COMPUTERS IN THE ARCHITECTURAL OFFICE

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Preface

The subject of computer use in the field of architecture is not a new one, yet only a small (but growing) number of design professionals are actively involved in utilizing computers in their practices. As the numbers increase and more architects begin to wonder what all the noise is about, the need for information on the subject grows as well. Many architects and design professionals are eager to understand and use computer aids in their practice, but they lack knowledge of how to even get started in the field.

This book has been written to fill what the author believes is a definite need in the profession. Currently, an architect has several places to turn for information on computers, but all are lacking in some respects. Most architectural, design, and construction-related journals now print articles on computer use, but one or two pages every few months does not answer even a fraction of the professional's questions. Some architectural firms that have successfully implemented computers are willing to share their experiences, but many do not have the time or the desire to teach others what they have learned.

Another source of information is a consultant who can give advice tailored to the needs of your firm, but for a hefty price. Numerous books on computers are available, but most are of limited use to the architect who needs information geared to his particular applications. Finally, this wealth of computer information does narrow down to a few specialized publications for architects, but most do not cover the topics that a novice in the field needs to know in order to actually begin *using* computers in his practice.

Architects who have little or no knowledge of computers except an instinct that they had better start learning now "or else," have a need at the outset for very specific kinds of information. First, they want to know (but very briefly!) what a computer is, how it works, and what some of the specialized jargon of the computer world is all about. The next two important questions are: "What can it do for an architect?" and "How can I begin using one?" Of course, under these subjects a

whole range of questions emerge on such topics as cost and financing, integrating computer use into office routine, and choosing which tasks to automate and when.

The material presented here is organized into three sections. Section 1, "Computing for Beginners," starts out in Chapter 1 with a brief introduction to computer basics. Chapter 2 addresses issues that are relevant to firms just beginning their involvement with computers. Section 2 is directed towards firms that have already spent some time investigating and using computers, and are ready to make a commitment to an in-house system. In Section 2, Chapters 3 through 6 explore the topics of software, hardware, office organization, and financial concerns.

The book concludes with Section 3, which presents an overview of computer applications for architects and design professionals. The appendices provide many sources of information for those who wish to explore the subject matter further. Appendix A lists suggested books and journal articles, while Appendix B gives the names and addresses of many companies and organizations which are mentioned in the book.

The following note of caution should rightfully appear in every publication on this subject matter. The field of computers is changing so rapidly that most books are considered outdated by the time they reach the bookstore. New types of hardware that are faster, more powerful, and less expensive emerge continually. The amount and sophistication of software and applications available for architects are continually on the rise.

In keeping with the intent of this book to be practical, informative, and application oriented, many prices are given for hardware, software, time sharing charges, service bureau fees, etc. Inevitably these charges will fluctuate, both up and down. Wherever possible, an estimate is given for expected price changes within the coming years. In general, "generic" hardware costs will go down, as the price of computer memory decreases, providing more memory for the same or lower price. The costs of hardware peripherals, especially graphic devices such as plotters, CRTs and digitizers have remained fairly stable and should continue to do so. Charges that are dependent on human labor and market fluctuation such as service bureau fees, software costs, and consultant fees are expected to rise.

Hardware costs may be dropping, but do not expect computing to

become cheap, nor use that as an excuse for putting off your entry to the field with hopes of "waiting until prices drop a bit more." For many firms, the time to start your involvement with computing is NOW. The information presented in this book should be an asset in starting you on your way.

Natalie Langue Leighton

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This book began as a Master's Thesis at Carnegie-Mellon University, in the Advanced Building Studies program of the Department of Architecture. I would like to thank Charles M. Eastman of C-MU for his guidance and helpful suggestions during the writing of this book, and his confidence that the material was timely, important, and worthy of publication. The suggestions and comments of all others who read the manuscript are highly appreciated as well. Thanks are also due to the people and organizations that provided illustrations and information, and to my husband Jeff for the many hours he spent typing the manuscript. Finally, I would like to thank all of my family and friends who encouraged me and supported my work to update, transform, and expand the material from thesis to book form.

It is my hope that this publication will help to ease the confusion that many architects are feeling as they take their first look at the bewildering array of computer aids that currently exist in our field. By taking the time to read, question, understand, and experiment, the advent of computers can and will be an invaluable addition to the designers' profession.

Natalie Langue Leighton

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Section 1
Computing for Beginners

1. Before You Start

THE BENEFITS OF COMPUTING TO ARCHITECTURAL FIRMS

The computer has taken a permanent place in our society and has found its way into a variety of aspects of human life. Many professions are exploiting its capabilities to the fullest and are involved in developing the increasing technology that continually produces more powerful and advanced machines, and more sophisticated software. The computer is not always welcome, however. Individuals have raised fears of the intrusion into privacy that it will cause; workers fear they will lose their jobs to a machine that can perform tasks faster, more accurately, and for longer time periods than a human.

The architectural profession is one group of people who, until very recently, have been reluctant to accept the computer into their work place. Many architects fear that the computer, with its rigid adherance to logic and quantitative analysis, will remove the creativity from the profession. Others fear being replaced by a machine, especially draftsmen, whose jobs can today be accomplished by a computer with much success. Some firms believe that computing is much too expensive to even consider and therefore do not bother to investigate whether or not their firm can actually afford it. By tradition, architectural firms are labor rather than capital intensive, and the profession is reluctant to change this image.

Despite the large amount and variety of negative attitudes, many architecture firms have been intrigued by the prospects of computerization. A few of the largest began investigating computers in the 1960's, and during the 1970's more and more firms became involved in their use. Several surveys conducted around 1980* showed that over one half

*The Sweet's division of McGraw-Hill Information Systems conducted surveys in 1979, 1980, and 1981, as did the U.S. General Accounting Office in 1979.

Fig. 1-1. A typical architectural firm is strong on man power but has little automation.

of all architecture and engineering firms in the United States used computers in some way. Throughout this decade, the percentage of computer users among A/E's should rise dramatically. However, computer use in design firms is not limited to the United States. England, Australia, the Soviet Union, Spain, Italy, France, Japan, Germany, Holland, and Denmark are a few countries which have explored this field to some extent.

What are the features of computing that have attracted and kept these firms? First, it should be noted that most computer programs do not attempt to replace the architect by actually designing a building. Instead, the computer is treated as a tool to aid in the design process. One way in which this is accomplished is by helping the architect to improve the quality of his design.

The computer can improve design quality in many ways. Its

extremely fast computational powers allow the architect to use more accurate and complex analysis approaches than he would consider doing by hand. This ability of fast analysis allows the comparison of more design alternatives than most architects would have the time to consider. For example, a computer program that provides a quick but accurate solar energy analysis can be run on several design alternatives. The results may help influence the choice of which design to carry forward for further development.

Several other features of the computer allow the architect to do things he would not have the time or desire to do manually. Computer graphics visually allows the comparison of many different designs, by viewing them from any desired angle and distance, or even placing the alternatives in the environment in which they will be built. Graphics programs can show shadow locations, provide a perspective base for a manual rendering, and even produce charts and graphs for easier comprehension of numeric data. Computers allow a more thorough visual and quantitative review of a proposed design, increasing the amount of knowledge and information the architect has on how the building will function and react to its environment.

The computer can also assist the architect by taking care of many boring, repetitive, and administrative tasks in the office, leaving him more time to devote to design. Production of specifications and working drawings can be handled very successfully by the computer, producing these documents faster and with more accurate information. By increasing the speed, accuracy, and quality of jobs handled in an architect's office, a firm could ideally begin to take on more jobs and increase its size. This would lead to the hiring of more employees rather than the loss of jobs, as some opponents to computers fear. A dramatic example is the firm Wolfberg/Alvarez/Taracido and Associates in Miami, Florida. After acquiring a computer aided drafting system, the firm tripled in size in two years from 50 to 150 employees.

Hopefully, by accepting rather than ignoring the current state of computer technology, architects will begin to realize that computers can be a true asset to their practice, rather than something to be feared. The benefits of computing for architects are real; those who do not embrace this technology may soon find the profession is passing them by.

COMPUTER BASICS

For any person unfamiliar with the world of computers, a short course on "computer basics" is a necessity. This chapter continues with a section that briefly explains the basics of what a computer is, and what some of the special vocabulary of the computer world is all about. An architect who is a novice in the computer field should begin by understanding the rudiments of computers before he seeks out any specific readings or discussions on computer use for architectural applications. Of course, any reader who knows his hardware from his software, and can differentiate between his bits and bytes can readily bypass this section!

Hardware

Computers are classified in three groups, according to their size and computing power. The largest are called mainframe computers. The midrange size are minicomputers, and the smallest are microcomputers. Recently, the distinctions between categories are becoming harder to detect, as more and more computer power is available in increasingly smaller "boxes."

Mainframe Computers. These are the largest computers and are usually out of the range of what an architectural firm would need. They are generally found only in large businesses and corporations that require large amounts of data processing. Universities often have mainframe computers which serve users throughout the campus. Some engineering and construction firms have enough computing work to make use of a mainframe. The other major purchaser of mainframes are companies called service bureaus. They generally purchase several large computers and run programs for customers that do not have access to their own computer. The mainframe market has been dominated by IBM, and prices range from $200,000 for a very basic model to well over $1 million for general purpose machines.

Minicomputers. As technology improved over the years, it became possible to place much more computing power into smaller and smaller "containers." (see Fig. 1-2). By the mid 1960s, computer companies

Fig. 1-2. A minicomputer. (*Courtesy of José Aldave.*)

were offering minicomputers with less computing power than a mainframe, but also for a much smaller price. This size is sufficient for most applications that an architectural firm would desire to implement. Also, many computer drafting systems run on minicomputers; however, their price is much higher than a standard mini because one is paying for the graphic software and peripherals as well. The most basic minis start at $5,000 and prices increase to over $250,000 for super minis. Mini-based drafting systems start at $150,000 for a one-user system and increase by approximately $75,000 for each extra user station. Some well-known manufacturers of minis are DEC (Digital Equipment Corp.), Data General, and Four Phase.

Microcomputers. The decade of the 70s produced computers which are miniaturized even further, by placing complicated circuitry on a chip the size of a fingernail. This development has made the microcomputer

possible, the most popular of which are the "home computers" marketed by companies such as Radio Shack, Apple, Commodore and IBM (see Fig. 1-3). Their computing power is of course less than the minis, but it is sufficient for a few smaller applications in an architect's office. The usefulness of micros increases as one adds various peripheral equipment such as hard copy output devices, electronic graphic tablets, and faster input and storage devices such as disk drives. Prices begin at a few hundred dollars, but quickly get into the thousands as more sophisticated peripherals are added on. Slightly larger and more expensive micros are marketed as business rather than home computers, by manufacturers such as Hewlett-Packard and Olivetti. Computer drafting systems based on microprocessors are also available, arriving about ten years after the mini-based drafting systems came onto the market. These systems cost less and have a smaller capacity than mini-based systems, but they are probably adequate for many smaller architectural firms. Prices for these systems average $30,000–$100,000.

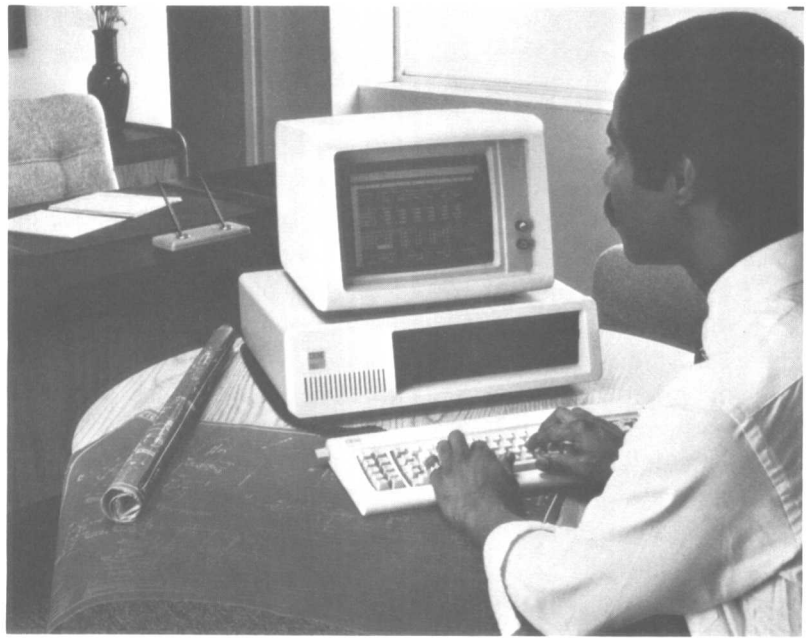

Fig. 1-3. An example of a microcomputer—the IBM Personal Computer. (*Courtesy of IBM.*)