CHAPTER ONE

Organization, Modernism, and Architecture

Form follows function.
—Louis H. Sullivan

Less is more.
—Ludwig Mies van der Rohe

MODERNIST ARCHITECTURE is the child of industry and engineering. Its rise during the early twentieth century dovetailed with the spread of scientific management, historically the most controversial and influential approach to the organization of work. The modernist architects read about scientific management, thought of buildings as machines, embraced the ideas of waste reduction and order, used such notorious efficiency techniques as time-and-motion study, collaborated with industrialists and firms, and strived to turn architecture into a science driven by method, standardization, and planning. They yearned to create houses, public buildings, factories, artifacts, and durable consumer goods combining beauty with technical, economic, and social efficiency. They became technicians, organizers, and social reformers as well as artists, adding the stopwatch, the motion picture camera, the slide rule, and the psycho-physiological test to their toolkit. Architecture and our experience of the built environment changed in ways still discernible today. Technology merged with style, science with history, efficiency with creativity, and functionality with aesthetics.

In this book I examine the parallels between scientific management and architecture in a variety of countries in Europe and the Americas between 1890 and 1940. I provide the first systematic assessment of the economic, social, and political conditions that prompted architects to pursue a modernist approach to design. It was the crucial influence exerted by engineering and scientific management that helps explain the emergence of modernist architecture. The link developed in the historical context of the appearance of new sponsors—industrial firms and the state—and of the professionalization of architecture following an engineering model rather than the traditional Beaux-Arts one. In some countries the modernists succeeded at reconfiguring architecture, especially by changing the way in which architects were trained.

Among the various arts, architecture proved most receptive to the new methods and ideas emerging from industry in the early twentieth century. Architecture and its associated activities—design of interiors, furniture, and household objects—produced an aesthetic companion to the influential technical and ideological messages of scientific management. Like organizational methods, architecture carries consequences for people's lives at home and at work (Smith 1993, 399). As Siegfried Giedion ([1941] 1982, 705) has pointed out, "architecture is a complex activity; it works in the boundary area halfway between the regions of aesthetic feeling and practical doing." Similarly, Magali Sarfatti Larson (1993, 16) noted that architecture is a peculiar "social art" because it contributes to the culture not only "discourse and codified practices . . . but also, and crucially . . . *artifacts* that are useful and can be beautiful." Architecture is "a public and useful art . . . that must convince a client, mobilize the complex enterprise of building, inspire the public (and not offend it), and work with the culture, visual skills, and symbolic vocabulary not of the client but of its time." In addition, the architect has become a professional expert who must strike a delicate balance between enjoying a "latitude for judgment and artistic freedom of expression" and complying with the "limits imposed by the client, the character of the site, the cost of construction, and materials" (Blau 1984, 28).

This book's journey through the times and places at which scientific management and modernist architecture blended into a single endeavor begins with a general characterization of the modernist movement in architecture. I focus attention on the ideas of method, standardization, and planning, initially developed in the United States, that the modernist architects borrowed from the world of industry and scientific management (chapter 2). I then characterize the various explanations offered by architectural historians and social scientists for the emergence of modernist architecture. What invited some architects to look into engineering and scientific management for ideas about method, standardization, and planning? Did modernist architecture emerge simply as a natural consequence of industrialization, or was it the result of an unusual degree of sociopolitical upheaval that encouraged new experiments in art, architecture, and urban planning? Was modernism made possible by specific class dynamics during the formation of the mass consumption market for artistic artifacts? How important were the state and industrialists as new sponsors of architecture interested in affordable housing for the masses and better, more efficient workplaces? Or was it the joint training of engineers and architects that helped the latter produce a new approach to design?

These questions and themes are outlined in chapter 3, and then assessed in chapters 4–6 using evidence drawn from the six largest European countries (Britain, France, Germany, Italy, Russia, and Spain), and the three largest Latin American ones (Mexico, Brazil, and Argentina). The case of the United States is covered in this first chapter because American managerial and architectural achievements represented an antecedent to modernist architecture rather than a culmination: it was European architects who developed the key insights pioneered in the United States and arrived at the new aesthetic that one associates with modernism in architecture. Specifically, modernist architecture was first formulated by German, Italian, Russian, and some early French architects educated as such in an engineering tradition, whereas most architects in Britain and Spain were not exposed to such an influence. In the Americas, a similar argument holds in that the reception of European modernism was more enthusiastic among architects exposed to industry and engineering during their education or early on in their careers (chapter 7). Thus, modernist architecture emerged when architects influenced by engineering and scientific management obtained commissions for "useful" buildings like factories, schools, or apartment buildings from patrons such as industrial companies or the state. In tracing the connections between scientific management and modernist architecture around the world, this book seeks to explain the shift in architectural leadership from France and Britain to Germany, Russia, and Italy during the early twentieth century, a process that produced a modernist approach that was reexported back to the United States in the years just before World War II.

It is precisely because aesthetics should be studied not in splendid isolation but in its historical and institutional context that I compare architectural movements in ten countries in Europe and the Americas between the turn of the century and World War II. I will follow the typical analytical approach in the sociology of cultural production, namely, to examine a new artistic movement as "both a social and an ideational phenomenon" because "it involves a new world view, new techniques, a community of interacting artists and a support structure," which in the case of architecture consists of theorists, practitioners, critics, sponsors, and educators (Crane 1989, 270). Finally, chapter 8 delves into the long-term consequences of the emergence and consolidation of modernist architecture as a public, moral, and social art, exploring such an important issue in the sociology of culture as the consumption of modernist architecture. The book ends with a reconsideration of the aesthetic dimension of scientific management and other organizational theories. In examining one specific link between organization and aesthetics, I suggest that we have misunderstood the theoretical meaning and social impact of such a key organizational theory as scientific management.

The chapters that follow do not amount to a comprehensive treatise on the history of modernist architecture. Rather, the analysis is mainly concerned with the critical junctures and processes in the development of a new vision of architecture as an activity and a profession based on ideas about method, standardization, and planning. While I pay some attention to the cross-national diffusion of modernist architecture as an institutionalized pattern, I focus on the emergence of the pattern itself, that is, on the process of institutionalization. And although the link between scientific management and modernist architecture has been observed by many art historians, critics, and sociologists—as well as by the modernist architects themselves—I offer the first comprehensive conceptual treatment and the first systematic cross-national comparison of the causes that produced it.

TAYLORISM, FORDISM, SCIENTIFIC MANAGEMENT

A key development initially unrelated to architecture was reaching a climax in the United States just before World War I: the formulation of a new model of industrial management known as scientific management, which highlighted method, standardization, and planning, elements that would later appeal to the modernist architects. The scientific managers believed that analytical methods such as the division of labor (or specialization), time-and-motion study, and flowchart analysis would help optimize the production process and the utilization of labor, making them more efficient. They also focused their attention on the standardization of products, tools, and equipment so as to achieve the highest possible degree of mechanization. Product standardization essentially meant simplification and interchangeability of parts and components. The scientific managers insisted on separating task conception from execution, thus elevating the role of planning above that of implementation. They initially applied these ideas to the organization of simple tasks. Later, it occurred to them that entire production processes, companies, cities, and even countries were amenable to the same principles and methodologies.

Like the scientific managers, the modernist architects initially sought to improve building practices but soon realized that method, standardization, and planning enabled them to formulate a new approach to architecture. The overarching idea in scientific management was that of order, one that subsequently captivated the modernist architects because it enabled them to move away from the prevailing eclecticism and to present themselves as organizers, as technocrats who could ameliorate social conflict and improve standards of living.[1] The modernist architects were frustrated at the inability of existing architectural approaches and practices to take advantage of the aesthetic possibilities offered by industrialization, and to tackle the social problems engendered by the growth of cities. Scientific management offered a set of ideas and methods that promised to reduce chaos and waste. Armed with them, the modernist architects thought they could arrive at an "orderly" theory and practice of architecture firmly rooted in the industrial era (see chapter 2).

The origins of scientific management date back to the second half of the nineteenth century. After the Civil War, American industry grew in size and bureaucratization, and managers and engineers began to complain about how difficult it had become to run complex enterprises and to keep the workforce disciplined and motivated. In fact, the period between 1890 and 1910 was one of acute labor turmoil. Unlike most business owners, whose instincts led them

[1] Technocracy is an important concept in sociology, one that includes two components: the use of technical knowledge, especially in a bureaucratized setting; and the appeal to an ideology of objectivity or neutrality to justify the power structure that results from the rise of the technocrats (Larson 1972–73).

to confront worker insubordination with force, American engineers and managers attempted to meet the challenge through innovation (Bendix 2001; Guillén 1994). The "American System" of interchangeable parts was an early attempt to solve the problem through labor savings (Hounshell 1984). In a related development, the so-called movement of systematic management of the late nineteenth century focused on increasing efficiency and reducing waste (Bendix 2001; Shenhav 1999).

It was Frederick Winslow Taylor, a self-made engineer, who came up with a coherent synthesis of these diverse efficiency ideas, which he felicitously labeled "scientific management" (plate 1.1; see insert). I will use the term "Taylorism" to refer to the "Taylor System," although Taylor himself preferred to present his own ideas as "scientific management" (Taylor [1912] 1972, 6). For the purposes of this book, scientific management is a much broader set of ideas and techniques that came to be identified with Taylorism as well as with the achievements of other efficiency experts and practitioners, including Frank and Lillian Gilbreth, Henry Gantt, Hugo Münsterberg, and Henry Ford, all of them deeply admired by the modernist architects (see chapter 2).

After having discovered high-speed steel in the 1890s, Taylor envisaged the gains that could be derived from the speed-up of the work process if tools and machinery were standardized, machine times estimated, and the human factor adapted to an ever faster work pace (Nelson 1980, 80–103). As novelist John Dos Passos wryly observed, he was called "Speedy Taylor" in the shop, and "couldn't stand to see an idle lathe or an idle man"; "production was an itch under his skin" (Dos Passos [1933] 1979, 44, 45). In 1903 Taylor published his first book, *Shop Management*. He recommended that all manual tasks be studied, divided, and, when necessary and economical, performed by different workers. Taylor's model of organization combined four elements, as enunciated in his famous *Principles of Scientific Management*: time-and-motion studies to standardize work tools and working conditions, and to divide the process into its simplest constituent tasks; selection of the cheapest yet adequate worker to perform each of the divided tasks; the "bringing together" of the scientifically determined task and the scientifically selected worker by means of functional foremanship and an incentive system based on differential rates; and the separation of the execution of work by the workers from its conception, which belonged to a "planning department" (Taylor [1911] 1967, 85; [1903] 1972, 4–45).

Although Taylor's ideas were met by managerial skepticism and worker fury, he succeeded at placing efficiency and planning at the top of the agenda for social and business reform in the United States and around the world (Guillén 1994; Merkle 1980). Meanwhile, Taylor's many followers refined several theoretical and methodological aspects of scientific management. The Gilbreths improved the methodology of time-and-motion study, introducing the cyclograph and the chronocyclograph (Gilbreth 1909, 1911, 1912; Gilbreth and Gilbreth 1917; see also Giedion [1948] 1969, 17–30, 101–13; plates 1.2 and 1.3). Motion study using motion picture cameras became much easier and cheaper to implement with the introduction of 16-millimeter film in 1921, and the Gilbreths used them assiduously (plate 1.4). "Scientific management, . . . early cinematography, Cubism, and Futurism reflect aspects of each other across the cultural spectrum like images of a house of mirrors. As the Cubists broke up and recreated bottles and guitars, Gilbreth broke down and reconstructed work processes" (Kern 1983, 117). Tellingly, Frank Gilbreth's first book (1909) was a treatise on efficient bricklaying for the construction industry, in which he proposed a new, adjustable scaffold to improve productivity. Gantt developed work flowcharts to optimize the use of resources over time (Gantt 1911, 1919), a technique that has become widely used in the construction industry.

Another prominent contributor to scientific management was Hugo Münsterberg whose 1913 book, *Psychology and Industrial Efficiency*, developed and systematized Taylor's observations about worker selection in *The Principles of Scientific Management*. These two books read more like manifestos than scientific treatises, perhaps one of the reasons why the avant-garde modernist architects were so fond of them. The modernists in Europe would find theoretical and practical inspiration in both books' insights, techniques, and overall ideology of order. Beyond its technical promises, scientific management proved influential because of its ideological claim to a superior scientific approach to work and organization, one that the modernist architects extended to the world of design and building.

Scientific management was fundamental to the development of what came to be known as Fordism, that is, mass production based on the assembly line, another system of management that was to capture the imagination of modernist architects. Like Taylor, Henry Ford was a self-made mechanic (Sward 1972; plate 1.5). "The American Plan; automotive prosperity seeping down from above, . . . But that five dollars a day paid to good, clean American workmen who didn't drink or smoke cigarettes or read or think . . . made Henry Ford the automobileer, the admirer of Edison, the birdlover, the great American of his time" (Dos Passos [1933] 1979, 73). He made extensive use of Taylorite techniques at his new factory at Highland Park in Detroit, hiring the best mechanics and scientific-management experts in the area. Ford's plant managers improved the production process on a trial-and-error basis, making use of standardization, time study, and systematic planning techniques. Gravity-slides, automatic conveyors, overhead conveyors, and the endless-chain conveyor for final assembly (1914) were the major technological innovations that resulted from their attempts to optimize the production of Model T cars (plate 1.6). Ford envisaged that "the big money was in economical quantity production, quick turnover, cheap interchangeable easilyreplaced standardized parts" (Dos Passos [1933] 1979, 72). For him, mass production was "power, accuracy, economy, system, continuity and speed" (Ford 1926), themes that would appeal to the modernist architects because of their inherent promise to reduce chaos and improve life.[2] The only Taylorite principles that Ford did not implement were functional foremanship and the differential wage rate, mainly because the speed of the assembly line and the feeder routes dictated the pace of work. Thus, the need for incentives and continuous supervising was greatly reduced or even eliminated. Like Taylorism, Fordism was also an ideology promising great gains for workers, managers, owners, and consumers alike, and it was perhaps this aspect that ultimately influenced the modernist architects most.

Scientific management made an enormous impact on American industry, government, and nonprofit organizations. While a group of notorious engineers active at the turn of the century provided a set of methods and metaphors to make organizational practices more "systematic" and "scientific," an equally prominent group of social and political reformers known as the Progressives extended the same set of principles to education, the government, and culture (Callahan 1962; Haber 1964; Fairfield 1994; DiMaggio 1991). The writings and practical accomplishments of Taylor, the Gilbreths, Münsterberg, and Ford provided the modernist architects with an endless supply of inspiration. The ideas of method, standardization, and planning came in handy when looking for ways to develop an approach to architecture consistent with the age of machines.

CONSTRUCTION AND ARCHITECTURE: AMERICA VERSUS EUROPE

In the midst of such an outburst of organizational innovation in the factory, much of the world of architecture remained anchored in the past. Historians agree that before the arrival of modernism, the theory and practice of architectural design prevalent on both sides of the Atlantic were conspicuously inconsistent with the increasingly pervasive reality of machines and industrial production. They also suggest that an inordinate enthusiasm for revivalism and historical styles had thrown architecture into such a creative deadlock and chaos that reform and renewal were unlikely to emerge easily from within. The historiography shows that the first designers to take advantage of the principles of machine production and of such new construction materials as steel, glass, cement, and plastics were not architects but engineers (Jencks 1973; Benevolo [1960] 1977, 219–50; Banham [1960] 1980; Curtis [1982] 1996).

Although the first major innovation in industrial-age building that captured the world's attention was the impressive Crystal Palace at the London Universal

[2] This article by Ford, prepared for the 1926 edition of the *Encyclopaedia Britannica* and later published in the *New York Times*, was in fact written by a collaborator of his, William J. Cameron. See Hounshell 1984, 304.

Exhibition of 1851, American constructors and engineers had taken the lead by the 1880s. They built massive factories, silos, grain elevators, bridges, and other types of industrial structures emphasizing efficiency, rationality, and functionality.[3] The Chicago architects—especially Louis H. Sullivan—used the new engineering techniques and construction materials outside the realm of industry, erecting the first skyscrapers and modernist office buildings (plate 1.7). Sullivan formulated the famous modernist principle of "form follows function." Most of his contemporaries, however, clung to the old-fashioned taste for superfluous ornamentation and fell short of producing an overarching theory of aesthetic design, a new vocabulary to guide the architect's work (Banham [1960] 1980; Benevolo [1960] 1977). Thorstein Veblen complained that the new industrial bourgeoisie regarded as beautiful artifacts that were rarely useful, and frequently wasteful of labor and materials (Veblen [1899] 1934). And when it came to designing useful artifacts, American designers and architects were forced to cater to the needs of a large mass consumption market that put ornament and kitsch ahead of rationality and functionality (Gartman 2000). Most importantly, the leaders of the Chicago Movement, Adler and Sullivan, and their most distinguished disciple, Frank Lloyd Wright, failed to nurture a college of followers or to influence architectural education (Benevolo [1960] 1977, 191–250, 629–83; Hitchcock and Johnson [1932] 1995, 38–54; Pevsner [1936] 1960, 32). Sullivan and Wright "had to live almost as exiles in their own country" (Giedion [1941] 1982, 391, 425, 500; Wright [1928] 1992, 257).

Wright occupies a prominent place in American architecture. Some historians argue that there were two Wrights, the forward-looking architect who developed an "architectural system" of his own by departing from the prevailing eclecticism, and the traditionalist who wished to preserve regional styles and craftsmanship (Curtis [1982] 1996, 113). Wright, heir to a long American tradition of rationalism, "became the prophet and genius of the so-called organic trend." He extolled "the horizontal, the ground line, unfinished materials sometimes crude and telluric, and the house anchored in the soil as a factor of a reintegrated landscape" (Zevi [1973] 1994, 210; plate 1.8). While the European modernists would receive and further develop some of these themes, they would reject others, including his organic expressionism. It should also be remembered that Wright ([1929] 1944, 129) did not fully come to terms with mechanization, which he "dreaded" and found "malevolent."

The World's Columbian Exposition of 1893 in Chicago illustrates why the incipient American architectural modernism of Sullivan and Wright failed to inspire his compatriots at the critical juncture of the turn of the century. The fair

[3] Pevsner ([1936] 1960, 126) has dutifully noted that the Chinese had successfully undertaken metallic construction of suspended bridges prior to the eighteenth century, and this was known in Europe and the United States.

offered architects a unique opportunity to influence tastes and trends in design. And yet, instead of finding inspiration in the works of the engineers, most of the architects commissioned to design the buildings looked towards France and the Beaux-Arts tradition. Sullivan criticized the exposition for being like an academic "plague," although his own contribution, the Transportation Building, was eclectic in that it combined Roman, Romanesque, Gothic and Islamic influences (Tselos 1967, 263–67). Wright lamented in his autobiography that "[t]he Fair is going to have a great influence in our country. The American people have seen the 'Classics' on a grand scale for the first time. . . . I can see all America constructed . . . in noble 'dignified' classic style" (quoted in Giedion [1941] 1982, 396). The Fair represented the "triumph of Beaux-Arts Classicism" (Pevsner, as quoted in Pfammatter 2000, 289).

History books profusely document that the first architects to fully grasp the significance of the industrial era, of the new methods and materials it offered, were European. They avidly learned from American industrial construction and from scientific management, applying engineering methods to all sorts of buildings and designs, and carrying the new principles to their ultimate aesthetic consequences. In the United States construction and building practices evolved to meet the requirements of mass production, while in Continental Europe—where large-scale industrialization was slower to develop than in the land of Taylor and Ford—modernist architecture emerged much more unconstrained, and played an independent role in shaping life at the factory, the home, and the public building (Smith 1993, 92, 398; Gartman 2000).

Modernist architecture in the relatively backward and politically troubled Continental European countries was in a position to lead rather than follow, allowing the architect to exert a tremendous influence over social and industrial organization as the designer and planner of dwellings, cities, and workplaces. While the American architect of the turn of the century caught up with developments in industry as an individualist and marginal player, and the British architect reacted against the machine age altogether, the architect in the relatively backward Continental European countries actively advocated and planned for a transformation of society. The emerging modernist architecture in Europe thus stood in sharp contrast to American architecture in that it was avant-garde, though not in the simplistic sense that it espoused art for art's sake but rather in that it was revolutionary, that is, moving at the forefront of social and economic change rather than following it.

The links between modernist architecture and engineering are hard to miss. "The engineer is the hero of our age," stated the German architect and product designer Peter Behrens in the early 1900s. He was one of the key pioneers of modernism in architecture and design. Upon being appointed chief architect and designer at the large electrical appliances company AEG—a firm fully committed to the implementation of Taylorism and Fordism—he promised to work toward the "most intimate union possible between art and industry"

(Buddensieg 1984, 207–19). Together with other leading German architects of the time, he took part in the Werkbund—the German version of the English Arts and Crafts movement—founded in 1907 to "introduce the idea of standardization as a virtue, and of abstract form as the basis of the aesthetics of product design" (Banham [1960] 1980, 72; Campbell 1978; Buddensieg 1984, 46).

European modernism did not arrive at an entirely novel approach to architecture and design until the 1920s, with the Bauhaus in Germany, constructivism in the Soviet Union, rationalism in Italy, and purism in France (see chapters 4–5). It was at this point that European architects made their revolutionary reinterpretation of scientific management in aesthetic terms. Walter Gropius, the founder of the Bauhaus school of art and architecture in Germany, was a firm believer in scientific management and became one of the most influential architects of the twentieth century. He wished to formulate a new theory of architecture and to develop "practical designs for present-day goods" that could be mass-produced (Buddensieg 1984, 18). He and his colleagues designed all manner of buildings, decorated interiors, and collaborated with many German manufacturing firms on product design. Most importantly, they proposed a new way to train the architect that departed from classicism and eclecticism, and emphasized method and utility.

As a result of German influence, the Russian arts and crafts movement had been toying with the artistic possibilities of mass production since the turn of the century (Lodder 1983, 74). While the Bolshevik revolution spurred myriad competing avant-garde movements, constructivism quickly gained sway over its alternatives (Bowlt 1988, 204–61). The constructivists proposed the ideals of the "artist-constructor" and the "artist-engineer," arguing for a functional and engineering-oriented approach to design, with extensive use of prefabricated housing, standardization, modular coordination, efficient building methods, new materials, and industrial production. As in Germany, the Soviet modernists created a state-sponsored school of art to realize their dreams, the Higher State Artistic-Technical Workshops, founded in 1920 to train "highly qualified master artists for industry" (Kahn 1982; Lodder 1983, 109–44).

In 1909 Italian futurism was launched as a literary movement by F. T. Marinetti, who entertained a political agenda of nationalism, violence, war, and destruction (Bowler 1991). Futurist ideas were developed and put into practice by the "rationalist" architects of the 1920s and '30s, who were interested in low-cost housing and furniture design, urban planning, prefabricated construction, factory architecture, and standardization (Banham [1960] 1980, 98–137; Etlin 1991, 53–100). Meanwhile, French architecture was revolutionized by Le Corbusier, a tireless advocate of scientific management. He was influenced by German, Russian, and Italian modernism. In the early 1920s he published what many regarded as the most revolutionary and influential modernist manifestos on architecture and city planning (Le Corbusier [1923] 1986,

[1924] 1987). Drawing on his experiences with manufacturers and his reading of Taylor and Ford, Le Corbusier developed and popularized the concepts of the "machine for living," the standardized "dwelling unit," and the "mass-produced house" (Benevolo [1960] 1977, 435–49; Brooks 1987, 107–25, 203–40).

The European architects and designers turned the mechanical into a metaphor for beauty and form as well as order and function. As a volume created by simple lines and plain surfaces, with seamless and unadorned shapes, the machine was raised to the status of symbol and muse. The Italian architect Antonio Sant'Elia put it concisely in 1914: "Just as the ancients drew inspiration for their art from the elements of nature, we . . . must find that inspiration in the elements of the utterly new mechanical world we have created, and of which architecture must be the most beautiful expression, the most complete synthesis, the most efficacious integration" (Sant'Elia [1914] 1973, 171–72).

A DEFINITION OF MODERNIST ARCHITECTURE

It should be carefully noted that the emergence of a discernible and unified "modernist architecture" in Europe during the early twentieth century is a matter of debate among art historians and critics. The chronicler-historians of the modern movement believed that a new, well-defined architectural style started to emerge in the late nineteenth century, and crystallized by the early 1920s if not prior to World War I, as reflected in the very titles of their books: Hitchcock and Johnson's *The International Style* ([1932] 1995), Pevsner's *Pioneers of Modern Design* ([1936] 1960), and Giedion's *Space, Time, and Architecture: The Growth of a New Tradition* ([1941] 1982). For instance, Pevsner ([1936] 1960, 38) asserted that "the new style, the genuine and legitimate style of our century, was achieved by 1914."

In contrast to contemporary accounts of the modern movement, more recent historical analyses have argued that "modern architecture" never was the "true style of our century." Rather, modernism includes several "discontinuous movements" not always fully compatible with each other (Jencks 1973, 11–13; see also Banham [1960] 1980; Benevolo [1960] 1977; Frampton [1980] 1992; Curtis [1982] 1996). This fragmentation was largely due to the ways in which architects combined the ideas coming from the world of industry with other trends they were exposed to. For instance, the English Arts and Crafts movement contributed to modernism the ideas of the well-crafted object, art for the people (as opposed to for the elite), coherence and simplicity in design, and architecture's moral role in setting the tone of the entire modern town (see chapter 4). Art nouveau, in spite of its conspicuous (though disciplined) use of naturalistic decoration, incorporated iron columns and frames allowing for the "free disposition of the rooms at the different levels, and the independence of the partitions one from another" (Giedion [1941] 1982, 305), as in Victor Horta's Tassel House of 1893 (plate 1.9).[4] Cubism offered architects new conceptions of light and space, turning the picture and the building into autonomous artifacts that depicted the psychic or the social rather than the physical, representing three dimensions on the flat canvas "without recourse to perspective illusions," (Weston 1996, 62; Banham [1960] 1980; Benevolo [1960] 1977; Kern 1983, 143–48).[5] Abstract art also exerted an influence on modernist architecture, with its conception of "art as 'research,' art as an end in itself, art as an expression of 'modernity,' art as '*avant-gardisme*,' art as a means of creating 'surprise,' art as 'not-art,' and art as 'pure art' " (Collins [1965] 1998, 274).[6]

In spite of its manifold roots and resulting fragmentation, it is possible to highlight some of the aesthetic qualities of modernism in architecture. The institutionalized concept of modernist architecture included first and foremost the trinity of "unity, order, purity" as the guiding principles of any design, from the building itself to the furniture and paintings inside it. Clean shapes and clarity of form became paramount; "less is more," declared one leading architect of the period (Mies van der Rohe), invoking a sort of economy of taste. The aesthetic order that emerged from European modernism in architecture has been defined by its three main principles: "Emphasis upon volume—space enclosed by thin planes or surfaces as opposed to the suggestion of mass and solidity; regularity as opposed to symmetry or other kinds of obvious balance; and, lastly, dependence on the intrinsic elegance of materials, technical perfection, and fine proportions, as opposed to applied ornament" (Barr 1995, 29).

Modernism was a reaction against the imitation of the classical canons and

[4] A key precursor of art nouveau was Eugène Viollet-le-Duc, who abhorred eclecticism, promoting instead the idea that architecture should be honest, truthful, and authentic in that it should reflect the conditions and materials of its time, without decorating them in artificial ways. He was "disturbed by the inability of the nineteenth century to find its own style" (Curtis [1982] 1996, 24, 27). Besides Horta, the other great art nouveau architect was his Belgian compatriot Henry Van de Velde ([1907] 1971, 18): "Thou shalt comprehend the form and construction of all objects only in the sense of their strictest, elementary logic and justification for their existence."

[5] Several modernist architects and designers started their careers as painters (e.g., Behrens, Chernikhov, Lissitzky, Tatlin, Le Corbusier, Chiattone, Terragni, O'Gorman, van de Velde), and many painters (Léger, Boccioni, Severini, Malevich, Kandinsky, Klee, the Mexican muralists) collaborated assiduously with the architects. The links between painting and architecture perhaps reached their zenith with the De Stijl movement in Holland, founded in 1917 on the basis of the abstractions of Theo van Doesburg and Piet Mondrian (Padovan 2002).

[6] Galison (1990) has observed the parallels between modernist architecture and logical positivism in philosophy, with both emphasizing the simple and the functional. The logical positivist philosophers visited with the Bauhaus frequently.

approaches rescued from oblivion during the Renaissance.[7] Many historians see in architectural modernism an attack on classicism's arbitrariness, emphasis on perspective and proportion, insistence on symmetry, and pervasive use of ornament. They single out symmetry as the key problem, for it "sacrifices the particular and individual on the altar of overall design, which is uniform, hierarchical, and unalterable" (Zevi [1973] 1994, 83; see also Giedion [1941] 1982, lvi). Thus, abandoning symmetry was one way to reintroduce the idea of order. The endless repetition of architectural elements became the modernists' technique for achieving an effect similar to symmetry. The departure from the principle of perspective owes much to cubism, which introduced time as a third dimension in painting, setting objects in motion, displaying their interior and exterior simultaneously and from several angles (Giedion [1941] 1982, 446–47, 521). With the elimination of the vantage point, one needs to walk around the building in order to grasp it, resulting in "space in time," a clear departure from the "compositional unity" of classicism, so entrenched in architectural practice since the Renaissance (Zevi [1973] 1994, 33; Giedion [1941] 1982, 529; Moore 1977). Like cubism, architectural modernism uses thin walls and large windows to blur the distinction between the inside and the outside, the inner and the outer reality (see plate 1.10).

In 1925 the Italian critic Roberto Papini described "modern European architecture" as having "these essential characteristics: a tendency toward the rational, the expression of structure, a free movement of masses, the emancipation from academic canons, an adherence to purely geometric forms, and independence from conventional proportions, and the maximum parsimony in ornamentation" (quoted in Etlin 1991, 238). Perhaps Giedion ([1941] 1982, 484–85) captured it best when he argued that modernism presented a "new conception of space," that instead of emphasizing the "supports of projecting parts such as . . . staircases," allowed for "freely hovering parts and surfaces." The modernist aesthetic sensation is triggered when "the relation between load and support is no longer traditionally obvious."

Modernism in architecture, however, was more than an aesthetic proposal. It included ideological and technical elements as well. European modernism sought to achieve order through the systematic application of method, standardization, and planning, embracing the "idea of technology as a social arbiter" (Maier 1970). Ideologically, modernism was antitraditional, antiromantic, futurist (i.e., forward-looking), and somewhat utopian. It was rational in the sense that "architectural forms not only required rational justification, but could only be so justified if they derived their laws from science" (Collins

[7] In philosophy and literature the reaction against the imitation of the classics took place during the eighteenth century, much earlier than in architecture. In each of these fields the modern movement was associated with an attack on imitation (Gomá Lanzón 2003, 22, 156, 167–68).

[1965] 1998, 198). It was functional in the dual sense of making "full use of modern technology and its honest expression in design . . . and [embracing] a scientific approach to human needs and uses in programming, planning and design" (Wurster 1965, 48; Poggioli 1968; Tafuri 1976).[8] Moreover, modernism aspired to revolutionize the process of artistic creation itself by applying method and science to both the design and construction of buildings and other artifacts. Traditional building practices—performed by a small number of craftsmen—were to be replaced by modern construction methods involving dozens of specialized subcontractors working independently, as in automobile manufacturing.

European machine-age modernism embraced scientific management in part because cost and efficiency were socially and politically constructed as important concerns. However, the romance of modernism with scientific organizational ideas went well beyond immediate economic considerations, leading to the formulation of an aesthetic based on the idea of order, on the promise of efficiency, and on technical virtuosity. The modernists "sought to merge aesthetic innovation with economic rationality" (Larson 1993, 50). By applying a mechanical metaphor to the design of houses, public buildings, schools, factories, and everyday objects, European modernism magnified the impact of scientific management, extending it into new realms. If scientific management argued that organizations and people in organizations worked, or were supposed to work, like machines (Morgan 1986; Perrow 1986; Schein 1988; Scott 1995b), European modernism insisted on the aesthetic potential of efficiency, precision, simplicity, regularity, and functionality; on producing useful and beautiful objects; on designing buildings and artifacts that would look like machines and be used like machines; on infusing design and social life with order.

Modernism, consistent with its emphasis on the technical rather than the humanistic or the social-psychological, aimed at democratizing good artistic taste (DiMaggio 1987, 448), making it available to the population at large, especially through housing projects, urban planning, and everyday objects for use in the home, the office, and the factory. The architect was to shift from being an aesthete to a reformer (Wurster 1965), to have in mind the user of the building rather than the client or sponsor; architecture was to be used, not admired or contemplated (Scully [1961] 1974, 42). In the end, modernism proposed an aesthetic companion to scientific management's rationalized machine world, a Taylorized sense of the beautiful. It contained a set of ideological, technical and aesthetic proposals that altered the way in which buildings were designed, constructed and used, as the next chapter documents.

[8] By "rationality" I mean the systematic application of method and planning, and by "functionality" the description and organization of elements of a system by reference to their needs and their mutual interaction.