

# *Patterns, Fabrics, Prototypes, Tessellations*

New technologies have enabled architects to develop sophisticated patterning techniques. This is epitomised by the expressive possibilities now available to the building envelope: smooth geometries, tessellation, material textures and layers, such as solar shading. For **Alejandro Zaera-Polo** of Foreign Office Architects, though, patterns have cultural and political possibilities far beyond mere decoration, enabling new practices to address in the urban context some of the crucial problems posed by globalisation: bridging the dichotomy between tabula rasa and contextualism, and the articulation between the local and global.

Patterns and fabrics have recently enjoyed a powerful return. Since groups such as Team X, the Dutch Structuralists and Japanese Metabolists attempted to correct the excessive focus on the object practised by classical Modernists by promoting the use of a serial, modular construction of the architectural project to enable flexibility and represent a democratic, bottom-up approach, patterns have been largely absent from architectural debate.

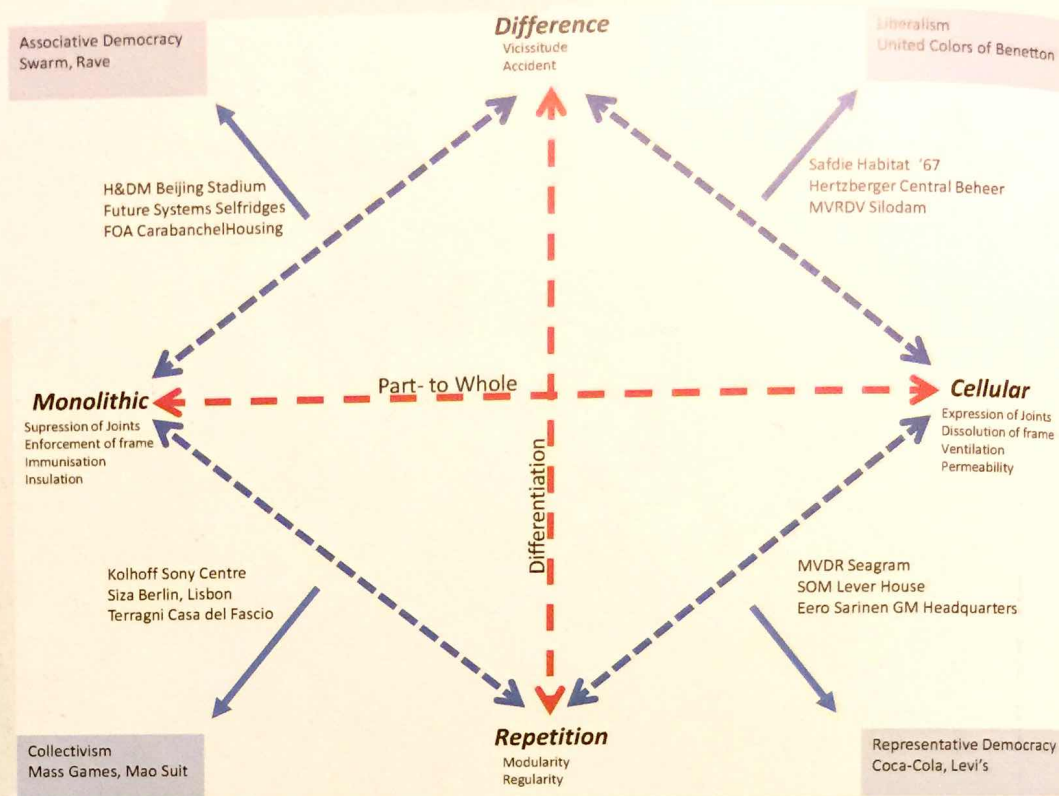
The climate of progressive politics in which the 1960s debate was framed meant that the investigation of patterns and fabrics became a promising opportunity, on both an urban and constructive scale, in the face of the exploration of formal autonomy that characterised Modernism. But the flexibility and openness of such proposals was limited to the addition and subtraction of, and replacement with, identical parts. Thus the possibility of addressing diverse needs within the structure was also limited. The Structuralist experiment was also severely restricted in its ability to produce an image of a whole. Some variations to the Structuralist approach were developed to introduce variation in the pattern: the reintroduction of 'wholeness', or monumentality, was often seen in the work of Louis Kahn or the Metabolists. And from the engineering fields, Le Ricolais and Nervi explored the possibility of topologically deforming patterns in order to accommodate the differential behaviours of structures.

However, these experiments to differentiate fabrics or to provide them with legibility could not prevent the

general crisis of Modernism and the emergence of Postmodernism as a response to the exponential proliferation of difference produced by the postwar economic, geopolitical and social order. Postmodernism abandoned the project of consistency embedded in the late-Modernist experimentations and delved into the exploration of autonomy on the levels of language, material consistency and part-to-whole relationship. The only remains of consistency were within the more historicist varieties of Postmodernism committed to the preservation of urban fabrics, fenestration and ornamentation patterns. If Modernism explored the autonomy of the object from the field, Postmodernism explored further the autonomy between the parts and the whole as an index of a seemingly fragmented and hybridised culture, giving expression to the collapse of the Modern project and its ambitions of consistency and collective redemption. Techniques such as collage and montage were prioritised as compositional devices against the characteristic patterned modularity of the Structuralist revision of Modernism, and the topological deformations with which informalism tried to inject new energy into the modern project.

It was not until the mid-1990s that the discourse on the generic resurfaced, propelled primarily by the theoretical work of Rem Koolhaas as well as his work on generic space and the architectural effects of globalisation. This opened the field to a range of explorations by a generation of younger architects aimed at overcoming the opposition between the generic and complexity as structuring and compositional devices, to investigate new technologies and sensibilities. Theorised under the labels of 'Intensive Coherence', 'Folding Architecture' and so on, these experimentations returned to the subjects of pattern as the material organisations suitable to embody the new forms of the generic.





FOA, Institute of Legal Medicine, Madrid, 2006  
The building envelope's tessellations.

### Pattern Domains: Urban Fabrics and Envelopes

If the current interest in patterns is likely to be an effect of the cultural necessity to embody complexity through consistency rather than through contradiction, this tendency has been reinforced by the availability of new technologies that enabled architectural practices – such as Foreign Office Architects (FOA), Greg Lynn FORM, Reiser + Umemoto, OMA and UNStudio – to develop increasingly sophisticated patterns on different scales of operation. These enhanced capacities of the material practices to deal with patterns have been applied primarily into two domains: the production of urban fabrics (from Peter Eisenman's master plan for Rebstock Park (2001) to MVRDV's 'datascape', and the design of envelopes such as in the work of Herzog & de Meuron and FOA.

One of the possibilities that artificial intelligence (AI) has made available is the ability to model fields that were not previously visible and for this reason had not yet entered into the instrumental realm of material practices. Linking directly quantitative analysis with a graphic output, and the consistency and exactness that the calculating engines introduce in this process, has enabled new practices to address some of the crucial problems posed by globalisation: namely, the dichotomy between tabula rasa and contextualism, and the articulation between local and global. This has become particularly evident in the design of urban fabrics. If Postmodernists resorted to the reproduction of urban patterns of the historic city and its typologies (historicists) or dissolving pattern in an inconsistent collection of objects

(Deconstructivists), the new experiments on urban fabrics are testing the possibility of constructing urban consistency without having to resort necessarily to the literal – or critical – reproduction of the material structures of the pre-existing city.

These new technologies have expanded the limits of urban context to include other dimensions of space and time. The same applies to the articulation between the parts and the whole within architectural artefacts. The dichotomy between bottom-up and top-down formal genesis has been put into crisis by artificial intelligence, which allows the modelling, with great precision, of the traits of a material mediation, rather than relying on an idealist worldview where the whole is built as the accretion of parts and where the part is a mere subdivision of the whole.

Having virtually disappeared from the technical arsenal of interesting architecture for two decades, the geometrical structure of the project – *tracé regulateur* – has regained relevance and become a common place of architectural experimentation. If the presence of a regulating mesh in the Structuralist approach seemed to throw into question the system's capacity for integration and flexibility, the new possibilities of operating directly in a vectorial space enable us to retain internal and external consistencies without resorting to a rigid grid or reference system.

### Pattern Politics: Difference/Repetition and Single/Multiple

One of the fields of contemporary architectural research where the investigation on patterns has been more intense is the subject of the building envelope. Compared with other domains of contemporary building technology, the building envelope is probably the most unities, and therefore the geometry of the tessellation is crucial to determine its various performances: environmental, iconographic or



expressive. The building envelope is also the architectural element that is more directly linked to the representational functions of the building. As the traditional articulations of the building envelope, such as cornices, corners and fenestration patterns, become technically redundant, the envelope's own physicality, its fabrication and materiality, its geometry and tessellation have taken over the representational roles that were previously trusted to architectural language and iconographies. The current proliferation of alternative political practices, such as trends, movements and other 'affect-driven'<sup>1</sup> political forms, runs parallel to the development of envelopes that resist primitive models of 'faciality',<sup>2</sup> no longer structured on the oppositions between front and back, private and public, or roof and wall, rendering the hierarchies of interface between building elements more complex.

The politics of rhetoric, symbolic reasoning and representation are giving way to a new breed of 'object-oriented' politics,<sup>3</sup> invested in modes of production and exchange and primarily implemented through the production of affects, an uncoded, prelinguistic form of identity capable of transcending the propositional logic of more traditional political rhetoric. The envelope, as the primary site of architectural expression, has become engaged in the production of surfacial effects, both as an environmental and a security device, and as the vehicle that will produce the building's facialisation, make it human, turn it into a political entity.<sup>4</sup> There is a new politics of faciality at play that affects the envelope as the locus of political expression.

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The renewed relevance of the subject of patterns as a critical expressive device in contemporary architecture stems from these changes in the nature of contemporary politics. Beyond the solution to environmental concerns, there are questions of representation that the patterns of the envelope need to address now. One such challenge is the production of identities for an increasingly inconsistent and mobile community while insulating and immunising its population against the abrasive global

atmosphere. Another is the representation of the emerging heterarchical orders that increasingly construct their power by both producing and using diversity, while simultaneously trying to produce consistency.

Frank Gehry's Guggenheim Museum in Bilbao (1997), Future Systems' Selfridges department store in Birmingham (2003), OMA's Seattle Public Library (2004) and Casa da Musica in Porto (2005), or Herzog & de Meuron's Prada Tokyo (2003) are notable examples of a tendency towards a multidirectional, differential faciality that resists linguistic coding, orientation and other traditional forms of representation to engage in the production of new expressions and political affects.

The demise of the primitive figures of building faciality has found resonance in the availability of technical possibilities (such as glass silk-screening technology and CAM manufacturing) which have enabled architects to play not only with smooth geometries, tessellation patterns and material textures, but also with a wide repertory of layers that can also perform technical functions (such as solar shading and visual occlusion). The introduction of certain cladding and roofing technologies, such as curtain wall systems, silicon joints and plastic waterproofing membranes, has eliminated the need for cornices, corners, pediments and window reveals. The difference between the roof and the wall has disappeared, as have many other traditional articulations of the building envelope.

These conventional figures of the building envelope are being replaced by more nuanced interfacial embodiments in which different layers of performance are played out against each other to produce a wide range of complex effects. The decoupling of the patterns of visual, thermal and atmospheric permeability has opened unprecedented possibilities for a molecular facialisation of the envelope by dissolving or intensifying the joints at will through the phasing and dephasing of these layers.

There seems also to be a tendency towards polygonal tessellations in contemporary envelopes – including PTW's Beijing Water Cube (2007), Future Systems' Selfridges department store and FOA's Ravensbourne College of Design and Communication in Greenwich, London (due for completion in 2010) – that oppose the Cartesian grid division of the late Modern screens. This tendency is first made possible by the release of the envelope from structural and environmental control functions.

Polygonal geometries have additional performances: for example, a hexagonal tiling has less joint length than a rectangular tile of the same area. If the contemporary envelope has more stringent requirements in terms of insulation and security performance, a polygonal tessellation will provide a smaller joint length per surface unit than rectangular grids, so this tendency may even be driven by a contemporary desire for sealed, immunising atmospheres.<sup>5</sup> But it is certainly enhanced by a faciality that is no longer structured in planar, vertical and discrete faces, as some of these envelopes explore differential geometries of the surface: the construction of bubble envelopes is not possible using a Cartesian tessellation.



**OMA, CCTV Building,  
Beijing, China, 2009**

The differential structural performance of the envelope has been made visible to produce a differentiated patterning of the surface.



Gehry's fish-like skins are an index of these tendencies: the staggering of the joints, originally driven by the constructive purpose of waterproofing the membrane by overlapping the tiles, becomes a characteristic pattern that breaks the continuity of the joints and enhances the three-dimensional, dynamic affect of the skin. The proliferation of diagrids and non-orthogonal tessellation patterns – OMA's Seattle Public Library (2004) and CCTV building (2009), Herzog & de Meuron's Prada Tokyo (2003) and Beijing National Stadium (Bird's Nest, 2008), Foster's Swiss Re (2004) and Hearst (2006) towers in London and New York, respectively – display a general tendency towards the incorporation of the structure in the skin, producing anti-gravitational, uprooted, unstable and differentiated affects.

The differential faciality that we find in some of the quoted examples here explores the expression of a sort of politics that moves away from the ideal, modular democratic organisation based on indifference, independence and interchangeability: if modularity was typically a quality of a democratic system that prioritises the part over the whole, some of the emerging envelope geometries seem to be exploring modular differentiation as a political effect and developing alternative forms of tessellation capable of addressing emerging political forms.<sup>6</sup>

The modular grid, indifferent to the relative weight of individuals or politically active subgroups, embodied the ideals of democratic equality and liberal individualism

and a preference for non-hierarchical organisations in which individuals are equal and will submit to the will of majority. However, emerging social structures characteristic of globalised societies and their heterogeneous populations tend to produce trans-scalar entities, from subindividual to transnational. In these emerging social assemblages, individuals, groups and other agents are primarily defined by relations of exteriority.<sup>7</sup> The allometric modularities and variable repetitions that emerge as almost generic traits of contemporary envelopes are probably more adequate to express a collective purpose within 'weighted' models of democracy (either those committed to the exercise of civil liberties or those that are driven by a hierarchical bureaucratic and authoritarian regime overlaid on to apparent democratic protocols).

The convergence towards those types of affect by both political structures with a multicultural tradition in the aftermath of 9/11 (such as Chirac's French law on secularity and conspicuous religious symbols in schools, and Trevor Phillips' 'Britishness') and states with an authoritarian background aiming to become integrative without losing their consistency, is remarkable. The question is whether the differentiated facialities and tessellations of the envelope seen emerging, for example in the Beijing Olympic projects, are genuine devices to allow the envelope to relate to a larger variety of concerns – environmental, social, economic and so on – or a strategy to step up the immunization levels while representing an ideally differentiated public. Do they inflect in response to multiple agencies and incorporate specificities rather than resorting to the production of spectacular embodiments of global capitalism and authoritarian bureaucracies?



As the politics of affect bypass the rational filter of political dialectic to appeal directly to physical sensation, the construction of an effective frame of reference within the discipline for discussing expression becomes critical. One can no longer sustain the ideological assumption that a more regular or a more differentiated pattern, one more permeable or more closed, is better at expressing a certain society and the production of transformative effects. The political accuracy of a certain envelope needs to be judged in respect to very concrete assemblages. The most acknowledged envelopes among the iconic Beijing Olympics projects are probably those in which the architects have succeeded in creating a plausible alibi for the differentiated pattern wrapped around the massive unarticulated volume of the buildings, where a resonance between literal performance and affect has been achieved. This is where a new discipline of the envelope becomes politically operative as an act of resistance that does not get caught in the negative project of the critical tradition or in the use of architecture as a mere representation of politics.

#### FOA's Pattern Politics

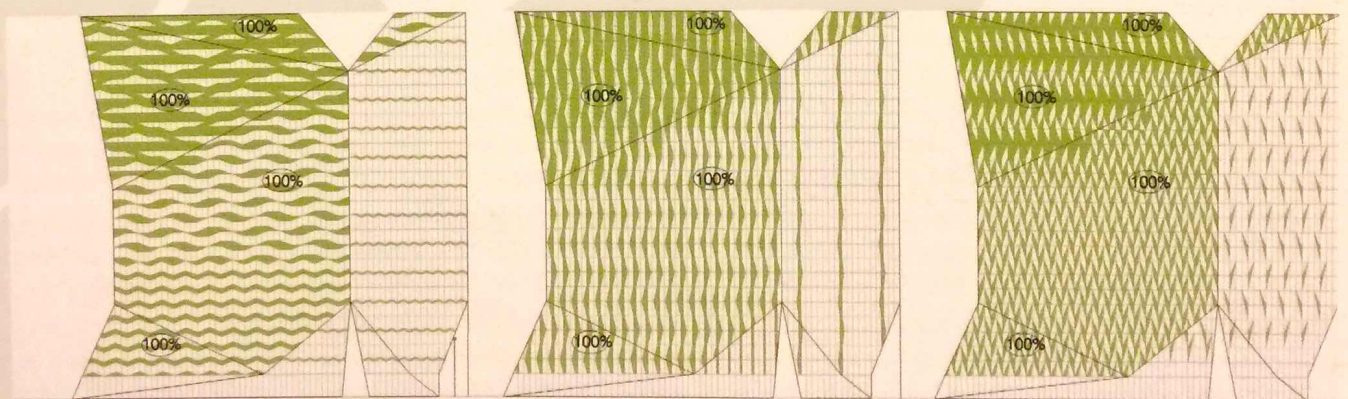
Probably as a result of its engagement with commercially driven projects, FOA has been investigating the problem of the envelope for a number of years. As a result it now has a body of project-based research on the problem of the envelope's tessellation. Considering the projects that have been engaged in this investigation, it is interesting to trace the tendencies present in the envelope's patterns, performing as environmental and expressive devices. The hypothesis of this analysis is that the four tendencies are towards the monolithic, differentiated, frameless and rootless,

and that these are representative of, and consistent with, the primary political affects of the work.

Firstly, there is a general propensity in the work towards envelopes that express a monolithic quality that foregrounds the perception of the object as a whole rather than as a composition of parts. In several cases, the massing of the envelope is predetermined by the nature of the programme or the project's site previous to FOA's involvement: the Spanish Pavilion for Aichi 2005 in Japan, Ravensbourne College of Design and Communication, the Trinity EC3 office complex in London (2006) or the Highcross retail and cinema complex in Leicester (2008) are exemplary of this tendency. The atomisation of the face, the seamlessness, the bias towards a body without organs which expresses changes of intensity rather than figures of organisation are some of the qualities these projects share. As a result, the buildings produce affects of effacement, liquefaction, de-striation.

A second trait that we can identify across all the projects is a deliberate attempt to produce differentiated patterns. In the Spanish Pavilion for Aichi 2005, the pattern is differentiated automatically by the particular geometrical quality of the six deformed hexagons, with no other purpose than to represent a differentiated colour field that, despite its contingent appearance, is governed by the geometrical laws of the parts. The Ravensbourne College of Design and Communication is the only project where we can see a pierced fenestration: the geometry of the pattern enables perforations of different sizes in respect to the specific needs of the interiors. The differentiated fenestration pattern is then projected into the structure of the tessellation pattern. Here, the differentiation is produced locally in respect to programmatic factors.

In the Affordable Housing in Carabanchel, Madrid (2007), the difference engine is located also in the contingent action of the inhabitants to set their own preferences in respect to daylight, shading and views, changing over time as those conditions change, as a direct register of the collective's desires; like in a swarm, the part and the whole are seamlessly related in performance and expression. And in the Leicester Highcross retail and cinema complex the differentiation



FOA, Building 1, Trinity EC3 office complex, London, 2006

Tests of solar-shading patterns. The cumulative exposure of the facade to solar radiation was measured locally and transformed into a different percentage of coverage for a silk-screened pattern, producing a palette of eight different tiles that can approximate the recommended G-values for every zone of the facade.



**FOA, Spanish Pavilion, Aichi Universal Exhibition, Japan, 2005**

*right:* Tessellation. Six different hexagonal ceramic tiles, colour-coded with a hue of yellow and red tones, form a system that automatically produces a contingent pattern of colour.

**FOA, Ravensbourne College of Design and Communication, Greenwich, London, due for completion 2010**

*opposite:* Correlation between windows and facade tessellation. The tiles are coded depending on their position in respect to the centre of the polar array of tiles that surrounds every perforation. The colour-coding of the tiles changes according to the size of the window, forming a varying pattern.



is embedded in the silk-screened pattern that covers the John Lewis department store's glass facade and the optimisation of the stainless tiling of the cinema block, but most importantly it is produced by the movement of the spectator around the building causing a flickering moiré effect, together with the changing reflections on the mirrored surfaces.

In the Iconic Towers in Dubai (2004) and the Trinity EC3 office complex, the differentiation of the pattern is local and generated by the differential solar exposure of the specific surfaces interacting with the facade tessellation. In the Institute of Legal Medicine in Madrid (2006), the circle-packing geometry is differentiated to adjust to the basic geometry formed by two spheres and a torus. Whether the differentiation is driven by the functional performances of the envelope in relation to varying parameters such as solar exposure, views and so on, or whether the differentiation is applied as a global order to the envelope, or it is related to the joints and joining patterns, details or the localised functional performances, the work displays a tendency towards differentiated patterns.

The envelope patterns in these projects present a tendency to merge the frame and the infill, the whole and the parts, which is particularly distinctive in comparison with other contemporary experiments in tessellation: the

Barcelona Coastal Park and Auditoria (2002), the Spanish Pavilion and the Ravensbourne College of Design and Communication present repeatedly an edge to the envelope that is directly conformed by the geometry of the tiles rather than by a cornice or a corner, or any other framing structure. The exploitation of an integral correspondence between parts and whole is one of the constants that appears repeatedly through the work, projecting the buildings as open, frameless, incomplete entities.

Finally, the analysis of the envelope's patterns displays a proneness towards polygonal tessellations and packing structures, a trope that we can see in most of these projects. From all the cases listed, the Leicester Highcross retail and cinema complex, the Affordable Housing in Carabanchel and the Trinity EC3 office complex retain the more conventional orthogonal grid as an organising structure for the envelope's construction. However, the orthogonal grid is usually disguised by introducing an overlapped pattern or a 3-D manipulation of the surface. The conceptual argument behind this approach could be addressed by different hypotheses, but one of its most direct effects is the suspension of gravity as the primary organising force behind the envelope tessellation. The envelope becomes, by virtue of this configuration, a hovering, rootless object that presents itself as a skin rather than as a topographic construction. The case of the Barcelona Coastal Park and Auditoria is interesting here as it is not an envelope proper, but a topography where the gliding of tiles in respect of each other produces an 'effect' of instability that communicates a similar 'affect' of rootlessness.





Analysing the work under this scope underlines the emergence of a series of affects in the patterns of envelopes that are to a degree independent of both the programmes and the technologies used in their design. These characteristics may be seen as the 'atmosphere' of the work. However, to take things a step further, these atmospheric qualities are a basic index of a political stance or the work previous to translation into a political vocabulary. In fact monolithicism, differentiation, framelessness and rootlessness are concepts with a strong political baggage. ▽

#### Notes

1. Following Deleuze, 'affects' are 'pre-personal intensities' that are transmitted by empathy between material organisations rather than through codes, signs or conventional forms of representation. Gilles Deleuze, 'Percepts, concepts, affects', in Gilles Deleuze, Félix Guattari, Janis A Tomlinson and Hugh Tomlinson (eds), *What is Philosophy?*, Columbia University Press (New York), 1996. As Nigel Thrift has pointedly noted, contemporary politics are progressively less reliant on representation and proposition and more dependent on the production of affects. See Nigel Thrift, *Non-Representational Theory: Space, Politics, Affect*, Routledge (London), 2007.
2. I adopt the term proposed by Deleuze to address the theorisation of systems of expression or representation. See Gilles Deleuze and Félix Guattari, 'Year Zero: Faciality', in *A Thousand Plateaus: Capitalism and Schizophrenia*, University of Minnesota Press (Minneapolis, MN), 1987.
3. The term is borrowed from Rodney Brooks, a pioneer of behaviourist AI, who has promoted the idea of a 'physically grounded artificial intelligence' from the field of robotics as an alternative to centrally

structured coded wholes based on symbolic reasoning. Brooks argued that interacting with the physical world is far more difficult than symbolically reasoning about it. Rodney Brooks, 'Elephants don't play chess', and 'Intelligence without representation', *Cambrian Intelligence: The Early History of the New AI*, MIT Press (Cambridge, MA), 1999. See also his 'The relationship between matter and life', *Nature* 409, 2001, pp 409–11.

4. The idea of extending a human, political dimension to things or sub-human entities is very much the project that Bruno Latour explores in his proposition of a Dingpolitik. This is the term coined by Latour to address the politics resulting from the crisis of objectivity triggered by the collapse of Modernity and the search for a new model of objectivity in which politics become intrinsic to the object, its sciences and nature at large. Bruno Latour and Peter Weibel, 'Introduction', *Making Things Public. Atmospheres of Democracy*, exhibition catalogue, MIT Press (Cambridge, MA), 2005.

5. 'Immunisation', 'insulation' and 'ventilation' are some of the terms coined by Peter Sloterdijk to describe the artificial diversification of the atmosphere within the capsular society. The human island, the capsule and the greenhouse are the prototypical devices for a new generation of buildings committed to this diversification of the atmosphere. Peter Sloterdijk, *ESFERAS III. Espumas. Esferología plural*, Siruela (Madrid), 2006.

6. Richard Sennett's definition of associative democracy, (see 'Democratic spaces', in *Hunch No 9*, Berlage Institute (Rotterdam), 2005); Latour's Actor-Network Theory (*Reassembling the Social: An Introduction to Actor-Network-Theory*, Oxford University Press (Oxford), 2007); and Sloterdijk's foams (op cit) coincide to describe emerging social structures as organisations where the articulation between individual and society, part and whole, is drawn by influences and attachments across positions, agencies and scales that transcend both the individuality of the part and the integrity of the whole.

7. Manuel DeLanda has applied Deleuze's theory of assemblages to describe these emerging forms of social and political organisation. Assemblages are non-essentialist, historically contingent, actual entities (not instances of ideal forms) and non-totalising (not seamless totalities, but collections of heterogeneous components). Manuel DeLanda, *A New Philosophy of Society*, Continuum International Publishing Group (New York), 2006.