The Impact of New Technologies on the Development of Architecture

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A view of the history of architectural technology can help us understand the stakes involved in the construction of buildings of different periods, styles, and structural systems. It can also help clarify why certain forms arose at particular moments in history, at specific sites, and under specific conditions. In all eras and geographical locations, technological innovation has influenced the development of architecture. This innovation has taken various forms—sometimes manifesting as new materials, either manmade or natural, and sometimes as new design tools or structural methods. The practical necessities of any given moment determine the technology that will arise to suit these demands, whether it relates to shelter, fortification, or religious ideas. Technology has been used to solve practical problems, but also to create symbolic orders, such as the assertion of human will over natural forces that arose in prehistoric building. Since antiquity, architects have stressed the significance of such knowledge to their field; the Roman architect and theorist Marcus Vitruvius Pollio (see box text on p. 174), for example, was trained as an engineer and frequently underscored the importance of technological understanding to the execution of architecture. In fact, we see this theme repeated in architectural theory across the globe. The *Manasara-silpasastra*, a seventh-century Indian building manual named for its author (see box text on p. 273), and the Chinese treatise Yingzao Fashi by Li Jie, a Song Dynasty book of architectural standards (see box text on p. 435), likewise argue that no architect can prosper without a thorough technical education. These theorists' shared emphasis on developing new technologies for new problems has been heeded by centuries of builders, who often draw imaginatively from other fields to meet challenges in their own.

Historians often point out that technology results from human ingenuity paired with available resources. For Stone Age architecture, the absence of written records means that researchers must use available technology (such as carbon dating and geophysical surveying) to make sense of what might seem at first surprising or enigmatic. For example, the site of Göbekli Tepe (Figure 1.1-7), near Şanliurfa, Turkey, presented scholars with a technological conundrum when it was accidentally discovered by a Kurdish shepherd in 1994.

Figure 1.1-7

Specifically, it forced researchers to change their conception of what was technologically possible during the Neolithic Era. The complex, comprising megaliths set into large, perfect circles of smaller stone, appears to have been a ritual structure of some sort. The T-shaped megaliths, standing some twenty feet in height, were precisely cut and dressed by skilled masons. Each megalith was decorated with both high- and low-relief sculptures depicting a range of animals. Gazelles, foxes, scorpions, and wild boars are easily recognizable, but other representations might refer to species that have simply gone extinct during the passage of twelve millennia. To date, only five percent of the site has been excavated, but geophysical surveys have revealed at least 200 megaliths standing in twenty circles. Equally significant is what has not been discovered at the site; in particular, though at least two phases of massive construction for ritual purposes have been uncovered, no residential buildings have been located. Furthermore, the numerous flint tools that have been discovered on the site provide insufficient explanation of how these monumental structures were built or decorated. Therefore, the site raises many questions that archaeologists continue to pursue: how were these circles built? Exactly which groups of people contributed to their construction, and for what purpose? Why was the site abandoned? Despite these lingering uncertainties, Göbekli Tepe offers insight into a single, clear fact: that early societies demonstrated a much more complex level of social organization than has previously been comprehended. The realization of this monumental structure would have necessitated a remarkably high level of planning, coordination, and specialization. Furthermore, the command of technology in evidence at the site—not only the clear invention of tools to accomplish particular tasks, but also the artistic and technical mastery of the building materials at hand—indicates that technological innovation as such was highly valued. At a site that is 7000 years older than Mesopotamia's fertile crescent, long understood to be the cradle of civilization, Göbekli Tepe reveals that some building techniques have an older history than is currently understood.

At Notre-Dame in Paris (Figure 9.2-14), the structural system suggested by the pointed arch was fully elaborated through vaulting, buttresses, and tracery decoration.

Figure 9.2-14

Both on the exterior and interior, the cathedral combined width and height to create a building of astounding spaciousness. Thanks to its builders, Notre-Dame was one of the first buildings in the world to adopt the flying buttress to relieve lateral thrust. These masonry pylons leapt from the cathedral wall to the ground, thus allowing the transept walls to remain extraordinarily thin and transparent. For a medieval user of the cathedral, the technological message of the cathedral would certainly consist of human structural achievements. More relevant, however, would have been Notre-Dame's assertion of the union of state and religious power, with its dissolved walls of colored glass evoking the riches of heaven that would reward obedient subjects. In fact, the entire cathedral operated not only as a building, but also as a visual technology that instructed the faithful in the workings of the divine. To modern viewers, the drama of Notre-Dame's feats of engineering symbolized different meanings; for some, its soaring height continued to express the power of God and the promise of heaven; for others, the structure seemed almost modern in its use of technology and its shimmering walls of glass. For the architect and theorist Eugène Emmanuel Viollet-le-Duc, Gothic cathedrals spoke eloquently about structural possibilities for the modern age. In his work as a preservationist architect, including the extensive restoration of Notre-Dame that he began in 1844, Viollet-le-Duc recommended hewing closely to medieval materials and techniques whenever possible. Though he freely added and subtracted elements from the buildings under his care, he believed that authenticity was to be found in the architectural technology itself. Taking a decidedly objective view of the cathedrals, in contrast to the dreamy romanticism that characterized the attitudes of many of his contemporaries, Viollet-le-Duc argued that their ribbed structure could be translated into the industrial materials of iron and concrete to suit modern needs (Figure 9.2-13). In schemes like his design for a Gothic-inspired auditorium or his drawing for a market hall supported by wrought iron members, Viollet-le-Duc envisaged historical forms brought up-to-date by industrial technology.

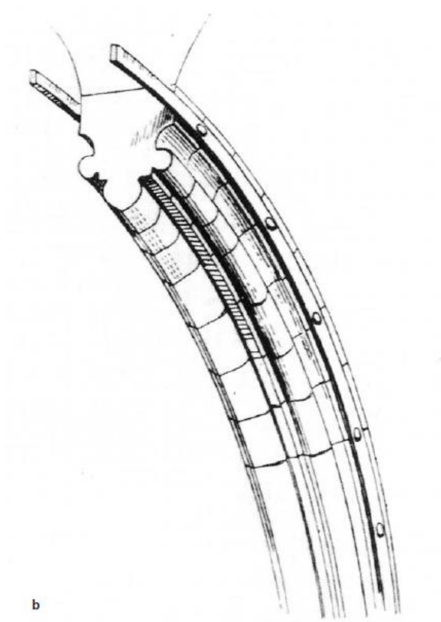

Figure 9.2-13

In fact, Viollet-le-Duc's work suggested the way in which the Industrial Revolution would precipitate an epochal transition in architectural thinking. The modernization of cities, transportation systems, and manufacturing methods created an analogous paradigm shift in architecture in which traditional craft-based ways of building ceded to factory production and mechanized assembly processes. This change had an important aesthetic component. Though the history of architecture has always paralleled the history of technology, in architectural modernism, buildings and cities were conceived of not only as the results of technical processes, but also as visual expressions of technology itself. For many modernists, the built environment was the medium by which the public could be taught to understand the machines that, by the mid-nineteenth century, seemed to govern every aspect of life. Architecture, then, was the means by which the machine—the source of increasing anxiety and alienation—could be humanized and brought under social control. Therefore, many architects began to design in a so-called "machine aesthetic," a set of formal characteristics understood to be logically "derived" from industrial processes. In the machine aesthetic, the industrial materials of glass, steel, and concrete assumed new configurations, with smooth, planar surfaces gathered together in rigorously geometrical plans (as in Walter Gropius's 1926 design for the Bauhaus in Dessau, Germany) (Figure 18.2-17).

Figure 18.2-17

Perhaps the architect whose vast international influence did the most to codify this machine aesthetic was the Swiss-born Le Corbusier, who famously declared, "A house is a machine for living in." Throughout his early writings, Le Corbusier exhorted architects to look with new eyes—the eyes of the engineer—in order to solve the problems of building that were particular to modern life. In his architectural and urban designs from the first quarter of the twentieth century, Le Corbusier pursued a poetics of technology in which the logic and efficiency of machine living resulted in the liberation of the human spirit. In 1914, he developed an idea for a prototype that he branded the "Maison Dom-Ino," or Dom-Ino house. His idea was that it would be a mass-producible house suitable for any income level. This simple concept resulted in an equally simplified form: the house was essentially three concrete slabs suspended from a steel frame, allowing the interior to be configured to suit particular inhabitants. Not only did the free-standing columns resemble domino dots in plan, but a dense row of these houses would also resemble dominos in play. Thus, the label "Dom-Ino"—the industrial patent name of the scheme—was intended not only to be a memorable brand name, but also to describe and advertise the product. Le Corbusier's hopes to patent his scheme in partnership with the concrete manufacturer Max Du Bois were bootless, but the Dom-Ino house (like many of his prototypes) reveals his belief that technology should determine architectural form. The same relationship with technology characterizes Le Corbusier's urban plans from the same moment, such as the Radiant City or the Contemporary City for Three Million Inhabitants (Figure 18.2-4).

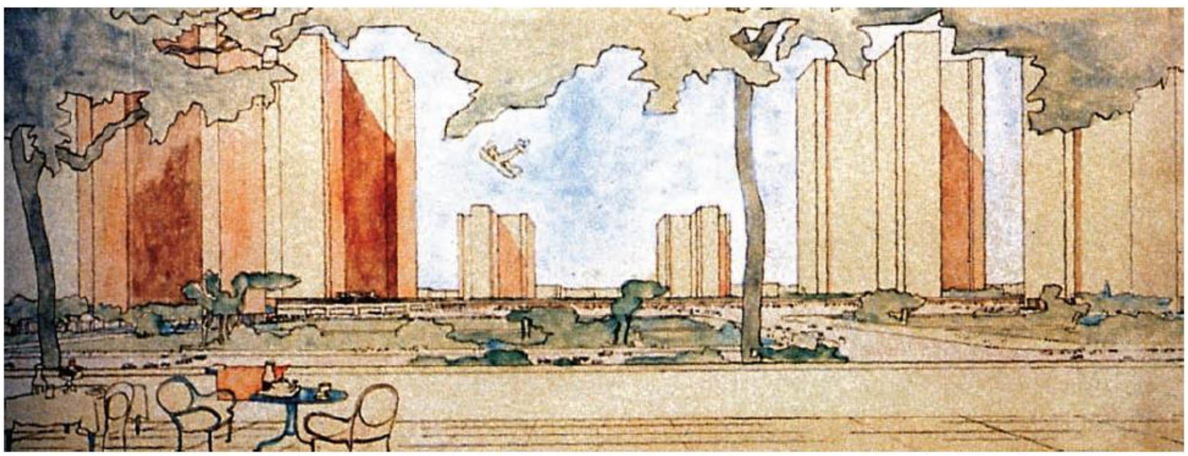

Figure 18.2-4

In these plans, urban density was achieved by bundling the population into prismatic towers of glass and steel set in expanses of green parkland. Transportation networks provided for the circulation of goods and people throughout the city, and air, automobile, and train traffic would descend in layers through the ground. Standardized and mass-produced, the architecture and infrastructure that Le Corbusier proposed in the Contemporary City would, in effect, automate human life, turning people into free-thinking and free-willed machines. In the later years of the twentieth century, both his architectural and urban prototypes were often understood as aiming for a soulless flattening of aesthetic experience—but that interpretation misses Le Corbusier's lyrical faith in the beauty of machine logic. Though he avowed, "All men have the same needs," these designs were not intended to limit or functionalize human experience. On the contrary, he believed that the flexibility of his projects would open up modern life to unlimited individual meanings and endlessly varying internal states. Though Le Corbusier's career was long and multifaceted, clumsy imitations of his machine-aesthetic designs came to populate cities across the globe. Far from humanizing technology, as had been modern architecture's intention, these ersatz projects seemed to stifle the vitality of interaction both in their interiors and at the street level. They have forced yet another reconsideration of the relationship between architecture and technology, with many architects turning to sustainable practices to imbue technology with ethical purpose.

For Further Reading

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