Architects' Encounters With Computers, 6 Computer L.J. 357 (1985)

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Architects, like most professionals, have found innumerable uses for computer technology. They use word processors to produce their letters and specifications, they run programs to perform routine analyses, they use computer graphics systems to automate drawing production, and they rely on accounting and project management systems to keep track of people, time, and money. This will surprise no one. Of much more profound importance is the impact that computer technology is having on our fundamental conceptions of what a building is, of what it means to design a building, and of how a building is used.

Buildings were long thought of merely as shelters. Aristotle, for example, defined a house as “a shelter against destruction by rain, wind and heat.” The elements of primitive construction were skeleton and skin, fabricated and erected by hand.

Nomads may erect simple shelters, but farmers have reason to erect more permanent and elaborate buildings, and the means to do so. The Neolithic Agricultural Revolution allowed the development of permanent settlements, the emergence of a skilled craftsman/builder class, and the beginnings of architecture.

Gradually, the activity of design separated itself from the activity of construction. Design decisions were systematically premeditated, and documented in drawings and written instructions, rather than made on site as immediate choices presented themselves. Until the nineteenth century, however, design documents were rarely extensive or detailed. The architectural drawings of Palladio, or of Thomas Jefferson, for example, illustrate this.

The Industrial Revolution changed this process. A vast array of new, manufactured construction components and materials emerged, making the task of selection and specification immensely more complex. Buildings began to have internal organs and physiologies, as well as skeletons and skins. They were equipped with increasingly elaborate...
heating, lighting, ventilating, and other systems, all of which had to be
designed. Furthermore, the context of the rapidly growing industrial
cities created the need for complex new building types, but precedent
and tradition provided little guidance for their design.

In sum, the sheer number and complexity of decisions to be made
and documented in the design of a building grew rapidly. Building de-
sign became a large-scale information processing task, and the architec-
tural profession grew, along with other professions engaged in
information work, as we entered the Post-Industrial Era.

Until the mid-1970s, the information processing tasks involved in
the design of buildings were carried out in a highly labor-intensive way.
Architectural offices consisted of professional staff teams, who worked
with very simple, inexpensive equipment, and whose services were
billed by the hour. The bigger the building, the more hours it took to
design and document, and the larger the fee.

Since then, the ongoing development of VLSI technology, and the
resulting precipitous drop in the cost of computing, has made it increas-
ingly attractive to replace labor by capital in the design process. The
first successes were in the automation of routine, repetitive drafting and
engineering analysis tasks. We now see increased use of computers for
more complex decision support functions, and in three-dimensional vis-
ualization and rendering. There is little doubt that the CAD systems
employed by architects will embody increasing amounts of expert
knowledge, and will perform a larger percentage of the work involved
in design and documentation of a building. As a result, architectural of-
ices are becoming much more capital-intensive, and we can expect the
demand for many traditional, manual architectural skills to diminish.

This important trend is intersecting with another one. Increas-
ingly, buildings not only have skeletons and skins, and mechanical
physiologies, but they also have control systems—nerves and brains, if
you like. These control systems exist at a number of levels. First, there
is a growing number of microprocessors in appliances, such as micro-
wave ovens, washing machines, and other equipment. Secondly, sophis-
ticated computer systems are being used in buildings to monitor and
control the operations of the air conditioning, elevator, and other
mechanical and electrical systems. Thirdly, buildings are increasingly
becoming nodes in electronic communications networks, and must be
designed to serve this function. Finally, as we enter an era in which
emphasis is shifting away from the creation of new building stock to the
management and transformation of existing building stock, computer-
based facility management systems are finding rapidly widening use.

A facility management system is essentially a database system
which maintains an inventory of all the space that exists in a building,
an inventory of the furniture and equipment associated with the building, and an inventory of the employees and organizational groups that use space and equipment within the building. The system also records the relationships between these things, such as the occupation of a space by an employee or piece of equipment, and the adjacencies of spaces. This description of the building and its occupants is kept current as changes take place, and is used to produce reports and analyses that guide management, maintenance, and planning for the future.

Where does all this leave us? Architects have begun to regard buildings not just as static structures, but as resource-consuming, adapting, aging systems that require skilled, careful management throughout their lives. The design of the control system to accomplish this is as much a part of the architecture as the design of the skeleton and skin, and of the mechanical and electrical systems.

In both the design and management of buildings, the trend of increased computer use will continue. In many cases, the database that is developed to document the design of a building will continue to be updated and used, after the building is constructed and occupied, as the heart of a facility management system. We can expect to see design (initial configuring of a building) and management (reconfiguring over its lifetime) become more closely integrated in this way.

The Agricultural Revolution gave us the possibility of architecture. The Industrial Revolution allowed buildings to become large and complex. The Computer Revolution has provided a way to manage this complexity.