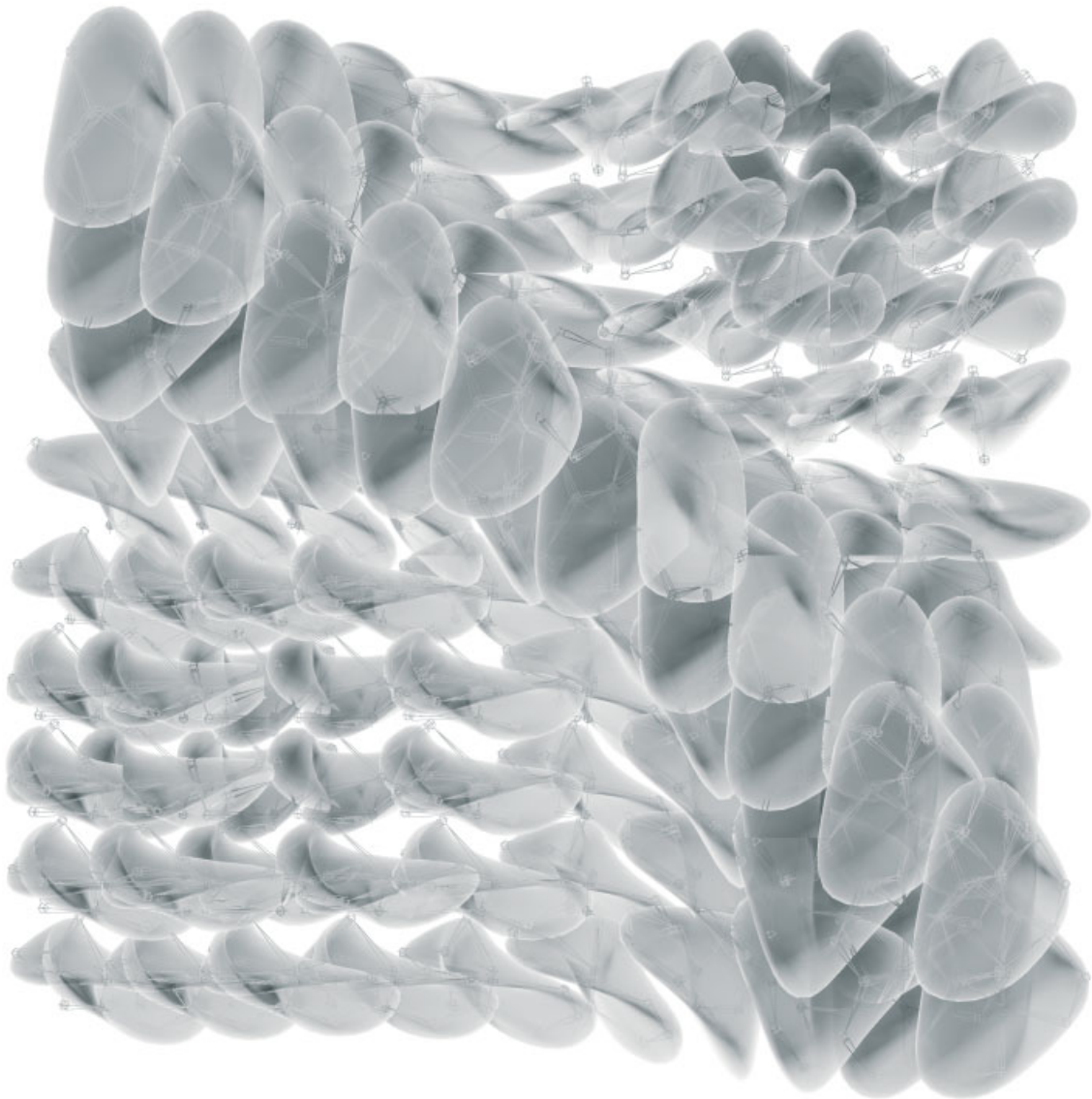


All-Over, Over-All: biothing and Emergent Composition

In the last decade, the impact of the digital on form-finding in architecture has been conspicuous. Could working with computational algorithms as the primary generative material, however, have deeper, more far-reaching effects on the creative field? Here, **Pia Ednie-Brown** asserts that a new paradigm in composition is being articulated, as exemplified by the Invisibles installation, created by the New York-based practice biothing.



Alisa Andrasek/biothing, The Invisibles interactive installation, Prague Biennale, 2003

Sample morphological stance from the Invisibles animation. The skin inflection emerges through the active relationship of a digital skin and a correspondent field of skeletal 'cells'.

‘A nonsensuous perception is an over-all perception, or an all-over perception, irreducible to its constituent parts.’

Brian Massumi¹

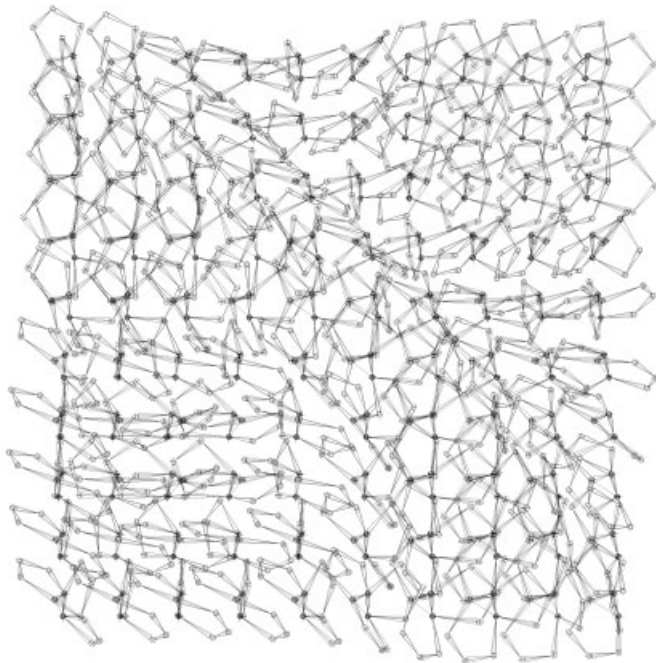
‘Composition is less a critical thought project than an integrally experienced emergence. It is a creative event.’

Brian Massumi²

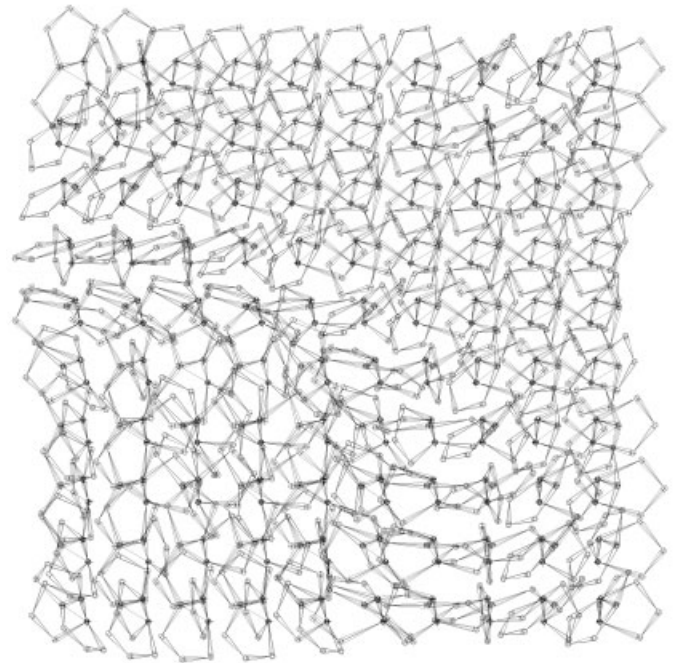
Diagramming is often associated with a dry, skeletal tone: the work of de-fleshed data spared of anything extraneous to a set of crucial relations. Bubble diagrams, massing studies, organisational charts and their functionalist leanings have helped foster such a reputation. Programming involves diagrammatic thinking, operating through notating and mapping out the interplays of relations. Both diagramming and programming seem rather abstract or, at least, reductively systematic in a technical and functional orientation. In this sense, they are often felt to be at odds with the more creatively inflected, generative approaches to design – as if the more embodied, intuitive designer-sensibilities are distinct from abstract modes of working. The analytical, reductionist tendencies of the sciences and the creative, critical practices related to aesthetics are often seen to be adjacent and in conflict. Contrary to these kinds of general, commonly held assumptions, the philosophical efforts of radical empiricism³ assert and sketch out how embodied feeling is inseparable from abstract relations.

This suggests that aesthetics and abstract compositional techniques could revive and refresh some old relationships. But this does not imply a nostalgic return to past compositional principles. Working with computational algorithms as primary generative material offers a different bent to, for example, the mathematical ratios of the Renaissance or the flow diagrams of Modernism. I am suggesting here that a new paradigm in composition is being articulated through the opportunities offered by digital technology, exemplified here in the work of biothing. A now more-or-less familiar word indicative of the nature of this paradigm is ‘emergence’.

Given the preoccupation with emergence within the sciences, it might seem desirable here to offer a scientific explanation of the term – a good bit of foundational bedding to grip on to as we heave our way through the complex vagaries of composition. But as desirable as this might be, science has no such explanation to offer, and this is precisely its poignancy. However, there does exist a well-understood description. John Holland’s influential book on the subject describes the hallmark of emergence as ‘much coming from little’.⁴ And Steven Johnson’s popular book, *Emergence*, summarises it as the ‘movement from low-level rules to higher-level sophistication’.⁵ These are provisional definitions to strap around an elusive problem because science is unable to explain how it could be possible for so much to come from so little. As Mark Bedau writes: ‘All the evidence today



A series of morphologies captured from the Invisibles animation.



Sample morphological stance of the skeletal field in the Invisibles animation. The field is constituted by an interconnected network of simple ‘cells’ programmed through inverse-kinematics-based skeletons in MEL script.

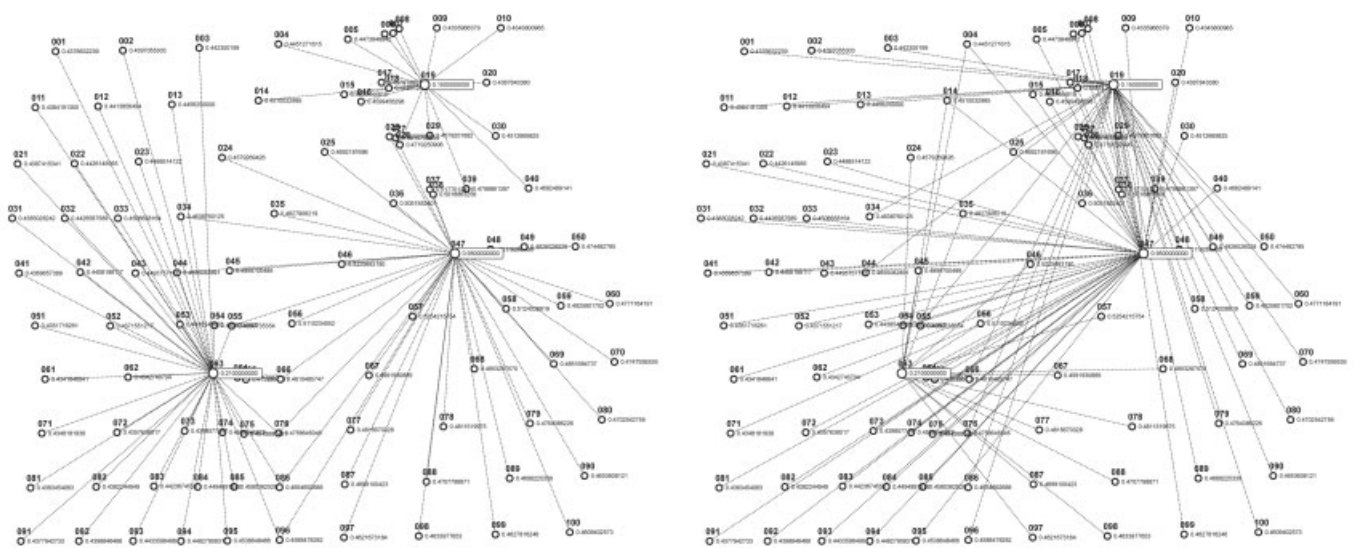


Diagram of algorithmic speed-distribution and cellular relationships. The field of speed distribution affects the rotations of the joints in the skeletal field. Speed of rotation is derived from a weighted average based on the speed of each of the three transitional activators. Three dominant cells act as input points for data from the changing sound frequencies bred through a process of granular synthesis (as part of the overall installation). All other cells adapt their speed of rotation to these master cells.

suggests that strong emergence is scientifically irrelevant ... Strong emergence starts where scientific explanation ends.⁶ This is where aesthetics comes in.

Interest in the issue of emergence and design has recently intensified in architectural discourse. This arena of design research tends to focus on emergent form-finding, where the emergent outcome is the form of a building. Significant precursors of this field can be identified in the work of Karl Chu, John Fraser, Marcos Novac and Greg Lynn, for example. NOX, the office of Lars Spuybroek, is among the more creatively thoughtful of those currently contributing to the discourse. And a recent issue of *AD*, *Techniques and Technologies in Morphogenetic Design*, guest-edited by the Emergence and Design Group, offered a very useful probing into the potential of emergence for design practice. Both Spuybroek and this group draw significantly on the work of Frei Otto, who exemplifies a focus on embedding structural behaviour in guiding emergent form-finding. Such issues are enormously interesting and, I believe, hold great as-yet-unrealised potential.

This article, however, approaches the subject with a different question in mind: What does emergence imply for the aesthetic nature of thinking-doing in architectural practice? Or, more specifically, how might the practice of architectural composition be considered in relation to models of emergence? The implication that emergence-oriented design research might freshly inflect aesthetic forms of architectural knowledge has not been explored to any significant degree. Emergent phenomena are always aesthetic

phenomena.⁷ This closely knit relationship can be seen as the core of the problem that confronts the sciences in their speculations on the unanswered conundrums of emergence. And yet, when architects pick up the tantalising threads that scientific formulations of emergence throw to the winds of wonder, they tend to avoid aesthetically oriented questions as well, largely preferring to rest their enquiries on the authorisations of scientific understandings.

In general, enquiries into the nature of emergence are inseparable from computation. Cellular automata, for example, have been a key tool for research. These enquiries are also inseparable from the question: 'What is life?' Life itself is the most mysterious of emergent phenomena. Where emergence has been used within architectural discourse, it is almost always closely affiliated with digital tools. It is frequently employed for its life-mimicking powers, or as forms that seem, in some more-or-less defined way, lifelike. The problem with most biomorphic approaches is that form is generated in *terms of form*, with the morphologies of living or organic things as the compositional measuring stick. The self-contraction implicit to this approach lies in the fact that, as Brian Massumi writes: 'Any potential the process may have had of leading to a significantly different product is lost in the overlay of what it already is.'⁸ Emergence, in other words, gets left out of the equation.

Practices that generate work with microscale algorithmic procedures to generate emergent morphological outcomes at another scale and ontology are not especially common. However, the work of biothing is one such rare moment.

Based in New York, the practice is directed by Croatian-born architect Alisa Andrasek, who also teaches at Columbia and the Pratt Institute. biothing is a research-design laboratory whose various projects emerge through the use of computational systems that underscore multiple-scaled expressions. My aim here is to explore some of the intricacies of biothing's manner of working – sketching out or depicting an event of generative composition before turning to consider the aesthetic implications therein. In doing so I concentrate on one very specific biothing artefact: the animation that was part of the larger the Invisibles installation project⁹ produced for the 2003 Prague Biennale. In order to maintain a deep focus of attention, I do not discuss here the role of the animation in the larger framework of the installation. The animation is explored as indicative of a mode of composition active throughout all of biothing's work. Other projects featured here, such as bifid and reticulars, give a sense of the consistency of the practice as a whole. And genware, a broad-reaching biothing research project, represents a core aspect of the firm's approach to generative design practice. This project explores how computational patterns can actively link projects, traverse scales and function through a network of practitioners collectively developing material in an open-source manner.

I will start by leaping into the deep with a particular kind of analysis, one that I call an 'affective diagram', a

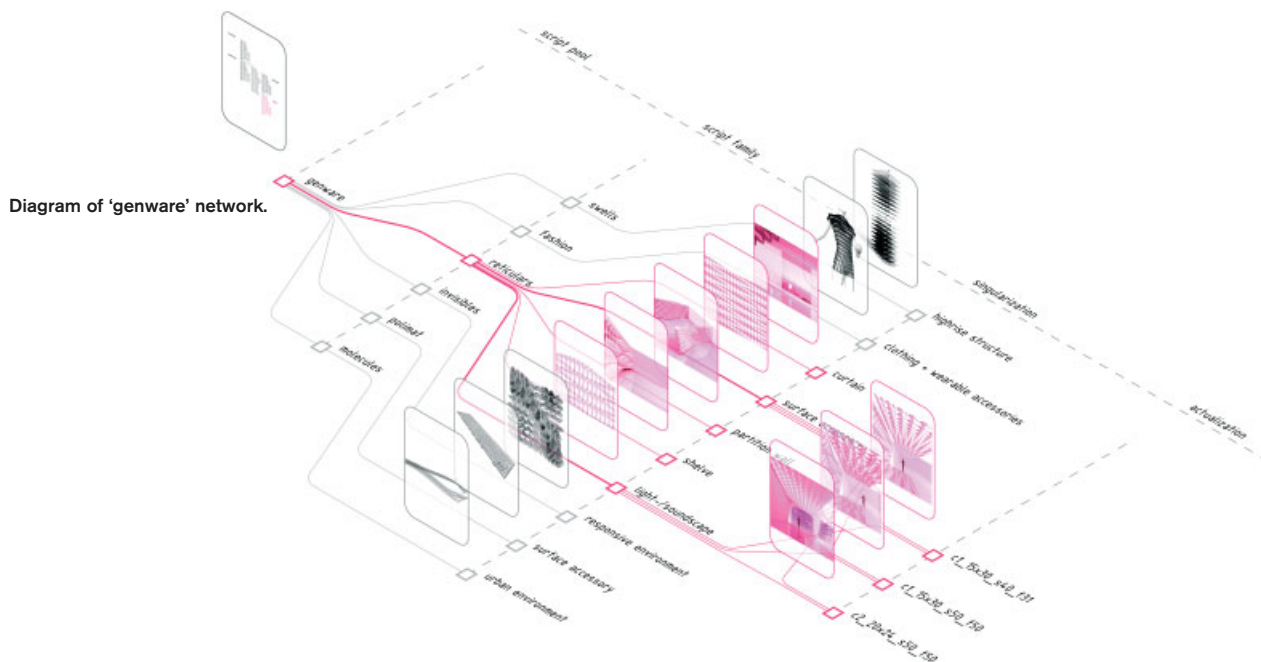
configuration wherein affective and abstract relationality explicitly coalesce. This particular affective diagram is drawn through words, in a little density of text I wrote in response to watching the Invisibles animation:

Watch biothing's the Invisibles animation.¹⁰ It washes through you. Caressing the senses nonsensically, sensuous waves unfurl and curl, nonsensuously foaming perception.¹¹ It strokes in plush gushing rushes. This velvety vigour is both qualitative enumeration and relational enunciation: in each case both crystal clear and ungraspable. It is effective in that it causes a strong impression and affective in that this cause is indiscrete. Effects are fielded and we fly affected with the flock. Simple trajectories and links are swamped in a more expansive sense and sensibility. Stunning.

This passage aims to diagram the indelibly intertwined relations between abstraction and affect, its impetus to analyse the aesthetic nature of the animation. Such issues are difficult to articulate. Any event of heightened aesthetic power tends to leave us, momentarily at least, speechless. We pause or falter, groan or gasp. We just don't know what to say.

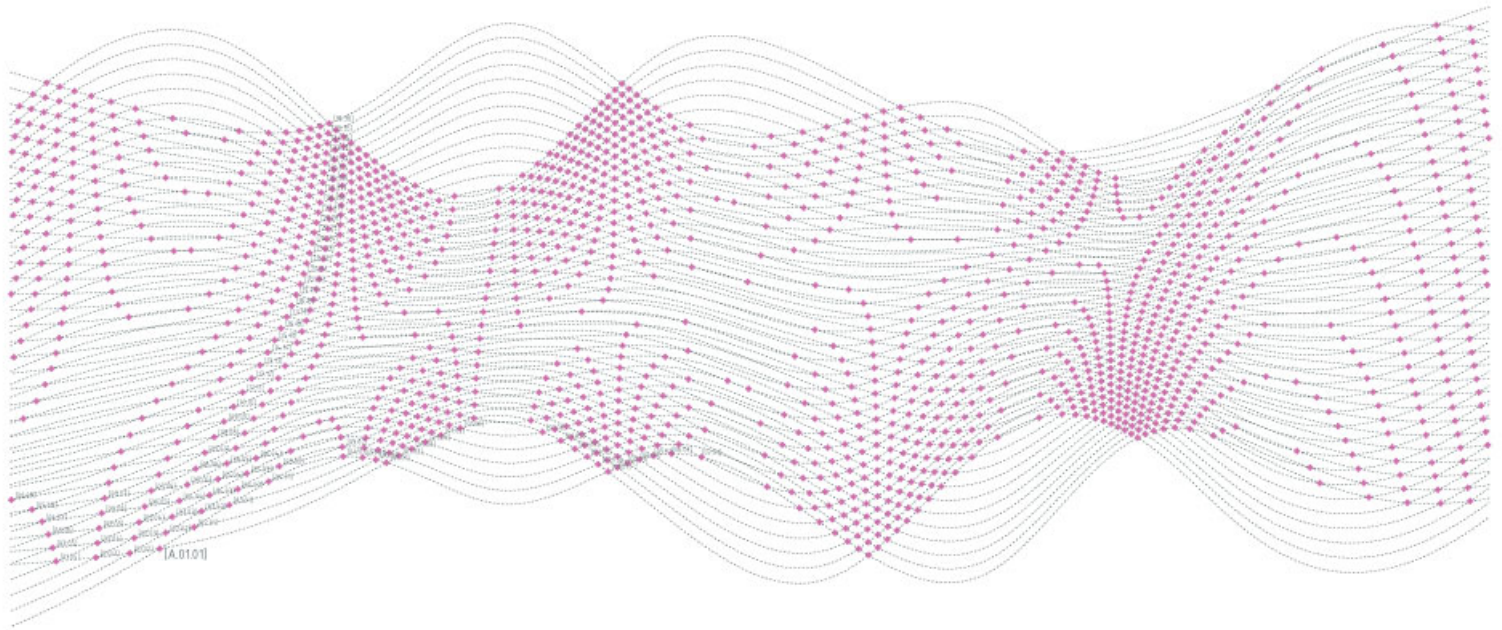
(pause)

As feeling blows in the face of speechless wonder, let's slip back to the beginning and feel our way through the process of coming into being.



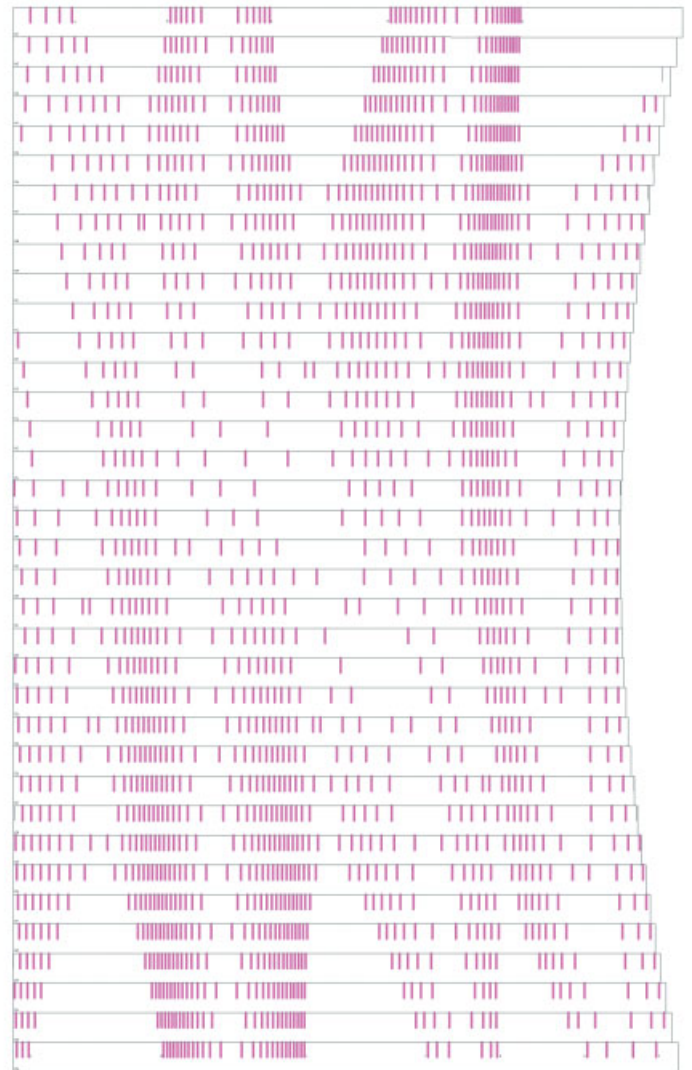
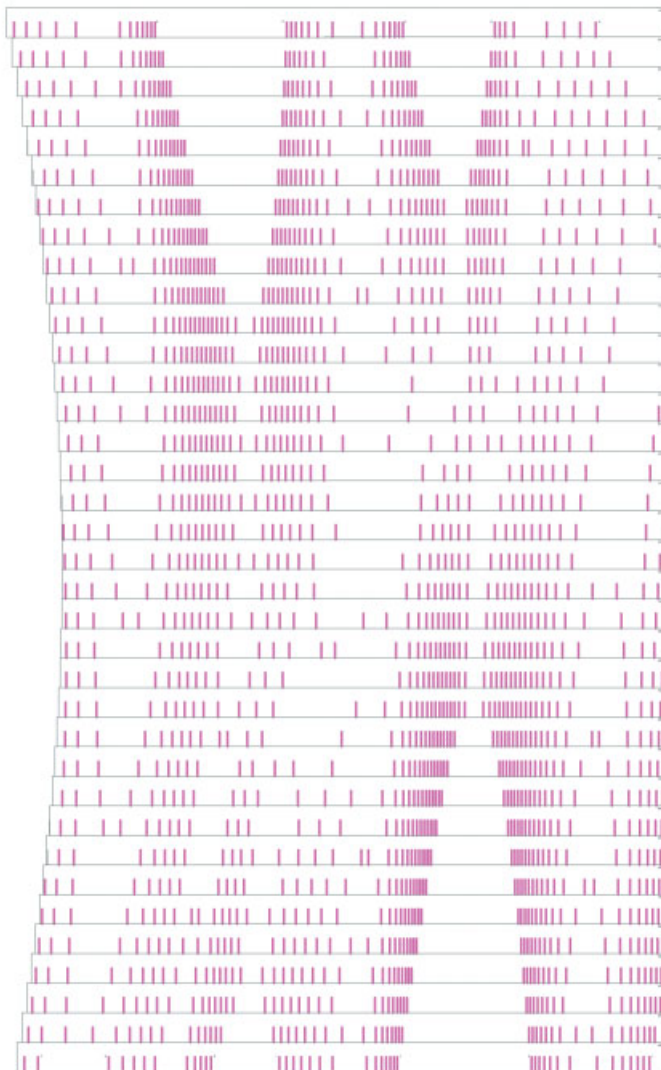
Alisa Andrasek/biothing, genware algorithmic library, 2001–06

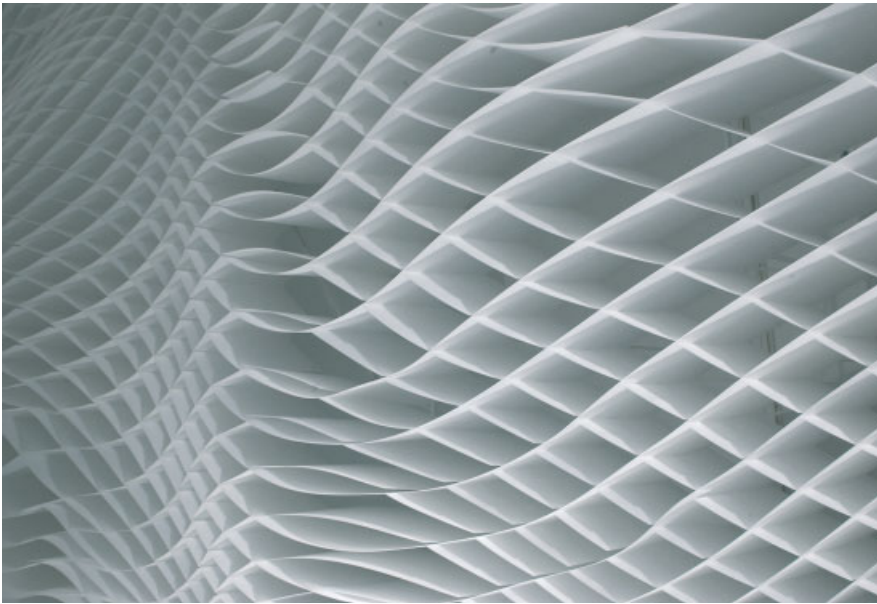
The genware project was conceived as a sharing collaborative platform. Incorporating both aspects of *genetic engineering* and *software design*, it allows a designer to work at the scale of information. Not unlike a genetic engineer, the designer writes and manipulates computer scripts and code sequences in the generation of abstract forms of digital intelligence. This intelligence is then channelled into any number of potential material sites and scales. Like a virus it circulates through a number of disciplinary contexts such as architecture, product design and fashion. In each case, abstract geometric transformations are linked to specific material and fabrication constraints as well as scales of production, allowing for a synthesis of design intuition, algorithmic programming and parametric limits as the very foundation of the design process.



Alisa Andrasek/biothing, bifid ceiling prototype, 2005

The bifid project explores the mode of composition discussed through the Invisibles while involving material computation. The differential behaviour of the material system is a composite of: (1) algorithmically derived intersections between components; (2) constraints of the laser-cut fabrication method; (3) material properties of the polycarbonate material. Initial small-scale tests were scaled proportionally to a large-scale field fabricated using CNC milling.





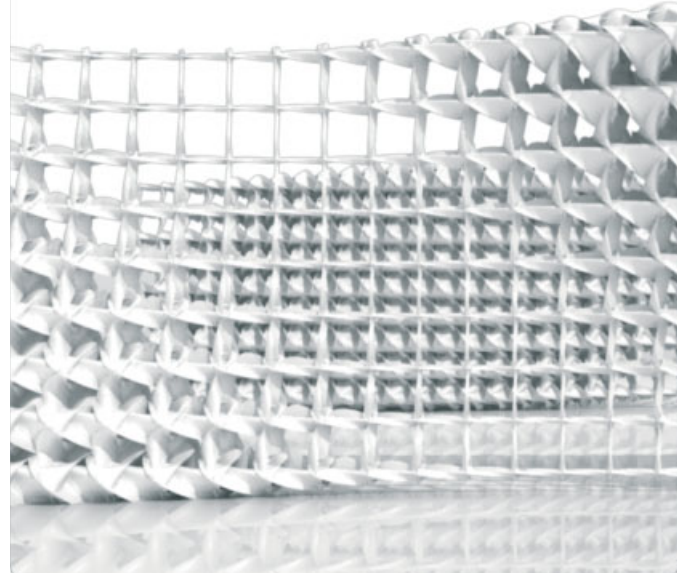
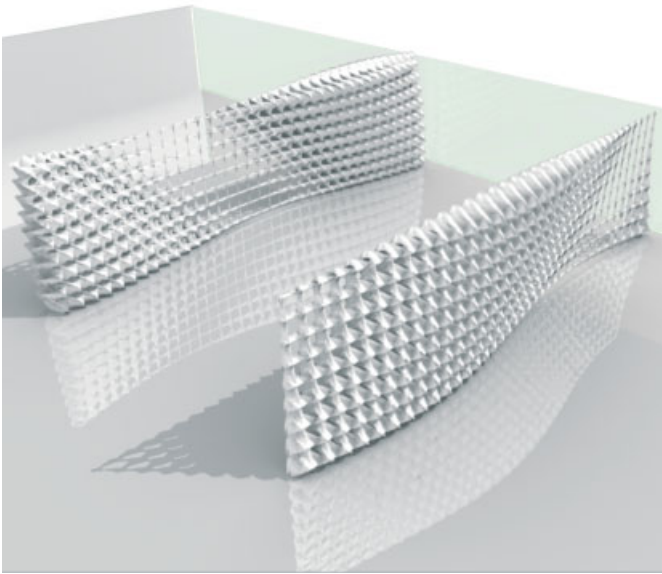
The intersection and fabrication pattern was generated algorithmically. The algorithm was based on wave interference logic. Parametric differentiation imbedded into the script derived multiple offspring conditions.



Ceiling detail. A field of LED lights which were programmed through the same logics of interference as the intersection patterns.



bifid v1.5. Alisa Andrasek and her algorithmic fabric 'creature' during installation at the KSA Gallery, Austion E Knowlton School of Architecture, Ohio State University. In often referring to her systems as 'creatures', Andrasek evokes their inherent dynamically behavioural coherence. This becomes powerfully manifest in her material computation techniques that intrinsically involve 'playing' with physical models, as can be seen in the bifid project.



Alisa Andrasek/biothing, reticulars (smart) surface accessory, 2005

The reticulars project investigates the production of architectural systems using algorithmically differentiated geometry. Such systems are designed to distribute various 'soft' infrastructures such as lighting, sound or light storage systems. Cellular units can be parametrically varied into a range of scales, orientations and densities that can provide variant storage capacities, different paths of lighting or sound distribution and different transparency levels. Lighting and sound can be programmed to emit distinct and, over time, variable behaviours.

But first, I will sketch out an outline of the dynamic system that constitutes the Invisibles morphology. The system is made up of three interrelated layers: a skeletal field, a speed-distribution field and a skin or surface field. The skeletal field starts with a simple geometrical unit sketched out in 'bones' connected by rotating joints. This unit, or 'cell', is programmed through inverse-kinematics-based skeletons in MEL script. Each is built with algorithmically defined constraints or limits to movement, so that it is programmed to operate within a range of potential postures. This simple unit is multiplied into a network of connected units, setting up a field of internally held tendencies of movement or behavioural properties, and becoming a tightly packed 'colony' of units.

This resulting colony-field needs to be provoked into action; it needs stimulus for its microbehaviours to leap into a collective swarming. And this is where the speed-distribution field comes in. This layer is a loosely gridded mass of data nodes that propel the rotations of the skeletal unit joints. Within the mass of nodes, three 'sense nodes' (or data-input points) are designated to provide the anchor points to which all other nodes are related. Streams of variational data (related to sound frequencies in the larger installation) enter through the sense nodes, the effects rippling out into all of the other nodes. As the ripples spread, their effects are registered through skeletal joint rotations, inducing a complex set of relations in a skeletal swarming.

Over these two interrelated fields lies the third, skin-

surface layer. Components of the surface-skin are behaviourally linked to corresponding units in the skeletal field. The skin leaps into patterned gestures that emerge out of this field of behavioural interrelations.

The description above roughly, or broadly, sketches out the technical, relational make-up of the morphologically dynamic system that constitutes the animation. But there is something missing in this account of its construction: the process through which it all 'came together', which enfolds more than one can simply mention. The enfolded complexity occurs through one dominant processual entity that tends to get left out of the accounts of generative systems: the designer. Behavioural properties or patterned gestures may emerge in the animation's different fields, but they do not emerge on their own. The emergent design process is not as simple as a purely bottom-up unfolding (as emergence theory would often have us believe). It is part of a larger event.

The animation's field system is emphatically, even if invisibly, part of a broader ecology through which parameters that do not enter into the digital data are enfolded. This involves a complexity of project criteria of many different kinds, along with the tendencies of the designer, knitted together by her habits, attentions, memories, affections and so on – a cluster of potential that can be folded into what we call 'personality', described by Brian Massumi as a 'pattern of preferential headings'.¹²

Personality enters into a dance with the potentials of the medium of design manipulation, accompanied by a range of

other pragmatic and intangible influences. In the event of negotiating an undulating ground of criteria-meeting-potential, the designer becomes part of a depth of complex relationality so that the totality of the compositional event becomes one evolving 'thing'. Within this larger thing, the developing digital system described earlier is a material in the making. As a collective composite it develops resistances and potentials that interact with other material resistances and potentials in the midst of this complex occasion. A series of textured materialities meet one another in a co-determining process of being made.

In the cacophony of this event there is a striving that tempers development: to create or compose the morphologically dynamic system that constitutes the animation. Creating such a systemic entity involves discerning a coherence that we might recognise as a kind of life-of-its-own. The designer leads, but not bluntly or brutally. Likening the process to the training of a pet, she talks about 'teaching it, guiding it, stirring in certain directions, but at the same time learning from IT'.¹³ The compositional process reaches a breakthrough point and enters another phase when IT's 'life' first flickers forward and the compositional event bifurcates into a clarity of differentiation between her and IT. It is at this moment that it also develops a 'pattern of preferential headings', or an abstract 'personality', and starts to lead as well as being led, to affect as well as being affected. Such a personality or character emerges through resonant intersections between the many materialities and potentialities.

This phase shift is a paradoxical moment: everything comes together at the same time that a clarity of differentiation emerges. The compositional event-thing bifurcates: IT and

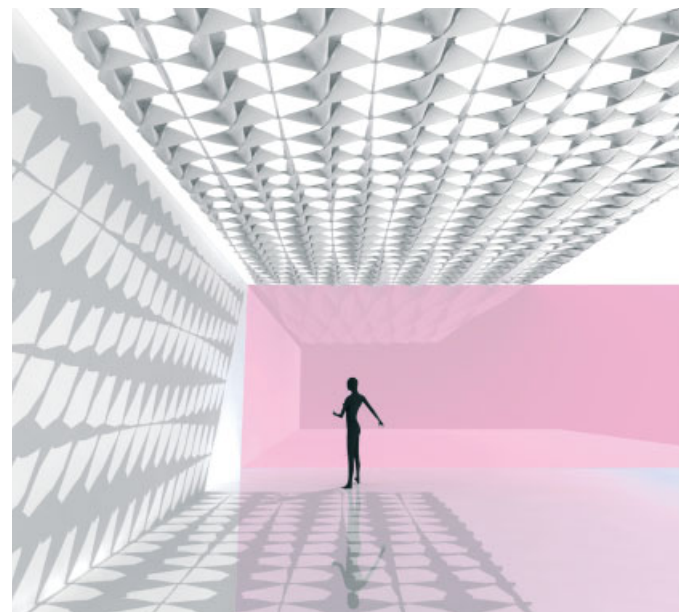
'her' pop out into a distinction. Following this phase shift the designer's role within the compositional event changes. She is no longer the only source of 'push' amidst a scattering of material because she now has an IT (a system) to play with. She, as designer, can now manipulate or play something that has developed a consistency of its own. It is a system of behavioural tendency, albeit one that requires further development.

The system is something. It becomes a system defined by *tendencies of behaviour* that give it a *consistency*. By consistency I mean the sort of thing we refer to when discussing the consistency of a cake mix. Rather than some idea of sameness or uniformity, consistency is the texture arising from *the way in which something dynamically holds together*. Its consistency means, by definition, that it is not limitless, but full of limits, tendencies and resistances. The strength of this consistency means that it develops enough behavioural tendency (or 'patterns of preferential headings') to have character, becoming something of a creature. Alisa Andrasek often refers to such systems as 'creatures', evoking their inherent dynamically behavioural coherence. This is powerfully manifest in her material computation techniques that intrinsically involve physical models, as can be seen in the bifid project, a ceiling prototype exhibited at the New Museum of Contemporary Art in New York in 2005.

The first physical model for bifid was laser-cut at the Spatial Information Architecture Laboratory at the Royal Melbourne Institute of Technology (RMIT). In this context I was able to literally play with the model, feeling out the behavioural tendencies of Andrasek's creature. This occurred while the designer was in residence, running her Material



Cellular partition system.



Potency seminar as part of a design studio,¹⁴ in which she would often evocatively orient the design investigations of the RMIT architecture students towards the production of a 'creature'. This is quite different to biomorphism as an approach because it is not about looking like or formally resembling a living thing. Rather, a pattern of relations is built into a physical model so that the behaviours of both the manufactured pattern (a colony of variationally repeated units constructed from strips of material) and properties of the physical material actively co-determine the nature of the creature's swarming morphology, which comes into being at a different scale and ontology to the ecology of relations through which it emerged.

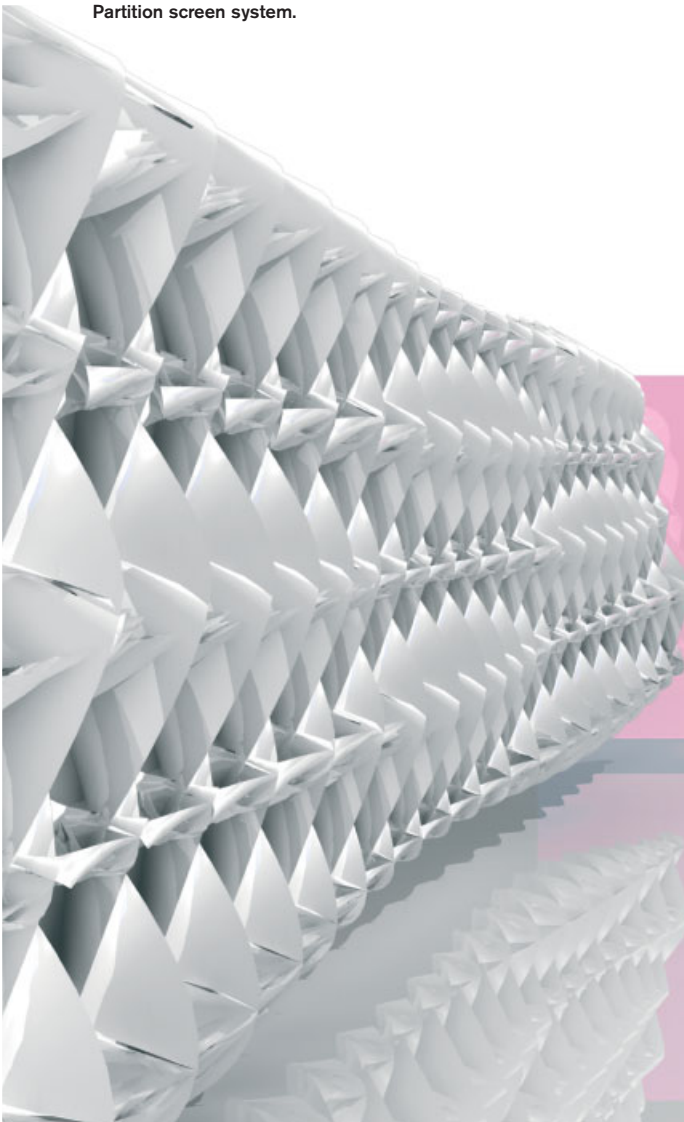
The behavioural material-pattern system of bifid is another example of the mode of composition that tempers the algorithmic one of the Invisibles. In both, the cohabitation of

a series of behavioural influences, each of which is constituted by multitudes of dynamic micro-interrelations, intricately and precisely collaborates in the emergence of an over-all, all-over consistency. Importantly, such cohabitation produces interference patterns through negotiations between interacting fields, influences and parameters. No component of the design event, including the author,¹⁵ remains unaffected by the cohabitation.

The aesthetic power of biothing's projects is integral to this mutual affectivity. Aesthetics is a form of knowledge that studies the experience of relation or relatedness. Aesthetic experience is the experience of interrelatedness. The relations that constitute biothing's compositional entities cannot be singled out: they are never experienced in isolation, not even as some part of a whole. As a multitude engaged in an emergent process of composition, they generate patterns or textures of multiple, mostly invisible, relations: a consistency. So, what we (aesthetically) experience is an all-over, over-all consistency. This is the aesthetics of emergence.

While I am suggesting that we are witnessing the development of a new compositional paradigm, the configurations I have sketched out and detailed here are not in any way exclusive to the domain of working with digital media. The history of art and architecture has long been privy to these issues. Work such as that by biothing foregrounds

Partition screen system.



largely unspoken, implicit operations that more or less quietly, I would argue, massage all acts of creative composition. The newness lies in the degree to which the implicit is becoming *explicitly* articulated, or where the invisible becomes undeniable. Δ

Notes

- 1 Brian Massumi, unpublished statement from early draft of 'Building Experience' in Lars Spuybroek, *NOX Machining Architecture*, Thames and Hudson (London), 2004.
- 2 Brian Massumi, *Parables for the Virtual: Movement, Affect, Sensation*, Duke University Press (Durham and London), 2002.
- 3 I am referring here to the field spawned by William James in the late 19th/early 20th century, as notably developed in the work of Brian Massumi.
- 4 John H Holland, *Emergence: From Chaos to Order*, Basic Books (New York), 1999, p 3.
- 5 Steven Johnson, *Emergence: The Connected Lives of Ants, Brains, Cities and Software*, Scribner (New York), 2001, p 18.
- 6 Mark Bedau, 'Downward causation and the autonomy of weak emergence', *Principia* 6, 2002, p 5.
- 7 I argue this in my current doctoral research at RMIT: 'The Aesthetics of Emergence' (to be submitted in 2006).
- 8 Brian Massumi, *A Shock to Thought: Expression After Deleuze and Guattari*, Routledge (London and New York), 2002, p xviii.
- 9 This installation is documented on the biothing website: www.biothing.org.
- 10 The animation can also be viewed on the biothing website: www.biothing.org.
- 11 This refers to that which Alfred North Whitehead, among others, referred to as 'nonsensuous perception'.
- 12 Massumi, *Parables for the Virtual*, op cit, p 205.

13 Email correspondence with Alisa Andrasek, 22 December 2004.

14 This was run in 2005, with the assistance of Chris Perry (servo), myself and Jonathon Podborssek (kikkugia).

15 This whole scenario can be usefully illustrated with the following: Research in *Neuroscience* tells us that if a rabbit smells a carrot, this smell induces a particular pattern of neuron firings in the brain. When the rabbit smells rabbit poo, a different pattern is provoked. These patterns are patterns of recognition. But should a rabbit encounter a smell that it can't recognise because it's never smelt it before, like coffee perhaps, not only is a new pattern of neuron firings established, but every previously established pattern becomes altered. This rabbit encountered an atmospheric character (a smell) that was utterly new to its experience of the world. The rabbit could not have perceived that smell without a 'smell intelligence': a capacity to sense it and place it in relation to every other smell it knows, so that from that moment onward nothing would ever smell quite the same again. That rabbit and its sense of the world had palpably, even if minutely, been reconfigured. The effect is all-over and over-all in a moment of nonsensuous reshuffling and a shift in the rabbit's whole texture or consistency. This was provoked in the encounter with a new pattern through smell, but every pattern is part of a broader nonsensuous, synaesthetic texture or consistency.

