

THE FUNCTION OF FORM

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“Form follows function.” There has never been a more seductive dictum in the history of architecture. In the nineteenth century, when it was first put forward by Louis Sullivan, function was understood in terms of its cultural and social role. Different building types were associated with different types of materials, which, to paraphrase Sullivan, included all things organic and inorganic, all things physical and metaphysical, all things human and superhuman, all true manifestations of the mind, the heart, the soul.¹ For the modernists who adopted this dictum in the twentieth century, function was narrowly defined as the use or utility of a built form,² an interpretation that has provoked disagreements among architects and theorists ever since.

But, if not function, what does form follow? A whole range of ideas and concepts have been imposed on physical forms in an attempt to find the answer. However, despite their differences, the theorists of modernism and the revisionists who came after them shared three underlying assumptions: first, that society is defined by a unitary culture; second, that physical form must be preceded by a fundamental principle or cause, a cause which is driven by either objective or subjective concerns – the way forms are built and used, or the way they are perceived – but never by both; and, third, that form either epitomizes or responds to a single, ideal meaning, identity or possibility.

These opposing views of function and the role of architectural form are typical of a whole range of binary oppositions that dominated the twentieth century: East v. West, Left v. Right, culture v. nature, mind v. matter. However, the end of the Cold War, the spread of global communications, the increase in multinational trade agreements, and the resulting mass migration of capital, labor, goods and ideas have brought radical and rapidly accelerating changes to cities and their cultures, and consequently to the practice of architecture. These changes demand that architects think and act very differently.

Our environment is the product of diverse processes that are linked in complex ways. Cities are no longer defined by, or even identified with, a single culture. They are spaces where a multiplicity of cultures and cultural forms cohabit and interconnect, where novel subcultures and identities are constantly emerging. Culture can no longer be considered as a set of universal values or conventions which have been established by practice and validated by consensus. Cities are characterized by difference and multiplicity, and this unprecedented level of complexity has increased the demand for built forms that provide higher levels of performance. Consequently, a vast number of new areas of expertise have evolved, each introducing a highly specialized system with a multitude of different components. These include transport consultants, archaeology consultants, wind consultants, fire engineering consultants, development managers, access consultants, risk and opportunity managers, sustainability consultants, planning consultants, crime prevention design advisors, public relations and communications consultants, property advisors and letting agents, professional construction consultants, rights of light consultants, façade consultants – in addition to the more familiar ones such as structural engineers, mechanical

engineers, cost consultants, project managers, landscape engineers, construction managers, acoustic engineers, lighting consultants, and so on.

A new binary process has emerged: architects endow a built form with unique sensorial qualities, while engineers and technicians address its technical requirements. This disconnect between needs and desires results in over-specified and over-complicated built forms, and does not allow the design process to respond effectively to urgent problems which are the outcome of a variety of causes, or to potentials that may reside in multiple spheres, whether climate change, urban sprawl, the decompression of the urban industrial city, housing diversity, or digital tools and technologies.

Such hybrid concerns cannot be addressed through binary thinking. They require a change in our approach toward materiality, away from an understanding of material as exclusively physical and tangible, to include both the physical and the non-physical – climate, sound or economics as well as wood, steel or glass. This expanded notion of materiality – one could describe it as “supramateriality” – liberates built form from a dualist approach that separate ideas from substances, objects from subjects, and production from perception. Today, abstract and dynamic materials can be precisely measured and visualized with the aid of digital software, and merged with concrete materials used to produce the design of built forms. It allows built forms to address multiple causes and hybrid concerns, and it allows us to redefine the role of function in built forms, aligning it with the way it is understood in other disciplines.

In mathematics, biology or computer science, function is seen as a unique, transversal process, performed by a medium that is specific to that discipline (for instance, a differential equation, an organ, a browser). Multiple inputs or materials (numbers, cells, content) are combined in a specific way to achieve a single output – a singular form (a specific curve, an organism, a body of information). It is the singularity of the resulting form that embeds it with a specific function. In architecture, diverse materials (physical elements, context, climate, economy) are combined to produce a built form, the medium being an assembly of physical elements. Each built form or assembly of physical elements functions or performs in a specific way as a consequence of the way in which the diverse materials are combined. That is, the function of each built form consists in a transversal process in which the production of forms and the performance of forms are combined, resulting in a singular form.

Per[form]ance of form

In his essay “Critical Architecture”,³ Michael Hays outlined two possible positions for architecture to adopt vis-à-vis culture: architecture is either an instrument of culture, or it is an *autonomous form*. Drawing on the work of Mies van der Rohe, Hays defined a “third position” in which architecture

operates independently, "between culture and form", as a critique of the dominant culture. Today these positions present architecture with two challenges.

First, in all three scenarios culture is represented as static, a monolith against which all distinctions and critiques are positioned. Mies, for instance, repeatedly referred to his buildings as a refuge from the "acute anxiety derived from the metropolitan experience". However, given the molecular nature of contemporary reality and the multiplicity of culture, finding a clear "in between" position such as the one Mies occupied is difficult, or even impossible. Cultural spheres and individual desires overlap and interact with one another to such an extent that single binaries rarely occur and, when they do, they are fleeting by their very nature. Architecture can no longer afford to structure itself as an instrument that either reaffirms or resists a single, static idea of culture. Instruments (codes, symbols, languages, etc.) simply repeat without variation. As a function rather than an instrument of contemporary culture, architectural forms need to vary in order to address its plurality and mutability.

Secondly, in all of the three positions outlined by Hays, form is an a priori, abstract principle that gives expression and meaning to matter, and consequently to culture, in a *downward* mode of causation, establishing a *hylomorphic*⁴ relationship between them. Historically, this detachment of form from materiality has resulted in architectural forms that arose either from concerns that related solely to the production of the "physical object", irrespective of how the object related to people and the environment, or from concerns relating to the way forms were perceived, irrespective of the way they were produced. That is, forms were unmediated, a direct consequence of either objects or subjects – either rational or sensorial considerations. Alternatively, as in the "between culture and form" approach, form has referred to autonomous ideas that mediate between people and culture. However, as Deleuze tells us,⁵ dialectical positions operate with polarities, extremes of difference which are synthesized into a new, third position that, because it remains "in between", ultimately preserves these polarities and thus the status quo. Therefore, in neither the unmediated nor the mediated approaches to culture and form have objects or subjects been considered simultaneously in a way that would allow them to have an influence on one another. This is how architectural culture was defined until the 1970s.

Unmediated forms

The approach that gives priority to the physical object has a long history, including the ancient Greek concept of *techné*, understood as the rational basis for the construction of objects, and medieval ideas of the mechanical arts, which considered built forms as utilitarian objects. It is found in the writings of Gottfried Semper in the nineteenth century, who advanced a theory of style that derived objective principles from systems, structures or manufacturing techniques which

could be used to determine the external appearance of objects and relate them to their context. In the same period, Viollet-le-Duc advanced his theory of structural rationalism, which concerned itself with functional efficiency and the honest expression of structures and materials as the basis for the external appearance of forms. For Modern Movement architects such as Walter Gropius, the machine aesthetic and the techniques of mass production served as the inspiration for built forms. Later in the twentieth century Aldo Rossi proposed a system of structural and spatial typology as another objective basis for style.

Conversely, approaches that focused on the intellectual process⁶ rather than the practical result include much of the literature on *disegno*, which was elaborated by Leon Battista Alberti in Florence and was later taken up by Vasari. *Disegno* meant more than the practice of “drawing” and more than the modern notion of “design” (in the sense of composition or pattern), although both words have been used to translate it. Crucial to *disegno* was the intellectual idea or concept present in the mind of the artist. The principles of perspective enabled artists and architects such as Leonardo da Vinci and Andrea Palladio to create their own ideal visualization of an object or scene, as distinct from its actual appearance, and to place it in a harmonious relationship with human beings. Discussions of architectural character, led in the seventeenth century by Perrault⁷ and in the eighteenth by Boullée, Ledoux and others, sought to establish a new language of forms – a “speaking architecture” (*architecture parlante*) based on simple geometrical forms – that would enable people to grasp the purpose and character of buildings. In the twentieth century Le Corbusier, in line with these earlier ideas, advocated the use of simple geometric objects that could be easily grasped. His use of the Modulor as a universal system of proportion for the elements of a built form, conceived in relation to the human form, and the *tracés régulateurs* – the outlines of existing buildings that he drew in search of the rules of their visual harmony – reflected his interest in the way forms would be perceived rather than the way they were produced. Later in the twentieth century, the CIAM group, including Siegfried Giedion, Josep Lluís Sert and Fernand Léger, and others such as Alison and Peter Smithson (New Brutalism) and Aldo van Eyck (Structuralism), were more concerned with collectivity than the production of the object, and attempted to incorporate a humanistic approach into the design of built forms.

Deconstruction, promoted in the 1980s by architects and architectural critics such as Bernard Tschumi, Mark Wigley and Philip Johnson, aimed to supplant purely object- or subject-oriented systems by creating a direct confrontation between them. The technique of collage was proposed as a way of acknowledging the differences – and the disjunctions – between object and subject that were being exposed in the post-modern era. In this approach, Wigley wrote, “forms are disturbed and only then given a functional program . . . Instead of forms following function, function follows deformation.”⁸ Such deformations, however, when uninformed by a functional program, ultimately resulted in a disconnect between objective and subjective concerns.

Mediated forms

Reacting to modernism's pure focus on the object (technology, machines, structure), theorists and architects of the 1970s sought a way of mediating⁹ between object (built form) and subject (people, the environment). Robert Venturi and Denise Scott-Brown advocated the addition of historical symbols or allegories (metaphors) to the modernist object as a way to contradict the rational and consistent disposition of structure and program, in order to project a "richness of meaning"¹⁰ and, as Charles Jenks has suggested, to create "a complexification of modern elements with other ones, that is, a double-coding".¹¹ Complexity was deemed synonymous with contradiction, as was apparent contradiction with actual contradiction. But a built form, even if consistent as a whole, is rarely perceived as such and can therefore elicit different, even contradictory, perceptions, and generate different responses. Moreover, the strategy of applying or assigning meanings to objects ultimately subordinated subjective considerations to objective ones, while the contradictions, or disjunctions, between form and the elements that projected meaning prevented any creative interaction between them, maintaining the duality between objective and subjective considerations and resulting in "double meanings rather than double functions".¹² Moreover, with the advent of globalization, symbols became increasingly ineffectual as a way of communicating meaning.

Another form of mediation, the "index", has been advanced in different ways by Peter Eisenman and Michael Hays as an alternative to pre-existing meanings. In his writings and work during the 1970s and early 1980s, Peter Eisenman proposed "autonomy of form" as the index that mediates between built forms and culture. The concept of autonomy, he argued, would enable architects to detach form from the way it had been previously actualized, thus limiting "the internal processes of architecture to their own internal possibilities", so that "the discipline is critical within its own project".¹³ Accordingly, form would be inherently critical and would "not rely on an external, subjective judgment of taste or value". However, by inhabiting a position of autonomy and confining itself to the intellectual and conceptual matters that concern built form (the object), this approach excluded social and environmental concerns. Detached from these other spheres, form as a purely conceptual index was unable to connect the object to the full range of subjects that concern built forms.

Michael Hays proposed an alternative approach in which "authorship" would serve as the index of a dialectical relationship between an autonomous formal concept, on the one hand, and the dominant external culture – the "free market" – on the other. Adopting a third, different, position, the designer would oppose the market's pure focus on economic objectives and its disregard for subjective concerns, in order to grow "knowledge according to its [the discipline's] own special beginnings and conventions".¹⁴ This notion of detachment assumed that knowledge of the discipline's procedures was sufficient to oppose the dominant culture.



It also implied that the role of mediation is subordinate within a culture which is static. However, culture is moving at an ever-accelerating pace, continually absorbing and co-opting critical positions, and it is no longer possible to grasp its perpetually changing processes from a position of detachment.

More recently, Jeffrey Kipnis¹⁵ has also proposed index as a form of mediation between built forms and culture. In a discussion of indexical relationships between the two, he suggests “that new feelings erupt into the world, that design and the arts give diverse and specific material moments to these feelings”. The idea that feelings and sensations are related to materiality is crucial, as these can only exist in the material world. But the question remains whether architecture is a medium that gives form to existing sensations, or whether the sensations are the product of the architecture itself. In other words, is architecture a form of mediation (an instrument of culture, criticism, etc.) and a product of culture, or is it a producer of culture?

Given the molecular nature of contemporary reality, forms of mediation have become elusive. Just as spoken and written language can function in radically different ways in different cultures, so can the relationship of people to built forms. When addressing an audience, we cannot assume universal fluency in or comprehension of a single language. Mediation, which is intended to facilitate communication, can just as easily obscure it. Attempts to relate built forms and people through an external medium are therefore destined to remain marginal and ineffectual.

Novel forms

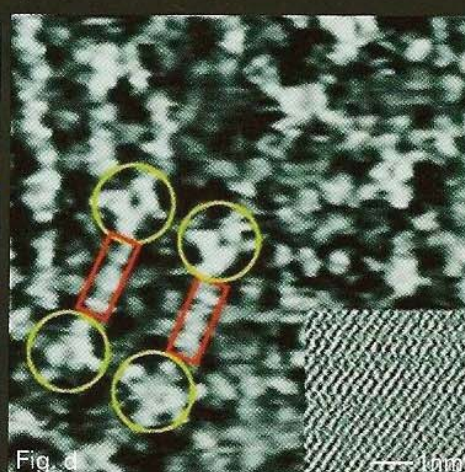
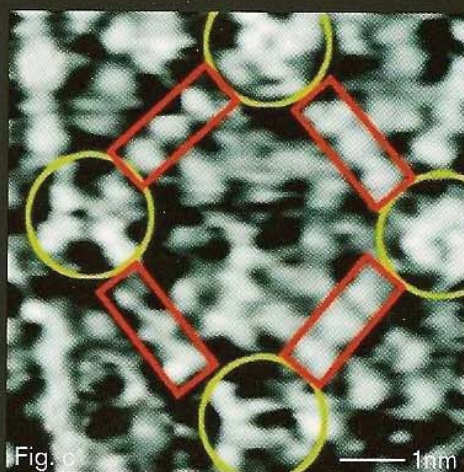
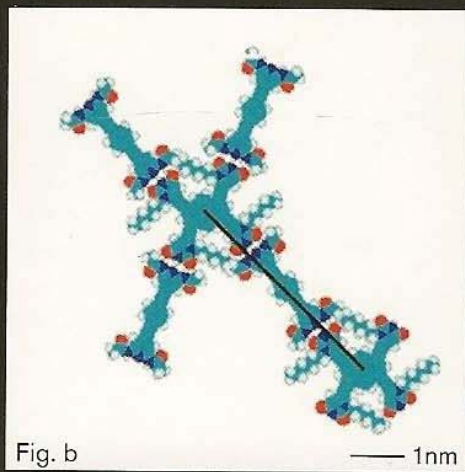
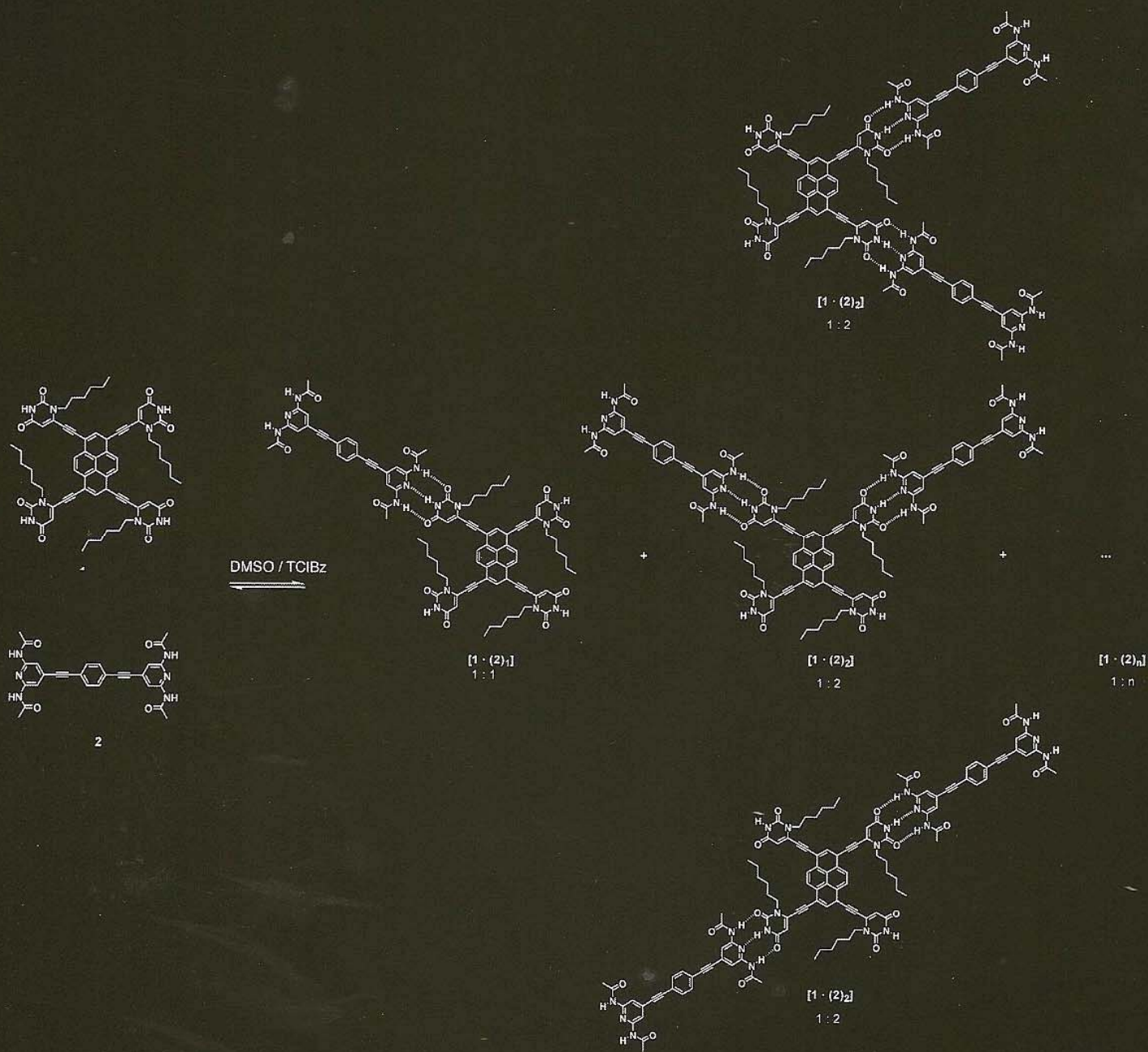
Since the 1970s, capitalism has entered a new phase characterized by decentralization and the transnationalization of production. Systems of production and consumption have been transformed as a consequence. The mass production of standardized goods has given way to a new mode of production, known as Flexible Specialization, which has introduced systems of labor and machines that can mass-customize products to cater to micro-markets and individual consumers. Driven by the need for novelty rather than volume, this new mode of production is establishing a connection between the way products are made and the way they are perceived. No longer exclusively a homogenizing force, capitalism now contributes to the production of difference and novelty.

Remember the pasta sauce your parents used to serve, then consider the fact that there are now thirty-six varieties of Ragú spaghetti sauce¹⁶ available at the supermarket. We may lament the global expansion of Starbucks, but it is easy to forget how uniform and bland coffee was before in most parts of the world. Now it can be customized: selecting from a wide range of coffee beans, ways of brewing the coffee, syrups to blend with it, choices of quantity and temperature, types of

milk or cream as well as sweeteners, Starbucks can make your coffee in 70,000 different ways. Denim jeans, once a ubiquitous uniform, have been diversified into cuts, wash-types and designs. Now they can be low-rise or ultra-low-rise, stone-washed, black, blue or white, flare-leg, boot-leg or straight-leg, with front pockets, back pockets or both, with or without studs, with or without colored stitching, branded or not, etc. In the automobile industry, sensorial qualities are being incorporated into the design of cars to multiply the options available to consumers. The appearance of a Fiat 500 can be customized in over 500,000 different ways by the addition of accessories or interior and exterior colors. Volkswagen cars, whether you are considering a Polo Match, a Polo Blue Motion or a Polo SE, may all be pretty much the same as technical systems, but they can be differentiated by endless options, including color, upholstery, internal lighting, sound system, or the shape of the rear lights. Such variations may not change the way the car functions technically, but they diversify the perception and sensation of driving it.

Industry crossovers have created another genre of differentiation, from internet cafés and music store cafés to crossovers between different fashion categories. In traditional tailoring and sportswear, decorative motifs, inscriptions, humor, textures and patterns which are typical of one have been transferred to and merged with the other. This interaction between two very different areas of fashion has not only introduced decorum to sportswear and comfort to traditional tailoring, but has fostered a multitude of novel fashion identities. Differentiation has also played an important role in the sciences and in the engineering of new structures and materials. All proteins are constructed from only twenty simple molecules of amino acid. However, the number of molecules and the sequences in which they are assembled determine the different proteins, each with a different function, enabling an organism to function in different ways. The multicolored flash of an opal is created by the organized self-assembly of identical building blocks. In this case, the difference in size of small spheres of quartz crystal that measures only in thousandths of a millimeter determines the wavelengths, and therefore the colors, of the reflected light. Similar principles underlie the design of photonic materials that direct the communications signals in the bundles of optical fibers that form the backbone of the internet. Even more intriguing, millimeter-scaled metal rings and other shapes are being assembled into special cloaking devices, whereby different orientations and slight variations of these elements can make the objects placed inside them invisible to the outside world. Finally, in the emerging multidisciplinary field of supramolecular chemistry a new family of molecular structures is being created from a small set of molecular building blocks, or sub-units. Designed with special connecting points on their ends, these sub-units have a unique structural outline and set of electrostatic charges which enable them to link up with complementary points on other sub-units. The way these connections are made can be altered by a change in the chemical environment, making it possible to create a variety of "supramolecular" structures





from a small number of units. This potential is being exploited to create new materials for electronic, optical and biological applications.

The internet and other forms of new technology have similarly contributed to the production of different products, tools and services. An increasing freedom from the constraints of experience, context and history, and a mass of easily accessible data, have made it easier to gather information from disparate sources and disciplines, and combine it into heterogeneous ideas and objects. Novel combinatory forms have entered every aspect of our lives to such an extent that the traditional oppositions – between people and things (objects and subjects), between technology and sensation, between production and perception – are no longer valid.

However, a distinction needs to be drawn between the New and the Novel. We are inundated by a whole variety of products such as sci-fi movies portraying a “new” world based on technology, or boy bands and girl groups based on the presumption that three or four individuals of the same sex but apparently different from one another, when combined into a group, can redefine pop culture. The New relies on an external, autonomous force to bring about an abrupt and complete change in a particular cultural sphere, discarding all existing forms. In order for culture to change, there has to be a foundational shift. In the absence of such a shift, culture remains static, unable to generate its own possibilities of change and development.

The Novel, by contrast, is the product of evolution rather than revolution – the result of one existing form combining with another to become a different¹⁷ form that meets a specific purpose, a cause. Novel forms are not random. Donald A. Crosby explains that novelty is a principle of selection that innovates through the exclusion of choices made available by causal processes.¹⁸ Thus novelty is never the replication of an existing form, but always a different form. Causes and novel forms inhabit a feedback loop: causes motivate the act of innovation that results in different forms, while novel forms make causes perceptible.

In all of the cases described above – whether it be the production of spaghetti sauce or coffee or jeans or cars – we have seen that the market produces novelty with the single and fundamental causality of sustaining and growing itself. In this sense, novelties produced by the market limit our freedom, since our choices can be limited by economic causes, which may be antithetical to other causes such as individual purpose or expression. If we allow the market to be the only source

Opposite page: **Fig. a:** Diagram showing some of the supramolecular structures that can be created from two simpler building-blocks, molecules 1 and 2. Successful assembly in this case depends on the choice of solvent for the molecules: if the molecules are dissolved in water, they do not adhere to each other, but if dissolved in gasoline they do.

Figs. b, c, d: Images of these supramolecules, created on a thin sheet of graphite (pencil lead) and recorded with a special microscope that can detect the individual atoms as (blurry) white dots. The atoms in image a are divided into two sub-units, illustrated in several different arrangements by image b. The sub-units are clearly visible in the zoomed-in images c and d. Note that the scale of these images is given in nanometers, or billionths of a meter. The molecular sub-units themselves are less than a thousandth of the width of a human hair. A. Llanes-Pallas, C. A. Palma, L. Piot, A. Belbakra, A. Listorti, M. Prato, P. Samori, N. Armadori, D. Bonifazi, *Journal of the American Chemical Society* 2, vol. 131 (2009), pp. 509–20.

of novel forms, culture will become stagnant and homogeneous. The fundamental challenge for architects and other producers of culture is to imbue the production of forms with a diversity of goals and causes which are not solely market-driven, thereby contributing to an environment that connects individuals to multitude of choices.

Though practicing in very different stages of the capitalist era, Mies van de Rohe and Rem Koolhaas are two architects who have succeeded in diverting market-driven causes towards architectural goals. Mies, who witnessed the advent of Fordism, recognized its huge potential for the building industry. Modern steel-frame construction enabled built forms to be liberated from the solidity and opacity of premodern construction, allowing for the development of a new, freer relationship between the interior and exterior of a building. Adopting the elements of Fordist building culture – the repetition of prefabricated steel components – Mies created careful architectonic assemblages, embedding spaces with an openness, transparency and tranquility that would contrast with the chaotic nature of the city. In each of his buildings, Mies dissected the tectonics of the frame (slab, rolled angles, channels, I-beams, and H-columns) and the enclosing skin differently. For example, in some of his long-span structures, the beam is placed inside the space, while in others it is above the roof. These beams could be part of a system based on a one-way frame, a two-way frame or a space frame; the exterior skin, almost always made of glass, would fill the spaces between the frame, which in turn could be left as raw structure or embellished with additional columns attached to it, in order to embed it with an affect of verticality. Mies sometimes used I-shaped columns, and cruciform columns at others; the junction between the columns and the beams or slabs was detailed in different ways, but always revealing the difference between the two elements. Such variations were internal to the frame, however, and did not alter its form. According to Mies, form was abstract, devoid of building problems that he was interested in. Mies believed that “it was not the task of architecture to invent form . . . it was a question of truth”¹⁹ directed “towards a spiritual purpose”.²⁰ And, with regard to the similarities between the Bacardi building and the National Gallery in Berlin, he said he refused “to design a new architecture every Monday morning. The Greeks needed hundreds of years to complete the Doric Column, and it’s all to do with completion.” Instead, Mies focused on creating ideal spaces through the repetition and variation of the steel-frame system. The success of this approach, he believed, was to be measured by its “beauty” and truth.

In his essay on the Ugly, Mark Cousins has written that, “from antiquity and massively reinforced by Christianity, we inherit a philosophical trinity of the Beautiful, the Good and the True” and this trinity has survived in the grouping of the negative of these terms – Ugly, Evil and Error – which “produces the theoretical basis for persecution and stigmatization”.²¹ “True”, for Mies, meant building according to the logic of materials; “good” meant serving the purpose for which the building was intended. Accordingly, a building made in this way would be “beautiful”. Given the multiplicity of contemporary culture, it seems inevitable that the idea of truth or beauty

as a measure of architectural merit has to be reconsidered. There can be no fixed definition of beauty, whether it relates to modes of building construction, the aesthetics of a composition, or moral and spiritual concerns. Beauty has to be considered in relative terms.

Like Mies, Rem Koolhaas embraces “ready-made” cultural forms and the technology of capitalism. But, whereas in the Fordist era technology acted as an autonomous force and affected built forms through the mechanics of industrial production, Koolhaas seeks to engage with it as a sociopolitical force operating in a broader arena, where social concerns and technological outputs are intermeshed. Mies manipulated tectonic structure to create an “ideal” beauty, expressed through the purity of the systems he assembled, while Rem Koolhaas embraces the hybrid nature of culture to challenge Miesian notions such as the timeless, the authentic or the pure. Instead, he explores the disposable, the synthetic, and the hybrid. By reappropriating materials such as plastic, cardboard, color and imagery, and assembling them into novel combinations, Koolhaas/OMA have challenged ideal beauty, producing built forms that respond to the flows, the mutability and the diversity of contemporary culture.

The question remains: how can a building perform as a multiplicity? Once assembled, built forms are fixed. Even if we pursue modernist and mechanical ideas of flexibility in which the elements of a building are designed to be movable, or spaces are designed to be adaptable to a variety of purposes, once the reconfiguration has taken place, the elements are, again, fixed and immovable. A possible explanation as to how forms, despite their origin, or the methods or intentions of the designer, can elicit multiple interpretations, and avoid being fixed, can be found in Deleuze’s discussion of affect. The term “affect” has been interpreted in many different ways which are most commonly associated with emotions and feelings. Deleuze’s interpretation (based on Spinoza’s *affectus*),²² as distinct from affections (Spinoza’s *affectio*), gives it a precise definition and helps us to understand how forms can perform as a multiplicity. According to Deleuze, an affection, such as a perception, relates to the state of a body which is due to the action of another body or form. Since this affection has to be enveloped by the human body, it is subject to personal, biographical or social mediation. Affect, on the other hand, is an “intensity” transmitted directly by an individual or form, the specific qualities of which depend on the characteristics of that individual or form. Affections are the effect of a form on individuals and are subject to different types of mediation, whereas affects are pre-personal and unmediated and can generate different affections in different persons.

The perception of an architectural form involves two stages. First, an affect is transmitted by a form. This affect is then processed by the senses to produce unique affections – thoughts, feelings, emotions and moods. As an affect can unfold into different affections or interpretations in different beings, it embeds a form with the ability to be perceived in multiple ways. Through the agency of specific affects, in each instance an architectural form performs as a singular multiplicity – as a “function” that connects human beings to their environment as well as each

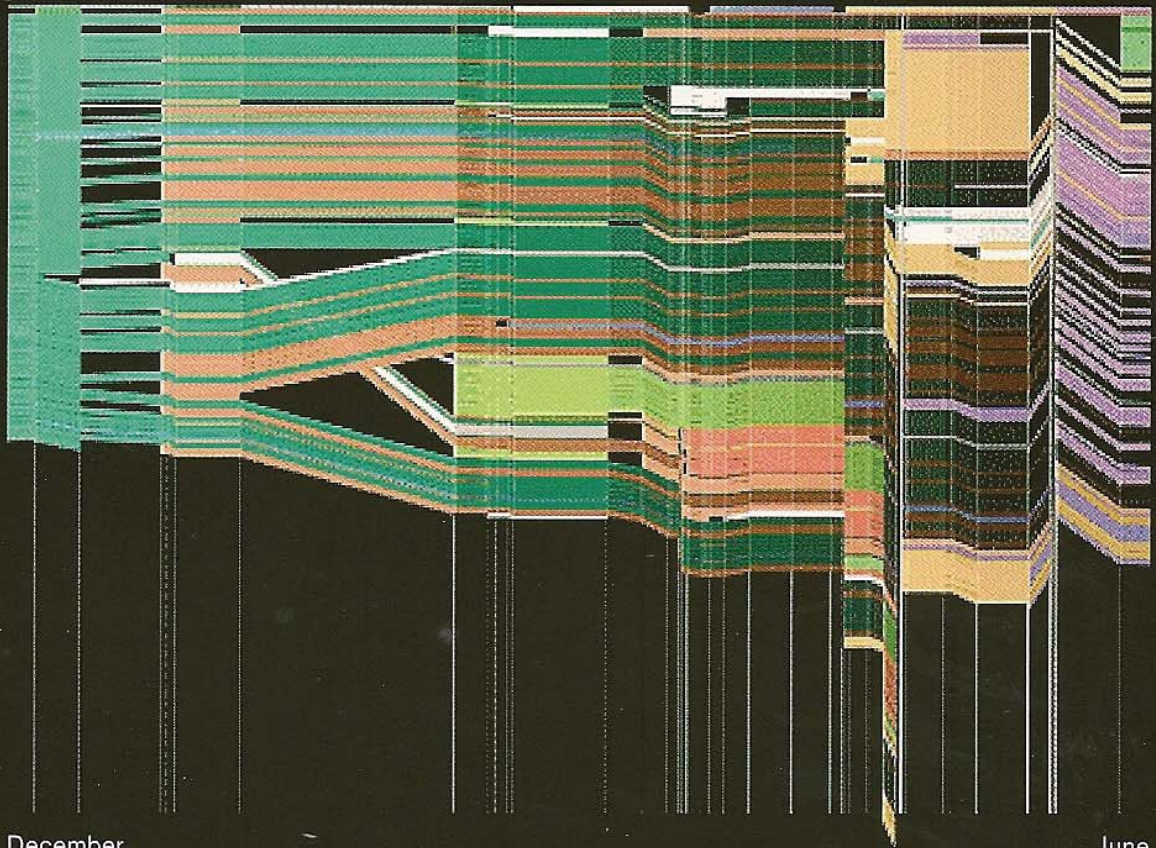
other, albeit in different ways.²³ In order to explore forms as multiplicities, designers need to focus on their affective functions.

We are very familiar with the affects Mies pursued: rationality, order, lightness, disappearance. It is also well known that he was interested in more than merely the rational assembly of architectonic elements, or the most efficient means of assembling a structural system. Rather, he sought the appearance and experience of rationality. He saw in the steel frame an opportunity to create ideal, free spaces which avoided both the “chaotic” affects of the modern metropolis and the heaviness and representational figuration of classical architecture. Mies well understood the affective potential of architectural forms, and in his works these affects are finely tuned and directed at eliciting a singular and clearly defined experience. The simple repetition of the steel frame contributes to the appearance of rationality. The way the elements are combined is always visible and the different elements of the forms remain distinct. Columns never merge with slabs, the mullions of the frame never merge with the infill panels. There is always a connecting element or a change in color or material.

Mies's interest in controlling the perception of rationality in his buildings is illustrated by the Seagram building in New York (p. 74). He designed this building to be viewed from Park Avenue as a pristine, slender, vertical tower. In fact, considerable effort was required to embed these affects. The tower has an irregular volume. The three modules that, viewed from Park Avenue, appear to make up the depth of the tower were in fact extended at the back by a further three bays to house ancillary uses. These were introduced by stepping the volume in to preserve the slender, three-by-five-module extrusion facing Park Avenue. Had Mies simply added the ancillary spaces as an extension of the bays on the Park Avenue frontage, the tower would have entirely different proportions, being six bays deep, with only five bays on Park Avenue. Not only would this have transmitted an affect of stumpiness rather than slenderness, it would also have changed the orientation of the tower away from its entry plaza on Park Avenue. Mies disguised the functional requirements of the building in order to produce a simple, extruded form. Even though he varied the tectonic elements of the steel frame – its “ornaments” (joints, seams, shapes, colors, depth) – the combinations were systematically controlled in the interest of conveying the sensation of rationality.

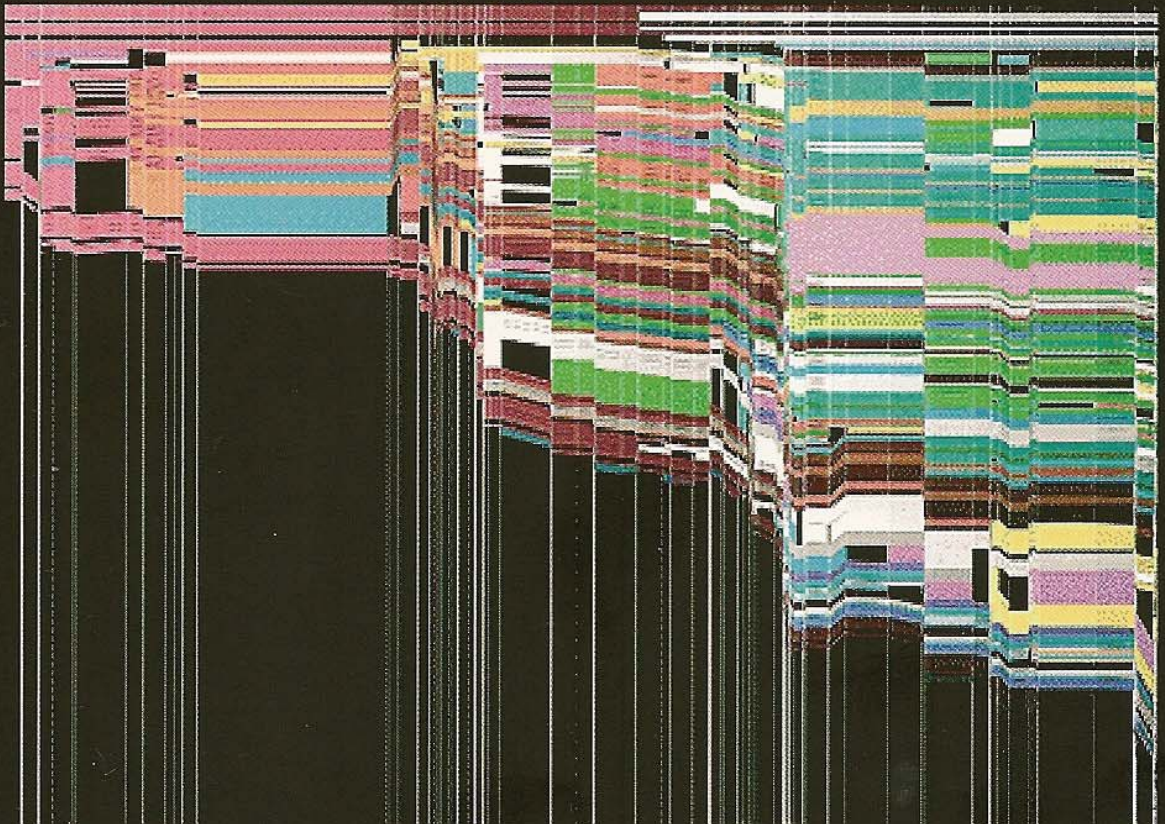
Certain parallels could be drawn between the way Mies's forms work and gym equipment. The typical piece of gym equipment is fixed and one-track-minded, developing a single muscle at a time through linear or isolated patterns of movement. A bench-press works your arms, a butterfly-press works your pecs, over and over again. The exercises require no coordination or concentration

Opposite page: *History Flow*, designed by IBM's Watson Research Center, is a tool for creating images of the evolution of a text and the interactions of multiple authors. The illustration above shows the Wikipedia entries on abortion and chocolate. The vertical lines track new versions and the colors track the contributions of individual editors. The form of the resulting pattern is intrinsic to the material being combined at a given moment, reflecting the transversal nature of Wikipedia as an information forum. Credits: Fernanda Viégas and Martin Wattenberg, Visual Communication Lab, IBM Research



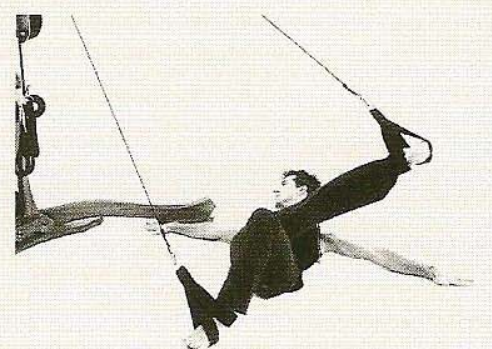
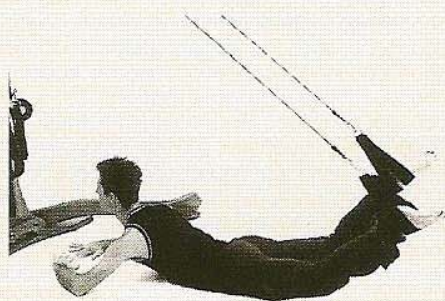
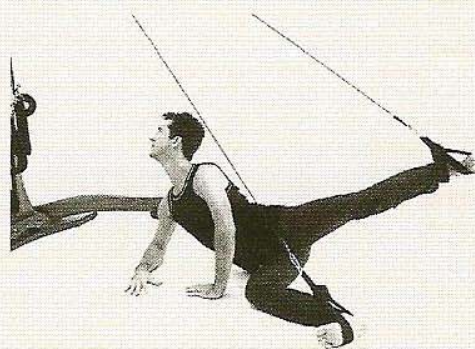
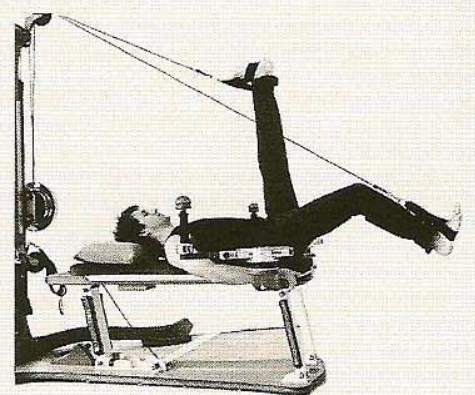
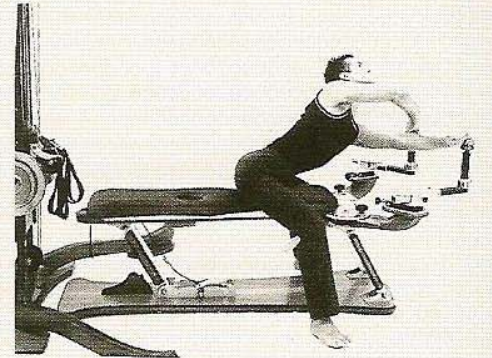
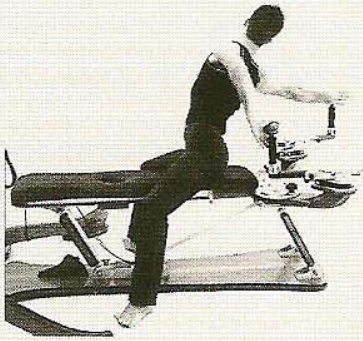
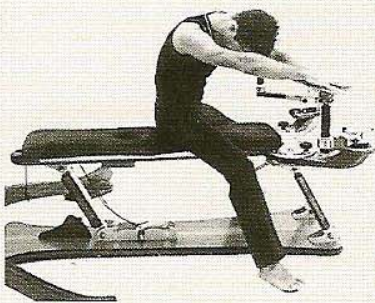
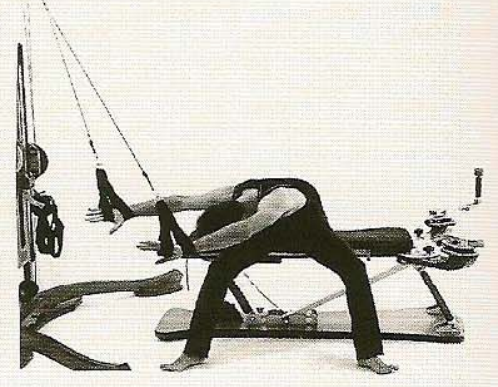
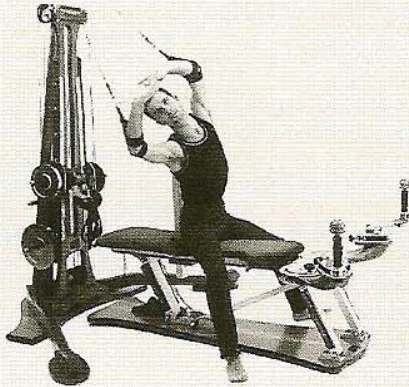
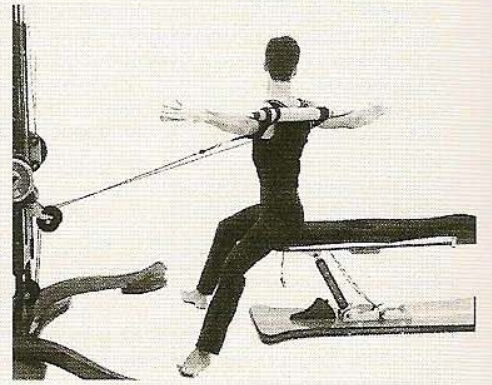
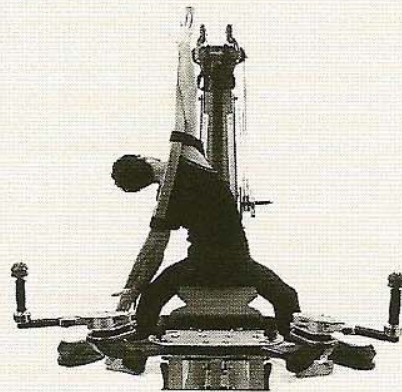
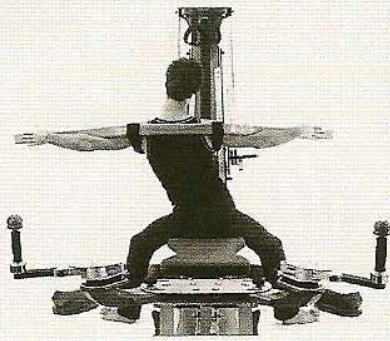
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– just your muscles: “the mechanics” of the body. Accordingly, most gyms are full of television screens, iPods and mobile phones. If you exercise with enough of the different types of equipment, you can achieve the promised “ideal” body, but you will almost certainly be uncoordinated.

Deleuze has proposed the substitution of machines for mechanisms. He associates mechanisms, which have a fixed function that they perform by themselves, over and over, with closed, autonomous forms that have a fixed identity, whereas machines depend on the connections they make with other machines, including the human body, and therefore have the capacity to foster multiple interpretations and an open-ended relationship between forms and people. Gyrotonic® machines, for example, are entirely different from conventional, pre-programmed gym equipment. The body and the machine work together in a holistic manner to develop not only isolated sets of muscles but whole functional lines of the body, including the connective tissue, ligaments, nerves and the energy that flows through these lines. You can control the machine as well as the exercises, which are synchronized with your own breathing patterns. If you stop breathing or if you lose concentration, you lose coordination and your machine is disassembled. It is your own interaction with the machine that unfolds the different exercises, and triggers the different functions according to your own needs, whether they be getting fit or lean, healing, or relaxing.

Closer examination of the steel frame reveals it to be more open than Mies allowed it to be. The steel frame is a structurally specific material system that responds not only to its own weight but also to external forces. Together, they produce a specific pattern of load distribution and constitute a specific assemblage of beams and columns, known as the frame structure. If the steel is replaced by glass, the load pattern is entirely different and produces a different material system. If the external loads are varied, the assemblage of beams and columns need to alter to allow yet another pattern of load distribution. As a material system, the steel frame carries traits which are sensible and affective as well as structural. When the frame converges with environmental forces such as wind, gravity, rain, snow, or with subjective forces such as the desire for different rises, spans or profiles, it takes on a unique form with varied affects. From the New York skyscraper, to projects such as 111 First Street, WTC, Agadir, and Jussieu Library, as well as the CCTV building (analyzed in this book on pp. 100-1), Koolhaas/OMA have explored the versatility of the frame, combining it with different external forces (spatial desires, circulation needs, the physical context) to produce novel forms, sensations and affects. Rem Koolhaas describes OMA's buildings as a “machine to fabricate fantasy – structured for others to have eureka^s”.²⁴ Instead of protecting the “purity of the frame”, as Mies did, these constructions by OMA invite “contamination” by external factors to generate hybrid forms that trigger a variety of affects – differentiation, skewing, continuity, contingency, immersion, compression, simulation. The Kunsthal

Opposite page: Most conventional fitness equipment segments the body – pecs, abs, biceps – and exercises isolated muscles in a linear sequence. The Gyrotonic® Pulley Tower works on the mind and entire functional lines of the body simultaneously, including muscles, ligaments, joints, nerves and the energy that flows through them. Photos courtesy of Gyrotonic®.

uses the frame in a non-repetitive manner, resisting a simple delimitation of interior- exterior. The WTC tower complex uses the frame in a non-extruded manner to create an “upside-down figure” with a stepped profile which is reminiscent of art deco. 111 First Street (p. 76) stacks tower blocks on top of one another. Looking up at the tower, you wonder if you are looking at a series of weightless towers, floating towers, or a pile of heavy boxes about to fall on top of you – or, indeed, if this is a giant looking down at you, since the three blocks resemble the legs, torso and head of a human being. For Rem Koolhaas, “coherence . . . is either cosmetic or the result of self-censorship”.²⁵ This of course does not mean that forms do not need coherence or that design is by nature not an act of censorship (selection). The work of Koolhaas/OMA questions the image of coherence in order to avoid limiting the building’s affective possibilities.

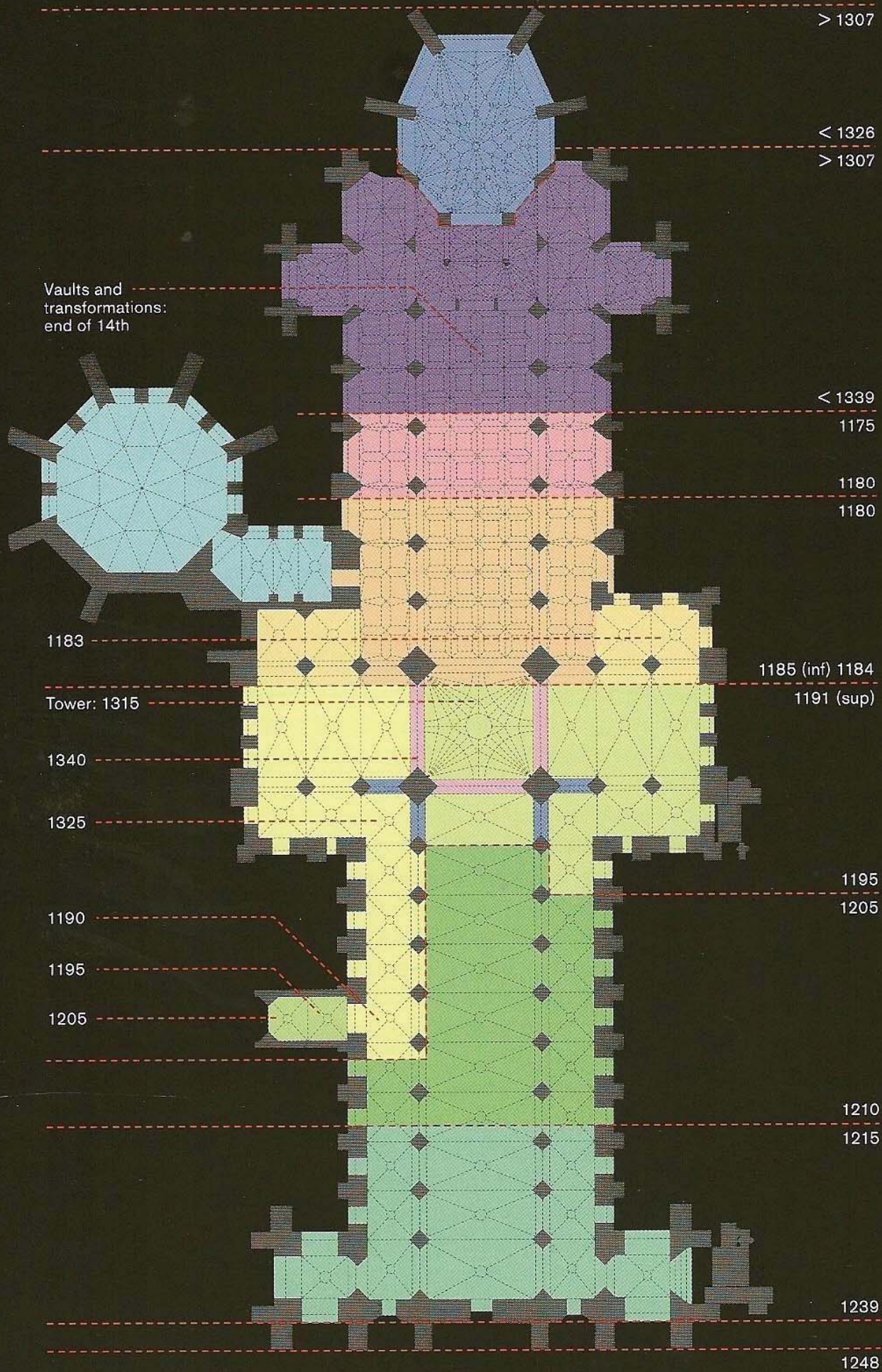
Other projects that perform as a multiplicity are documented in this book. One example is the Yokohama International Port Terminal by FOA (p. 392). Although St. John’s Abbey by Marcel Breuer (p. 352) or the Air Force Academy Chapel by SOM (p. 386) also use a folded plate structure, they simply repeat it to produce a single, undifferentiated space and, consequently, a single percept, triggering the same affects of pleating, axially and uniformity throughout. The material system of Yokohama International Port Terminal is a hybrid composed of steel folded plates and pairs of steel girder bridge systems, which together make it possible for the form to vary along both its length and its width to cater for varying programmatic, circulatory, structural, and services requirements as well as those of the predetermined asymmetrical foundation piles. Girder bridge systems allow the orientation, geometry and length of the circulation system to shift in order to accommodate disparate requirements, while the folded plates shift in orientation, scale of folding and sectional profile to accommodate different spans and changes to the girders. The hybrid nature of this material system results in a complex form providing spatial variety as well as multiple percepts and affects. The parking level transmits affects of flatness, pleating, openness and axially, and efficiency, while the terminal level transmits arching, pleating, diagonality, asymmetry and purposefulness, and the roof plaza transmits undulation, smoothness, landscape, valley, mountain and perambulation. These diverse affects contribute to a variety of percepts – origami; landscape; a whale, ship deck, pier or wave – and ensure that the terminal is not reducible to a single interpretation or meaning.

Similar explorations of the diagrid by OMA and FOA have generated other novel forms. Since the triangular members of a diagrid can distribute gravitational loads as well as lateral forces, they obviate the need for the conventional vertical columns on the building perimeter, allowing more freedom in the floor plan, and the construction of complex tubular forms. Two examples of tower forms that explore the characteristic elasticity of the diagrid are 30 St. Mary Axe (p. 120) and the Hearst Headquarters (p. 102), both by Foster and Partners. 30 St. Mary Axe (Swiss Re) uses the diagrid as part of the main load-bearing system, and the diameter of its floors varies in size to produce a tower with a conical profile. The diagrid is carefully designed to transmit affects of latticing and twisting. The cross-bars – composed of a series of two-story-high triangular A-frames

which are placed end to end – are painted a very dark blue, while the diagonals are white, so that the form reads externally as a pattern of four-story-high diamond shapes. Two colors of glass are used to clad the diagrid, with a darker shade assigned to the diagonal atrium that extends along the height of the building to transmit an affect of twisting. More than merely a product of inventive engineering, Swiss Re is a unique example of the integration of engineering with sensorial desires. On the other hand, the building remains isomorphic, much like the Hearst Tower in New York. Because both of these buildings are based on a symmetrical plan form (the circle and the square) they perform in the same way in all orientations. The Hearst Tower uses two plan shapes, a rectangle and an octagon, which repeat cyclically to create a tower form that transmits affects of crystallinity and three-dimensional latticing. Both towers are situated in dense urban conditions, where they can be seen from many different directions, and by appearing the same from every direction they confine different people's interactions with the towers to identical percepts.

The CCTV Headquarters by OMA (p. 100) performs very differently in each of its orientations. Six horizontal and vertical sections are grouped around an open center. The horizontal and vertical sections join as a continuous loop, dispensing with vertical corner columns that would reinforce the division between the sections, to create a complex form with an irregular diagrid on its enclosing surfaces. Unfolding through a series of ever-changing percepts, reminiscent of cinematic images, the building transmits affects of gradation, differentiation, latticing and looping. The P&O Elizabeth Tower by FOA (p. 114) also explores the potential of the diagrid to produce, in this case, a vertical tube with a crystalline form. The tower has a diamond rather than a rectangular plan-shape, which is mirrored in orientation in twelve-story sections. Each of the intermediate floors is slightly different in order to mediate between the two plan orientations, creating a non-extruded twelve-story-high section. This section is repeated and mirrored three times to create the overall form. The result is a complex form that appears broad from some directions and slender from others, and thus transmits a variety of affects such as crystallinity, latticing, asymmetry, slenderness and broadness, triggering multiple percepts – an “hourglass” from St. James's and Elephant & Castle, a diamond from Embankment and Southwark, a spire from Vauxhall and London Bridge.

These are projects which move design beyond the construction of a static identity and the representation of a single critical position. Like a kind of political physiology, they overcome the conventional split between concepts and percepts, opening the design process to the different ways in which they can combine to develop forms that allow people with differing views and sensibilities to develop an affective relationship with their environment. Contemporary reality with its molecularized nature offers an infinite variety of possible combinations. But in order to avoid the formation of identical combinations and a homogeneous environment – to ensure that “difference inhabits repetition”, as Deleuze describes it – we need to reconsider the systems used to generate such combinations.



The production of form

Throughout the history of architecture the development of built forms has unfolded within two systems that could broadly be described as top-down, in which a single principle determined the relationship between an ideal whole and its constituent parts, and bottom-up, where a single principle determined a system of parts that were repeated to produce the whole.

The top-down approach can be traced back to the architecture of the ancient Greeks and Romans, which tried to imitate the beauty of natural forms. Greek systems of proportion based on the Golden Section and the system of symmetry and ideal proportions described to us by Vitruvius provided a hierarchical framework for determining the relation between the parts and the whole. During the Renaissance, a figure, type or grid, as in Leonardo's centrally organized plans for churches or the tartan grid used by Palladio in his villa plans, provided two-dimensional "ideal" rules which, with the aid of the technique of perspective, were transformed into three-dimensional ideal wholes from which the parts were generated. Although these wholes could be combined to produce variations, as in the case of Leonardo's churches or Palladio's villas, the possible combinations were limited by the symbolism embedded in the originating rules. In the seventeenth century and later, during the Enlightenment, these earlier aesthetic and metaphysical systems were replaced by typology,²⁶ which emerged as an epistemological system for determining the whole and its parts. The idea of architectural "character", as proposed by architects and theorists such as Boullée and Ledoux, served as the basis for a system of elementary geometric forms and applied symbols, each of which was capable of transmitting a unique sensation and therefore appropriate for a particular building type. These forms were then subdivided to produce the individual parts. Durand put forward an alternative typology based on a system of prototypical geometrical units that could be combined to generate different building types. The aim of this rational system was to create an autonomous design method "subject to purely geometric rules of association and efficient",²⁷ which could refocus each assembly towards fitness and economy, seen as the measures of moral utility. This was achieved through the simplicity, regularity and symmetry of the parts and the resulting compositions. However, such a fixed notion of utility limited the way the elements could be combined and ultimately this too was a closed, part-to-whole system. In the twentieth century, typology was defined by post-modern theorists such as Aldo Rossi²⁸ and Robert Venturi as a set of formal properties that can be repeated to produce built forms. Rossi proposed a set of highly reduced structural and spatial types, derived from the vernacular and classical traditions, as the constituents of the city as a whole, whereas Venturi proposed the addition of archetypal symbols to systems of space. Thus typology, in all its different guises, was essentially a top-down system based on a set of ideal or a priori forms.

Opposite page: The building of Wells cathedral began in 1175 and spanned four centuries, under the supervision of a series of bishops, master masons and architects. The inherent flexibility of the Gothic system enabled each phase of expansion to take on a unique spatial configuration, introducing different affects and sensations without compromising the coherence of the whole.

Modernism sought a new approach, a rational system for determining the relationship between whole and its parts, based on principles derived from the processes of mass production. Mies van der Rohe's Seagram headquarters is an example of a building based on modern industrialized building technology, using glass and steel frame construction. Although, as mentioned earlier, any number of silhouettes could have been derived from the steel frame system, Mies pursued the simplest option in order to achieve the image of rationality. During the same period Le Corbusier, with his idea of the Modulor,²⁹ sought to establish a universal proportional system of relating the different elements of a building, from three-dimensional space to structural modules, sections and elevations. This system relied on the human eye, positioned at a predetermined height, rather than the intrinsic dimensional requirements of its constituent parts. Thus the Modulor was also essentially an idealized system of visual control.

A very early example of the bottom-up approach to form can be found in Islamic architecture, in which a system of mathematical formulae governed the repetition of geometrical figures to produce whole surfaces. In the 1960s and 1970s, functionalism, as proposed by CIAM (Dutch structuralists such as Aldo van Eyck, Herman Hertzberger and Piet Blom), and later by Team 10 and the Metabolists, advocated the use of "modules" that could be repeated to produce an architectural whole. The Capsule Hotel in Tokyo, by the Metabolist Kisho Kurokawa, exemplifies this approach. The fourteen-story tower contains 140 individually articulated capsules stacked around a central core, with each capsule designed to be detachable and replaceable. However, this idea of flexibility is limited to the possibility of replacing the capsules and the whole is essentially an addition of identical parts. As in other bottom-up systems, it cannot respond to specific needs. During the same period, Louis Kahn and Robert Le Ricolais produced alternative modular systems in which spatial and structural requirements were related topologically. The intention of this topological approach was to enable the parts to change shape while retaining the same properties. But, because such changes were limited to needs that were internal to the system, they resulted in isomorphic wholes.

Both the top-down and bottom-up approaches to the genesis of form were based on essentialist, idealized views of the world. Geometric systems of proportion, perspective, typology, the Modulor, the geometrical tiling of Islamic architecture, and functionalism were all based on a priori, ideal principles that either repeated the parts or subdivided the whole, in response to concerns that remained internal to the given system. Furthermore, since the parts and the wholes were conceived as fixed geometric aggregates, they could not combine to modify each other.

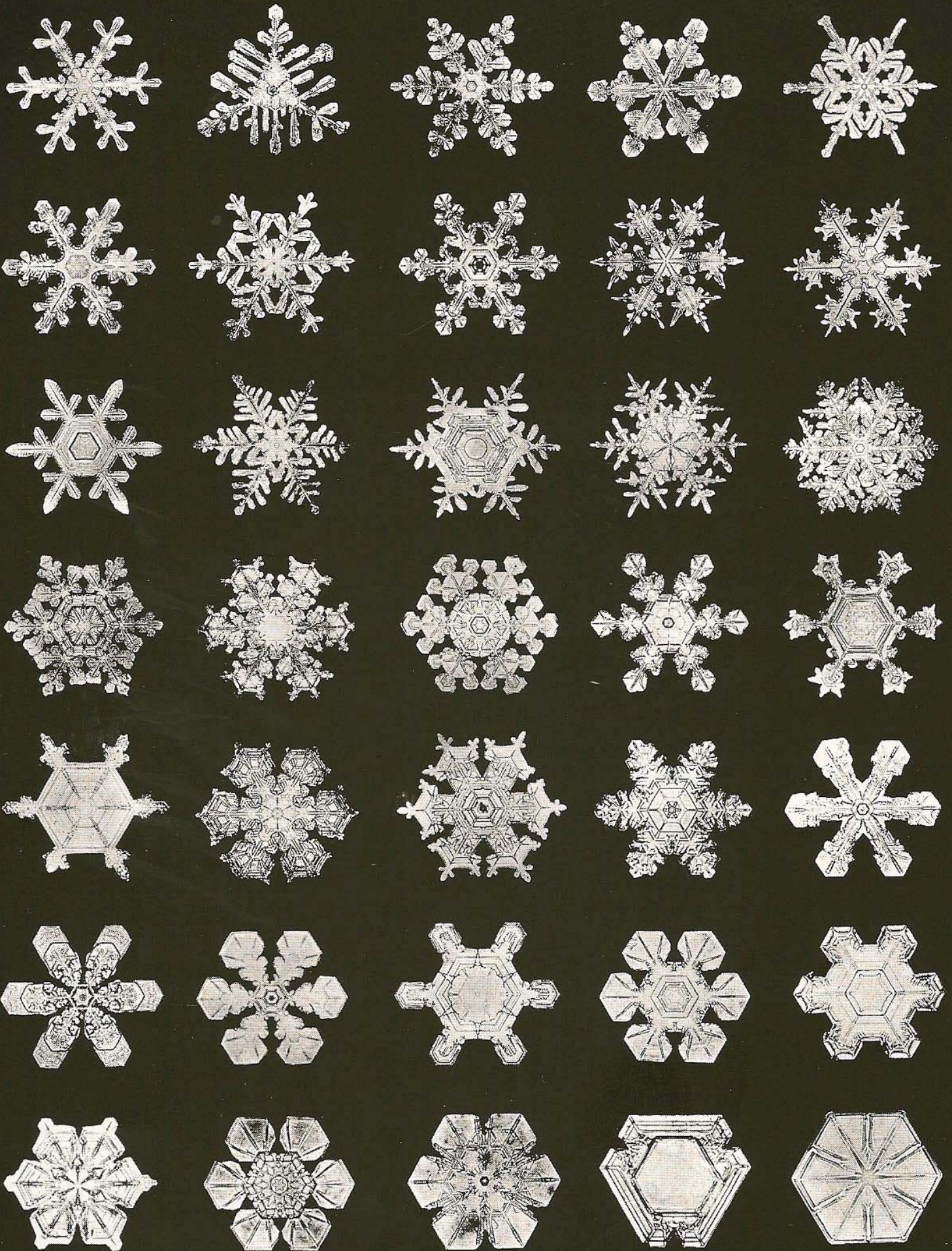
Transversal systems

This book proposes a transversal approach to the production of forms. In a transversal system, a "base unit" assembles a variety of causes and concerns into a complex supramaterial whole – an amorphic rather than hylomorphic whole; that is, the way the elements combine is not

subject to a predetermined system but is specific to those elements. The amorphous nature of the base unit means that it has no fixed shape but is embedded with proto-geometric properties that are physically and geometrically specific but not exact – for example, load-bearing capacities that govern the ways it can tessellate (that is, “repeat and vary”³⁰) in response to external contingencies such as the physical requirements of the site, climate, local tools and technologies, economic factors, or subjective desires. The proto-geometry of the base unit also embeds it with affects that remain a consistent feature of any form it generates. Because the base unit is not geometrically fixed, it is versatile and can vary as it repeats, or even mutate, when hybridized with other base units, into novel and unpredictable forms that are temporally and spatially specific yet capable of responding to external concerns.

Gothic architecture employed a unique transversal system that was simultaneously objective and subjective, technical and sensorial, visual and non-visual, abstract and concrete. Its palette was supramaterial and included gravity as well as stone, light and space as well as glass, and built forms were associated with different types of materials, both physical and non-physical. The base unit of the Gothic system comprised a pair of crossed roof arches with a polygonal ground plan, buttressed by side arches. The crossed roof arches formed a vertical space that embedded the base unit with an affect of verticality and spirituality, while the plan area, with the side aisles set within the buttresses, formed a horizontal space where people could gather. The height of the central and side arches could vary to be either equal or different in height, and the shape of the plan could also vary, with the resulting space ranging from axial to more centrally focused. Accordingly, the relationship between the plan and the enclosing load-bearing structure embedded the base unit with material (physical, structural, sensorial and affective) traits that were realized differently across different sites, resulting in singular forms that not only evoked powerful sensations of lightness, verticality and spirituality, but many others such as ribbing, stepping, asymmetry, crystallinity, cellularity and fanning.

Unlike essentialist, transcendental³¹ approaches to form in top-down universal systems or bottom-up modular systems, the Gothic approach could be described as non-essential, focusing instead on assembling forms that were tied to specific material components. Gothic architecture adopted the pre-existing Romanesque vaulting system and deployed it as a “machine” to decode and re-code – in other words, to change and vary. The Romanesque groin vault was difficult to build and the resulting forms had to remain more or less square. Gothic introduced diagonal reinforced arches resting on thin pillars, which enabled the stone to channel compressive forces more efficiently, so that the vault could become thinner and extend higher, and the walls could be hollowed out and filled with windows. In this way the Gothic multiplied the technical and affective performance of the Romanesque groin vault, as it could now generate a variety of plan forms, orientations, degrees of crystallinity, openings and heights that previously would not have been possible. Moreover, the Gothic system prioritized visual sensations, despite the fact that its spaces were intended for people to congregate and listen to an oration. The great heights and volumes produced by the



Gothic system resulted in long sound reverberations which obscured the clarity of speech and music. As a consequence of this acoustical affect a whole series of developments emerged in the institution of the church. Chanting, choral music and other slow-paced musical styles gradually evolved to cater for the long reverberation time. And, as the only instrument with sufficient power and grandeur to fill such a large volume, the organ eventually became a permanent fixture. To this day, religious services in Gothic cathedrals are totally dependent on their affiliation with these external materials: chanting, specific styles of music, and the organ. Since no two cathedrals are the same, this relationship is played out differently in each case, making each service unique.

Because Gothic church architecture was based, not on an ideal geometrical system, but on a protogeometry that was anexact (precise, but not metrically so), it was supremely pliable and elastic, able to respond to many different concerns (productive, economic or subjective) such as adapting to an irregularly shaped site, the involvement of different architects, or the changing demands of the patrons. Gothic cathedrals are the epitome of a form which is connected to multiple causes yet remains domain-specific. Their growth is similar to that of a snowflake, where two hydrogen atoms bonding with an oxygen atom (H-O-H) at an angle form six-sided flakes that sprout six branches and side branches in a direction and shape which are influenced by a whole array of environmental factors such as temperature, humidity, wind, and position in the cloud. This process results in an infinite number of variations: thick, dendritic flakes in stormy conditions; long, needle-like crystals in windy but warmer temperatures; hollow, hexagonal prisms in weather that is colder but not windy. Similarly, the Gothic base unit was capable of changing in response to both the physical context and the passage of time.

The flexibility of the Gothic system is illustrated in the history of Milan cathedral, which was built over four centuries, under the supervision of more than eight architects and engineers. Each of the architects and engineers had a different idea for the relationship between the central and the side aisles. The differences lay in how it would be realized – the extent to which the side aisles and the central aisle would be visually connected, and whether the orientation would be predominantly axial or also transversal. Most Gothic cathedrals remained under construction for many years, but the inherent flexibility of the base unit enabled it to be varied as it repeated to accommodate specific requirements in different regions of the building, evolving over long periods of time into different spatial configurations with distinct affective properties.

The Gothic was unique as a moment in the history of architecture when form was both physical and abstract. In all other periods form and matter have been considered in opposition to one another, a duality which is paralleled in Western thought: the empirical world that we see and sense on the one hand, and the non-physical, which accounts for the mental and spiritual world.

Opposite page: The growth of a snowflake is controlled by the movement of supersaturated air inside a cloud. Each flake is subjected to different conditions along its trajectory and therefore develops a unique shape.

This split began with Plato, for whom abstract, intelligible ideas (Forms) inhabited the world of pure reason, while sensible and physical things (forms) were a reflection and imitation of these archetypal Forms. The question of whether the physical or the non-physical has priority has preoccupied succeeding generations of philosophers.

From the seventeenth century onward philosophers began to challenge the transcendental tradition in philosophy. However, despite their disagreements over whether the physical or the non-physical provided identity and meaning to forms, all of these critiques maintained, in one way or another, the fundamental distinction between ideas and matter. Every form was a replica, and identity remained singular, complete and atemporal. The idea of repetition was therefore controversial, since a form that represents a pre-existing ideal lacks the capacity to evolve or to generate a new identity. Deleuze offers a solution to this problem with his conceptual framework of the virtual and the actual. According to Deleuze, nothing exists outside the world we live in; there are no transcendental ideals. Our world is composed of virtual forms and actual forms. Virtual ideas are differences in themselves, and these differences are like intensities that differentiate them from one another. Virtual forms are therefore not ideals detached from reality, but abstract ideas not yet actualized. Owing to their abstractness, they can be interpreted in a variety of ways to produce a variety of sensible forms, a process that Deleuze has referred to as differentiation. There are therefore two types of difference: an intensive difference that relates to difference in kind between abstract ideas, and an extensive difference that relates to the degree to which one sensible form is different to the other. This degree of difference is explicated as a simulacrum³² that in turn affects us in specific ways. A simulacrum is not, however, the representation of another thing (for example, the representation of an ideal form), but an image whose identity depends precisely on the difference between the virtual and the actual.

We therefore need abandon the polarity of simple v. complex repetition, which considers simple repetition as mere replication. Difference is to be measured not only in spatial extensity – that is, the way a form is spatially varied – but also in the intensity of a form and according to the specific way it affects us. Architects can embed the environment with difference in two ways: by producing different kinds of ideas for built forms and by exploring different ways of actualizing ideas as built forms. Current architectural investigations are mostly focused on internal geometrical variations of forms, rarely focusing on how the ideas they embed differ from other ideas or on how the built forms they produce differ from other built forms. Yet two forms that actualize an idea differently but involve no internal variation can embed the environment with a greater degree of difference, by affecting us in very different ways, than two forms that are internally differentiated but actualize an idea in the same way, thus transmitting identical affects.

This book explores the idea of architecture as a continuous process of creating novel forms and identities through the repetition and differentiation (tessellation) of virtual forms. In doing

so, it seeks to move built forms away from essentialism, from any theory that claims to identify a universal, transhistorical cause. Instead, it seeks to establish a productive relationship between architecture's past and its future by analyzing virtual and actualized forms that have been created throughout history and exploring their potential to actualize novel forms and identities in the future. The virtual forms assembled in this book are material systems that conjoin physical and non-physical materials and yield unique structural as well as affective traits. Each built form is the consequence of one such material system, its capacities (freedom) as well as its constraints (structure) – a unique conjunction of objective and subjective, structural and experiential, physical and nonphysical materials. It is through the medium of built form that architecture blurs the boundaries between oppositions and distinctions to produce differences in kind as well as degree, embedding the environment with simulations (*simulacra*) rather than representations.

Different material systems have been studied in this book, and the virtual idea, or base unit, of each system has been extracted. Each base unit identifies a series of elements that are assembled in a unique way to define the affective qualities and structural capacities that remain as specificities as well as constraints of the system as the base unit is repeated and varied (*tessellated*) to produce different forms. As in a cyborg that involves the fusion of machine and organism, or in music, where a novel genre or sub-genre emerges when form is infused with different techniques, styles, contexts or themes, the constraints and capacities of each base unit are activated by a range of external inputs or material such as regulatory policies (planning guidelines), social and cultural circumstances (program, the construction culture of a particular city), economic criteria (budgets, construction costs), climatic conditions or affective desires. Although it is not within the scope of this book to investigate this external material, each base unit has been tested against a series of differentiating processes such as variations in tessellation and geometry, or hybridization with other systems, as examples of differentiations which are necessary to incorporate such external material. Since all of the material systems are by nature *protogeometric*, they are pliable and can vary to accommodate external material, producing in each instance a novel form with unique sensations and affects. Built forms, accordingly, are determined not only by technical efficiency but also by the specific choices (subjective) that architects make among a myriad of possibilities that each material system offers. The differences between forms are a product of the complex interaction between material systems (virtual forms) and external materials (the environment).

It is in this light that we should interpret the similarity of the Glass Pavilion (p. 118) to 30 St. Mary Axe (p. 120), or the Tall Building Master Thesis 2 (p. 98) to CCTV (p. 100), or St. John's Abbey (p. 352) to the Yokohama International Port Terminal (p. 392). Each of these pairs of projects is based on the same virtual idea that has been repeated differently in different locations to produce novel physical forms. This revision of repetition as an evolutionary process enables us to think laterally across geographies or locations to address the globalization of the architectural practice. Ideas can originate anywhere, but they need to combine with material that is specific to the

environment where they are to be actualized to produce novel forms. Forms in this way motivate the generation of other forms and they perform transversally, addressing locally multiple criteria and concerns which may belong to different geographies or time in history.

We no longer need to think in terms of irreconcilable oppositions – mind v. matter, people v. objects, production v. perception, rational v. sensorial, old v. new, difference v. repetition. Our environment includes all of these and this necessitates an “ecosophical”³³ practice that considers all forms of ecology together, whether environmental, mental or social. This calls for a transversal design process that bypasses the traditional top-down or bottom-up approach. A transversal approach, in which causes and concerns that are immanent in the environment are combined to generate forms, enables us to harness the transformative power of contemporary reality. Moreover, it enables us to incorporate greater levels of complexity within built forms, allowing multiple inputs to interact simultaneously on the same plane to generate a multitude of novel forms, each with unique expressions, sensations and affects. Because such affects and sensations are conditioned by individual experience, their reception is inevitably different in each case, and therefore multiple. Thus the environment acts as a social matrix in which built forms provide a link between individuals with different views. Given the increasingly plural nature of society, the affective character of built forms can play a powerful role by embedding the environment with multiplicity, providing society with the means to conduct an autocritique.

Notes

- 1 Louis H. Sullivan, "The Tall Building Artistically Considered", *Lippincott's Magazine* 57 (March 1896), pp. 403–9, cited in *Kindergarten Chats and Other Writings* (New York: Wittenborn Art Books, 1976).
- 2 Henry-Russell Hitchcock, Jr., and Philip Johnson, *The International Style: Architecture Since 1922* (New York: W. W. Norton & Co., 1932).
- 3 K. Michael Hays, "Critical Architecture: Between Culture and Form", *Perspecta 21: The Yale Architectural Journal* (1984), pp. 14–29.
- 4 In Aristotle's concept of *hylomorphism*, material objects are composed of matter, which is passive, and form, which is active and makes the object an actuality. Expression or meaning resides within the form, prior to and independently of matter.
- 5 Deleuze writes, "Hegelian contradiction appears to push difference to the limit, but this path is a dead end which brings it back to identity, making identity the sufficient condition for difference to exist and be thought. It is only in relation to the identical, as a function of the identical, that contradiction is the greatest difference. The intoxication and giddiness are feigned, the obscure is already clarified from the outset. Nothing shows this more than the insipid monocentrality of the circles in the Hegelian dialectic." Gilles Deleuze, *Difference and Repetition* (London: The Athlone Press, 1994), p. 263.
- 6 For a comprehensive survey, see: Leandro Madrazo, "The Concept of Type in Architecture: An Inquiry into the Nature of Architectural Form" (Ph.D. dissertation no. 11115, ETH, Zurich, 1995).
- 7 Claude Perrault, *Ordonnance for the Five Kinds of Columns after the Method of the Ancients* (1683), translated by Indra Kagis McEwen (Santa Monica: The Getty Center for the History of Art and the Humanities, 1993).
- 8 Mark Wigley (with Philip Johnson), *Deconstructivist Architecture* (Boston: Little, Brown / New York Graphic Society Books, 1988), p. 19.
- 9 The most comprehensive account of architectural mediation is by Charles Sanders Peirce who, in the nineteenth century, classified signs as icon, index, or symbol. According to Peirce, an icon (a picture, image, model or diagram) is a sign which itself demonstrates the qualities of its "dynamical object", as manifested by quality, feeling, freedom or multiplicity. An index (such as a clock, thermometer or medical symptom) is a sign that demonstrates the influence of its "dynamical object", as manifested by action, reaction, causality, reality, actuality or factuality. A symbol (examples might include a trophy, medal, receipt or diploma; a monument; or a word, phrase or sentence) is a sign that is interpreted as a reference to its "dynamical object", and manifested by representation, thought, continuity, order, unity, or generality. Of the three sign systems, index is the one that is dependent on materiality. Two sections of the book *Signs, Symbols, and Architecture*, edited by Geoffrey Broadbent, Richard Bunt and Charles Jencks (New York: Wiley, 1980), provide a very clear outline of Peirce's categories: "The Architectural Sign", by Charles Jencks, pp. 71–118, and "Building Design as an Iconic Sign System", by Geoffrey Broadbent, pp. 311–31.
- 10 Robert Venturi, *Complexity and Contradiction in Architecture* (New York: The Museum of Modern Art Papers on Architecture, 1966). p. 22.
- 11 "But the shift from one to the next is not a reversal, not an opposition; rather it is a hybridisation, a complexification of modern elements with other ones, that is a double-coding." Charles Jencks, *A Post-Modern Reader* (St. Martin's Press, 1992), p. 12.
- 12 Mark Wigley (with Philip Johnson), *Deconstructivist Architecture* (Boston: Little, Brown / New York Graphic Society Books, 1988), p. 19.
- 13 Peter Eisenman, "Autonomy and the Will to the Critical", *Assemblage* 41 (April 2000), p. 91.

- 14 K. Michael Hays, "Critical Architecture: Between Culture and Form", *Perspecta 21: The Yale Architectural Journal*, 1984, pp. 14–29.
- 15 Jeffrey Kipnis and others, *Mood River*, exhibition catalogue (Columbus, Ohio: Wexner Center for the Arts, 2002).
- 16 According to Malcolm Gladwell, Howard Moskowitz, a Harvard psychophysicist, reinvented spaghetti sauce as well as other food products such as Pepsi, Prego, Ragu and many others by convincing the food industry to abandon Platonic notions to explore instead the infinite variety of human preference. Malcolm Gladwell, "The Ketchup Conundrum", *The New Yorker*, September 6, 2004.
- 17 Here the contrast between the New and the Novel is similar to Deleuze's discussion of Identity v. Difference in: Gilles Deleuze, *Difference and Repetition* (London: The Athlone Press, 1994), chapters I and V.
- 18 Donald A. Crosby writes in the preface to his book *Novelty* (Lanham, MD: Lexington Books, 2005), "Novelty is not opposed to efficient causality but complementary to it. In fact, the argument here is that, without novelty, causality would be unintelligible, just as, without causality, novelty would have no meaning."
- 19 Recollection by Peter Carter, in "Mies van der Rohe: An Appreciation on the Occasion, this Month, of his 75th Birthday", *Architectural Design*, vol. 31 (March 1961), pp. 95–122.
- 20 *Der Querschnitt* 4, no. 1 (Berlin: Propyläen Verlag, 1924), pp. 31–2.
- 21 Mark Cousins, "Disabling Beauty", *Portfolio* 30 (1999), pp. 52–3.
- 22 Gilles Deleuze and Félix Guattari, *What is Philosophy?*, translated by Hugh Tomlinson and Graham Burchell (New York: Columbia University Press, 1994), chapter 7: "Percepts, Concepts, Affects", pp. 163–99.
- 23 In *The Ethics*, Spinoza writes: "Different men can be affected differently by one and the same object; and one and the same man can be affected differently at different times by one and the same object." Benedict De Spinoza, *Ethics* (London: Penguin Books, 1996) p. 96.
- 24 Rem Koolhaas writes, in the context of the OMA French Library project, "Beyond all exploitation, there is also altruism at work: OMA – machine to fabricate fantasy – is structured for others to have the eureka's." Rem Koolhaas, Bruce Mau, *SMLXL*, p. 644.
- 25 OMA, Rem Koolhaas, Bruce Mau, *SMLXL*, p. xix.
- 26 For a comprehensive survey on approaches to typology, see: Leandro Madrazo, *The Notion of Type in Architecture: An Inquiry into the Nature of Architectural Form*, Ph.D. Dissertation no. 11115, ETH, Zurich.
- 27 For a comprehensive analysis of Durand's ideas, see: Antoine Picon, "From 'Poetry of Art' to Method: The Theory of Jean-Nicolas-Louis Durand", introductory essay to the English translation of Durand's *Précis des leçons d'architecture données à l'École polytechnique de 1802–1805*, and *Partie graphique des cours d'architecture faits à l'École royale polytechnique depuis sa réorganisation de 1821* (Los Angeles: Getty Research Institute, 2000).
- 28 Aldo Rossi, *L'Architettura della città* (Padua: Marsilio Editori, 1966).
- 29 Le Corbusier, *Vers une architecture* (Paris: Les Editions G. Crès et Cie, 1923).
- 30 "Repeat and vary" is akin to the process of "divergent actualization" described by Deleuze.
- 31 In Spinoza, Deleuze discovers another possibility: that the resources involved in the genesis of form are not transcendental but immanent to matter itself.
- 32 Deleuze's position on the simulacrum differs from that of Baudrillard or Adorno, for whom it represents a hyperreality that disguises the absence of the authentic.
- 33 Felix Guattari, *Three Ecologies*, translated by Ian Pindar and Paul Sutton (New Brunswick, NJ: Athlone Press, 2000). According to Guattari we must reconsider the narrow conception of ecology that reduces it to purely environmental concerns, to include the mental and cultural/social spheres that affect our environment as a whole.