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Gropius, Machine Design,
and Mass Production*

Die Architekturstoriker nach Nikolaus Pevsner und Sigfried Giedion unterstreichen immer wieder die lineare Entwicklung, die die architektonische Form von den Konstruktionen der Ingenieure des 19. Jahrhunderts bis zu den Gebäuden der modernen Architekten des 20. Jahrhunderts genommen habe. Bei dieser Interpretation kommt jedoch der Einfluß, den die Produktionstechnologien des frühen 20. Jahrhunderts auf die architektonische Theorie und Praxis von modernen Architekten wie Walter Gropius, Martin Wagner, Bruno Taut und Ernst May ausgeübt haben, zu kurz. Die Planung und Errichtung von Neubauten in Deutschland war geprägt von den Massenproduktionstechniken eines Henry Ford und den Methoden der wissenschaftlichen Betriebsführung eines Frederick W. Taylor. Gropius' serienmäßige Fertigung von Häusern in Dessau Törten in den 20er Jahren ist dafür ein typisches Beispiel. Auch das äußere Erscheinungsbild der Bauten spiegelt sehr stark die Produktionstechniken wider, die die frühen modernen Architekten von Ford, Taylor und anderen modernen Ingenieuren übernommen haben. Ihre Gebäude sahen aus wie maschinell hergestellte Produkte, weil schon ihre Planung mit Maschinen rechnete.

Historians of technology may see facets of Walter Gropius's architecture more clearly than historians of architecture. This is especially true of a new generation of historians of technology who choose to study technological change in a social or institutional setting, an approach to be contrasted with the more traditional emphasis on straightforward description of machines, devices, processes, and structures. Many architectural historians prefer to concentrate on the analysis of architectural forms and to place these in a chronological narrative. These historians of architecture tend to isolate architecture from the social context within which it has evolved.

Historians of architecture, especially those influenced by Nikolaus Pevsner and Sigfried Giedion, take into account technological influences on architecture, but they tend to see technology as materials and construction techniques associated with civil engineering; they do not suitably stress technology as a highly organized means of production grounded in economic principles.' Giedion, for instance, in *Mechanization Takes Command*, describes the introduction of the machine and the assembly line into production of goods, but he does not sufficiently stress the economic principles

* Paper presented at the Symposium on the *Social Origin of Modern and Post Modern Architecture* (July 25-27, 1984) held at the Institute for Advanced Study Berlin (Wissenschaftskolleg zu Berlin).

and organizational structures that allowed the assembly line to function. Pevsner and Giedion have the point of view of engineers who concentrate primarily on the technical component of complex technological problems which, in fact, additionally involve economics, politics, and other institutionalized social factors.

In contrast, Walter Gropius and some of his contemporaries of the modern movement were aware, in the early twentieth century, of the nature of technological change. By then technology had taken on the highly complex, institutionalized character it has today. By 1900 business corporations, government bureaus, and military departments presided over technological change. Financiers, managers, and bureaucrats were as deeply involved in technology as engineers, craftsmen, and workers. Technology had become a cultural artifact reflecting the values and institutional structures of the era of high capitalism in the West. Gropius could not have managed great corporations like the Ford Motor Company and Allgemeine Elektrizitäts-Gesellschaft (AEG), but he did have a good understanding of the financial, managerial, and technological principles that shaped the institutional structure and the production strategy of large-scale technological and business enterprises. This knowledge he wanted to apply in the practice of architecture. Gropius had the breadth of vision of an architect-entrepreneur.

To understand the architecture of Gropius, historians cannot, as already noted, simply and exclusively place him in an architectural tradition, even if the tradition is the so-called modern that Pevsner and others traced back into the 19th century. Gropius's references were to the highly organized world of technology and business as well as to the architectural. He was marching to a different drummer than his tradition- and discipline-bound architectural contemporaries. Like so many truly innovative persons, he distanced himself from the on-going institutions and ideas of his field and sought applicable analogies in other realms of human activity. With the notable exception of a few years immediately before and after World War II, Gropius behaved like a technological enthusiast. He believed that technology shaped the modern world more fundamentally than any other historical force, and he was determined to express the spirit of this age in his architectural practice. He declared that architects have always had to come to terms with the technology of their era.'

Descriptions of modern technological materials and forms in Gropius's buildings are common; rarely, however, do historians stress Gropius's concern with the means of modern production. Some fail to do this because they are blinkered by the programmatic pronouncements that Gropius and his associates published when they founded the Bauhaus at Weimar. Before the admission of Laslo Moholy-Nagy to the Bauhaus faculty and the influential visits of Theo Van Doesburg in 1923, Gropius and the Bauhaus went through

an expressionistic phase that celebrated the presumed values of the medieval, holistic handicrafts.' Even before the move in 1925 to Dessau, however, Gropius showed increased interest in modern industrial culture and a growing determination to relate the philosophy and practice of the Bauhaus to it. This shift was not entirely unrelated to the attenuation of the spirit of withdrawal, and of the longing for utopianism stimulated in sensitive souls by the horrors of the war. Doesburg's reminding Gropius of his prewar commitment to industrial architecture especially factory design; the move to industrialized Dessau; the end of inflation; and the growing expenditure of government funds for housing development all reinforced Gropius's renewed interest in the interactions of architecture, technology, and industry. Considering Gropius's subsequent commitment to applying modern technology to architecture and his prewar dedication to industrial architecture, the expressionist and handicraft phase of his career appears the exception, not the rule.

Historians of architecture also fail to appreciate fully Gropius's commitment to modern production technology because they see him through the filter of the memorable image and phrase-maker, Le Corbusier. He so vividly defined the shapes of modern architecture that those who have read him tend to organize their knowledge of the modern movement and of modern architects, such as Gropius, in terms of Corbusian metaphors. First it should be noted that Gropius elucidated concepts and built buildings of a modern character a decade before Le Corbusier published *Vers Une Architecture*.⁴ Then it should be stressed that the grain elevators, airplanes, ships, and automobiles portrayed by Le Corbusier were the products of modern technology, not the methods of modern technology. Le Corbusier's juxtaposition of the Parthenon and the Delage »Grand-Sport« car - a memorable image of forms - has wrongly led many architects and historians to define modern technology entirely in terms of form rather than of form and methodology. Le Corbusier did in fact have a substantial interest in mass production techniques,⁵ but this can be overlooked in a superficial reading - or seeing - of his published work. If Le Corbusier had used illustrations of a Ford production line and a Taylor plant layout, he would have come closer to the heart of modern matters, at least as understood by Gropius.

Letters, memoranda, and publications testify to Gropius's technological enthusiasm and to his familiarity with the means of modern production. During the mid-twenties he explicated the technology of mass production in his advocacy of the standardization of precision component parts; the variability of the assembly of these; the use of capital-intensive, labor-saving, special-purpose machinery; and the division of labor. He showed his familiarity with the economics of production through his application of cost accounting techniques, his emphasis on unit cost, and his concern about dead capital.

He revealed his awareness of modern managerial practices in the layout of production facilities for housing in accord with scientific management philosophy. He also borrowed such general concepts from modern technology as the notion of invention and patents, research and development in a laboratory setting, and factory production. His complex and coherent philosophy of production was not borrowed from 19th century civil engineers; it was modelled on the strategies and structures of twentieth century, institutionalized, science related, economics permeated, production technology.

Before providing evidence of Gropius's entrepreneurial style as an organizer of the means of mass production, one should acknowledge that the Bauhaus faculty and Gropius's architectural associates influenced him - his was a collective enterprise, not simply a heroic *Siegeslauf*. Other modern architects in Germany including Peter Behrens, Ernst May, Bruno Taut, Martin Wagner, also used modern production methods in their housing construction.⁶ These architects undoubtedly influenced one another, but the prime sources of their and Gropius's production techniques were engineers, managers, and financiers who created and presided over great mass production enterprises. The most famous of these, even in Europe, was Henry Ford whose autobiography, *My Life and Work*, was translated and widely read in Germany.⁷ »Fordismus« became the popular term for modern mass production. Frederick W Taylor, the American pioneer in scientific management, enjoyed even greater respect among professionals, including the European architects of the modern school. Germans named his philosophy »Taylorismus.«

In Germany, the theory and practice of engineers and managers at AEG (German General Electric) also significantly influenced the modern architects. But AEG leaders acknowledged their debt to American practice as well. Peter Behrens provided a linkage between industrial practices at AEG and architecture. He was AEG's consultant from 1907 to 1914 on product design, trademarks, worker housing, and physical reorganization, or space utilization. During this period, Walter Gropius, Le Corbusier, and Ludwig Mies van der Rohe worked in Behrens's architectural bureau. Not only did Behrens influence other architects through direct contact, but also through the prominent part he played in Werkbund debates about architecture and technology.

Ford production methods are too well known to require detailed explication here. Massive functional coordination of raw material suppliers, manufacturing processes, and dealer sales to insure a smooth and massive flow of products were hallmarks. Less well remembered today is Frederick W. Taylor's insistence that workers be relegated to the role of programmed component parts in production systems and that these systems be methodically planned and organized to minimize the expenditure of animate and inanim-

ate resources. German commentators on the modern production methods often combined Fordism and Taylorism under the embracing concept of »Rationalisierung.«⁸

In the case of AEG influence, Walter Rathenau, the head of the firm, presented a grand vision of »Rationalisierung« and the political economy of production through a series of books popular among intellectuals. A leading engineer at AEG, Michael von Dolivo-Dobrowolsky, explained mass production at AEG to a select audience.⁹ The ideas of Rathenau, Dolivo-Dobrowolsky, and those of other engineering and managerial personnel at AEG probably filtered into the architectural world through Behrens or directly to interested architects such as Gropius. Ideas expressed by the highly influential architect and publicist, Hermann Muthesius, resembled in striking ways the philosophy of manufactures prevailing at AEG and other giant German manufacturing enterprises.¹⁰ As is often the case, general notions or ideas that influence a movement or an age cannot be attributed to a single source because they are widely shared and broadly publicized. The point to be stressed here, however, is that the breeding ground of ideas and practices applied by Gropius and other architects of similar mind was the world of contemporary technological affairs.

Gropius elucidated his views on modern production technology in several publications. Among the most explicit was an essay first published in 1924 in the *Berliner Tageblatt*. Entitled simply »Wohnhaus-Industrie« the article predicted a revolution in production techniques and related architectural style. The latter depended on the former. Unlike Le Corbusier, Gropius did not say that a house was a machine to live in; he believed that a house was a machine-made product. At hand, Gropius insisted, were the technological means to fulfill the age-old dream of an inexpensive, attractive, and healthy house for everyone. Inertia and sentimental attachments, however, had prevented the production of houses in a way similar to that in which Henry Ford had produced an inexpensive, attractive automobile. Not far off, Gropius predicted, was the day when houses like shoes could be ordered from a catalog. Also forthcoming should be mobile homes for modern transient people. Gropius wanted factories to produce standardized, interchangeable house components that could be assembled rationally into various combinations or forms. In automobile parlance, there would be different models of houses, but variation from standardized components was limited - the consumer could have any color house he wanted as long as it was white.

In a striking contrast to handicraft techniques, Gropius advocated using large, capital-intensive, labor-saving machines in housing factories. He wanted materials to be used that especially suited machine manufacture. Gropius understood that both material and form had to be adapted to machine production, not on aesthetic grounds, but because machine charac-

teristics determined to a large degree product characteristics. Plane surfaces and right angles, for instance, suited many production machines better than undulating and convoluted shapes. This was commonplace knowledge among design engineers; some architects had a difficult time grasping the concept. Gropius, more aware, pointed out that the art of architecture ought to be practiced within the range of variation that machine production allowed.

Historians of architecture have often confused the forms shaped by machine technology with forms borrowed from the shapes of machines. Gropius did not. An architectural form modelled on machine forms can resemble an architectural form designed for machine manufacture, but deriving forms from the method of manufacture is more original and fundamental than simply imitating machine design. Machines look like the products they make because machines are also designed for machine manufacture. Architects familiar with industrial practices, like Peter Behrens and Walter Gropius, were inspired not only by bridges, railway stations, and other engineering works or products; they were also moved by the methods that the engineer used to construct these.

If his dependence on the concepts of the technological world is not sufficiently evident from the preceding remarks, one should consider Gropius's call for a research and development laboratory. He recommended the establishment of experimental laboratories staffed by architects and engineers and influenced by businessmen; laboratories that would invent and develop the building materials, standardized building components, and production machines required by the new housing industry. On occasion, Gropius and his associates spoke of patents for invention being taken out by architects. After the move of the Bauhaus to Dessau, Gropius described it as an experimental laboratory for the housing industry"

In 1924 Gropius, Martin Wagner, Bruno Taut, and Ernst May borrowed from industry the organizational concept of a *Kopfgemeinschaft* (oversight consortium) and founded DEWOG (Deutsche Wohnungsfürsorge A.G. für Beamte, Angestellte und Arbeiter), an enterprise dedicated initially to the invention, design, and development of experimental houses that could become models, or exemplars, for mass production. Obviously this was analogous to the laboratory model or semiworks developed by industrial scientists and engineers for the same mass production goal. Each of the participating architects agreed to design and construct an experimental, or test, house and to share with the others the experience gained and the income derived from patents. The members of the consortium explicitly defined economic and technical parameters. The house designs should suit a mode of production that would be large scale, rationalized, and systematized. DEWOG circulated a memorandum stating economic principles of production that

would be observed. The goals were intensive labor saving, full plant utilization, economic material handling, and vertical integration of production facilities.¹²

After the move of the Bauhaus, Gropius discussed with Hugo Junkers, the Dessau airplane manufacturer, the possibility of establishing a house building factory. In a proposal, Gropius estimated the capital requirements of the initial outlay as 220,000 marks, and apportioned it among administrative costs, factory buildings, and machines. (Gropius seems to have been especially interested in acquiring cranes and a motor-driven truck.) He specified a factory employing twenty men with a capacity to produce 1000-1200 houses over a five-year period. In this modest proposal, Gropius was limiting production to the Dessau market.¹³

In 1926 Gropius secured the opportunity to fulfill his long-standing desire to become a production entrepreneur when the city of Dessau commissioned him to plan and supervise the construction of a housing project in Törten, a suburb of Dessau. The plan culminated in over 300 houses between 1926 and 1928. Gropius designed several basic house types, all of which were suited to modern production methods and intended for worker families. The plan and project gave Gropius and his associates the occasion to apply economic, technical, and managerial concepts expressed in his programmatic essays, in DEWOG memoranda, and in housing factory plans. The National Society for Research into Economic Building and Housing encouraged him and provided financial support, as it did other architects who applied modern production techniques.¹⁴

The most effective way of showing Gropius's theories as practice is through diagrams and photographs of the Dessau project. These reveal the use of low-cost materials, special purpose machinery, and flow diagrams and time charts to coordinate machinery and labor in a dynamic process. The construction site layout also brings to mind Taylorismus and Fordismus.

Gropius and his associates took inordinate pride in the machines used in component manufacture and construction on the site. They were especially pleased by the installation of a large crane and of rails for local transportation of materials. A machine for on-site manufacture of iron-reinforced beams (*Betonrapidbalken*) also delighted the machine enthusiasts. Along with these, there were concrete mixers, stone crushers, and building-block machines. As Gropius had explained on numerous occasions, the size of the project made possible the use of machines, for the investment could be spread over many housing units.

Existing manufacturers supplied the machines, but probably according to specifications of the Dessau Törten planners. On the other hand, the layout of the on-site construction and manufacturing facilities were innovations. The layout resembled the ground plans of an assembly-line production facil-

ity. Gropius and the contractors organized the various machines, material-storage areas, and railways systematically around, and between, a parallel line of row houses. There were eight building-block machines for making the hollow blocks from various materials, including cinders, and these machines were moved from one group of eight houses to another. Appropriately located storage bins fed raw materials such as rock, sand, cement, and cinders to the machines. The most complex of the machines, the roof-beam maker, had the primary position at the head of the building site, and rails spread out from it to the various houses under construction. Gropius said that the scheduling of production, delivery, and work resembled that used by large railway management. There were numerous charts scheduling the movement of machines, materials, and work crews from one set of houses to another.

The fact that Gropius designed for machine production and mass production is of considerable consequence for the interpretation of the social origins of modern architecture. It also throws postmodernism into perspective. Gropius and other moderns designed under the influence of the modern means of production because their goals were similar to those of the engineers, managers, and financiers who invented, developed, and organized modern mass-production technology- the production of low-cost products for a mass market. The market for mass housing in Weimar Germany was a major source of commissions for the modern architects. The list of housing developments in Berlin, Frankfurt, and elsewhere in Weimar Germany is a long one. The analogy between a mass-produced Ford automobile and mass-produced products in which to live was too obvious to be missed by architects whose objectives were similar to those of Ford. Like Ford, they were deeply influenced not only by the technical aspects of modern production but by the social and economic principles shaping it as well.

Conclusion

The point of view taken in this interpretation of the origins of modern architecture has stressed factors - especially modern technology - in the historical context in which the movement emerged. Relatively little has been said about the architectural tradition against which the architects of the modern movement reacted. If an analogous point of view were taken with regard to the postmodern movement, then emphasis would also be on the historical context. Essays on postmodernism usually stress, in contrast, the reaction of the movement against the modern movement, hence the name »post-modernism.« It would be worthwhile to search for influential contextual factors shaping postmodernism that have had an effect comparable to that of the modern means of production, or technology, on modern architecture.

Footnotes

- 1 Nikolaus Pevsner, *Pioneers of Modern Design* (New York: Museum of Modern Art, 1963). Sigfried Giedion, *Space, Time and Architecture* (Cambridge, Mass.: 1941).
For an exceptional essay that does stress the means of production, see Karin Wilhelm, »Von der Phantastik zur Phantasie: Ketzerische Gedanken zur »Funktionalistischen Architektur,« in *Neue Gesellschaft für Bildende Kunst, Wem gehört die Welt: Kunst und Gesellschaft in der Weimarer Republik* (Berlin: NGBK, 1977), pp. 72-86.
- 2 Walter Gropius, »Monumentale Kunst und Industriebau,« typescript (37 pages) of an address given in the Folkwang Museum, Hagen, Westfalen, 29 January 1911, pp. 9-11. File so titled in Bauhaus Archiv, Berlin. Hereafter cited as B.A. Ideas expressed by Gropius in this address reflect in many instances those of Peter Behrens in »Art and Technology,« a lecture delivered at the 18. Jahresversammlung des Verbandes Deutscher Elektrotechniker, Braunschweig, 26 May, 1910 and reprinted in Tilman Buddensieg, *Industriekultur: Peter Behrens and the AEG, 1907-1914*, trans. Iain Boyd Whyte, (Cambridge, Mass.: MIT Press, 1984), pp. 212-19.
- 3 Reyner Barham, *Theory and Design in the First Machine Age* (Cambridge, Mass.: MIT Press, 1980), pp. 276-85.
- 4 On Gropius's early views on industrial architecture and his Fagus Werk, see Karin Wilhelm, *Walter Gropius Industrie Architekt* (Braunschweig / Wiesbaden: Friedr. Vieweg & Sohn, 1983).
- 5 Stanislaus von Moos, »Le Corbusier und Gabriel Voisin,« in *Avant Garde und Industrie*, hrsg. v. Stanislaus von Moos and Chris Smeenk (Delft: Delft University Press, 1983), pp. 77-103.
- 6 Justus Buekschmitt, *Ernst May* (Stuttgart: Verlagsanstalt Alexander Koch, 1963), pp. 33-57; Kurt Junghanns, *Bruno Taut, 1880-1938* (Berlin: Henschelverlag Kunst und Gesellschaft, 1970) pp. 61-86. Rosemarie Bletter of Columbia University, N.Y. is preparing a book on Taut.
- 7 *Mein Leben und Werk* (1923) sold more than 200.000 copies. Jost Herman und Frank Trommler, *Die Kultur der Weimarer Republik* (München: Nymphenburger Verlagshandlung, 1978), pp. 52-54.
- 8 Otto Bauer, »Rationalisierung und Gesellschaftsordnung,« in *Kapitalismus und Sozialismus nach dem Weltkrieg* (Berlin, 1931) reprinted in *Rationalisierung 1984*, Ausstellung Katalog Staatliche Kunsthalle Berlin und Neue Gesellschaft für Bildende Kunst (Berlin, 1984), pp. 117-126.
- 9 Michael von Dolivo-Dobrowolsky, »Modern Mass Production in the Electrical Appliance Factory of the AEG,« a lecture delivered in AEG Conference Hall, 17 January 1912 and reprinted in Buddensieg, *Industriekultur*, pp. 256-61.
- 10 Hermann Muthesius, »Handarbeit und Massenerzeugnis,« *Technischer Abend im Zentralinstitut für Erziehung und Unterricht*, IV (1917), a 30 page essay.
- 11 Walter Gropius, »Wohnhaus-Industrie,« *Berliner Tageblatt*, 24 September 1924. See also Gropius, *Scope of Total Architecture* (New York: Harper, 1955), pp. 128-35. Gropius to Schumann Haus- und Küchengeräte, Berlin, 11 July 1925. Korrespondenz W. Gropius über Rationalisierung im Bauwesen. B.A. »Arbeitsprogrammskizze für einige Versuchswohnhäuser,« a 6 page typescript dated 29 December 1924. Korrespondenz 1924/26. Dewog. B.A.
- 12 »Arbeitsprogrammskizze für einige Versuchswohnhäuser.«

- 13 Gropius, »Plan zur Errichtung einer Wohnhausfabrik.« Undated manuscript (5 pages) with a pencil notation »to Junkers, Dessau.« Manuskripte verschiedener Bauwirtschaft, 1922-1934. B.A.
- 14 Reichsforschungs Gesellschaft für Wirtschaftlichkeit im Bau- und Wohnungswesen eV., *Bericht über die Versuchssiedlung in Dessau*. Sonderheft 7, Gruppe IV, Nr. 4, 2. Jahrg. April 1929. Walter Gropius, *Bauhausbauten Dessau*, Bauhausbücher 12 (München: Albert Langen, 1930), pp. 152-200. See also, Reginald Isaacs, *Walter Gropius: Der Mensch und sein Werk* (Berlin: Gebr. Mann, 1983), I, 383-5.