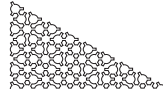


before any external influences or allegiances.

Bracchi's work is certainly 'late' work, in the sense that that term is usually used, signifying a lostness or degenerate ennui of intention and outlook. It is disillusioned art which reflects the state of the world by turning away from it, by abandoning representation to portray instead nightmarish landscapes of confusion and regret, of psychological pathos. This is an art obsessed with decay, with decomposition, with deterioration, both pictorial, institutional and civil. In its more formal sense it is work which circumvents depth, symbolism and metaphor with the distraction of surface decoration. The world in which these drawings are made, and of which they are representations, is a barren, desolate occasion of surface. Time does not exist in his drawings, nor does life. Figures represent facades in ways that evoke the underground forms of early Christian art, and traverse plains their artists likewise neglected to adequately portray. What we find in Bracchi's drawings, however, instead of the pedagogic and awestruck immanence of belief of early Christian art, is instead a murk of obliteration or incipient meaninglessness. In this sense it can claim as its own the august company of works by Goya,

Redon, Klimt, Magritte, and Baselitz. Bracchi's is an art that betrays profound uncertainties regarding the very worthiness of the artistic enterprise, the very possibility of continued artistic expenditure. It is art that flagrantly wonders whether art is not over after all, whether art is even worth the effort. Bracchi makes art, I would guess, against his better judgment. Decorativeness here is the acknowledgement of this pessimism, or perhaps its denial. It is, also, I should also add, quite beautiful, and engaging, as its characters collapse into the utter senselessness of their dumb stares and broken, incomplete outlines, and their menace fades as the background emerges—along with the individual demarcated lines—from the commotion, frustrated and significant. It exists on its own and without explanation, the works themselves both the occasion and the grounds upon which the disillusioned artist works uncertainly, summoning the ghosts of drawing's past.

**Mark Molloy** received Bachelor of Arts degrees in English and Philosophy from the College of the Holy Cross in Worcester, Mass. He lives, writes poetry, and works in New York City.



**RAPPAPORT, Nina**

## Deep Decoration

Decoration has evolved into a new paradigm for the relationship between structure, form, and aesthetics in architecture. Architects and engineers are using patterns generated by algorithmic formulae, such as fractals, pinwheels, as well as cellular and reticulated structures to become the organizational system for a building's structure. The wake of postmodern discourse, and of the smooth surface rendering that followed the arrival of the computer, has created a need for a visual surface simulation and depth often in an overall network of distribution, rather than the classical hierarchical organizational and proportional system of a façade viewed from only few controlled perspectives. Buildings are evolving a new relationship between skin (façade), and bones (structure), crossbreeding ideas of structure and concepts of decoration. On the one hand, the pervasiveness of so many forms of media has so dematerialized architecture as to separate decoration entirely from structure, to suggest for the first time that structure may in fact be obsolete. On the other hand, an emerging interest in structure as a generator of form, has resulted in structural skins functioning both visually and physically as supportive elements and surface, evolving new typologies. The

complexity of these new forms of structure and decoration, run deeper than the surface of either issue.

The use of overt patterning in structural systems blurs the line between what is structural and what is decorative, and results in a third thing, a deep decoration—a decoration that is both below and in the surface, that creates new spatial effects and comprises holistic atmospheres. A few recent buildings: LAB Architecture Studio's Federation Square in Melbourne (2002), Cecil Balmond and Toyo Ito's Serpentine Pavilion in London (2002), and PTW Architects and Tristram Carfrae of Arup's project for the Beijing National Swimming Center, known as "The Water Cube," (2008) exemplify these ideas of the deep decoration as structure based on complexity and a common cultural interest in nonlinearity, nonlinear determination, and nature's own organizational systems.

### Repetitive Array as Spatial Structure

The repetitive array becomes spatial in two modes of operating. The first involves the use of patterning an overall field or system, while the second relies on an exo-skeleton of structural elements as decoration. In terms of pattern structures, these recent projects have in common repetitive geometric elements, which are both comprehensive and expandable; they envelop space, but they also organize into forms that are self-generating. The systems, in as much as they affect a *decorum* can be seen as part of the origins of a decoration that relates

to new ideas in society and science of complexity, an inside/outsideness, or intricacy.<sup>1</sup> These arrays manifest a material surface structure rather than dematerializing structure by wrapping it in layers transparency, reflectivity, and mediation.

### Exo-Skeletal Structure

The second orientation of deep decoration and structure emphasizes the exo-skeleton. Here the structure is the essence of the building's exteriority in a paradigm closer to that of the Art Nouveau as exemplified in Horta and Guimard's organic structural elements for Metro stations in Paris, hand railings, and furniture. Structure in this orientation doubles as ornament. As Pierre Francastel wrote, "Everywhere there was an oscillation between the austere style of Mackintosh and the floral style of Horta. The interrelatedness of structure and décor is the most salient feature of this period."... "Both of these opposing principles—one seeking to integrate structure through the unity of surface ornamentation and the other seeking to maintain a strictly structural harmony—sprang from experiments carried out before 1880 throughout the world."<sup>3</sup>

The former is seen in Greg Lynn's scheme for the Slavin House where the structure is based on a looped thread, closer to a form of decoration. The later is evident in the organically shaped highly integrated structures of Pier Luigi Nervi or Felix Candela, in which structure is also decoration as it is part of the building's form, conveying a direct understanding of the operation of forces on the building. However, just because a structure is exposed does not mean it is decorative, nor does all structure immediately enter the conversation on decoration as soon as it is identified in architecture. High-tech structures, for instance, are not considered decorative, nor are other means of making a structure explicit and comprehensible that hybridize structure with a legibility of the object. On the other hand the diagonal structural grid (the diagrid) as exposed on OMA's Library in Seattle, Herzog and de Meuron's Tokyo Prada Store, or Norman Foster's St. Mary's Axe, in London could be labeled decorative as well. Applied ornament that underscores structure is likewise excluded from this discussion as in Sullivan's use of foliated ornament, which is an added surface that neither defined nor obfuscated the structure that it clad.

### Biomimicry

Engineers, architects, and artists often refer to nature as a basis. Many engineers find their structural inspiration from plant life, in a spider's web (often a reference for Peter Rice), a piece of coral, a beehive, or in the structural development of animals. Biomimicry is a particular moment in which architecture, engineering, and art converge as they are using the same inspirations. Joseph Paxton was inspired by the giant water lily, the Victoria Amazonina, which led to the development of the beam structure for the greenhouse at Chatsworth Park and the Crystal Palace (1851). With the publication in 1917 of D'Arcy Thompson's *On Growth and Form*, the under-

standing of nature's interior structures of cells, honeycombs, crystals, snowflakes, shells, even direct comparisons to skeleton's and bridge structures, carried through to the formation of study centers for biomimetics.<sup>3</sup> The links between nature and art were further drawn in studies of the array such as those in Gyorgy Kepes's *New Landscape* exhibition at MIT in 1951, and also included in the Vision + Value series, as well as in new discoveries made possible through microscopic visual dissections of plant life and materials.<sup>4</sup> These analyses indicate that with holistic structures in particular, such as crystals, there is no distinction between structure, decoration, and the thing itself. That is where there is a difference between the holistic structure and the more explicative structures of Nervi. Deep decoration, the structure that influences form, is as much about interiority and affect as it is about the filling of space. Structure in this case is not opening up space, but becoming a part of it.

Robert Le Ricolais (1894-1977) the noted French engineer who taught at University of Pennsylvania from 1954 until 1976, made a career in analyzing natural forms and incorporating their properties into the field of structural design. He revealed that when working with the structure of bone "If you think about the voids instead of working with the solid elements, the truth appears. The structure is composed of holes, all different in dimension and distribution, but with an unmistakable purpose in their occurrence. So we arrive at an apparently paradoxical conclusion, that the art of structure is how and where to put holes. It's a good concept for building, to build with holes, to show things which are hollow, things which have no weight, which have strength but no weight."<sup>5</sup> Le Ricolais was also fascinated with radiolaria, "forms that encompass the properties of both stressed-skin and triangulated structures. They are just in between: configurations with multiple holes, a perforated membrane in tension working together with a triangulated frame. And this may give an analogy, based on a few topological notion for the arrangement and number of holes, that could bridge the gap between two kinds of structures, and possibly, the two technologies."<sup>6</sup>

The discussion of decoration plays out in the arrangement of shapes, whether solids or voids, that form the spatial object in an aggregation. Today there are different uses of patterning at work that incorporate the structure, or even inform the structure. Questions can be asked such as: Does structure become decorative? Is it the array of a shape as it accumulates into a pattern that is what makes it decoration? What is decoration and structure when modernism rejected decoration.

### Federation Square: Deeper Uses of Pattern and Algorithm

Federation Square in Melbourne, Australia, was designed by Peter Davidson of Lab Architecture Studio with Bates Smart after being selected as the winning team in a 1997 competition and completed in 2003. The project, which decks over one section of the city's railroad yards, has become a dynamic 7,500-square-meter public space with numerous cultural institutions in the surrounding buildings. Using the concept of geometrical connections to the city, via angular forms, the architects and

engineers employed a system of triangulated fractals for the building façade tiles cut in local stones and in zinc that reflects and refracts the sunlight. Lab and Smart also designed a glazed atrium with a structural patterning of the same triangulated forms. A structure with an underlying coherence from the whole to the fragmentary assemblage, this pattern pervades the project from the ornamental, or accessory elements of the tiled skin through to the structural skeleton. Simultaneously holistic and expansive, the pattern becomes decoration when it engages in the act of defining a spatial affect.

As Neil Thomas, engineer with Atelier One of London who worked on the project says, “Fragmentation extended to the building structure with the pattern of the Penrose pinwheel so that the triangular element can extend and regenerate the surface in a way that is not dissimilar to membrane structures, and it regenerates to suit, as the best fit.”<sup>77</sup> The Penrose pinwheel, discovered by Roger Penrose, comprises a set of a-periodic tiles with five-fold symmetry (impossible in periodic crystals), and has been used to explain the structure of certain “quasi-crystal” substances.

The architects wanted to break out of the normal way in which walls, windows, and apertures work. The facades of the main buildings are composed of a double-layer rain screen, with the outer layer of triangular tiles left open-jointed. The inner layer is the weatherproof skin, in a thin aluminum sheet. By using an integrated cladding and structural system to wrap around the building, the architects form and characterize internal spaces by the shape of the holistic building envelope. The Penrose algorithm allows for the shape of the envelope to change and fold dynamically. Even the plaza surface is based on this triangulated system. As the triangle is turned and shifted the compositional array organizes into a design. The pinwheel triangle can be divided into five equal triangles so that they all can continue to be subdivided but stay in proportion to one another, creating a fractal system. One set of panels is mounted to a framework and the framework, becoming a larger panel, is attached to a triangular galvanized steel frame. The pinwheel construction is appropriate for the façade in that no sealants are required so that it creates a cleaner, smooth surface even where the majority of the triangles meet. The system is a different concept than the “fractile” patterning of the proposed and unbuilt, Victoria and Albert Museum addition in London designed by Daniel Libeskind with engineer Cecil Balmond.

The glazed atrium structure at Federation Square exemplifies more intensely the new relationship between structure and decoration. It is a pinwheel algorithm, a structural framework that forms the basis of an intricate variegated structure from a limited kit of parts and follows the same pinwheel scheme as the surface tiles. Two structures are separated by a cross-bar structure with the wall frame being a superstructure of 200-millimeter-square hollow section that comprise two skins separated by an average gap of 1.5 millimeters. Similar to Toyo Ito’s Serpentine Pavilion with Cecil Balmond (see below), the atrium is an exposed structural form that in its repetition and distribution proposes ideas of patterning and algorithm as structure and decoration. The frames are four-to-five-sided irregular polygons connected by in-plane

diagonals, with strength and stiffness provided by truss and moment resisting actions. The two skins are not parallel and are connected by diagonals to provide stability. The open network of this framework of 3000 members seems to fold in and out within the open void formed by the outer and inner glazing.

A secondary steel structure with a pinwheel-shaped frame, in a finer interpretation of the Penrose geometry, supports the glazed panels. The structure is visible through the glazing and then informs the comprehension of the rest of the structure, while spilling over to the panel system and sharing the pinwheel and non-orthogonal patterning. The new form and surface patterning merge physically in the building and in the minds eye as decoration.

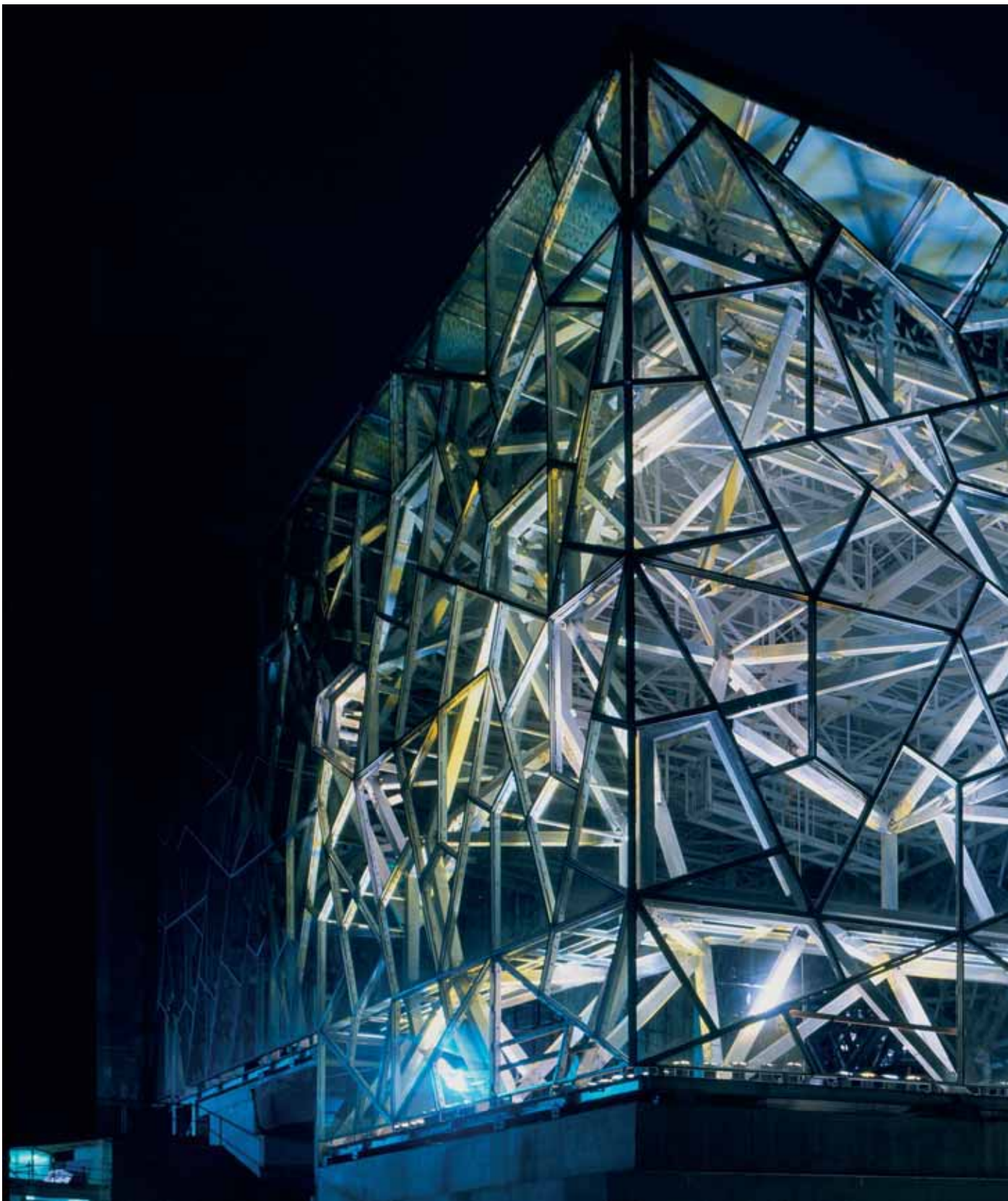
### **Serpentine Pavilion: Building as Structure**

Cecil Balmond, Deputy Chairman of Arup, in working with architect Toyo Ito on the 2002 Serpentine Pavilion design, in London, employed a structure based on a circling placement of twisted squares and their primary lines of force that then wrapped down and around the space, crossing and folding back to form angular forms which were, according to an algorithm, filled with solid or glazed surfaces for ceiling, floor, and walls.

This pattern is based on the action of spiraling squares. Flat steel was used for the angles and for the diagonal members, which form a dense structural net. The overall patterning of the shell of the space makes the skin and structure one, more similar in concept to a traditional load-bearing wall than to hierarchical systems of separate structure and infill. The pavilion is a physical manifestation of an algorithm: pattern and structure are integrated. As Balmond says, the design started with a simple line that was repeated, “releasing architecture from structure, rather than trapping architecture through the structure.”<sup>78</sup> The roof panels vary in size, most weighing between 5 and 10 tons, while the biggest wall panel is 20 meters long and 4.5 meters high. Ito and Balmond have created the building out of structure, as structure, which produces decoration out of geometry, and complex patterning.

### **Water Cube: Matter and Geometry**

A third project exemplifying characteristics of structure as deep decoration is the Beijing National Swimming Center, known as the Water Cube, under construction for the 2008 Olympics. PTW Architects of Australia, and the CSCEC (China State Construction and Engineering Corporation and the CSCEC Shenzhen Design Institute) designed the scheme in a 2003 competition, to include five pools enclosed within blue bubble-pack walls. Tristram Carfrae of Arup’s Sydney office, coordinating engineer for the project, emphasizes how previous structural problems have come down to architectural forms and the services required to support them from within. Instead with the Water Cube he focused on how structure itself fills space, a process closer to that of form-making in solid natural objects such as beehive structures that multiply, as space as a robust structure.





*Federation Square, LAB Architecture Studio, Melbourne, Australia, 2002. Courtesy LAB Architecture Studio.*





*Serpentine Pavilion, Toyo Ito Architects and Arup Engineers, London, 2002. Courtesy Arup/Ulrich Rossman.*



*Beijing National Swimming Center, "The Water Cube," PTW Architects and Arup Engineers, Beijing, 2008. Courtesy Arup+CSCEC+PTW.*



*Beijing National Swimming Center, "The Water Cube," PTW Architects and Arup Engineers, Beijing, 2008. Courtesy Arup+CSCEC+PTW.*

Carfrae considered using vertical tubes that would appear as circles on the outside of the building, to filter direct sun light filter. But he wondered, "What would make the wall horizontal? What would the joint between them be? And how would it transition from the vertical and horizontal?" He recognized that the geometry appeared to be an organic structure as structure in space. "Usually we are interested in planes. Bucky had structure covering surfaces. My question was, What about it occupying space?"<sup>9</sup> He researched the classic question, of bubble theory. Carfrae was inspired by the shape of cell formations and soap bubbles in an array and their connectivity (not their structural form as in Frei Otto) as a way to divide space. French mathematician Joseph Plateau, in the eighteen century, observed that soap bubbles agglomerated with the walls coming together in four lines to form a tetrahedral, but this was a subjective observation, and was never proven. Soap bubbles will naturally dispose themselves in a series of equal volumes so that the partitioning area was minimized. Calvin's answer was highly regular and then Carfrae found the 1993 studies of two physics professors at Trinity College, Dublin, Weaire and Phelan, which looked at the connections between bubbles. It could be buildable, but looked random just as in the space filling patterns of cells and crystals. Carfrae plugged it into a 3-D CAD program and instead of orienting it on a Cartesian grid placed it at an askew angle and it looked random and it worked in terms of the architectural ambition of the project. The structure would then find the surface pattern together with the internal structure creating organic patterns that are both functional and decorative.

There were numerous structural issues that had to be solved once the main form was decided on, such as how to keep the structure light-weight enough for the long span roof to be successful as well as to meet seismic requirements. The resulting structure is a 177 × 177 × 31 meter Vierendel-type space frame based on a geometric cell of 12 pentagons and two hexagons that can be infinitely repeated. Composed of a series of steel tubes welded to round steel nodes, which vary according to loads, with 22,000 steel members and 12,000 nodes overall. 4,000 bubbles will make up the cube some 7.5 meters wide. Though the repeating cells are of only two different sizes, they are randomly distributed and are cut arbitrarily by the building surface planes, creating a non-repetitive pattern. Cladding with ETFE foil cushions, referring to the idea of the cells and soap bubbles, while functional and an efficient structure, as well as environmentally sustainable, it non-optimized qualities, which are decorative. This creates an aesthetic affect, that combined with the structural system that comes from within and without in a unified holistic environment as complex decoration.

## Conclusion

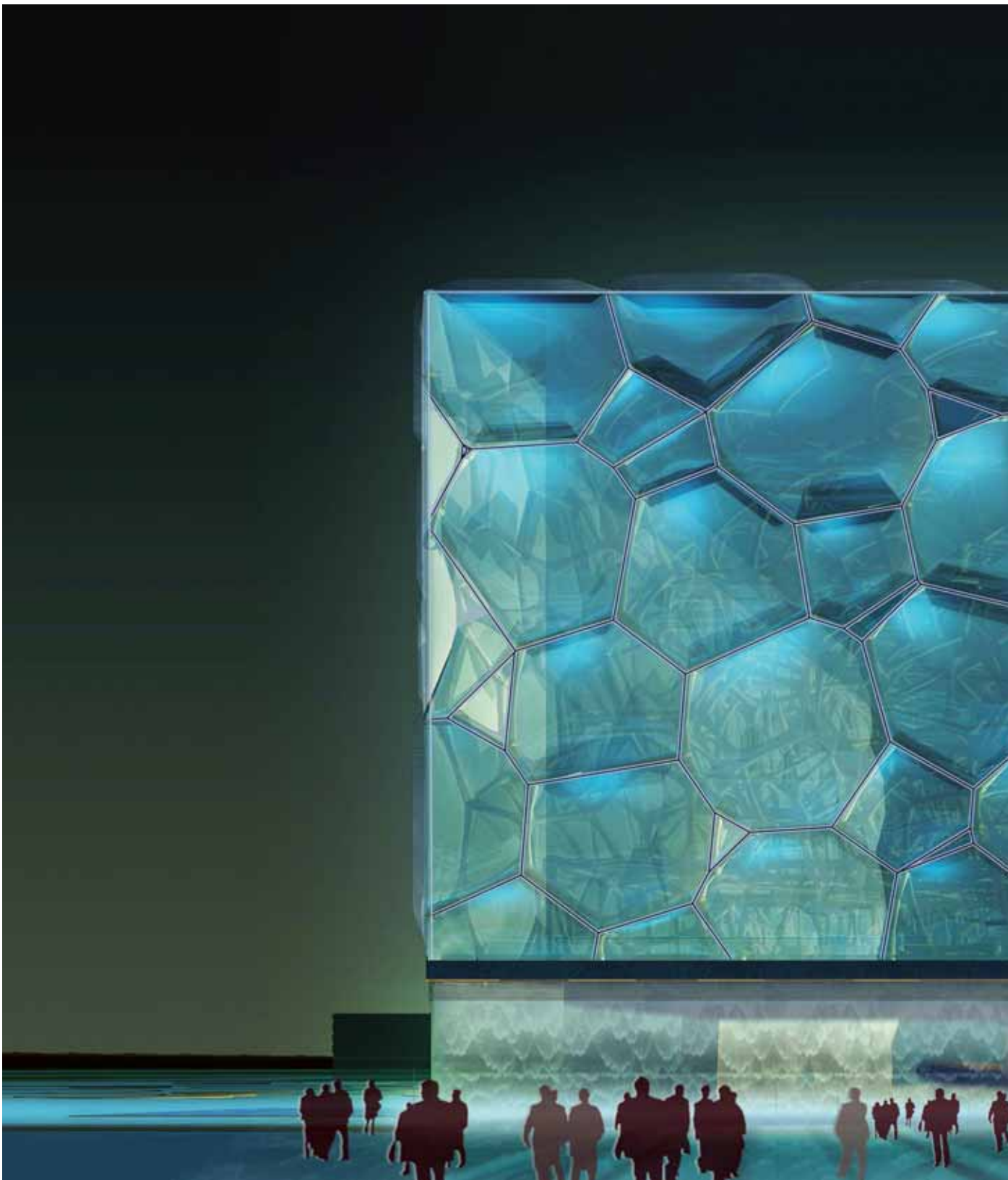
When the stable relationships of decoration as a mere appendage to an optimized structure begin to break down, a synthesis between pattern and structure emerges where the two are unified. Decoration is no longer a contradiction for a contemporary architecture, but embodies a more inclusive approach to it, as an embedded patterning emerging from and/or penetrating to structure. As Kent Bloomer notes, "Decoration delimits a building, otherwise it is chaotic but it also becomes a decorum or a reflection on society"<sup>10</sup> and could have thus been a different direction of for design, as an unarticulated, nonlinear, and holistic architecture. Decoration is thus controlled by means of the limit of the building's shape, held in place by a spatial generation of a pattern that is both walls and floors and surfaces enrapturing the participant in repetitive tropes, in a homogenous form. If decorum is about society, and decoration is about fashion, perhaps the synergy between decoration and structure goes even deeper in a non-hierarchical three-dimensional space.

## References

1. *Intricacy was used as a term by architect Greg Lynn to define that complexity of surface and form and was an exhibition at the ICA, Philadelphia, and Yale School of Architecture, New Haven.*
2. *Francastel, Pierre, Art & Technology in the Nineteenth and Twentieth Centuries, Zone Books, New York, originally published 1956, this edition 2000, page 203.*
3. *See for example the Centre for Biomimetics, The University of Reading, or work of Benyus, Janine M. Innovation Inspired by Nature, Periennial Books, New York, 1997.*
4. *Kepes, Gyorgy, Editor, Structure in Art and Science, George Brazillier, New York, 1965.*
5. *Le Ricolais, Robert, quoted in, "Structures, Implicit and Explicit, Interviews with Robert Le Ricolais," VIA, University of Pennsylvania, 1973.*
6. *Ibid, pp. 90–91.*
7. *Neil Thomas, in discussion with author, 2005.*
8. *Cecil Balmond, in discussion with author, 2002.*
9. *Tristram Carfrae in discussion with author, 2005.*
10. *Kent Bloomer, in discussion with author, 2005.*

**Nina Rappaport** is an architectural critic, curator, and educator. She is publications editor at Yale School of Architecture and editor of the school's biannual publication *Constructs and the exhibition catalog series*. She has contributed articles and essays to *Architecture, Architectural Record, Praxis, Future Anterior, and Tec21*. She teaches seminars on the post-industrial factory and on innovative engineers and is currently working on a book on contemporary engineering.







*Beijing National Swimming Center, "The Water Cube," PTW Architects and Arup Engineers, Beijing, 2008. Courtesy Arup+CSCEC+PTW.*