

The Users

Architectural Archives in the Digital Era

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Abstract: As with records everywhere, more and more architectural records are being prepared in a digital format. Even though this format shift is taking place gradually due to the complex nature of programs used in architectural design, digital designs are quickly becoming the designs of record, especially those of three-dimensional models. The increased digital nature of architectural records, many of which are viewed as disposable by their creators, raises questions for archivists about the records' intellectual and artifactual values. In addition, archivists must deal with the vast amount of digital records, the instability of their storage media, and the short life span of most software and hardware products used to create architectural designs. Developing strategies to deal with these issues is essential to the survival of architectural records created in the late-twentieth century and by future generations.

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THE THEME OF MY discussion is the transformation from paper to digital records in architectural offices and the implications of that change for architectural archives. This shift to the digital recording of information is fundamentally altering the nature of archives, and it is likely to continue to do so, as is clear from developments in computer technology itself.

The first of these developments is faster, cheaper, more ubiquitous computation power. Every year, the speed at which certain computational operations can be performed doubles, while the cost of performing these tasks stays the same, and the end is not in sight. We can expect this trend to continue for at least the next ten years. A second development, the drop in the cost of computer memory, is equally spectacular. The price of a gigabyte of disk memory has already dipped below \$1,000; a year from now it will be only two-thirds of what it is today. Again, projections of existing technology make it clear that this progression will continue.

Perhaps more important than either of these developments is the extraordinary expansion of computer networks and, with them, capabilities for digital transfer and remote processing of information. I remember the inauguration of node number one of the Arpanet, the predecessor of the Internet, in 1969, when I was at UCLA. We thought it was extraordinarily funny, the idea of a one-node network. Now the Internet has many millions of daily users worldwide, and it is just one of the digital networks.

Two of my predecessors at MIT, Pietro Belluschi and Lawrence Anderson, eminent former deans of architecture and planning, recently passed away. Both left extraordinary paper records which will be immensely valuable as historical documents of the architecture of their time, and of the people and the social processes connected with it. But anybody who might be interested in my records would find that almost all the important correspondence that goes through my office (perhaps 80 or 90 percent), is in the form of electronic mail messages. I transfer perhaps a hundred of these a day into a running archives. Some are trivial, but others are important: correspondence with architects who are doing significant work, for example. An archivist would want to preserve these.

In architectural practice also, digital records are replacing paper—more gradually (it began in the 1960s), but inexorably, and at an accelerating rate. This trend is gradual because the technology used to manipulate and represent architectural designs is much more complex than the corresponding technology used to handle text. A distinction can be drawn here among different types of digital records, because they have rather different properties.

First, in architecture as in other fields, we see text records—electronic mail and word processor files—accumulating at an extraordinary rate. But these are relatively simple compared to visual records.

Second, we are beginning to see digital images accumulating at a very rapid rate. By “digital image,” I mean the product of an electronic scan of an image, such as a photograph or the output from a digital camera. The result is basically a grid of numbers that record intensities on a pictorial surface, which is relatively simple to handle technologically but typically requires a great deal of storage space. We are starting to see the development of consumer-level digital cameras that will allow direct production of digital images and, I think, will rapidly replace traditional photographic films.

Third—and this has been going on for some time now—we are seeing very extensive development of the use of digital drawing files created on computer-aided design (CAD) systems, such as AUTOCAD. These are now extremely common in both large and small architectural offices, and in most of the offices I am familiar with, the CAD files have

become the definitive record—the core of the representation—of a project. The printouts or prints generated from CAD systems are ephemeral things, in the view of the practitioner, and are quickly discarded.

A fourth type of record consists of three-dimensional models used in the design process—digital models used to generate drawings and CAD instructions for the production of artifacts. These models are being developed more slowly because they represent a more complicated technology than that used to represent two-dimensional objects. But it is now possible to develop and document a design by producing a complete three-dimensional model rather than a set of two-dimensional drawings, and to treat drawings and other documents as reports from the three-dimensional digital database.

In Frank Gehry's office in Santa Monica, for example, the original conceptual design work, by and large, is done not by sketching but by assembling a three-dimensional sketch model with blocks of wood, pieces of fruit, all sorts of strange things. These sketch models are very ephemeral, of course. Even if you wanted to preserve one, the curatorial problems would be immense, especially with the fruit. Once this model has been produced, it is converted to a three-dimensional computer model using 3-D digitizers. The digital model is used for the precise design development which, in a conventional process, would be done in a series of drawings. Then, interestingly, the digital model becomes a basis for building a physical model using techniques of three-dimensional printing or a computer-driven, five-axis milling machine. That is an important step from the architect's point of view because the physicality of the actual model is desirable for some purposes. Very beautiful artifacts are in fact produced in this way.

Most interesting about this process is that a large number of traditional working drawings are simply eliminated. Shop drawings are also eliminated to a large extent, sometimes completely, because the digital model is then used directly to drive computer-controlled fabrication machinery and computer-controlled erection techniques on site. (In some sense this solves the problem of whether or not to preserve the shop drawings; they are never produced!) Probably the most spectacular example at the moment is the Disney Concert Hall in Los Angeles, which has a very complex curved surface geometry of beautiful cut stone. The stonecutting will be done, not by craftspeople with chisels, but by using a CAD technology developed for the aerospace industry, which models the curved surfaces digitally. Then, multi-axis milling machines are used directly from the digital model to carve very beautiful curved surfaces.

This type of digital representation raises several issues for archivists. The first is that of intellectual value. As I have said, the digital model is, increasingly, the definitive record of the design, particularly if it is three-dimensional. Plots, printouts, computer-generated physical models, and so on really are seen more and more, at least by practitioners, as throwaway byproducts, and they are not likely, in the normal course of events, to have a very long life. The digital model is the thing to keep in order to retain what the architect considers the complete, detailed, definitive record of the design.

Furthermore, and very interestingly, the digital model often provides a complete and detailed process record. Designers working in a digital environment normally keep earlier versions of their work, not only for backup, but also for reference and possible return points in case they want to go back and redevelop a design from an earlier point, just as people do when they write with word processors. I would guess that an archivist would want to keep not only the final digital model but also the multiple versions that develop, since these show the evolution of a project. In a well-organized office that is based on digital technology, the backup and storage of files are, to a large degree automatic, so

there is a great potential for tapping into that routine. And any architect in his or her right mind who depends on a digital model would not only back that model up every day but also preserve the tapes at some offsite location. Those records have to be organized, and that can be done with the concerns of an archivist in mind.

Another question is that of artifactual value. Is the digital model a valuable artifact? In one respect, it could be considered to have almost no artifactual value. A digital model, even a very large one, can be replicated quickly and from a distance across a network. You may have seen the news coverage regarding an MIT student who was arrested for making software available on a network so that people could dial in and replicate it, and therefore obtain it without paying for it. Digital information is one of the few things that you can give away and still have. You can distribute electronic copies indefinitely without losing the original because there is no meaningful way to distinguish between original and copy.

All of these characteristics of a digital work are problematic from the standpoint of artifactual value. In this connection, our concepts of intellectual property and of publishing and distribution of digital information are changing radically. In the future it will be of great value to have the electronic distribution rights to material of genuine intellectual interest, which certainly could include architectural archives. Bill Gates, for example, has been acquiring digital reproduction and distribution rights to major museum collections all over the world.

I would end by discussing some of the practical problems of dealing with digital information. These are not insoluble, but they are difficult indeed. First, at a basic level, the fundamental storage media used for digital models in architectural offices are very volatile. Floppy disks, hard disks, digital tape, and so on are not archival media. For instance, information can be transferred to compact disks, which have a much longer life and could be thought of as an archival medium, although we really don't know how long a compact disk lasts.

Transferring the contents of an architectural office—floppy disks and old tapes and so on—to an archival medium can be very difficult. The difficulty is compounded by the fact that you also have, typically, a very disorderly collection. Because storage of digital information is so cheap, the tendency is to retain everything in a disorganized way. Now, one could argue that the results have value; but it is extraordinarily difficult to find one's way through old digital archives. File names are often meaningless, and there is an immense proliferation of versions of documents that are only subtly different from each other—or maybe not different at all—but, at least in the case of visual information, there is no way to tell.

In order to read a digital document, the software that was used to create it, or something equivalent, is required. With text files, this is often not difficult, because text files are relatively simple things. However, computer-aided design files, particularly big, complicated geometric models, generally can be read only with precisely the same software that created the document. But software has a very short life, so there are already a tremendous number of unreadable records. A researcher would have to go to the immense effort of re-creating the software in order to read the documents. In many cases, even with the appropriate software, it would be necessary to have the hardware for which it was designed, and hardware also has a very short life. The Computer Museum in Boston has a wonderful collection of artifacts from the early computer era, but few of them actually work; they are dead systems.

The combined problems of immense volume, unstable storage media, and obsolete software and hardware add up to some very tough problems for the archivist to deal with. If we take our archival functions seriously, we will have to bring a high level of sophistication to research in order to develop strategies for dealing effectively with digital media. Otherwise we will lose the records of the architecture of the late-twentieth century and beyond.