The role of architecture and urbanism as an adhesive administrative mechanism necessary to this linking of multiple interdependent scales and disciplines is crucial, yet effectively missed as a leveraging position for architecture.
5. For example, the ability to shift from the tired fantasy of expendability in a disposable culture that delivered us such material innovations as Dryvit™, to the realisation of engaging self-healing material versions that have sentient intelligence and snap-to assembly logics.
6. Janine Benyus, *Biomimicry*, William Morrow Press (New York), 1997, p 104.
7. Ibid.
8. Marshall McLuhan, *Understanding Media*, University of Toronto Press, 1964.
9. Haraway, op cit, p 11.
10. Ibid, p 136. Although recently invented and explored techniques of modelling have certainly called into question the legitimacy of our default to orthographic projection, the preoccupations engaged by these techniques have tended to remain rather singular with respect to the production of form and space. Additionally, construction packages, although increasingly parametric, still largely work within the modality of layered montage and configuration, whereby much performance criteria specific to discreet systems is lost in modification procedures.
11. Félix Guattari, *Chaosmosis*, University of Indiana Press, 1992, p 99.
12. Haraway, op cit, p 12.
13. Witness the current polarisation of McWorld vs Jihad.
14. Throughout the modern era, although neither one-off building nor mass manufacturing were socially, technically or economically positioned to accommodate the integration of complex data into the design process, the economic polarisation of these modes within throughput economies will be effectively altered: ironically, in a closed-loop material economy, architecture becomes the administratively important mediating social and material scale from the molecular to the urban. It may actually be in the cohesive visualisation of complex information management through computing that architecture has its most important re-emergence as a social force.

Architectural Design

Versioning: Evolutionary Techniques in Architecture

Guest-edited by SHoP/Sharples Holden Pasquarelli

'Versioning' is a new term coined by the award-winning, young New York practice SHoP/Sharples Holden Pasquarelli to represent an entirely new model for architectural practice. As digital, or 'blob', architecture has become the received aesthetic for experimental architects, SHoP is spearheading a new generation that is actively questioning and stretching the established applications of electronic media. Having surpassed the current obsession with computer-aided imagery, the partners are taking on the real design and construction challenges posed by the digital age.

Intent on exploring the computer's capabilities for changing design processes in the act of making, SHoP uses versioning to describe the significant shift in the way technology is being applied to expand, in time as well as in territory, the potential effects of design. This requires rethinking the design process in terms of procedure and outcome in ways that are totally unprecedented in both the construction industry and conventional design methodologies. It also has far-reaching implications on the entire design process and existing design/production partnerships. For this reason, SHoP has asked contributors from very different disciplines to participate in this title, drawing on those engaged at the cutting-edge in product design, product manufacture, engineering and cultural theory, as well as those in architecture. (There is also a preface by Michael Speaks and an interview with Bernard Tschumi.) In effect, versioning advocates that emerging technology becomes the catalyst that redefines both theory and practice equally, completely changing the trajectory of the avant-garde from text and image to space and effect.

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ISBN 0-470-84569-
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