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DVORAK'S INSIDE TRACK TO THE Mac

JOHN C. DVORAK, MIMI SMITH-DVORAK,
BERNARD J. DAVID, & JOHN A. MURPHY

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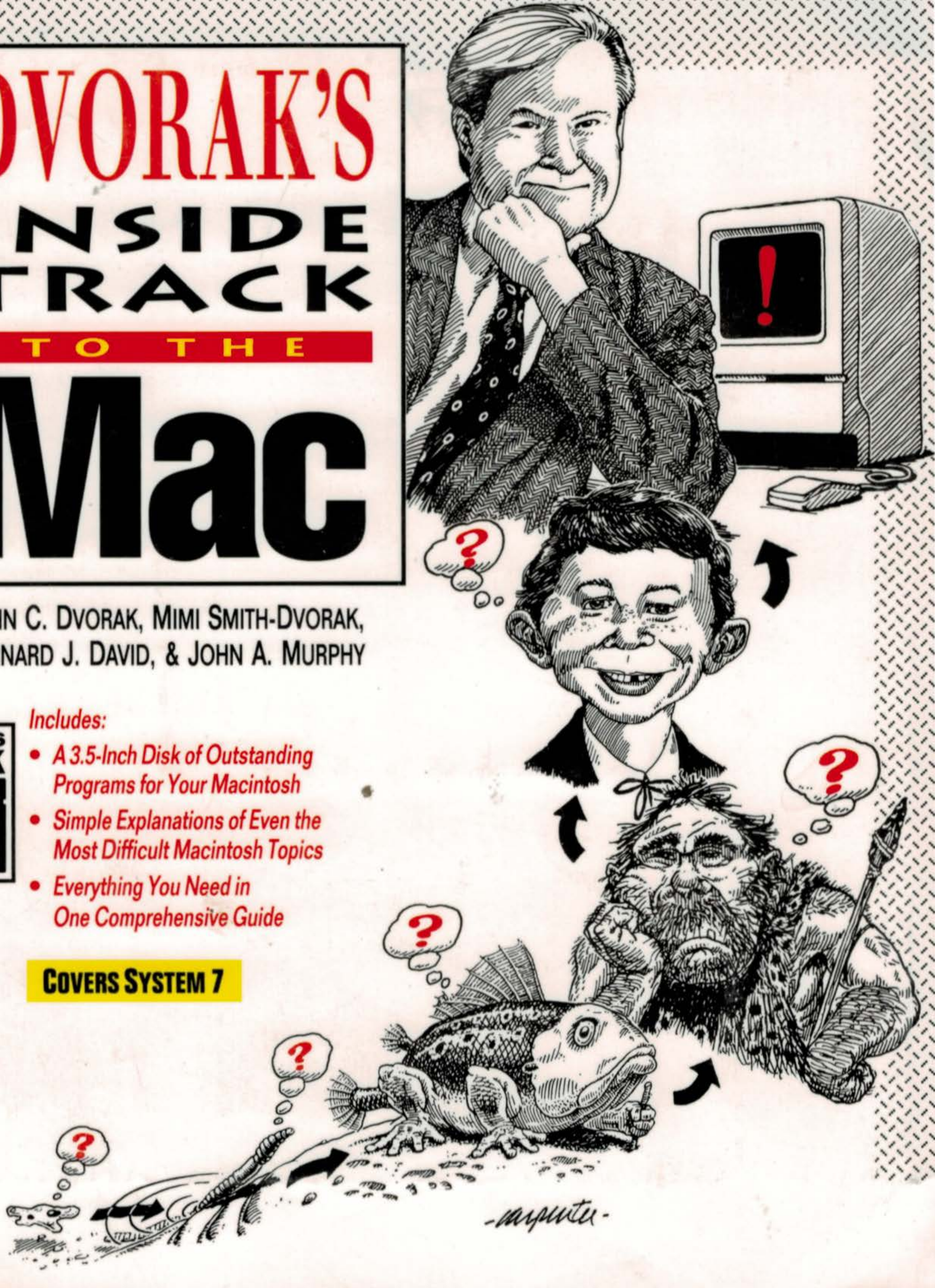

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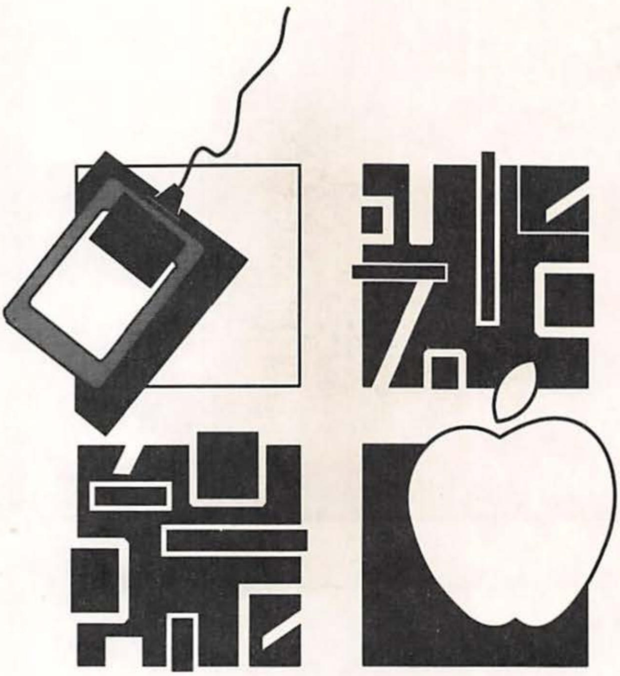

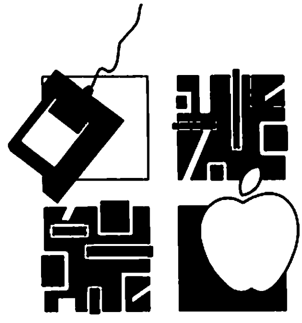

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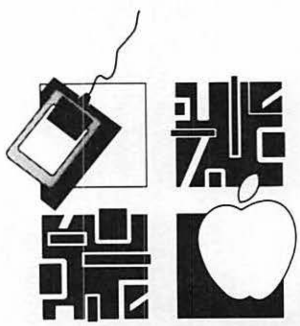


PREFACE

The fact is simple. The Macintosh is one great computer—no matter what IBM PC or Amiga users like to think. The world has taken to the idea of the Mac's graphical interface. Everyone agrees that it is the model for the future and will be used by everyone, whether in the form of the Mac operating system, or Windows, or whatever. By making the Mac your machine of choice, you can be assured you have a state-of-the-art computer for years to come. The idea now is to maximize its usefulness. That's what this book is for.

While the Mac is as easy to use as they say it is, that doesn't mean it's completely effortless. It's not. Confusion and frustration do indeed exist in this environment. Newcomers buy a Macintosh and might never figure out all they can do with it. Once they've mastered a few basic programs they never look for other software and peripherals. In short, they never explore the machine fully.

That's why we decided to do this guide. It's also why we wanted to make it as complete as possible.

HOW THE BOOK IS ORGANIZED

With this guide, you will learn about the Macintosh and how it works. You will read about different areas of Mac software and how they could be of value to you. There are chapters on spreadsheets, word processing, databases, telecommunications, file management, educational programs, and desktop publishing. There is a chapter on HyperCard, which walks you through the creation of your own HyperCard stack. This means you will learn the basics of programming.

This book covers the Macintosh in a logical order. We begin with a brief discussion of all computers, then move to Mac commands and information on the operating system, INITs and CDEVs, and desk accessories. Wherever possible, we make recommendations, called "Tips," "Notes," and "Cautions."

From the basics we move to application-specific information. Each chapter is designed to give you an overview as well as an in-depth understanding. There is a discussion of the application and a sampling of the important software and hardware available.

SHAREWARE PROGRAMS

There is more here than just a book. BMUG (Berkeley Macintosh Users Group) created a disk for us, and it's included free with this book. The disk is chockful—down to the last byte—of useful stuff. BMUG chose a sampling of shareware and freeware programs from what's available through users groups all around the country. The programs are neatly filed into folders labeled "Utility," "Business," "Games," and "Telecommunications." There is also a folder called "About BMUG," with more information on the users group.

Try out the shareware files. If you like them and want to make them a regular part of your Mac experience, send the registration fees, as indicated in their files on disk. This will entitle you to free upgrades and technical support. The freeware (public domain) software is just that—free. Use it; make copies for friends.

The Utility folder contains SoundMaster (discussed in Chapter 11, "The Noisy Mac"), which is a program to add, delete, and change sounds used by the system for startup, error, and other system functions. There's also a folder of sounds ranging from a Big Ben gong to a coyote howl. (The coyote howl, by the way, is a Dvorak favorite.) The other utility in the folder is FileTyper, a popular and highly regarded shareware file utility program.

The Business folder has an excellent check register program called Register and a label program called Simple Label.

The Games folder has six exciting and popular games. (The difficulty range is from preschooler to adult.) There is something for everyone here, from a shoot-em-up called Star Trek, to a more cerebral simulation of an open-ended psychoanalytical interview, called Eliza. Dvorak insisted his personal favorites be included: GunShy, a matching game, and Brickles (complete with Dvorak's scores). There's also String Art and Bikala, a Tetris/Hextris-like game.

The Telecommunications folder contains FreeTerm 3.01, a terminal emulation and telecommunications program.

We hope this disk will spark your interest in shareware and freeware, because these are excellent sources of inexpensive and valuable software.

CHAPTER 1

COMPUTER BASICS

Computers are hunks of fused sand and petrochemicals that cost too much money. They don't think. They don't feel. So why is it so many people are intimidated by computing machinery? Who knows? If you learn one thing from this book, you should learn that there is nothing to fear. You can't break your computer. It's not laughing at you. Without you it's nothing.

THE CPU

The central processing unit (or CPU) in a computer can do just three things: move numbers around, do simple arithmetic, and compare the values of things. That's it. A processor imitates thinking by performing these three actions terrifically fast—hundreds of thousands, even millions of times every second.

To make use of all this processor hyperactivity you need:

- a way to tell the processor what to do
- a way for it to show you the result of the work
- a place to store these results

Computer types call these three actions *input, output,* and *storage.* When designing a computer, manufacturers surround the processor chip with devices for input (a mouse and keyboard), devices for output (the screen, printer, and speaker), and data storage devices (memory and disk drives). The surrounding devices are called *peripherals.* With them you can give the processor instructions and, in return, the processor will show the results.

The microprocessor, or CPU, interprets software instructions and tells the computer how to work. The microprocessor performs the processing and coordinates the operations of other computer components.

The microprocessor may get assistance from a coprocessor to perform its tasks. A floating-point unit (FPU) coprocessor performs calculations on very large numbers at very high speeds. It helps spreadsheet, graphics modeling, and other programs run faster.

COMPUTERS AREN'T THE ONLY ONES

Not just computers have processors, input, output, and storage. Consider, for instance, the humble and often annoying "boom box" tape recorder. The microphone and antenna are input devices. The speaker is an output device. The cassette is a storage device, and the electronics of the cassette recorder are the processor.

HARDWARE AND SOFTWARE

The processor, input, output, and storage devices in computers are collectively called *hardware,* because, well, they're hard. (Drop one on your foot, then it will make sense.) The programs that run on the hardware, like spreadsheets, word processors, and databases, are called *software.*

When you use word-processing software, for example, you use the keyboard (an input device) to enter the words into memory (a storage device). The screen (an output device) displays the stored information. Eventually, you will send the text to the printer (another output device), unless your spouse tells you to quit playing around with that computer and come to bed (a put-out-that-gosh-dang-light device).

MACINTOSH HARDWARE

Like the generic computer just described, the Macintosh consists of a processor surrounded by input, output, and storage.

Macintosh uses Motorola's 68000 processor family. The Mac Classic uses the 68000 processor. The LC uses a later generation of the 68000 called a 68020. The more expensive Macs use a 68030 processor, and the newest high-end Macs use a 68040.

All the newest processors are 32-bit. That means they can process chunks of data 32 bits at a time. A *bit* is the atom of the computer world—the smallest unit of information. Eight bits are used to represent each letter of the alphabet. This fundamental data size is called a *byte*. Processors that handle data in 32-bit chunks are faster than those that work with only eight or 16 bits at a time, just as an eight-lane freeway can move more cars faster than a two-lane country road.

Processors in the same family may also run at different speeds. The 68000 in the Macintosh Classic runs at 8 megahertz (MHz), that is, 8 million cycles per second. Every action performed by the processor takes several cycles, so the average speed of an 8 MHz processor is one million instructions per second, or one MIPS. The 68030 in the Macintosh IIfx runs at 30 MHz. It's a 4-MIPS machine. Since the 68030 also has a more sophisticated set of instructions available to it, programs written specifically for the chip may operate more than four times faster than programs written for the 68000. For compatibility reasons, all but the most demanding Macintosh applications are written for the lowest common denominator, the 68000.

The IBM personal computer and its clones use an Intel chip family called the 8088. The original PC used an 8-bit 8088 running at 4.77 MHz. Newer PCs use the more powerful 32-bit 80386 and 80486 processors running as fast as 50 MHz.

Because the Macintosh and PC families are based on different chip families, they are incompatible. Programs written for the Motorola chips will not run on Intel processors, and vice versa.

The biggest difference between the PC and Macintosh families is not what's under the hood, though, it's what you see on the screen, and that's a manifestation of their vastly different operating systems.

Computers have personalities. Some are difficult. They want you to conform to their particular way of getting things done; they force you to become computer literate. Others are "friendly." They work in a fashion similar to the way you think and act. A pioneer in user-friendly computing, Apple Computer has worked hard to make Macintoshing easy.

Don't let this faze you. If you haven't quite figured out the Mac and all it's user-friendly stuff, that's what this book is for.

COMPUTER MEMORY

Computers have two kinds of memory storage: short term and long term. The short-term memory works while the computer is on. It is made up of random-access memory (RAM) chips built into the computer's main printed circuit board (the mother board). RAM chips are very fast, fast enough to keep up with the processor chip. Data and program instructions are kept in RAM so that the processor doesn't wait around for them. As fast as RAM is, it has two drawbacks—cost, and it requires a constant supply of electricity. When you turn off your computer the RAM forgets everything stored in it. That's why it's called short-term memory. Computer jocks usually refer to it simply as "memory," as in "my new Mac has twice as much memory as yours."

Your computer also has long-term memory, which is called *disk storage*. Disk storage is much slower than RAM, but it's permanent. Once data is recorded onto the disk surface it stays there (as long as you keep the disk away from magnets and small children). Programs and documents are usually stored on disks until you actually work with them. Then the computer will load the instructions and data it needs from the disk into RAM for faster access.

RANDOM-ACCESS MEMORY

Random-access memory provides the microprocessor with active thinking space. It's where the microprocessor places information and programs to be acted upon quickly. Information is given an address and stored randomly throughout memory. The microprocessor then accesses the addressed information directly from RAM. This provides faster access to information and also faster data storage. Without RAM, the microprocessor would have to hunt through memory sequentially from beginning to end. This would be like fast-forwarding through a VCR or audiocassette tape to find a specific part.

ABOUT THE ...
Million Zillion Trillion

Ever heard six-year-olds counting? "It's a hundred, million, zillion, garillion and ten." That's what this computer memory stuff sounds like at first. Every salesperson at every store, every magazine, and every advertisement list the K, MB, or some such metric-sounding gibberish.

Early PCs (way back in 1981) boasted a whopping 64K of memory (the *K* represents kilobyte). The big upgrade, which really did cost some bucks, was to a 128K machine.

Memory is like income: the more you make, the more you use, the more you wish you had. With more available memory the applications programs became more intricate, included more features, and needed more memory. (It's like a dog chasing its tail.)

When the 128K computers were all the rage, not much was stored on the computer. Most of the programs and files were stored on floppy disks. (That's why there were two disk drives, one for the program disk, the other for you to save your files to.) Now with all this hard disk storage space, it's easier to leave everything on the machine, including lists, memos, personal correspondence, the kids' school reports, and on and on. It's like a file cabinet, and sooner or later the drawers get full and you wish you had more drawer space. You'll see. Once that hard disk is almost full you'll get that faraway look in your eye, wishing for a bigger hard disk.

With each new design the required minimum memory jumps. It's a vicious cycle. What does it all mean?

A bit is the lowest number. It's one on-or-off point in memory. A byte is a "word" expressed by on-or-off sequences. It's usually made up of around 8 bits. A kilobyte (K) is in the neighborhood of one thousand bytes or, roughly 10,024 bits. A megabyte (MB) is getting up there, about one million bytes (or, 10,024 bits times 10,024 bits). The granddaddy of the memory world is the gigabyte (GB), which is a multiple of one billion (loosely meaning 10 bits to the ninth power).

I'm sure someday you'll hear some computer salesman say, "Yep, this baby has over a zillion trillion bytes of available storage."

RAM allows the microprocessor to access, or read, information from RAM, and to store, or write, information into it. RAM is temporary, or volatile, memory. When you switch the Mac off, everything held in RAM vanishes.

READ-ONLY MEMORY

Read-only memory (ROM) is where critical instructions and routines reside permanently. ROM is nonvolatile. When you turn off your computer or the power goes off, nothing is lost. ROM is called "read-only" because the microprocessor can only read the information held there; the information stored in ROM can't be added to or altered.

MAGNETIC DISK STORAGE

Magnetic disks are used to provide larger, longer-term storage. It's where most computer programs, documents, and records are kept. Disk storage is also nonvolatile. This means nothing stored on disk will be lost if the power goes off. Information can be added or deleted from disks. You can read, write, and erase them.

Every Macintosh computer contains at least one 3 1/2-inch floppy disk drive. The term *floppy* refers to the thin, flexible, magnetic disk found inside the rigid diskette case. The drive rotates the disk past a read/write recording head to store information. SuperDrives employed on Mac computers read/write onto 400K, 800K, and high-density 1.4MB capacity disks.

The Mac can also have additional hard disk drives. The hard disk can be inside the machine or sit on the desk as an additional piece of hardware. Compared to a floppy drive, a hard disk drive stores huge amounts of information and can access it faster. Apple Mac hard disk drive options come in 20, 40, 80, or 160MB sizes. When it comes to hard drives, the bigger the better. (A Dvorak tip: Always buy the largest hard drive you can afford.)

OTHER STORAGE DEVICES

Other forms of storage serve as alternatives or enhancements to floppy and hard disks. These devices handle huge amounts of information and are used to store backup copies of your software and information files. None of them is standard with a Macintosh, but each can be added. (They are all covered in other chapters in this book in greater detail.)

These are some of the special-purpose storage devices:

- *Disk cartridge drives* These special disk drives store information on removable magnetic disk cartridges.
- *Magnetic tape drives* Magnetic tape cassette, tape cartridge, and digital audio tape (DAT) are also used for computer backup and archiving tasks. While magnetic tapes can store large amounts of information, they can't get to the data fast.
- *Compact disk read-only memory (CD-ROM) drives* CD-ROM is the optical disk computer equivalent of an audio compact disk. The disk stores enormous amounts of information, 700 megabytes. Information can be read from but not written to CD-ROM. Publishers and corporations produce and distribute encyclopedias, books, travelogues, directories, product documentation, and other large collections of information on CD-ROM disks.
- *Write-once read-many (WORM) optical disk drives* A WORM optical disk will let you save files to a CD one time. Once it's there it might as well be engraved in stone. You can read it as often as you like. A WORM disk can hold a gigabyte of data. It is used primarily for backup and archive storage.

THE OPERATING SYSTEM

All computers need an operating system before they can do any useful work. The operating system (OS) is a program to tell the processor how to interact with the peripheral devices and the user.

In the earliest days of computing, the OS was loaded into RAM by an operator who flipped switches on the front panel of the computer in a tedious process. The process had to be repeated each time the machine was turned on. It didn't take long for these blistered-fingered programmers to automate. Floppy disks, magnetic tape, and ROM chips were all incorporated. The ROM chips were built into the mother board of the computer.

Loading the operating system is nicknamed *bootstrapping*. Modern day computer jocks call this process *booting up*. The computer learns how to interact with the outside world by loading progressively larger programs, first from ROM, then from disk.

WAKE UP MAC!

Here's what happens when you turn on your Macintosh. Power is fed to the processor chip, which wakes up and loads in a small program from ROM. As this program runs, it beeps to let you know the bootstrapping process has begun; then it checks the integrity of the circuits on the mother board and the memory chips in the computer.

You can observe this happening in the first few seconds after the machine is turned on as the pattern on the screen shifts while the processor writes test values into screen memory. Should any of these tests fail you'll see a frowning Mac icon (called the *sad Mac*), the screen will darken, and the computer will stop working. The code below the sad Mac icon indicates what kind of problem the processor encountered. If all the circuits pass this initial test you'll see a smiling Mac icon in the middle of your screen, and the boot process will continue.

Now the computer looks for a bootable disk, that is, a disk that contains a System folder. Every bootable disk contains a small program written on the first few tracks called the *boot sectors*. This program sets parameters for the computer. These will remain valid for as long as it's on. The program contains things like the maximum number of files it can have open at once, how much memory to reserve for system resources, and so on. The boot program also tells the computer to open a file called the System.

The System File

As the System file is opened and accessed, your computer will display the familiar "Welcome to Macintosh" screen. The System is not an application program. It's a library of resources that the computer will use during its operation. Display typefaces are generally stored here, as are the desk accessory programs from the Apple menu. The fundamental elements of the Macintosh look, like window and menu descriptions, are defined in the System. The System file will remain open as long as the computer is on so programs that need the resources stored there will have instant access to them.

The Boot

After the System file is opened, the boot process continues by loading any Extensions stored in the System folder on your boot disk. Extensions are small programs like Adobe Type Manager, Superclock, Suitcase, Vaccine, and Soundmaster that load into memory during the boot and stay there as long as the computer is on. They usually modify the computer's behavior in some way. For example, the Extension program Superclock puts a digital clock in the upper-right corner of your screen. Superclock was written as an Extension because it must run continuously to keep the clock ticking. Take a look at the disks that come with this book for some useful Extension programs.

Finder

Finally, in the last stage of the boot process, the Finder is launched. The Finder is the only part of the Macintosh operating system that interacts directly with you. Think of it as your ombudsman with the computer hardware. It interprets your requests and then passes them along to the appropriate department.

You will use the Finder to load your application programs, and to copy, delete, and organize the files on your disks. The Finder is your friend. Get to know it and it will reward you with thousands of hours of fun. (Oh, all right, maybe not.) But if you can use the Finder you'll be comfortable using almost any Macintosh application and you'll be way ahead of those propeller heads using DOS.

CONCLUSION

The Macintosh is really a fun machine. It has all the regular computer stuff like CPUs and floppy drives, bytes, and booting, plus it's been designed to be "user friendly." The Mac is different from DOS machines (and that wasn't by accident).

CHAPTER 2

THE MAC FAMILY

The IBM personal computer was only a few years old when Apple began building the Macintosh, but the designers already knew they wanted to create something better. They wanted an operating system that would be easier to use than anything that had come before, particularly for people new to computing who weren't interested in spending time mastering the intricacies of bits and bytes.

THE MACINTOSH METAPHOR

Apple's designers liked to compare the Macintosh to a toaster. You don't have to read a manual to use a toaster—its operation is intuitive. The designers' dream was to create a computer that people could use right away, even if they'd never used a computer. (It's not really *that* easy, but the creators like to say it is.)

To produce such a computer, the operating system needed to do more than just help the processor talk to the disk drives. The Macintosh operating system (OS) would have to embody a new metaphor for how a computer worked, a metaphor that would insulate the user from the complexity of the hardware, but wouldn't seem to come between the user and the computer. The designers wanted to describe the computer's operation in a way that would make sense to someone who had previously used only a typewriter, pens, paper, and filing cabinets.

Coincidentally, in Palo Alto, California, computer scientists at Xerox's Palo Alto Research Center (PARC) had been attempting to solve just this problem. These philosophers of office automation had hit on several inspiring ideas about how humans and computers could work together. Chief among them was the heretical notion that computers should work the way people do, not vice versa. This might seem obvious now, but in those dim dark days B.M. (before Macintosh), computers were more masters than servants, tended to by programmers who spent years learning how to use the machines.

The wise scientists at PARC reasoned that, since people were already familiar with the business office, why not model the computer's workings after it, creating an electronic office? This was the metaphor the Macintosh design team was searching for.

THE ELECTRONIC DESKTOP

The Macintosh screen would become a desktop. On the desktop would be scattered the documents the user was working on and the various tools the user required—just as they would be on a real desktop. The documents themselves would look exactly like their printed counterparts, something Mac users call *WYSIWYG* ("what you see is what you get," pronounced *wizzy-wig*). Multiple documents could be open at the same time, layered one on top of another or placed side by side in windows. To reduce clutter, documents and tools not in use could be shrunk down into graphic symbols called *icons*. Related icons could be stored in folders.

So far, so good—but the Mac team faced a problem. Like a real desktop, this electronic desktop would have numerous documents and tools on it. How would the user select which ones to work with? The user needed a way to pick up and move items on the screen, just as one would pick up and move items on a real desk. The gurus at Xerox PARC had an answer for this, too.

ENTER THE MOUSE

Now that a mouse comes with almost all personal computers, it's hard to understand the ridicule with which it was greeted when the Macintosh was first introduced. Admittedly, using a mouse is not intuitive—more than a few new Macintosh owners attempted to roll the mouse over the screen instead of on the mouse pad. Over time, the mouse has more than proven itself. (It's a handicap to use a Macintosh without one.)

With the addition of the mouse, the Macintosh user interface began to take shape. The design so far included a desktop covered with documents in windows, icons to represent closed documents and applications, and folders to store them all in. There was just one little addition left—menus.

It would be nice to have all of the tools that a user needed right on the desktop next to the documents, but even in the real world that wouldn't work. A real desk has drawers to store tools in. On the Mac desktop, tools and commands are kept out of the way in *menus*. Users can use the mouse to access them as needed.

By introducing icons, menus, windows, and a mouse to work with them, the Macintosh design team created a metaphor that is easy to grasp, but complex enough to accommodate most people's computer needs.

APPLE BEGINNINGS IN A NUTSHELL

The Mac wasn't created overnight. In 1976, in Steve "Woz" Wozniak's garage (located in an area later dubbed "Silicon Valley"), he and Steve Jobs assembled the first Apple I. (At the time, Steve Jobs was a part-time Stanford physics student, and Woz was an associate engineer at Hewlett-Packard.)

The Apple I wasn't the first "micro" computer. In 1975, the Altair 8800 was featured in Popular Electronics magazine. That, according to most, was the first PC. Imsai and SOL were other players, way back when. These early attempts at personal computing were crude by today's standards.

BIG COMPUTERS: BULK AND POWER

Computing in the mid-1970s was mostly done by big, bulky, expensive mainframe computers. The "wave of the future," according to IBM, would be that many, many people would hook up to these mainframe computers with "dumb" portable terminals. The computing would be done far away by the mainframe, and the terminal would be the means of input and output. It wasn't very personal, and not at all private. In fact, many of the files of corporate mainframes were scanned for "secret" information. (You could lose your job for misappropriating the computer's resources.) You couldn't print out your information, or at least not easily. Usually, a big, centralized print shop handled the jobs.

The next most popular computers were the so-called *minis*. These were much smaller, but limited in the number of terminals that could be hooked to them. Some people (rich ones) had minis in their homes, but few people had the space, the smarts, or a reason to buy one.

It's not hard to see why Apple's microcomputers were popular. "Woz" and Jobs quickly sold over 200 Apple I's.

Jobs and "Woz" started the design of their next computer, the Apple II, but money and management were needed to get this new computer and their start-up company off the ground. They turned to Armas "Mike" Markkula, a 33-year-old millionaire businessman. Mike agreed to come out of early retirement, invest some cash, and help manage the company.

When the Apple II was introduced, sales skyrocketed. In 1978, Apple sold 7,600 machines. That number quadrupled in 1979, and rose to 78,000 in 1980. Apple, the company and the computer, were on their way.

TWINKLE, TWINKLE, LITTLE STAR

The characteristics of *user-friendly* computing employed by the Macintosh didn't originate entirely with Apple. Some of the concepts were first developed at the Stanford Research Institute and Xerox PARC, as mentioned above.

In 1981 (the same year IBM announced its first personal computer, the IBM PC), Xerox came out with a new computer called the Star. It was the first commercial computer to utilize a graphical user interface (GUI). Users communicated with the Star by manipulating graphical symbols on a TV-like screen with a hand-held pointing device called a mouse.

The Star may have been friendly, but it was also costly. Prices were in the $15,000 to $20,000 range. This was a far cry from a "personal" price, especially in 1980s dollars. The Star also had limited software resources (application programs to make a computer useful). The Star was used primarily as a super word processor to produce printed documents and reports. It lacked other application programs to take full advantage of its friendly interface.

Xerox never captured a large following of Star users. The Star remained an expensive personal computer for a limited number of corporate users.

THE LISA

The Lisa was Apple's first attempt at a friendly graphical interface. It was partly based on technology built into the Star. Jobs visited Xerox PARC and came away with ideas—things like the graphical user interface and the mouse. He also came away with some of the people at PARC. A few employees left PARC to join Apple and become a part of the Lisa development team.

In January 1983, the Lisa was introduced. It suffered from a problem afflicting the Star: a high price. At about $10,000 a unit, businesses and hobbyists both balked. Jokingly, some dubbed the Lisa a "Starlet."

Apple's initial estimate of selling over 10,000 Lisas within the first year was optimistic. (Actual sales reached about 6,500.) The Lisa just never caught on.

Apple used the Lisa as a prototype of what a friendly computer should be. What was needed was a more affordable computer, one that would appeal to individuals as well as corporations. The ideal machine would be one that a person could take out of its carton, plug in, and run within an hour.

THE FIRST MACINTOSH

The first Macintosh was announced in January 1984, exactly one year after the Lisa's introduction. Apple hoped to position the $2,495 Mac as an economy-model computer.

The first version of the Mac needed some fine-tuning. Eight months after it was introduced, Apple lowered the price of its original model, the Mac 128K, and introduced a beefed-up 512K version, affectionately called the "Fat Mac." A little over a year later, an even fatter Mac Plus came along, a Mac with 1MB of memory.

The Mac, with its graphical interface, was applied to work on graphical programs that demanded more memory. The 128K memory limit on the first model proved to be inadequate for the more unique, and sought after, applications that were later developed.

ABOUT THE...

The Dawning of the Age of Mac

Super Bowl Sunday, 1984, was the big day. Apple spent over one million dollars for a minute's worth of advertising to convey the idea that the Macintosh was the computer of the future. Apple's halftime commercial showed a sprightly young woman in a track suit running through a conference hall filled with an audience attired in a uniform shade of gray. Approaching the stage, she hurled a sledgehammer through a large screen displaying an executive mumbling some corporate credo. The "Woman with a Sledgehammer" TV commercial may have lacked informative content, but it was effective in hammering home its message: The Mac is not an IBM PC.

Soon after, Apple had a "Test Drive A Macintosh" promotion that allowed the public to take a Mac home, try it, and see if they liked it. Many did, and ended up buying one.

The Mac did well even before the Super Bowl XVIII spectacular and the Test Drive promotion. Sales reached 1,000 a day just two months after the formal introduction. Two months later, over 50,000 Macs had been sold. On a single day in May, the University of Texas placed an order for 13,000 Macs.

Apple didn't win these sales on the Mac's merits alone. The company had the foresight to launch a number of aggressive campaigns to foster independent software development for the Mac.

The Apple University Consortium was formed the day the Mac was announced. The consortium was a group of colleges and universities that had agreed to work on Mac development and to commit $61 million to the task. Apple followed this with a MacCollege program geared to assist the independent software developers by providing free technical data, private consultations, and laboratory time.

Within six months of its introduction, over 80 software packages were available for the Macintosh. It was difficult to get the disk manufacturers to produce enough of the hard-shell 3 1/2-inch floppies. No one had expected the computer—said by some to look like "two-six-packs piled on top of each other" — to do so well.

The long-term benefits of Apple's educational vision were obvious. Some of the student programmers became Mac software developers even before graduation. They helped increase the number of programs for the computer quickly. Today, there are thousands of programs for the Mac, and even more programmers.

An example of these memory-hog programs is desktop publishing. A Mac coupled with a laser printer could print typeset-like pages for a fraction of the cost. Typesetting machines, which were hard to use and required messy chemicals and special paper, cost $25,000 or more. Desktop publishing on the Mac, in 1985, came in at well under $10,000 with laser printer and software included.

Still, the Mac had a hard time getting its foot in the door at most businesses. PC-addicted managers and executives were blind to the Mac's graphic advantages. They considered the Macintosh a toy, until they took a look at the desktop publishing work it could produce. Willingly or grudgingly, they purchased Macs to work alongside their PCs.

ONWARD AND UPWARD

1987 was another successful year for Apple. The Mac II was introduced, and it was distinctly different from previous models. One difference was that the Mac II was modular in construction (previously, the monitor and the computer were in one un-openable case).

The monitor came in its own separate cabinet. Display options included color (previous Macs were black and white only). The Mac II was expandable; it could be made more powerful with Apple or independent vendor cards. This was another first for the Macintosh, but a return by Apple to its Apple II configuration.

Apple hadn't discarded its original, more compact, all-in-one profile. The company also introduced the Macintosh SE (a classic-looking Mac) as a more powerful version of the Macintosh 128K, Macintosh 512K, and Mac Plus family. Like these older, compact Macs, the SE came with a built-in display. Unlike the previous versions, it could also accept a single expansion card.

Other, newer Macs have followed in swift succession. Today Apple offers four distinct Mac families:

- *The Classic Series* This family is based on the compact profile of the original Mac (see Figure 2-1).
- *The PowerBook Series* This family of lightweight, notebook-sized laptop computers can operate off an internal battery (see Figure 2-2).
- *The Modular Series* The monitor is packaged separately from the main computer module (see Figure 2-3).

- *The Quadra Series* A modular computer with extra speed and power. This is the top of the line (see Figure 2-4).

These families and their models differ in their relative price and power. Table 2-1 is a list of Macintoshes, both currently available models and versions that are no longer on the market.

Macintosh had another major introduction in October 1991. At Comdex, in Las Vegas, Nevada, Apple announced a new line of highly anticipated notebook-sized computers, two high-powered desktop machines, and an Advanced Macintosh Classic II.

THE ADVANCED MACINTOSH CLASSIC II

The Mac Classic II has the same all-in-one (nonmodular) design of the original Classic, but features a number of higher performance features. Notably, it is based on the 16 MHz Motorola 68030—which doubles the performance from the original Classic, and allows users to run more sophisticated applications. The RAM can be expanded to 10MB. The

FIGURE 2-1

The Macintosh Classic II follows the same compact, all-in-one design as the first Macintosh 128K introduced in 1984

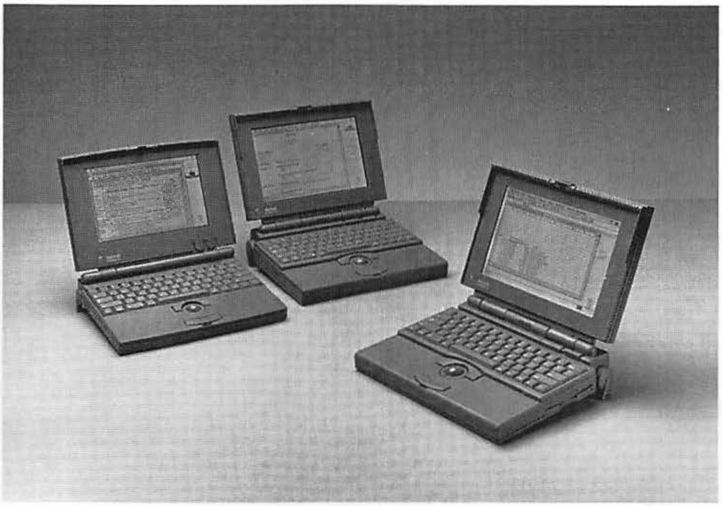


FIGURE 2-2

The Macintosh PowerBook uses a trackball rather than a mouse as a screen pointing device

FIGURE 2-3

The Macintosh IIci is modular in design and separates the display from the computer system unit

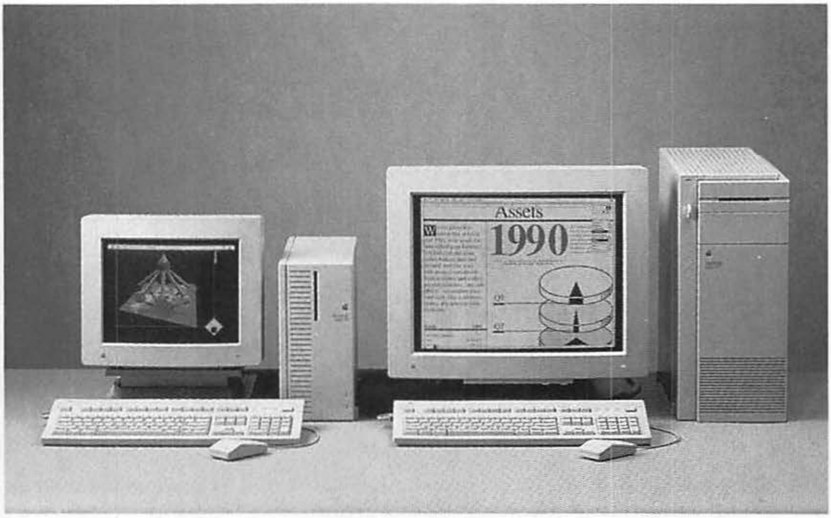


FIGURE 2-4
The Macintosh Quadra is the top of the line, with added speed and power

Classic II also incorporates an internal, on-board connector to support a floating point math coprocessor, and a microphone and sound input capabilities have been added.

THE NEW PORTABLES

Apple's former "portable" was a lug-along beast which met with groans and complaints when it was introduced. The new PowerBook portables are an impressive group.

The PowerBook portables operate with the System 7 operating system and have all the icons and GUI (graphical user interface) of a regular desktop Mac. The PowerBook Macs come in three flavors: the 100, 140, and 170.

The PowerBook 100 is the most affordable. It is also the lightest. The 100 weighs in at 5.1 pounds. (Its dimensions are 8.5 by 11 by 1.8 inches.) It comes standard with 2MB of RAM and a 20MB hard internal drive.

The PowerBook 100 is based on the Motorola 16 MHz 68000 microprocessor. It connects to a new external 1.4MB SuperDrive floppy drive from

Model	Year Introduced
Classic (Compact) Series	
Active:	
Mac Classic	1990
Mac Classic II	1991
Retired:	
Mac SE/30	1989
Mac 512K	1989
Mac SE	1987
Mac Plus	1985
Mac 512K	1984
Mac 128K	1983
PowerBook (Portable) Series	
Active:	
PowerBook 100	1991
PowerBook 140	1991
PowerBook 170	1991
Retired:	
Mac Portable	1989
Modular CPU Series	
Active:	
Mac LC	1990
Mac IIsi	1990
Mac IIfx	1990
Mac IIci	1989
Retired:	
Mac IIcx	1989
Mac IIcx	1988
Mac II	1987
Quadra (Power) Series	
Active:	
Quadra 700	1991
Quadra 900	1991

TABLE 2-1
Macintosh Family Members and Year Introduced

Apple, allowing users the flexibility to travel with or without its additional weight. With a special adapter it can connect to a desktop computer (through the standard SCSI—small computer systems interface—port) to transfer information. It will also connect to MS-DOS-based systems by way of a built-in serial port. The sealed lead-acid battery provides two to four hours of usage before recharging is necessary. It has a full-page width backlit Supertwist liquid crystal display.

The PowerBook 140 is the midrange member of the PowerBook line. It has performance equivalent to the popular Macintosh IIxc, or 2.5 times the Mac Classic. Based on a Motorola 16 MHz 68030 microprocessor, the PowerBook 140 weighs 6.8 pounds and has more storage options than the 100. It measures 9.3 by 11.25 by 2.25 inches. The 140 comes standard with a 1.4MB SuperDrive and 2MB or 4MB of RAM. It is configured with a 20MB or 40MB internal hard disk. It also has a full-page width backlit Supertwist liquid crystal display.

The PowerBook 170 is the most expensive, and highest performing of the group. It features a 25 MHz 68030 microprocessor and 68882 math coprocessor combination to offer users the computing power equivalent to a Macintosh IIci. It also has a state-of-the-art backlit active-matrix liquid crystal display, a built-in 2400 baud modem (with fax send at 9600), a 1.4MB SuperDrive, 4MB of RAM, and a 40MB internal hard disk. It weighs 6.8 pounds and measures 9.3 by 11.25 by 2.25 inches.

Both the PowerBook 140 and 170 will support external monochrome and color displays and projection devices (with a third-party video adapter). There is also a microphone and sound input capability. Both are powered by a NiCad battery with two to three hours of usage before a recharge is needed.

THE NEW POWER MACINTOSHES

The Quadras are up to twice as fast as the Macintosh IIfx (previously the fastest, most expensive of Apple's offerings). The Quadra 700 and 900 are the largest single jump in computing performance since the introduction of the Macintosh II in 1987. The new Apple Macintosh Quadra personal computers are built around the latest Motorola 68040 microprocessor. The 68040 has more than 1.2 million transistors. This allows for a number of important features to be incorporated directly onto the microprocessor chip, including 8K of fast cache memory, a floating point coprocessor, and a memory management unit. Incorporating these features, which are often separate components in other computers, onto a single chip improves overall performance and reliability. The Quadras are among the highest performance computers in the PC industry.

The Quadra 700 is the "smaller" of the two. The 700 and 900 share many common features:

- RAM expansion: up to 20MB on the Quadra 700, up to 64MB on the Quadra 900 (by using 4MB SIMMs)
- graphics subsystems: support for all Apple monitors—true-color capability for 12- and 16-inch monitors, high-performance graphics processing, additional support for VGA, Super VGA, PAL, and NTSC modes
- NuBus expansion: two slots on the Quadra 700, five slots on the Quadra 900
- sound: sound input (microphone included) and stereo sound output
- SuperDrive 1.4MB floppy with the ability to read and write other formats such as MS-DOS, OS/2, and ProDOS

The Quadra 900 has some other features, including:

- storage capacity: up to four 5.25-inch half-height SCSI devices, two of which can have front panel access for removable media—CD ROM, magneto-optical, cartridge drives, and so on
- a 300-watt power supply to provide increased power for the five NuBus slots and four internal SCSI devices
- key lock: three modes of operation—on, off, and lock. Lock mode shuts off the floppy drive unit, mouse, and all keyboard operations

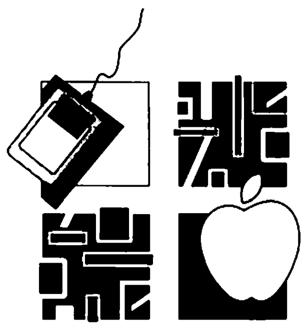
NEW QUADRA UPGRADE AVAILABLE

Owners of a Macintosh IIcx and IIci computers can upgrade to the power and performance of the Quadra 700 with a simple logic board. This dealer-installed option offers all the features of the Quadra 700, including on-board true-color graphics, high speed Ethernet networking, and sound input. Each logic board upgrade comes standard with 4MB of RAM and 512K of VRAM.

CONCLUSION

When Macintosh was first unveiled in January 1984, many were skeptical of this new computer. It looked so cute. Computers, some thought, should look seriously scientific, not like something out of *Architectural Digest*. Even now the Macintosh meets some resistance from defenders of the IBM PC faith. But in the eight years since its introduction, the Macintosh has won millions of converts. Even hardened IBM users are beginning to see the advantage of a graphical user interface, as evidenced by the success of the Mac-like Microsoft Windows for the PC. Macintosh has clearly set the standard for ease of use in computers.

As wonderful as the Macintosh user interface is, it isn't perfect. Anyone who has used it for long has a complaint or two, and Apple itself has seen fit to update it more than seven times in the past eight years. Yes, it's easy to use—but it's no toaster. You may still need to read the manuals. (And, fortunately for the authors, there is still a need for books like this one.) Don't feel foolish if everything about the Mac isn't obvious to you. It's not the perfect computer, but it's certainly a lot better than those that came before.



C H A P T E R 3

YOUR MACINTOSH

It's a great sales point: the Macintosh is ready for use "right out of the box." It's even almost true. The only catch is you have to put it together first. If your only experience with "some assembly required" items has been building a tricycle at 3 a.m. on Christmas Eve, don't despair. It's much easier than that—in fact, you don't even need a screwdriver.

NOW YOU'VE GOT IT, WHERE WILL YOU PUT IT?

The time you spend designing a workspace for your computer will pay off. Comfortable furniture and a convenient location will help you create the ideal Macintosh environment. You'll get more work done, enjoy it more, and come away less tired.

Here are a few basics. First, invest in a good power supply strip to give you all of the outlets you need for your Mac and its peripheral hardware. (There's nothing worse than crawling under a desk to plug and unplug devices.) Make sure the area has good lighting to minimize glare on the screen.

The computer shouldn't get too hot. (Direct sunlight will play havoc with a laser printer's image. It can make strange stripes and weird blotches on the printout.) The Dvorak rule: If you're too hot (at the time of day when there is the most direct sunlight streaming into the room), your Mac is too hot. Move it.

Place your computer in a safe location away from magnets and magnetic motors (next to the refrigerator may not be the best place). Keep diskette drive openings out of reach of toddlers—no small feat. (Or you might find pennies, catsup packets, or bits of crackers in them.) Make your computer area functional and comfortable. A telephone nearby is nice, and if you want to use a modem, it's required.

BASIC HARDWARE COMPONENTS

The Mac Classic, Portable, and Modular computers all include these basic components:

- *System unit* This is where information is processed and stored. The system unit is the "computer." It contains the Mac's logic and control circuits, power supply, memory, and most of the information storage facilities.
- *Display monitor* The display monitor is the TV-like screen where computer commands, text, and images are displayed.
- *Keyboard and mouse* The primary input tools used to enter commands and data are the keyboard and mouse. The mouse also contains a button to click and activate screen objects and menu commands.

A Macintosh can include optional hardware components, which can enhance or expand the Mac's capabilities. They can be add-in cards or modules which plug into the system unit, or they can be external peripherals which connect or interface with the computer by cables.

ERGONOMICS AND YOU

The hot word for computer space is *ergonomics.* This nineties buzzword means how something relates to a muscle group. It's probably a derivative of *ergometer,* a device used in the late fifties to measure the work capacity of muscles.

It's not that the concept of ergonomics isn't valuable, but there are some pretty uncomfortable contraptions on the market billed as ergonomic. (A pillory might be more comfortable.)

The backless chairs are great for a few hours, but if you have a little extra weight around your middle, they can fatigue your back and put undue pressure on the blood veins to your feet. The result is a sore back and sleeping feet. (Then again, even regular office chairs can be tiring if you don't change your position frequently.)

The good part of ergonomics is, it makes people think about furniture and their relation to it. (An old card table and metal chair just don't cut it.) Buy adjustable furniture.

The issue of ergonomics has made people more aware of their physical endurance. You cannot just sit and work and work and work. It's hard on your muscles and joints to perform the same task over and over.

Get up and move around every hour. Use a footstool under your desk and change the elevation of your feet. Lean back and put your feet on the desk (and the keyboard on your lap). Variation and variety are the keys.

Apple Computer publishes an ergonomic configuration for the average-size adult. The chart has recommended work surface heights based on physical height. A similar chart is shown in Figure 3-1.

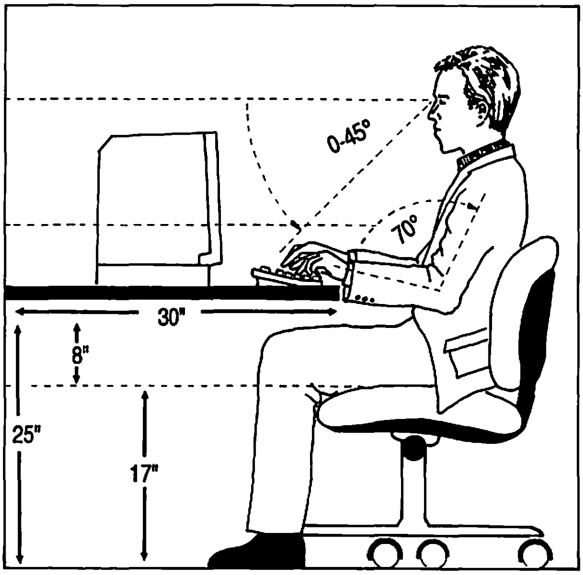


FIGURE 3-1
Average computer work surface configuration

ABOUT THE ...
Oh, My Aching Wrists

Do you know about carpal tunnel syndrome? It's a very painful condition that affects the wrists and hands. It can be a crippling hand disorder.

The carpal tunnel is in your wrist. The wrist has bones on three sides (you can feel them), and the underside is enclosed by the strong and inelastic tranverse carpal ligaments. (You can feel your pulse by pushing the vein against these ligaments.) In the center is an opening, the carpal opening, which is just big enough for the finger tendons and the median nerve (like sewing thread through the eye of a needle).

Both the median nerve and the finger flexor tendons are jammed through the small hole. The finger flexor tendons connect the fingers to arm muscles, and the median nerve is the "sensation connection" for the entire hand and all of the fingers. The tendons are surrounded by insulation membranes called *synovial sheaths*. These are filled with a fluid, and their purpose is to keep the tendons "well oiled" and protected. When finger tendons are overused (by banging on the keyboard for hours, playing a marathon game of ping-pong, or chopping wood), the synovial sheaths do their job to protect the tendon from more damage: they fill with extra fluid. (It's like your body's response when you sprain your ankle—it swells to keep you from continuing on that 30-mile hike.)

When the synovial sheaths swell, any remaining room in the the carpal tunnel is filled to capacity. The hitch is that the median nerve gets squashed.

When the median nerve does its job correctly, it communicates pain—a lot of pain. The agony is interpreted by the brain as pain in the hand, the fingers, the wrist—anywhere. (Even your fingernails hurt.) In fact, any and all movements in the hand's parts are registered as pain.

There may also be some unknown factors which may cause the syndrome, such as a virus. Some people are just put together a little differently, which makes them more prone to inflammation of the synovial sheaths, possibly because the opening in their carpal tunnel is smaller. Whatever the cause, the cure is—at first—rest, rest, and more rest. There are anti-inflammatory agents to reduce the swelling. Then, it's time to look at the way you hold your wrists while you type.

You probably know bad posture and bad habits can cause backaches. It's the same with your wrists. Holding them in an unnatural position will cause stress and strain. Over the long haul, this strain will cause damage.

ABOUT THE ...

Oh, My Aching Wrists (continued)

Try to keep your wrists straight while typing. Adjust your chair so your elbows are at the same height as your wrists. Alternatively, you can get an ergonomic pad designed to raise the keyboard. One such product is the CTS-Pillow (from ERGO-NOMICS, 4102 E. 7th St., Long Beach, CA 90804, 213-438-8951). The pillow is a bean bag-type "lap desk" that fits a Mac keyboard perfectly. (A new version has space for a mouse to roll around.)

Forget that "sit-up straight" stuff. If you have a lot of typing to do, strike the Dvorak position: lean way back in your chair, put your feet up on the desk, put the keyboard in your lap, and type away. (With the CTS-Pillow, you can even mouse around while you're laid-back.)

Do you have the bad habit of resting the heel of your hand on the desk? If you do, stop it. If you really can't type unless your hands are resting on something, find a hand-heel rest. Use a rolled towel, or some foam rubber to get your wrists up above your fingers (at least two inches above the keyboard).

Finally, remember to rest your wrists every hour—shake them around, wiggle your fingers, wave them in the air, get a cup of coffee, and go gossip for a while.

SECURITY

If you live in an apartment, get some insurance. If you have a house, or if the Macintosh is for your business office, add a rider on your policy. Even if you nail the Mac down, it is not a sure-fire way to prevent theft, damage, or destruction. You've just made a substantial purchase; you ought to insure it.

There is a discussion of ways to secure data in Chapter 7, "Disk and File Management." This is an area worth exploring if the data on your Macintosh is related to your business, or if it is valuable enough that you'd really be in trouble if you lost it.

POWER BASICS

The Macintosh power cord requires a three-pronged, grounded outlet. Most new buildings are wired with these outlets. Old buildings sometimes have a combination of outlets from the very old "one-plug" outlet to the two-prong outlets (no ground).

However, if you're in an old place, you can buy a two-prong to three-prong adapter plug. Adapter plugs have a metal ring for you to secure the adapter to the outlet. (They're also supposed to act as a ground.) This is really a short-term solution, at best. A better idea is to have an electrician replace the old plug with a new, grounded one.

Extension Cords

Extension cords can be hazards. Use common sense when you consider an extension cord. (Could you stay closer to the outlet? If you must use an extension cord, don't have a cord where people walk, and don't let the dog chew on it.) One thing is a given: don't use cheap, poorly insulated, non-grounded cords like the type found in grocery stores and drugstores for two dollars. Use a heavy-duty one. If you'd plug your chainsaw into it, it's okay for your Macintosh.

Surge Protectors A surge protector is a "fuse" to guard your equipment against damage if a spike should happen. A *spike* could be caused by many things: a bolt of lightning hitting a power line; a gush of electricity after a brown-out (like when your hose is kinked and the water slows to a trickle—and when you unkink it, it's a gusher). When the air conditioner, refrigerator, or washing machine suddenly powers down; or, when someone at the power company goofs a spike can occur. Spikes and low power are a lot more common than most people think. (Think of the times you've seen your lights suddenly dim just for an instant.)

All electrical devices are designed to accommodate some ebb and flow, and your Macintosh is able to handle many of the normal changes in power. But some of these spikes are able to do real damage. For that reason, buy a device with some surge protection ability.

A quality power strip with surge protection capabilities will give you those extra power plug slots and some electric immunity as well. They are an excellent investment. Prices range from 10 to 30 dollars. (This isn't a place to scrimp and save. Save on the desk, pens, pencils, or TV dinners, not on power items.) You'll protect a couple thousand dollars or so of computer equipment and your data. Protect your investment.

Some power strip makers include Curtis, Zero Surge, Telemax, PowerCenter, and Lunalite.

ABOUT THE ...
Power Pointers

Do you have a lot of unexplained crashes with your computer? The problem is probably improper AC wiring and inadequate grounding. Many buildings, especially older ones, have some wiring problems. According to one Canadian study, most computer problems can be traced to electrical grounding anomalies. There is a story about a network administrator who was electrocuted because he had one hand on a computer and touched a true ground. A surge protector does not protect you against bad wiring. There are three prongs in the socket and a hundred things which can be wrong. There are ground shorts, reversed polarities, open neutrals, ground and hot reversed, neutral and ground shorts, and so on.

You can pay for an electrician to come out and check every plug, or you can buy a wire test unit and do it yourself. These hand-held units typically have a three-pronged plug which you plug into the wall socket. There is a panel of lights on the unit, and you can locate the problem by which combination of lights light up. (Then you can call an electrician to fix the particular problem. The unit will pay for itself on one defective outlet.)

Perhaps the best device is the Accu-Test II wiring integrity tester. We recommend the elaborate $198 system from Ecos Electronics in Oak Park, Illinois.

UNPACK YOUR MACINTOSH

Open the box. Unpack it. If you purchased your Macintosh prior to May 13, 1991, the box will have a bunch of documentation labeled "open first," "open second," "open third." Open the first document to set up your Macintosh.

The first package contains three booklets and three disks. The booklets are "Setting Up Your Macintosh," "Special Features of Your Macintosh," and "Network Products Installer." The disks are Macintosh Basics, A Closer Look at Your Macintosh, and Apple Network Product Installer.

Open the second packet for learning and reference materials. The packet contains three manuals: "Macintosh Reference," "Getting Started

With Your Macintosh," and "HyperCard Basics." Again, you'll find three disks, called Macintosh System Startup, Macintosh Additions, and HyperCard Program.

Open the third packet for important documents and details. This packet has the "official" Apple One-Year Limited Warranty, the Apple Software License, and some Apple logo stickers.

THE APPLE WARRANTY

Originally, Apple Computer had a 90-day warranty. This caused a stir among Macintosh resellers and end-users because other computer vendors offered a 1-year warranty. Apple Computer was eventually swayed by the grousing. They changed the warranty coverage to 1 year.

However, the change was not without a few hitches. The warranty's wording included the sentence: "This warranty applies only to hardware products manufactured by or for Apple identified with the 'Apple' trademark...." This clause was designed to put a halt to one of Apple's problems. Many Macintosh dealers, in order to be competitive, swapped genuine "Apple" trademark products with "Apple clone" products. This practice is still a problem.

If you purchased an Apple Macintosh at a bargain price, your system may contain clone parts. This occurs fequently with devices such as hard drives, floppy disks, and RAM. The bogus parts are not covered by the Apple 1-year limited warranty.

SET UP YOUR MACINTOSH

Each type of Macintosh system is slightly different. Refer to the diagrams for your system in the following sections.

POWER SWITCH—OFF

If your Macintosh has an on/off toggle switch, it should be in the off position. This prevents any accidental damage to the system while you plug in the power cord. (Most of the newer models have just a little "on" button on the rear of the case. This button has a circle with a line in it. You can't turn it "off," but you can turn the machine on—when there's power—by pushing the button once.)

PLUG IN THE POWER CORD

Plug the power cord into the back of your Macintosh.

CONNECT THE MONITOR

Place your monitor where you will use it. If the monitor is very large, do not put it on top of your system. Attach the video cable to the back of the monitor and to the video card (which you may have just installed). Connect the power cord from the monitor to the back of the computer. The cables can only fit one way. It is impossible to get this wrong.

ABOUT THE ...

The Mac Package

The package contents vary among Macintosh systems. It all depends on when your Macintosh was originally manufactured and packaged.

You'll receive version 6.0.2 or higher of the Macintosh System Software and the following disk combinations:

- *System 6.0.2* Systems Tools, Printing Tools, Utilities 1, and Utilities 2 disks
- *System 6.0.3* Systems Tools, Printing Tools, Utilities 1, and Utilities 2 disks
- *System 6.0.3* Network Products Installer, Systems Tools, Printing Tools, Utilities 1, and Utilities 2 disks
- *System 6.0.5* Network Products Installer, Systems Tools, Printing Tools, Utilities 1, and Utilities 2 disks
- *System 6.0.7 (for 800K disk computers)* Network Products Installer, Systems Tools, Printing Tools, Utilities 1, and Utilities 2 disks
- *System 6.0.7 (for 1.4MB disk computers)* System Startup and System Additions disks
- *System 7 (for 800K disk computers)* Install 1, Install 2, Install 3, Printing, Fonts, Disk Tools, Tidbits, and More Tidbits Disks

ABOUT THE ...

The Mac Package (continued)

All packages contain the following:

- HyperCard Program disk
- HyperCard Stacks disk
- Macintosh Networking Basics disk
- Macintosh owner's guide
- Macintosh Utilities user's guide
- Your Apple Tour of the Macintosh/MacBasics
- Macintosh Quick Reference card
- Product registration card
- Warranty card

If anything is missing, contact the dealer who sold you your system.

CONNECT THE KEYBOARD

If you have a Macintosh Plus, plug the keyboard cable into the port on the back of the keyboard. The other end of the keyboard cable should be plugged into the front of the computer.

For all other models, plug the keyboard cable into the Apple Desktop Bus (ADB) port on one side of the keyboard. Plug the other side of the keyboard cable into the ADB port on the back of your Macintosh.

CONNECT THE MOUSE

There is a mouse port on the back of the Macintosh Plus. Plug in the cable and tighten the thumbscrews on the connector.

For all other models, connect the mouse to one of three places: the unused ADB port on the back of the Macintosh SE, the unused ADB port on the right side of the keyboard, or the unused ADB port on the left side of the keyboard. (If you are right-handed, you should plug the mouse into the right ADB port on the keyboard. If you are left-handed, plug it into the left ADB port.)

If you unplug your mouse or your keyboard while the system is on, the device will not work again until you restart your Macintosh, and you may damage your logic board. Don't plug in or unplug ADB devices when the Mac is powered on.

CONNECT THE MICROPHONE

On the LC, IIsi, Quadras, and PowerBook 140 and 170, the microphone connection is the sound input port on the back of your Macintosh. (It has a microphone icon on it.) Plug the microphone into this port. You can plug your own microphone into this port if it has the same type of microphone jack.

ADD DEVICES

Two types of peripheral devices connect to your Macintosh, Small Computer System Interface (SCSI) and non-SCSI devices.

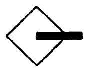
SCSI DEVICES

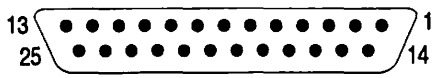
The SCSI ("scuzzy") standard defines the link between computers and peripheral devices. This interface connects printers, external hard drives, tape backups, CD-ROM drives, and scanners. You can connect up to seven of these by daisy-chaining.

Every device must be identified by a SCSI ID number between 0 and 7. Your Macintosh uses the SCSI ID number 7, and the internal hard disk, if any, uses the SCSI ID of 0. This leaves numbers 1 through 6 for other SCSI devices. Figure 3-2 shows a typical SCSI ID selector.

The SCSI ID number can be changed (use a straightened paper clip or a ballpoint pen). You should set the SCSI IDs in a priority order, because the system accesses the highest SCSI IDs first. You cannot have two peripheral devices with the same SCSI ID number. (If you try this, neither device will work and your system will crash.)

The SCSI port on the back of your Macintosh looks like this:





The icon above the port is the symbol Apple uses to indicate a SCSI port.

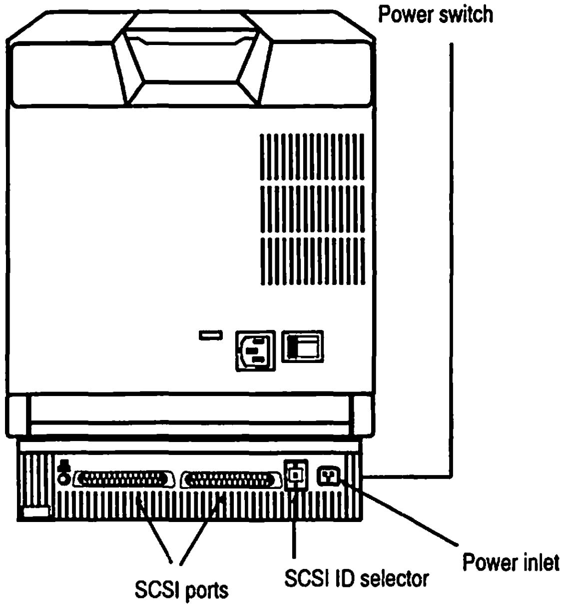


FIGURE 3-2
Back of a typical external SCSI device

ABOUT THE ...

What, How, and Where to Attach Peripherals

Devices and peripherals can connect to the Macintosh in different ways. There are devices that connect internally and reside with the system unit. Other stand-alone peripherals or external devices are connected by cables to sockets or ports on the system unit.

These are the most common connecting devices or peripherals:

- *Slots* Most Macintosh systems have one or more internal expansion board slots. Circuit board devices plug directly into these slots and become part of the computer.
- *Serial ports* Macintosh computers come with two serial ports. They are used to attach an external modem and a printer. The Macintosh can also connect to adjacent computers over a local area network, or LAN, using the printer port. (See Chapter 23, "Networking," for more information on LANs.)
- *SCSI port* Macs come with a SCSI port, which is used to connect an external hard disk, CD-ROM drive, printer, scanner, voice command box, tape drive, and so forth.
- *ADB port* All Macintosh computers have at least one Apple Desktop Bus (ADB) port, used to attach the keyboard and the mouse or other screen pointing devices.
- *Floppy disk drive port* This port is where you would attach an external floppy disk drive. Most Macs are equipped with one.
- *Audio out port* A stereo/audio port with which you attach a set of headphones, an amplifier, or other audio device is also standard hardware.
- *Other ports* Depending on the specific model, a Macintosh may also have a video port to attach an external display and a sound-in (audio input) port to add a microphone.

ADD A SCSI DEVICE

To add a SCSI device to a system with one internal hard disk:

1. Turn off all devices and discharge any static electricity (touch one of the metal connectors on the back of your Macintosh).
2. Attach the DB-25 connector to the Macintosh computer SCSI port (see Figure 3-3).
3. Once you've connected the SCSI cable, tighten the thumbscrews on the DB-25 connector.
4. Attach the 50-pin connector on the other side of the SCSI cable to the SCSI port on the back of the scanner.
5. Secure the connection by pressing the wire clips into the connector and snapping them into the clip brackets.
6. If the attached peripheral has a separate power cord, plug it into the unit first, and then insert the plug into a three-pronged outlet.

Connect Multiple SCSI Devices

To connect more than one SCSI device, plug the second device's Peripheral Interface Cable (50-pin connectors) into the second available

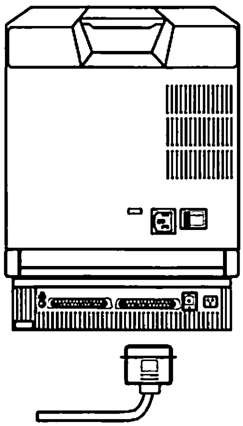


FIGURE 3-3
Attaching a SCSI cable to the back of a Macintosh

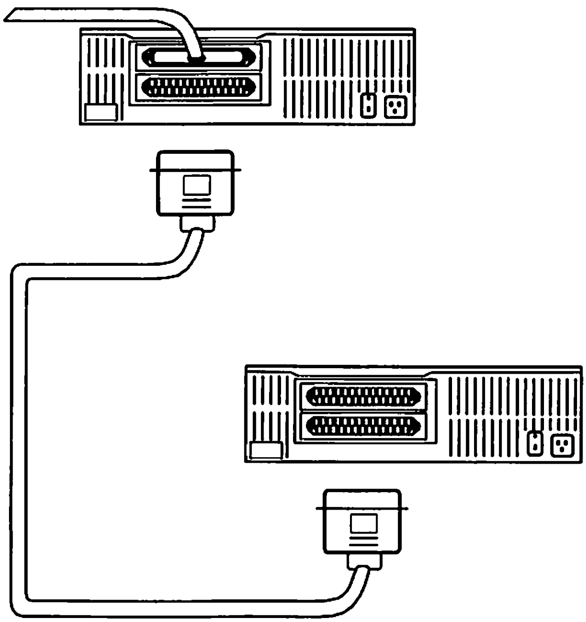


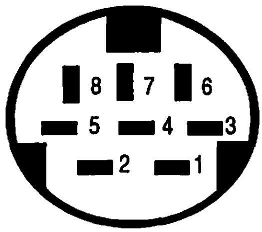
FIGURE 3-4
Connecting a second SCSI device

SCSI port on the first device, following the same steps just listed to connect a single SCSI device. The cable connects to the first SCSI port on the next device. Figure 3-4 shows this configuration.

The last SCSI device must have a terminator. If the terminator is internal, make sure the device is at the end. If the devices do not have an internal terminating device, attach a cable terminator to the last available port on the last SCSI device.

CONNECT NON-SCSI DEVICES

Most printers and a variety of other peripherals are non-SCSI. Non-SCSI devices connect to the serial port of your Macintosh. Here is what the serial port looks like:

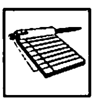


The Serial Printer Port

The serial printer port is located on the back of the Macintosh. It is designed to have a DIN-8 standard cable plugged into it. The port is marked by an icon of a printer spewing paper.

Configure the printer through the system. Move your cursor with the mouse to the Apple menu (the little apple with the bite taken from it in the upper left corner of the screen). Select Chooser from the pull-down menu, as shown in Figure 3-5.

Chooser presents a list of possible printer choices, as shown in Figure 3-6. Select your printer and close the Chooser by pointing to the square in the upper left corner of the menu and clicking the mouse button once.

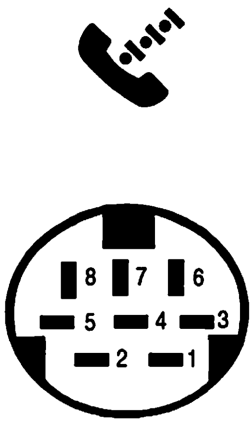


Systems 6 and 7 offer slightly different icon representations on the screen, but they work the same.

For more information on how the menus and the mouse work, refer to Chapters 4 and 5. For more information on printers, refer to Chapter 8.

The Serial Modem Port

The serial modem port is located on the back of the Macintosh. It has a telephone handset icon to mark it, as shown here:



This serial port can be used for a modem, a printer, or any other device that needs a serial port.

For more information on modems, refer to Chapter 12.

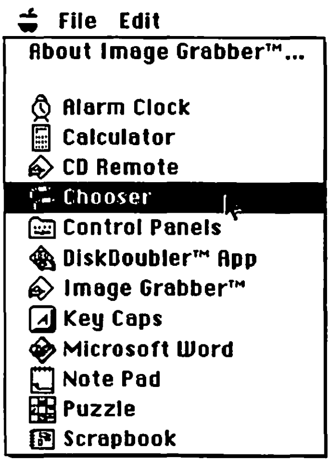


FIGURE 3-5
Apple menu with the Chooser selected

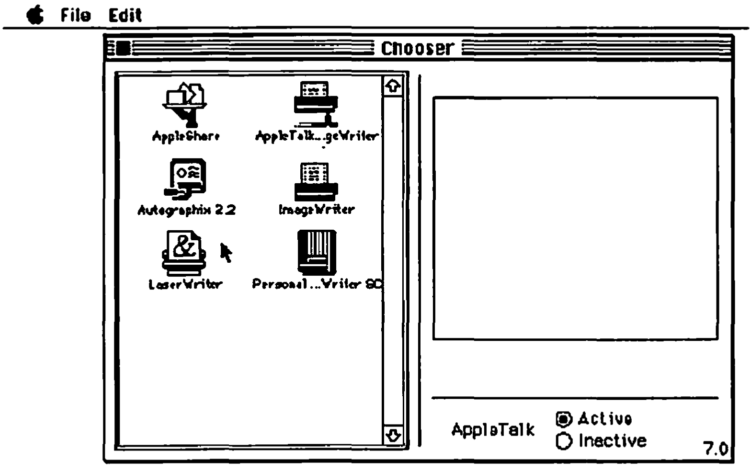
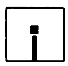
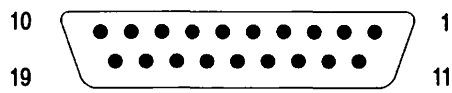


FIGURE 3-6
Chooser printer choices

EXTERNAL FLOPPY DISK DRIVE

If your Macintosh has an external disk drive port, it will look like this:





One end of the disk drive cable connects to this port on your Macintosh, and the other connects to the drive. The system automatically sees your drive. It displays an icon on the Macintosh desktop screen once you restart your computer.

VIDEO CARD (OR ANY NUBUS EXPANSION CARD) INSTALLATION

If you have a Macintosh IIcx or IIfx, you'll need to install a video card to connect a monitor to your computer. This card drives the connection between the computer and the monitor.

The IIsi and IIci have a built-in video. To install an expansion card, remove the security screw from the upper center of the computer's back panel. Pull up on the two latches on the rear corners of the case to open the lid. Touch the power supply inside the computer to discharge any static electricity from the system.

There is one expansion slot in the back of the Macintosh IIsi, three in the IIcx and IIci, and six in the back of the IIfx. There are holes covered with plastic plates that must be removed when installing a card.

To install an expansion card on a Macintosh IIsi, take the cover off of the access port on the back of the computer. Remove the NuBus card from its static-proof bag and attach it to the adapter card assembly—a card attached to a metal bracket. Insert the second connector on the adapter card into the expansion slot on the main logic board on the IIsi. Take the thumbscrews and tighten them on the outside of the Macintosh IIsi chassis to attach the adapter card assembly to the Macintosh IIsi. Replace the cover and secure those thumbscrews.

For all of the other models with expansion slots, push one of the cover plates out of its slot. Take the video card and align it over the open expansion slot. Press the video card into the expansion slot until it is firmly seated. Replace the lid of the system by aligning all of the guides on the lid with the case. Lower it back into place and replace the security screw on the back panel.

Install an 030 Direct Slot Card in a IIsi

Take the 030 Direct Slot card and its adapter out of the static-proof bags. Remove the access port cover from the back of the Macintosh IIsi. Now, use the hardware supplied with the 030 card to secure it. Attach the plastic bracket to the end of the 030 Direct Slot card without the connector. Take the adapter card and put the 030 card at a right angle to it. Secure the 030 card to the adapter card. Find the expansion slot on the main logic board and seat the adapter card connector into it. Attach the plastic bracket on the 030 card to the Macintosh IIsi's power supply. Replace the lid after the board is seated.

SET A IICX OR IICI ON ITS SIDE

The IIcx or IIci can be set up on its side. Turn your IIcx or IIci on its left side (as the computer faces you) and pull the four rubber feet from the bottom of the computer. Return the computer to its original upright position. Insert the four rubber feet into the four slots provided on the left side of the system.

START YOUR COMPUTER

Turning the system on varies slightly depending on the model:

- On a Classic Macintosh, LC, or a Macintosh Plus, turn on the system with the off/on toggle switch on the back of the computer. Most of the newer models have an "on" button at the rear of the case. It is a round button with a line on it.
- On a Modular Macintosh, depress the key with an arrow pointing left (positioned either in the upper right corner of your keyboard or in the upper middle of your keyboard).

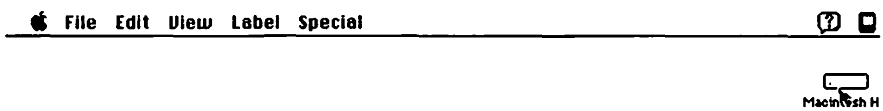
Tutorial Disks

If you have never used a Macintosh before, use the tutorial disk enclosed with your machine. There are different versions for the different Macintosh models. The most common is the MacBasics disk. The label of the floppy disk should be on top, and the metal end goes into the drive first. Push the floppy disk into the slot until it clicks. After you insert the disk, start your computer.

If you have a Macintosh Plus, you'll find a disk labeled "Your Tour of the Macintosh."

PREPARE YOUR HARD DISK

Your computer may or may not have the operating system loaded. If the operating system is loaded, you will see the Macintosh desktop with a hard disk icon in the upper right corner of the screen, as shown here:



If the operating system is not loaded, you will see a diskette icon with a blinking question mark in the center of your screen.

ABOUT THE ...
Check the Version of Your Operating System

To make life even more confusing, Apple recently released a new operating system called System 7. Some people have changed their operating system over to the new system, and some have not. Some new computers have been sitting on warehouse shelves since before the new system, and some may have it already installed. The period of changeover can be lengthy (up to two years) before everyone is onto one system.

The old system, System 6, may be one of several extensions. An *extension* is a period followed by a revision number. It's used in software to show how recently the software package has been updated. For example, suppose you found a software package at a garage sale, labeled version 1.02. If you went to a software store and looked at that same software package, and the newest version was 2.03, you'd know the garage sale version was outdated. On the other hand, if the current version was 1.04, it's not too different, and it would be possible to get an update of the garage sale version.

The different revision numbers of the Macintosh operating system (OS) don't vary much in function and appearance. The different system numbers are worth noting—they usually mean a big difference. To address everyone, and to make this book a little more confusing for all of us, information about both operating systems is given (whenever needed). If you've just purchased an already loaded computer, you may need to find out which system you have.

You can determine the OS by moving your pointer to the Apple menu and holding down the mouse button. If one of the menu choices is "About This Macintosh," you have a System 7 OS. If the menu choice reads "About the Finder," you have a System 6 OS.

THE OPERATING SYSTEM

The operating system is the Mac's boss, housekeeper, and traffic cop. The system software controls when the hardware, peripherals, and other programs will work and determines what they will be given to work on.

The Mac's operating system consists of two main components, the System and the Finder. The System runs the utilities, the numerous small housekeeping programs, and the instruction routines that control everything else. The Finder keeps track of the information and programs going in and out of the disk.

HOW TO INSTALL SYSTEM 6

Insert the disk labeled "System Startup" into the disk drive slot. "System Startup" will appear on the screen below your Macintosh HD icon. Double-click the icon. The floppy disk window opens. The icon labeled "Installer" will appear among the other icons on the System Startup disk, as shown in Figure 3-7.

Click the Installer icon twice. Then click OK to move beyond the Installer's opening "Welcome" box. Move your pointer to the Install button and click it. The installation will proceed automatically.

When the computer is finished digesting the information on this disk, it will prompt you to insert the "System Additions" disk. (The Macintosh will begin to read the disk as soon as it is inserted.) When it is finished, a

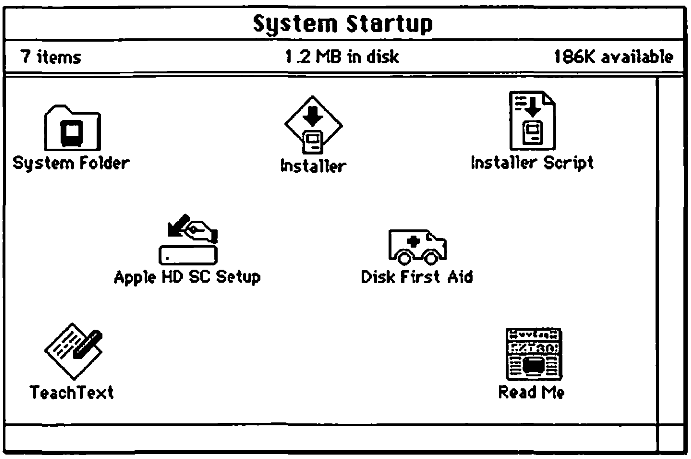


FIGURE 3-7
Contents, including the Installer icon, on System Startup disk

message will let you know the installation was successful. Click the Quit button.

The last step: with the mouse, move the pointer to "Special" on your menu bar. Point to it and hold down the mouse button. You'll see the pull-down menu. Continue to hold down the mouse button as you move the pointer to "Restart" on the menu. Release the mouse button. The Macintosh will eject the System Additions disk, make a sound (like "bong"), and reboot.

SYSTEM 7 INSTALLATION—TIPS AND TRAPS

Install System 7 the same way you installed System 6: Put in the Install 1 disk and double-click the Installer icon. The process is identical from there on. If you've had your machine a while and want to change over from System 6, you might want to run the following safeguards and checks.

BACK UP YOUR SYSTEM

It's a good idea to back up your hard disk, especially your System Folder, to floppy disks (or other storage media) before you install any new system software. (It may take a while to back up your entire system, but your long-term sanity is worth it.) One reason to back up is because sometimes, in the worst-case scenario, half-way through a change-over, it becomes apparent that something isn't working right, or you've made a mistake. If you've made a backup, you can reinstall the old system and still use your computer until you've worked out the bugs. If you don't make a backup, you're downstream without a life jacket. (It may take several days of work to replace the old system, and several more to emotionally recover from the miserable experience.)

THE COMPATIBILITY CHECKER

The Compatibility Checker is a crucial element of a System 7 installation. It is a program that runs through your hard disk and searches to see what information is and is not compatible with the System 7 OS. A printed report is generated. The report tells you what may or may not work with System 7. Read the report carefully. The report's findings may be your deciding factor in determining if you want to install System 7. Keep in mind that the Compatibility Checker is very conservative; it always paints a black picture. Use it with a large dose of salt. Figure 3-8 shows the opening screen of the Compatibility Checker.

Once you see this screen, click the Start Checking button. If it runs into incompatible or unknown items in the System folder, you'll see the message: "Attention: Potential Problems With System Folder Items." If you get this message, click Move Items. This creates a new folder on your desktop (automatically) entitled "May Not Work With System 7."

Check the report to see why each of these items is in this folder. (It is strongly recommended that you print and read the Compatibility Checker report.)

If you don't see any warning message, print the Compatibility Checker report.

Move Incompatible Items

If there are items in your System folder listed as incompatible on the report, remove them.

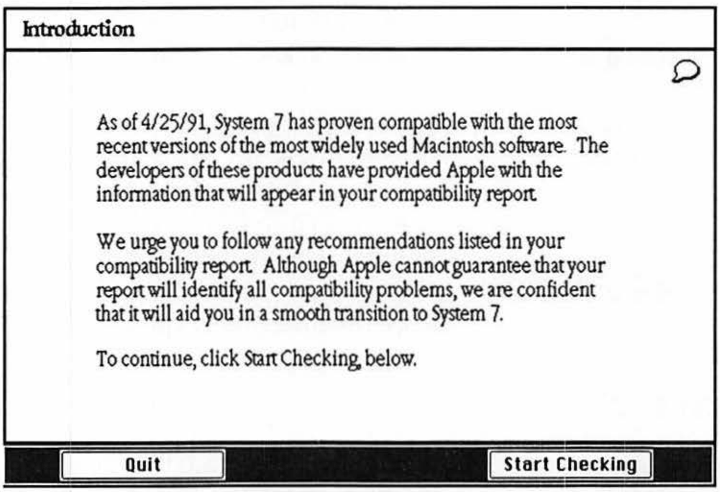


FIGURE 3-8
Compatibility Checker opening screen

COMPATIBILITY CHECKER NOTATION

The next section of the Compatibility Checker report is the list of compatible and incompatible software. It has *notations*—or recommendations—on what you should do to address a situation. The notation falls into two elements: Categories used in the report and Notes used in the report.

Categories

This is a list of the Categories used in the report:

- *Compatible* The software version you are using is recommended for use with System 7. While this notation seems like an endorsement, it guarantees nothing about what System 7 features the program may or may not contain. In fact, the software might not have any System 7-specific features.
- *Mostly compatible* The software is compatible with System 7, but it is not the most recent version of the program (maybe it's time to upgrade the software). It's probably best to contact the vendor about a more recent version or find out about what incompatibilities exist. Don't just assume it's okay, or you could lose important files (unless you have backed everything up, in which case you might want to play around).
- *Must upgrade* This software version is incompatible with System 7. You need to upgrade to a compatible version in order to use it with System 7.

Be careful of the "must upgrade" message. Read the notes which accompany it. For example, your Compatibility Checker report may recommend you upgrade because your software version doesn't work with file sharing. If your Macintosh isn't on a network with file sharing, there isn't any need to upgrade the software. Contact the vendor with any questions about the "must upgrade" message.

Notes

These are the notes used in the Compatibility Checker report:

- *Version numbers* A version number in the Notes column shows that the first version is fully compatible with System 7.
- *AD* This software does not work with 32-bit addressing. If you have turned on 32-bit addressing, turn it off before using this program. The Mac manages memory with 32-bit addressing, which allows the Macintosh IIci, IIfx, IIsi, or LC to use 10 to 128 megabytes of RAM with applications that use a lot of memory.
- *CD* Contact the developer of this item for information about a compatible version. (Apple provides a list of companies and telephone numbers in the Compatibility Checker report.)
- *FR* A free upgrade is available from the developer.
- *FS* This software does not work with file sharing. If you have turned on file sharing, turn it off before you use this program. (System 7 allows you to share information with other people on your Macintosh computer network without special networking software.)
- *MO* The item has already been moved into the new folder, "May Not Work With System 7." Contact the developer for compatibility information.
- *RI* To upgrade to System 7, replace this item with the version on the System 7 installation disks (or on one of the other disks) included with your upgrade materials. (This almost always applies to Apple Computer software.)
- *TT* This item does not support TrueType fonts larger than 127 points.
- *UN* This item is not needed with System 7.
- *UP* Get a compatible version of this item from an authorized dealer, an electronic bulletin board, or a Macintosh user group.
- *UR* This version is mostly compatible with System 7, but the developer encourages you to upgrade to a more recent version. (This is a vague message. You may not need to upgrade depending on how you use your application. Contact the vendor.)
- *VM* This item does not work with virtual memory. If you have turned on virtual memory, turn it off before you use this program.

HOW TO USE THE SYSTEM 7 INSTALLER

After you back up your system, run the Compatibility Checker, read the report, and move tagged items out of your System folder, there is a nine-step process to follow:

1. Choose Shut Down from the Special menu.
2. Insert the Install 1 disk into a floppy disk drive on your Macintosh.
3. Turn on your computer. When you turn on your system, the "Welcome" screen of the Installer appears.
4. Click OK to clear the "Welcome" screen.
5. Make sure the disk indicated on the screen is the one you want to use to install the system software.
6. Click Install.
7. Follow the instructions on the screen.
8. When the installation is successfully completed, click Quit.
9. A dialog box in the Installer will appear. Click it to restart the computer.

The System 7 operating system is loaded and usable.

If there is limited space on your hard disk, you have the option of installing a smaller version of System 7. At the System 7 installation screen, instead of clicking Install, click the customized installation process. Select the Minimal Software option in the dialog box and then proceed with the installation. This installation doesn't load many of the drivers, fonts, and desk accessories (which hog disk space).

C H A P T E R 4

USING YOUR MACINTOSH

If you've ever used a computer—DOS-based, Macintosh, or even an old clunker—you know the computer is not like a television. You don't just turn it on and immediately start. Instead, you turn it on and wait.

A computer must test itself each time it is powered on. The computer generally checks all available memory to see if it is in good working order. Then it inventories its components (hard disk drive, floppy drive, and so on) and checks the peripherals, both attached and online (printer, modem, or scanner). If everything checks out, the system loads the operating system information. This operating system information is the basic building block for running all of the other computer application software properly. Finally, on a DOS system, the DOS prompt is displayed to let you know that it's ready for a command. (For a system without a hard disk, you load the application after the prompt by means of your floppy diskette.)

The entire checking and loading process is called the *boot,* which is computer slang for *bootstrap.* Bootstrapping is old computer lingo for turning on a system. It dates back to the early tube and wire, room-sized beasts. The system must boot before you can use any of your programs.

On a DOS computer, the boot process is reported on the screen, in the form of English-like jargon, as it is going on. On the Macintosh, all the English-like jargon has been changed into symbols called *icons*. Each icon represents a part of the boot process.

WELCOME TO MACINTOSH

When the Macintosh is turned on, a little picture of a Mac with a face on it appears on the screen. This is an example of an icon; the Mac has many of them. You'll get used to them.

The little icon's face will smile if the system goes through its proper startup sequence. If you have a frowning face icon and a black (not gray) screen, something is wrong. This icon is always accompanied by a series of numbers, known as *error reference numbers*. The corresponding numbers in the Macintosh reference manual define the problem.

"Welcome to Macintosh" appears once the system has sucessfully completed the initial boot. Now it can load all of the Mac things such as INITs and CDEVs. *INITs* (short for initialization programs) are utility programs which load and activate routines performed by the operating system. *CDEVs* (pronounced "see devs"—an abbreviation for *control devices*) are programs in the Macintosh Control Panel. The Control Panel is discussed in the next chapter.

As most INITs and CDEVs load, their representative icons will flash across the bottom of the screen. If you have no INITs or CDEVs, you'll see nothing after the "Welcome to Macintosh" screen.

THE FINDER DESKTOP

The Finder is the Mac's software for file and disk management. The Finder is the overseer in the operating system; it gives applications the ability to open. The Finder is a part of all Macintosh system software.

When the Macintosh starts, the Finder runs automatically. Its job is to create a part of the desktop called the Finder desktop. The Finder desktop includes all of the icons you see on the desktop. More importantly, it incorporates all of the menus in the Finder menu bar across the Finder Desktop screen (but more about the menus later).

When the system is ready for you to use, the desktop appears. It's not much to look at—just a blank screen with a couple of icons on the right side. The background (the blank part) can be customized with some pretty pattern using the Control Panel. You can also get a nifty program like Wallpaper from Thought I Could. A typical background is shown in Figure 4-1.

TITLE BAR

In the top of the window is the title bar. The title bar displays the name of that particular window. All windows have title bars that tell you the name of the application or file you are working on. You can rename the window anything you want, up to 31 characters.

ICONS

In Figure 4-1, you can see some icons which will become familiar. In the upper right corner of the screen is a picture (oops, it's an icon) of a flattened little rectangular box. This is supposed to represent a hard disk.

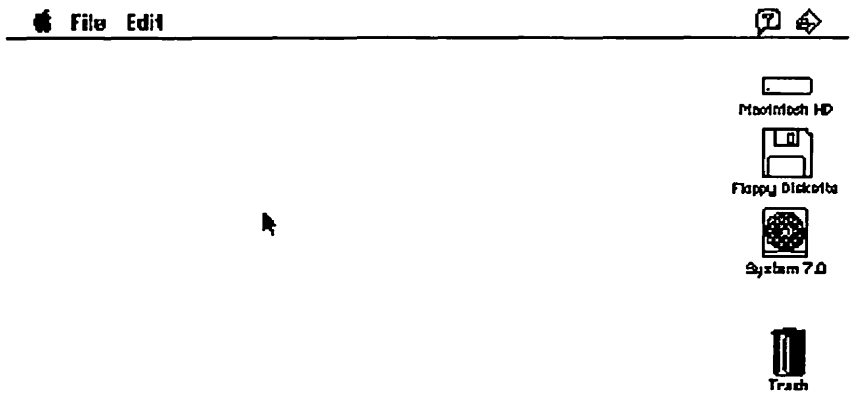


FIGURE 4-1
A Macintosh background

It's labeled "Macintosh HD." Underneath it is another icon of a floppy disk, labeled "Floppy Diskette." Below this is the icon for CD-ROM, entitled "System 7.0." All of these are storage devices. They contain information (programs, files, and so forth) for use on the Macintosh.

If you double-click any of these icons, they will open to show everything they contain. After you open the icon, you'll see more icons. The two most common icons you'll find are the file and folder icons. If you double-click the Macintosh HD icon, it opens to show a group of file folders. This is shown in Figure 4-2. The folders look like manila folders. Files look like a sheet of paper with a folded edge. You can place file icons inside the folder icons. At the bottom of the opening screen is a cute little trash can. We'll get into that later (figuratively, of course).

Double-click one of these file folders, and it will open to show you the documents it contains. An example of this is shown in Figure 4-3.

THE MOUSE

What's all this "click" and "double-click" stuff anyway? It is a series of steps that involves the use of the mouse. The standard Macintosh mouse has one button. There are three commands on the mouse: one click, two clicks, or click-and-hold-the-button-down.

The mouse is a pointing device. With it, you can move a pointer and the cursor around on the screen. (You can use the arrow keys on the keyboard to move the cursor, too.) Once you get used to manipulating the mouse, it's as easy as chewing gum and walking—(sort of).

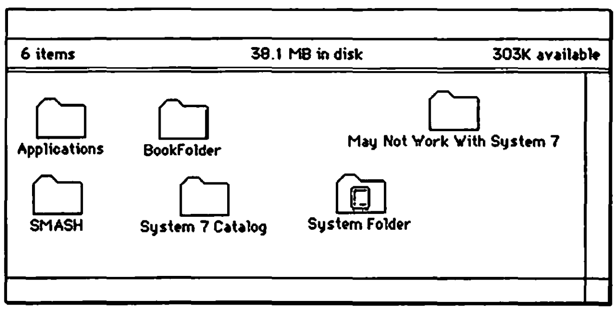


FIGURE 4-2
A group of file folders

ABOUT THE ...
Rename an Icon

To rename an icon, click the title part of the icon. A little "dog bone" text cursor will appear. Use the keyboard as if you were in any text application. You're limited to a total of 31 characters for a filename. Any combination of letters, numbers, spaces, slashes, dashes, periods, or other symbols can be used, except colons.

In System 7, the rename function has been improved. Move the pointer to the text part of the icon. Click the text. A box appears and the text is highlighted, as shown here:

You can rename title bars in the same way by clicking the title part of the bar.

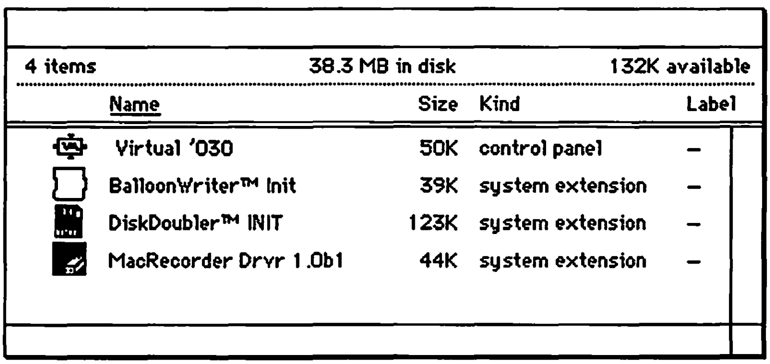


FIGURE 4-3
Contents of a file folder

The pointer looks like an arrow sometimes (when it's acting as a general pointer) and a dog-bone-shaped thing at other times (when it's on a word-processing document acting as a text pointer). It can also appear as a straight stick (when it's the insertion pointer). On other applications, it can take other forms, such as a paintbrush, a finger, and so on. It can also turn into a clock face (complete with moving hands) when the Macintosh is too busy executing a command and cannot accept any new orders. Some of the pointer's many variations are shown here:

 Insertion Pointer

 Text pointer

 General pointer to point, drag, and select

The mouse doesn't directly move the pointer. The mouse has a ball on its underside, something like the one on a roll-on deodorant. It moves freely. (Unless there's hair and junk in it—then it's like a shopping cart with a grape in its wheel—it goes every way but the way you want it to go.)

Electronic signals sent by the mouse are translated into movements of the pointer, which correspond with a location on the screen. (You don't need to know exactly how it works to use it. Do you care how your vacuum cleaner sucks dirt off the floor?) If you move the whole mouse assembly clockwise around the surface of the desk, the pointer will move in a clockwise circle on the Macintosh screen. Roll the mouse away from you and toward you and the pointer moves up and down. Move the mouse left and right and the pointer moves back and forth across the screen.

The faster you move the mouse, the further the pointer goes. If you move very slowly over a three-inch area, for example, the pointer will move slowly. It may move all of half an inch on the screen. If you move the mouse very fast over that three-inch area, the pointer moves about six inches. This is due to *scaling* (also known as ballistic drivers): the faster it goes, the further it goes.

Click

The rectangular button on the top of the mouse is the *function key*. Press the button once and let go to select something. This in Mac jargon, is called *clicking*. When you click an icon on the desktop, it darkens. That's the Mac's way of saying, "Okay, now what?" When you are in an application program, most functions need just one click.

Double-Click

Once you've selected an icon on the desktop, you can open it with a double-click. This makes the icon blossom into a big window.

If you click twice, but place a long interval between clicks (like click..................click, instead of click...click), the mouse interprets it as two single clicks. You have to get that double-click rhythm right to open an icon.

Drag an Icon

You can click to select an icon with the mouse. Instead of just pressing the mouse button and letting go, hold the button down. This grabs the icon. You can then *drag* the icon all over the screen. (Some people spend hours arranging and rearranging their desktop by dragging icons here and there—really!)

TRASH

One place you might want to drag an icon is to the cute little garbage can in the lower right corner of the screen. This is called the *trash*. The trash is used to delete things. You can trash files, folders, or storage devices. (The "removal" is slightly different with each of these.)

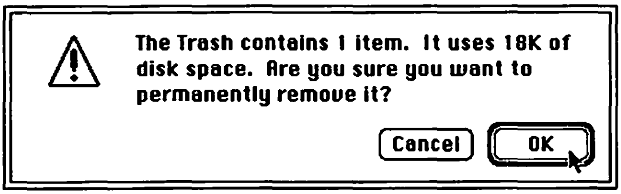
Discard an Icon

Drag an icon to the trash to delete it. You must align the icon exactly over the trash can. You know that you've done it right if the trash can darkens. When you let go of the mouse button, the trash can gets fat. An example of the bulging trash can is shown here:

This expansion shows there's something in the trash ready for removal. To remove the item, use Empty Trash on the Special pull-down menu. In System 6 and earlier systems, the trash empties when the machine is shut down and when you copy or open anything. In System 7, the trash remains intact until the trash is emptied with the Empty Trash command.

To access this command, click the Special pull-down menu and hold down the mouse button (as if to drag). Scroll down the menu items, which list the actions you can choose from, until you get to the Empty Trash choice. Move the pointer to this option and let go of the mouse button. Bingo! You've selected an action.

The Macintosh may ask you a question with a *dialog box*—a box that appears on the screen either to convey information or to request an action from you. The following dialog box is a confirmation that you have items in the trash and you really want to discard them:



Click OK to dispose of the item, or Cancel if you don't want to continue. Either way, the trash becomes it's regular svelte self again.

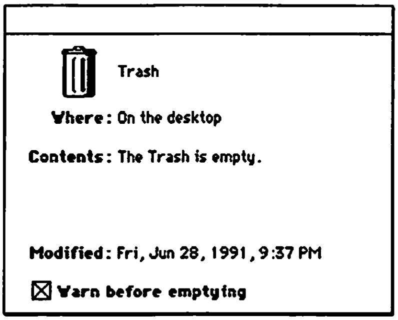
ABOUT THE ...
Mac Messages

The Macintosh has two types of special user messages. They are the dialog box and the alert box.

- *Dialog box* A dialog box is a window that appears on the screen to convey a message, request information, or ask for a decision. This message may be accompanied by a sound.
- *Alert box* An alert box gives a warning that something has gone wrong. It also reports error messages in an application program. The alert box is accompanied by a sound.

ABOUT THE ...
Trash Option

System 7 has a new Trash option called the Get Info window. This is where you turn on and off the warning displayed before you empty the trash. Hold down the Command key, which looks like a cloverleaf, and the I key. The Get Info window is displayed as shown here:



Notice the box (called a *check box*) next to the text "Warn before emptying" in the lower left corner. Select the check box with a click of the mouse button. (If the box is already selected, it will have an "X" inside it.)

With the check box selected, you'll see a warning dialog box every time you try to empty the trash. The dialog box tells you how many items are in the trash and the amount of disk space emptying the trash will liberate. The dialog box then asks you if you want to permanently remove these items.

Let's say you forgot what you put in the trash (or your toddler was fooling around the machine, and you want to check why the can is fat). Double-click the Trash icon. A window appears displaying everything waiting for removal. Click any icon to drag it back to the safety of the desktop. If you take everything out, the trash will return to its normal appearance.

If you empty the trash and discard an item, the only thing removed is the means to access the file or application. The information remains there until another file writes over it. In other words, there's still hope if you trash the wrong file. (This is explained in more detail in Chapter 7, "Disk and File Management.")

Discard a Storage Device

You can discard a storage device. This can be a floppy, a hard disk, a CD-ROM drive, and so on.

If you stuff a floppy diskette icon in the trash, the diskette is ejected from the drive. To remove a disk (either hard or CD-ROM) attached with a SCSI connection, drag the icon to the trash. After you empty the trash, you can't use that disk. (As long as the device is still attached to the Macintosh, it will appear on the desktop the next time you boot.)

One of the reasons to place a device icon in the trash is to *unmount* it. It's a way to eject SyQuest and Bernoulli drives. You can't eject them until they're "trashed." Other hardware device icons should not be dragged into the trash.

MENUS

One of the main differences between the Mac and DOS-based computers is the menu command interface. On DOS, each and every program has a different command scheme. At the DOS system level, the command interface is just a prompt. It's a blank line to be filled in with a command. These commands are combinations of letters, slashes, spaces, and dots. (It's not too hard once you get used to it; if you have a reference guide on hand to remind you of all the commands, it's even easier.)

The Mac's uniform menu system is the reason why it is said to be user-friendly. All the commands are readily available at the top of the screen. You don't have to rely on your memory or tape a list of commands onto your desk. The Mac has them right there, in the same place every time.

PULL-DOWN MENUS

Across the top of the desktop is the menu bar. This space is reserved for pull-down menus on all Macintosh programs. It's what makes all the

Mac programs familiar and consistent. What you see across the top of the screen are the *keywords* of the menu. If you click and hold down the mouse button on any one of them, a whole laundry list of choices appears. Anything and everything on each list is a command. This is how you communicate with the Macintosh.

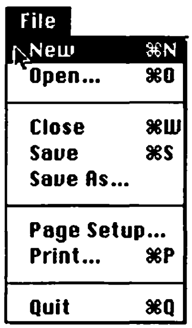
Pulling Down a Menu and Choosing a Command

How do you use a pull-down menu? Move the pointer to the menu bar keyword you want. Click and hold down the mouse button. Don't let go, or the menu will close.

To choose a menu item:

1. Hold down the mouse button.
2. Drag the pointer by moving the mouse to the command you want to execute.
3. Release the mouse button.

The menu item you've selected will now command the Macintosh to do something. To open a new file, select New in the File menu, as shown here:



Macintosh users and documentation frequently refer to a *launch*. A launch is not a command. A launch refers to the double-click of an icon, which opens an existing document and its associated application software. *Commands* include opening a new file, saving a file, printing, changing a font, and so forth.

THE SUBMENU

A *submenu* is a menu item within a menu. (It's like, "Do you want cheese on your sandwich? American or cheddar? White cheddar or yellow cheddar?")

How do you know if you have a submenu? Choose a menu item. The laundry list will roll down the screen. Any one of the items on this list with an arrow pointing to the right or left of it, is a submenu.

To open the submenu, keep the mouse button depressed and drag the pointer to the item with the arrow. Drag the mouse in the direction of the arrow (either left or right) and there it is. Figure 4-4 shows a submenu.

POP-UP MENUS

Pop-up menus are another kind of menu. They appear in places other than the menu bar. As their name indicates, they pop up. Here's how they work: You select an item on a menu and a box pops up in the middle of the screen (usually), just like an alert box or dialog box. Then, you set the different selections needed to execute the command. They show up when a choice must be made on how a program should proceed in a specific situation. (One good example is the Print command, whose pop-up menu

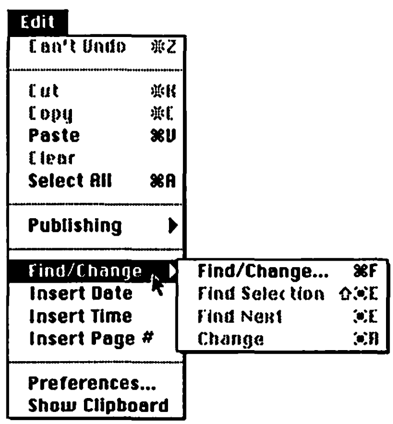


FIGURE 4-4
How to launch a submenu item

lets you decide which pages you want printed, which printer you want to use, and so on.)

THE FINDER MENU BAR

On the initial boot (when you turn on the computer), the menu bar is Finder-related. This means that the System level rather than application level is working. The menus are Apple, File, Edit, View, Label, and Special. System 7 added Help and Application icons. Here is how the Finder menus look on screen:

A similar menu will appear on most of your applications programs as well. The only difference in the menus is where you are in the System (at the Finder level or in an open application) and a program's specific menu requirements.

APPLE MENU

In System 7, the Apple menu gives you rapid access to frequently used programs, desk accessories (mini-application programs), documents, and folders. (In System 6, the Apple menu will only give you access to desk accessories.)

The Apple menu in System 7 gives you the option of moving items into it from anywhere on your Macintosh. To do so, drag the file or folder into the Apple Menu Items file in the System folder.

FILE MENU

The File menu has commands that affect entire documents. These commands include New (creates a new document), Open (opens an existing document), Close (closes a document), Save As (retains a document), Delete (removes a file—just like stuffing it in the trash can), Print, Find, Get Info, and Quit. Since all programs designed for the Macintosh use the same graphical user interface (GUI), these commands are uniform throughout all applications.

Open

The Open menu item opens a file or folder on the desktop. You can access the Open menu in one of two ways:

- Hold the mouse button down, drag the pointer to the Open option, and release the mouse button.
- Hit the Command key and the O key at the same time. Select a device, folder, or file, and delve deeper into it by double-clicking.

Close

Close is used to close the active file. It doesn't save the file; it just closes it so it is no longer active. You can also activate the Close menu item by depressing the Command key and the W key at the same time.

Save As

The Save As feature saves a document with a different name. Let's say you've written a letter to Joe and it's already saved as JOE. You could open the letter to Joe and change it into a letter to Sarah, with minor modifications. Use Save As to save this letter with a new name, SARAH. Now you'll have two files on your computer: JOE and SARAH.

Get Info Menu

Get Info, another File menu item, displays information about an item. The data displayed in Get Info includes the following:

- *Kind* tells you whether the item is a file or disk.
- *Size* tells you the size in kilobytes or megabytes.
- *Location* includes a SCSI ID number if it is a SCSI device.

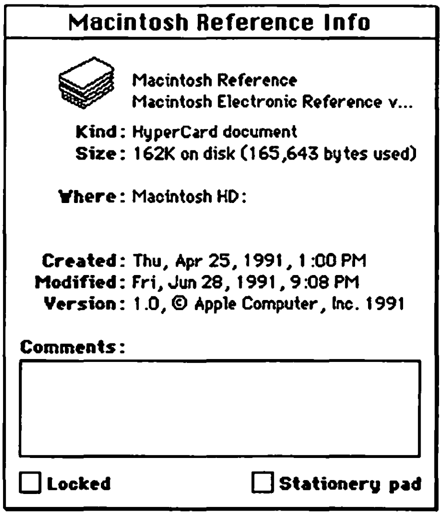
SCSI (Small Computer Systems Interface) is any hardware that can hook on to the computer, such as printers, scanners, and so on. The ID number is needed if there are multiple items connected. It's their "address" in the system.)

Get Info also lists when the file was created and last modified. A Lock icon shows whether the document is modifiable. Finally, Get Info will display comments regarding a document or disk.

System 7 offers a new addition to the Get Info feature—the ability to customize icons. You can customize storage media, files, applications, and folders. Each has different levels of customization.

ABOUT THE ...
System 7 Get Info

System 7 offers an addition to the Get Info feature—the ability to customize icons. You can customize storage media, files, applications, and folders. Each has different levels of customization. The Get Info window from a file is shown here. Remember the window will look slightly different in different applications.



Storage Media Get Info Dialog Box

You may customize the icon and the comment box in a storage media Get Info dialog box.

ABOUT THE ...

System 7 Get Info (continued)

Customizing the Icons The icon is the visual image of the storage media. It is the picture on your Macintosh screen. You can customize the icons you see in the Get Info window of files. When you click the icon in the window, a square box appears around the icon. Once the square box appears, you can change the picture.

To change the picture:

1. Go to the Edit menu on the top of the screen.
2. Select the Edit menu by holding down the mouse button.
3. Drag the mouse to the Cut menu item and select it. (Now you have no icon in the window of the Get Info dialog box.)
4. If you select the Paste item from the Edit menu, the icon you've just cut will reappear in the window. (The Cut and Paste functions are used, in many applications. You'll read more about these later.)

Comments The Comment option is available in both System 6 and System 7. The Comments box is in the lower part of the Get Info dialog box. If you click inside the Comments box, you can type any message you choose.

Why would you want to do this? It's a way for you to earmark the contents of this storage media so you don't have to launch it to see what is inside. For example, if you had a series of letters, you could put a comment for each, such as "credit bureau request," "protest to credit bureau," and "credit supporting documents."

Files and Folders Get Info Dialog Boxes

Get Info dialog boxes for folders are modified the same two ways they are for storage media: you can customize their icons and add descriptive information to the Comments box. When you are working in files, however, the Get Info boxes have icon customization and Comments capability, plus the features Locked and Stationery pad.

Locked Locked works in both System 6 and System 7. To lock a file, click the check box in the lower left corner of the Get Info box. The file cannot be modified or discarded if it is locked.

ABOUT THE ...

System 7 Get Info (continued)

Stationery Pad The Stationery pad is a feature of System 7 only. It lets you use the document as a template to create a new document patterned after it. To do this, click the check box next to "Stationery pad." This creates a copy of the document. The original goes unmodified. Every time you open the Stationery pad documents, a new document patterned after the original is created.

Applications Get Info Dialog Box

With the Get Info boxes in applications, you can customize an icon, add comments, lock the application, and change the amount of RAM the application will use when launched. The memory feature is in the lower right portion of the Get Info box in System 7. It is also possible to change the memory usage in System 6 through the MultiFinder.

A user might want to change the amount of RAM for an application because the programs are set to minimum RAM requirements. With more RAM allocation, there may be better performance and fewer crashes. (It is best to consult the individual program documentation or technical departments for more information on the particulars.)

What Is Memory Allocation? The software company allocated an amount of memory for use with its application. Software developers try to use the least amount of memory possible, yet still enough to efficiently run the program. This is not an arbitrary thing—it is based on the individual program's unique requirements.

A little more memory may improve the performance, though sometimes marginally. In the case, for instance, of a big 24-bit paint or word-processing program, the improvement can be spectacular. A little less memory may slow the program's performance or even disrupt the program. If you're short of memory space, you might try to use a little less, but you'll be warned every time you use the application that there's not enough memory.

The Find Menu

The Find command allows you to search for files and folders. The More Choices item in the Find command is a new feature of System 7. The additional choices (displayed in Figure 4-5) allow you to choose selection criteria for a search. The figure shows a search for "Dvorak Book" on all disks in the System. You can create a search with any combination.

Page Setup

Page Setup allows you to change the page size, orientation, and other print options.

EDIT MENU

The Edit menu allows you to work with text or graphics, or to undo a particular action. The Edit menu choices include Undo, Cut, Copy, Paste, Clear, Select All, and Show Clipboard.

Undo

Undo reverses the last action you performed. The action may be as simple as replacing the last string of text you cut. This string is retrievable because your last piece of cut text (or graphics) is put in a holding bin called the Clipboard. If you've made a mistake in cutting, Undo allows you to

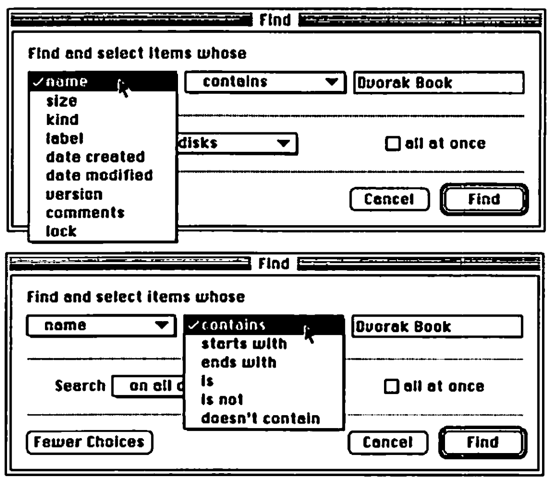


FIGURE 4-5
More choices criteria

easily recover from it (as long as you don't make a second mistake before realizing you made the first one). Undo can only fix the last error because the Clipboard holds your last piece of cut text or graphic. Each time you cut something, it automatically replaces whatever was previously in the Clipboard.

Cut

Use the highlighting feature to use the Cut function. (You highlight a graphic or text by clicking your pointer and holding it down while you drag it over the graphic or string of text to highlight.) When highlighted, select the Cut command from the menu. The graphic or text will leave the document and move to the Clipboard.

Copy

The Copy function works in a similar fashion to the Cut function. Highlight the desired graphics or text. Select the Copy command from the menu. This text is now copied to the Clipboard, but the original text also remains in place, unlike the action of the Cut command.

Paste

Paste moves the information in the Clipboard to a specific location in a document. Place the cursor where the pasting should occur and select the Paste command from the menu. Only the last item placed into the Clipboard can be pasted.

Don't try to cut, cut, cut, and then paste, paste, paste. It doesn't work that way. All you'd get would be three copies of the last item cut. Instead, you have to cut and paste, cut and paste, cut and paste.)

You can also use the Paste function to paste a copy of the graphics text. If you paste, paste, paste, you'll have three copies of the copied information in the Clipboard.

Clear

Clear gets rid of a string, a graphic, or a block of text. Highlight text and select the Clear command from the menu. This text is not saved in the Clipboard once it is deleted.

Select All

The Select All feature highlights all of the information in the document. Once selected, you can use the Cut or Copy function to further manipulate the information (you might change the font, style, or size, for instance).

Show Clipboard

The Show Clipboard menu item shows the text or graphics contained in the Clipboard. Look here if you are unsure of what you've cut.

VIEW MENU

You can change the way items are displayed in an active window with the View menu. You can view items by Small icon, Icon, Name (an alphabetical listing), Size (from largest to smallest), Kind (application, folder, or file), Label, and finally by Date (from most recent to oldest). Examples of these displays are shown in Figure 4-6.

New Window Feature—The Triangle

In windows with folders, System 7 offers a new feature known as the *triangle.* A triangle sits to the left of the folders in the window. If the point of the triangle faces right, the contents of the folder are not displayed. If the point faces down, the contents are displayed. An example of triangles is shown in Figure 4-7.

THE SPECIAL MENU

The Special menu has six specific function items in it:

Clean Up Desktop	Neatly arranges the icons on the desktop.
Empty Trash	Removes items dragged to the trash can.
Eject Disk	Ejects the floppy diskette in the drive and leaves a dimmed shadow of it. (The better way is to drag the disk into the trash.)
Erase Disk	Completely removes the contents of a disk.
Restart	Closes all open applications, ejects any diskettes, and reboots the Macintosh.
Shutdown	Shuts down the machine the correct way.

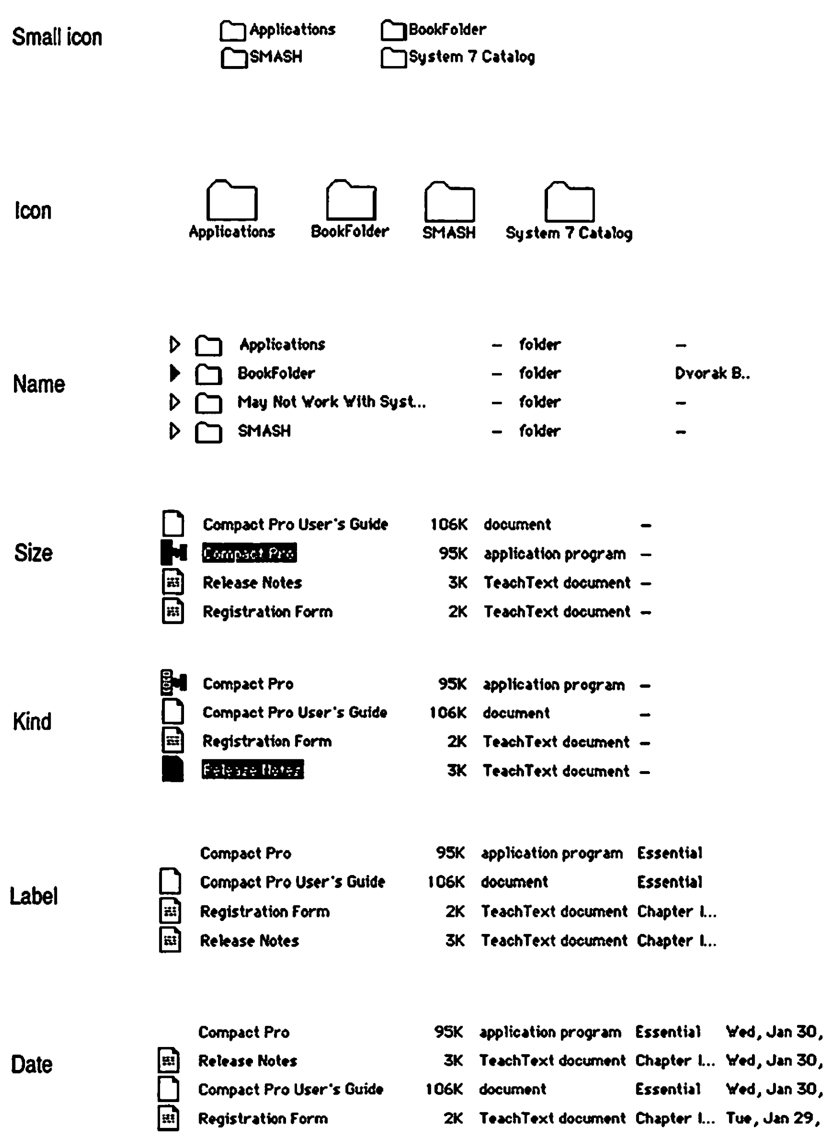


FIGURE 4-6
Various ways to view icons

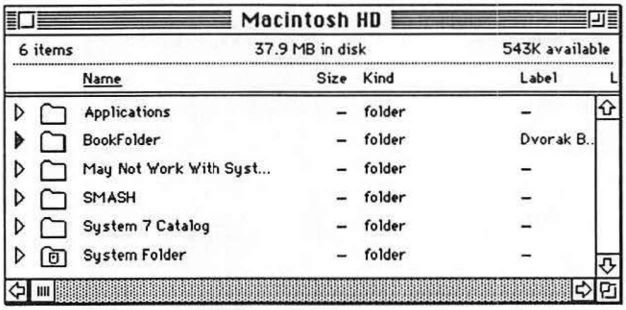


FIGURE 4-7
Triangles and their use

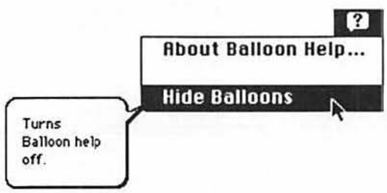
THE LABEL MENU

The Label menu lets you create labels for icons displayed in the desktop. These icons may be folders, files, or storage devices. Under System 7, you can modify the names of the labels to create a "filing" system. These labels are in color on color monitors. For more information, see Chapter 5.

HELP MENU

The Help menu lets you learn more about all the applications on your desktop. System 7 has Balloon Help. (The information shows up inside little balloon icons.) With the Balloon Help feature, you can point to an item on the screen and a balloon will appear to explain what it means.

Balloon Help is accessed through the question mark in the upper right side of the menu bar. Click this menu icon and drag the pointer to select Show Balloons on the pull-down menu. Once you've had enough of the balloons, choose Hide Balloons from the same menu.

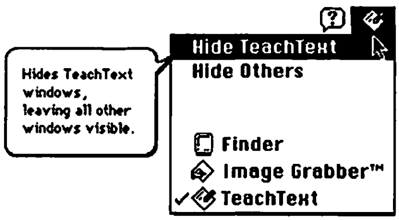


The Finder has Balloon Help. Applications must be modified for it to work.

APPLICATION MENU

The final item in the Finder menu is the Application menu. This menu lets you switch between applications programs when more than one program is open. Click this menu and drag the pointer to the application. Release the mouse button, and the application will be in the foreground of the screen.

The application menu gives you the option to keep applications active but hide them from view. The following illustration shows the Hide "application" (program's name) item from the application menu.



WORKING IN APPLICATIONS

The Finder controls the items of the desktop. Its basic functions apply to all of the applications you run on your Macintosh. The following sections tell you how to access and manipulate your applications.

OPENING AN APPLICATION

Double-click one of the icons in the Finder, such as the System 7 Catalog. The result is the series of files listed in Figure 4-8. Double-click one of the files in this folder to open that specific file. When you open a file, you also open the application it was created under. Figure 4-9 is an example of a double-clicked, opened file. In this case it's called "1.Introduction information."

Let's say you have two different word-processing programs: Microsoft Word and T/Maker's WriteNow. You use Word sometimes and

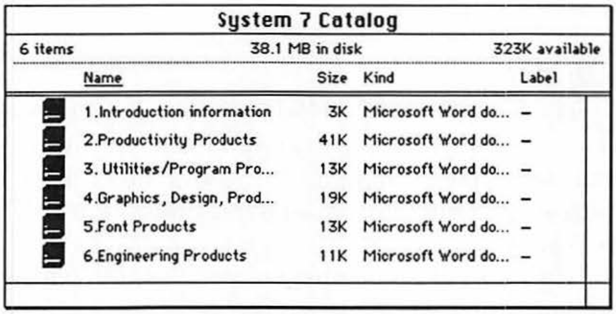


FIGURE 4-8
Series of files in System 7 Catalog folder

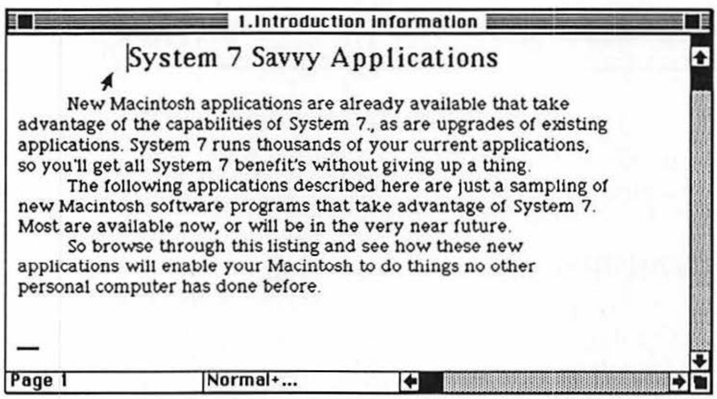


FIGURE 4-9
An open file

save files, and you use WriteNow sometimes and save files. The Macintosh won't get confused. The file and the application program are forever linked—well, not forever. You can convert them (but that's getting ahead of ourselves.) If you open a document written with Word, then remember that you need information from WriteNow, you have to close the Word document to get into the WriteNow document. (In effect, you must close one application and open another.)

If you suddenly remember it's not a WriteNow file but a Word file you need, you can open the new document without closing the other. Files of the same application (or compatible ones) can be used together. If someone sent you a file written on Claris's MacWrite II and you didn't have a copy of that program on your Macintosh, you couldn't open the file. The Mac would show a dialog box with the words "Application not found."

SCROLL

An entire document may not fit onto the computer's screen. In order to see everything, you'll need to scroll.

There are two scroll bars. One is at the bottom of a document's window, and the other runs the length of the right side, as shown in Figure 4-9. You can use these to move up and down or back and forth in a window one of two ways. The first is to move the pointer to the upward-pointing arrow or downward-pointing arrow and click. One click at a time will move the document down one line at a time. Clicking and holding will make the lines scroll up in rapid succession. The second way to scroll is by using the little square within the scroll bar, called the *scroll box*. This is a "slide" scroll (also called a *slider thumb*). Move it to the center of the scroll line and you'll be in the center of the document. Slide it to the bottom (next to the downward-pointing arrow) and you'll be at the end of the document.

ZOOM BOX, SIZE BOX, CLOSE BOX

In the upper right corner of the screen, above the scroll line, along the title line is the *zoom box* (see Figure 4-10). If you click the zoom box once, all of the contents of the window are displayed, if possible. This is accomplished by resizing the window. When you click after the window has been resized, the window returns to its original size. (If you hit the zoom box

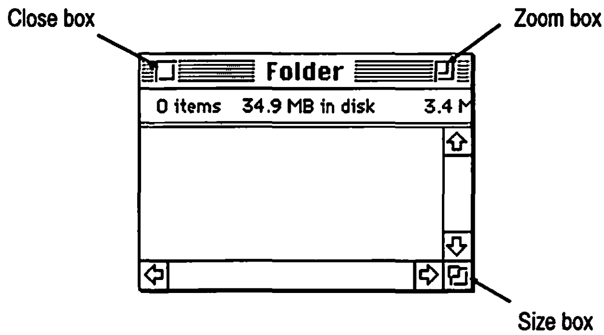


FIGURE 4-10
Zoom, close, and size boxes

by accident, and everything seems to zoom to the left, for instance, just click the zoom box again to re-center it.)

At the bottom of the screen, at the intersection of the two scroll bars, is the *size box*. Move the pointer to this box, click and hold. Drag the pointer and you can make the window very small or as big as the available screen space.

The *close box* is in the upper left corner. When you click the close box, the window closes. (If it is the only open window, and you close it with the close box, you'll need to go up to the pull-down File menu and choose the Quit command to open another application or file.)

MAKING AN OPEN WINDOW ACTIVE

You may have multiple windows open at once on your desktop. On the Macintosh, you can keep multiple windows in sight and bounce back and forth between them by pointing and clicking with the mouse.

When multiple windows are open, they overlap each other. You can see part of one under the active window. (The windows under the active window will not have a zoom or close box.) Just point to the document and click. That document will become the active one. To eliminate a window, click the close box.

COMMAND KEYS

How do you exit your favorite Macintosh program? Chances are you select Quit from the program's File menu. As long as we're practicing mind reading, let's go a step further. In most cases, Command-Q will work, too.

Command-Q is a Macintosh keyboard shortcut. Thanks to Apple's foresight in defining a standard user interface, most Macintosh programs use the same basic Command-key shortcuts. When you learn them, you'll be one step closer to the Holy Grail of the power user: never reading the manual. The most common Command-key combinations and what they do are listed in this section.

The Command key can be found on the bottom row of your keyboard, to the left of the SPACEBAR. Some keyboards have a second Command key to the right of the SPACEBAR. On older keyboards, look for the cloverleaf design on the key. Newer Macintosh keyboards will have the cloverleaf and also have an Apple symbol on the Command key: ()

The Command key is a modifier key, which means pressing it by itself does nothing. Like the SHIFT key, it modifies any other key you press with it. These Command-key shortcuts require you to press the Command key and a partner at the same time. It's usually easiest to hold down the Command key first and then press the second key.

The following Apple-defined Command keys work in almost all applications. The chief exceptions are terminal emulation programs like MicroPhone and MacTerminal. These programs often use the Command key to emulate the Control key found on other kinds of computers, so Command-key shortcuts are unavailable.

Command-.	Cancels the current operation, usually printing. (That's command and period.)
Command-W	Closes the top window. Many older programs don't use this shortcut, but most of the newer ones do.
Command-Q	Quits the program.

The next five keys can be found in sequence just above the Command key on the left side. These are very commonly used commands, so their shortcut keys were selected not for their mnemonic characteristics, but because they are easy to type.

Command-Z	Undoes the previous action.
Command-X	Cuts the selected item and places it on the Clipboard.
Command-C	Places a copy of the selected item on the Clipboard.
Command-V	Pastes the contents of the Clipboard at the current insertion point.
Command-B	Clears the selected item, to delete it. This key is less commonly used.

The next set of Command keys contains shortcuts for commands to change the font style. They usually work on the currently selected text. Some programs may also require that the SHIFT key be pressed for these shortcuts.

Command-B	Toggles bold text on and off. (Notice that this conflicts with the Clear command above. A program can only implement one or the other.)
Command-I	Toggles italic text.
Command-O	Toggles outline text.
Command-P	Toggles plain text.
Command-S	Toggles shadow text.
Command-U	Toggles underline text.

There are also three Apple-defined Command keys that require the SHIFT key to be pressed at the same time:

Command-SHIFT-1	Ejects the diskette in the internal disk drive.
Command-SHIFT-2	Ejects the diskette in the external drive.
Command-SHIFT-3	Saves the current screen image as a PICT file. The PICT file can be read by the TeachText program that comes with your system, and by many other graphics programs. The files are named "Picture 1," "Picture 2," and so on.

Macintosh implements the above Command-SHIFT key shortcuts as small programs called FKEYs. They should work no matter what program is running. In the days before System 7, you could press Command-SHIFT-4 to print the current screen. Apple no longer supports this command, but you can install it yourself using software from other companies. You can also install other FKEYs into your system as Command-SHIFT-5 through 0.

Although Apple hasn't defined them, several other Command keys have become de facto standards.

Command-A	Selects all the items in the current document
Command-D	Duplicates the current item (in some programs, deletes the current item)
Command-F	Uses the Find command
Command-N	Creates a new document
Command-O	Opens an existing document
Command-P	Prints the current document
Command-S	Saves the current document

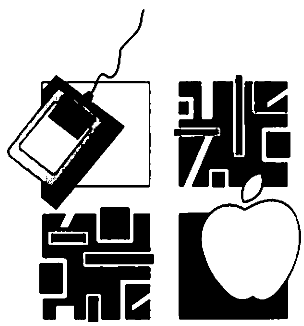
If you are in doubt about whether a program supports any of these Command keys, or you want to know about other shortcuts it offers, look at the menus. All the supported Command keys should be listed there, next to the menu commands they invoke.

Advanced users can even add their own Command-key combinations to programs, or modify existing ones, using a resource editor like ResEdit, Redit, or Resourcerer. Command-key definitions are usually stored with the menu definitions in the MENU resource.

CONCLUSION

The Macintosh is called a user-friendly machine. This doesn't mean it is free of frustration or completely intuitive. (If you'd never used a telephone, it wouldn't seem so simple, either.) It is not friendly if no one has explained the basics. Once you've got the basics, it doesn't mean every nuance of a Mac program will be obvious. (Just as knowing how to read doesn't make every book on every subject easy to understand.) Some programs are more advanced, involved, and intricate than others. Others are a snap to figure out.

Once you understand the basics (how the mouse works, the difference between click and double-click, how the menus work, and so on), you are well on your way to proficiency with a valuable tool.



C H A P T E R

5

THE SYSTEM FOLDER

Every Macintosh needs a System folder somewhere on the desktop. If the System folder is missing or damaged the machine won't work. The System folder contains programs to start and operate the computer. It has both stand-alone files and folders. The System folder, as shown in Figure 5-1, contains:

- Apple Menu Items
- Clipboard
- Control Panels
- Extensions
- Finder (discussed in Chapter 6)
- Note Pad File
- Preferences
- PrintMonitor Documents
- Startup Items
- System

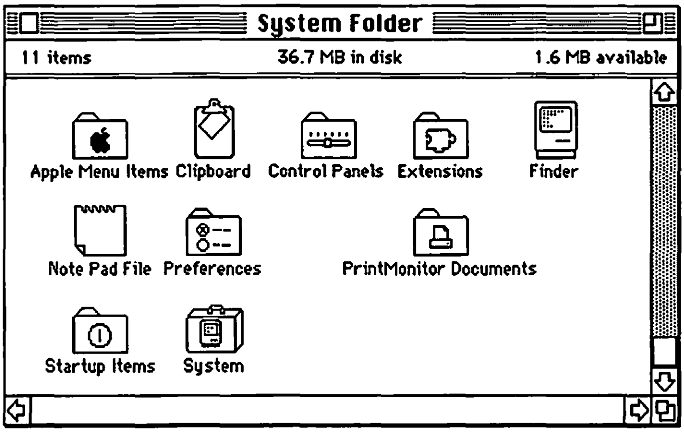


FIGURE 5-1
A System folder in System 7

(There may be additional files depending on the system you have and the programs you have added.) These basics make up a big part of the Macintosh as you know it. Don't trash any of these items unless you fully understand their purpose and *know* you won't need them. They are all important to your system.

The operating system is contained in the System folder. Finder also resides in the System folder, as do a variety of different INITs and drivers. (A *driver* is a routine within the operating system which instructs the computer on how to handle individual peripherals like printers, CD-ROM units, scanners, and so forth.)

Two special items reside in the System file under System 7: sounds and fonts. In order to install them, drag them into the System file in the System folder. You can't just drag them into the System folder; they must be in the System file. (Chapter 9 is all about fonts, and Chapter 11 covers sound.)

PRINTMONITOR

The PrintMonitor folder serves as a holding tank for items sent to the printer. This is called a *printer spooler* (although it is not actually a spooler).

The documents to be printed are sent to the PrintMonitor and then forwarded to the printer when it is able to accept them. If you have sent a host of documents to the printer, the PrintMonitor folder will hold them while they wait to be printed.

STARTUP ITEMS IN SYSTEM 7

The Startup Items folder contains items that will be opened as the Mac boots. Just drag a program into the Startup Items folder. When you next start your system, the item will automatically open. You can even open documents when you put them in the Startup Items folder. The Startup Items look for the application, open it, and then open the document placed in the folder. To remove an item from the Startup Items folder, drag it out of the Startup Items folder and the System folder. The next time you start your system, that item won't start automatically.

APPLE MENU ITEMS IN SYSTEM 7

The Apple Menu Items folder in the System folder contains all the programs available under the Apple icon (in the upper left corner of the screen).

The Apple menu gives you rapid access to frequently used programs, desk accessories, documents, and folders. All of the really important files can be made available under the Apple menu icon. It doesn't matter what program you are in, or what else you're doing, the Apple menu selections are available at any time.

Desk accessories can be added to the Apple Menu Items folder. In System 7, there is no limit to the number of things—files, folders, programs, and so on—which may be added. (In operating systems 6 and earlier, there is a limit of 15 items.) Figure 5-2 shows an Apple Menu Items folder.

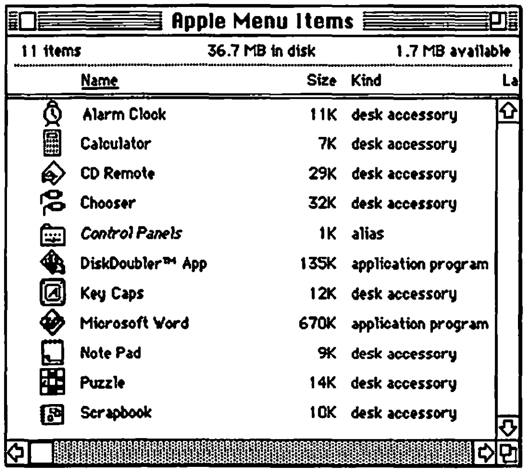


FIGURE 5-2
Apple Menu Items folder

DESK ACCESSORIES

The Apple Menu Items folder is full of desk accessories. They are small programs (also called mini-applications) available to you at any time, within any program. Click the Apple menu to select one. The desk accessories commonly include an Alarm Clock, a Calculator, Chooser, and a Battery icon (for laptops and portables).

ALARM CLOCK

The Alarm Clock selection from the Apple menu is a way to set the time and date. Select Alarm Clock from the menu. A box will appear under the "time" in the upper right-hand corner of the screen. The box displays the time in digital fashion (the seconds are ticking away) with an alarm time box under it. (The alarm time box is also a digital display set at 12:00 A.M.) Under these two boxes is a third box containing a series of three icons. The first icon is an analog clock face, the second is a 2 behind a 1, and the third is an analog alarm clock with a bell on top.

ABOUT THE ...
How to Install Desk Accessories

Installation of desk accessories is different under System 6 and System 7.

To install desk accessories in System 6:

The Font/DA Mover is a utility used to install and remove fonts and desk accessories. The program comes standard with the Macintosh (it is included on the operating system disks). Find the disk with the program, drag the Font/DA Mover to your hard disk and double-click it to launch. You'll see a menu where you can choose to move either fonts or desk accessories. Choose Desk Accessories. On the list, find the folder or disk the desk accessory is on (you won't see icons, just filenames). Indicate the destination location (folder) on the hard disk by highlighting it and opening it. Click your choice in the Font/DA Mover and a button will appear. This button asks you to either remove or install the desk accessory.

Click the Install button. The desk accessory will move to the hard disk. Quit the Font/DA Mover. When the Finder reappears, the program will be available for your use. To remove a desk accessory, follow the same process, except click Remove instead of Install.

To install desk accessories in System 7:

Find the desk accessory, click it, and drag it to the Apple Menu Items folder on your hard disk (in your System folder). Your desk accessory is loaded. It is not necessary to restart your system to make it active. To remove the desk accessory, drag it out of the Apple Menu Items folder.

The date and time may be set by selecting the analog clock icon and typing in the correct hour, minute, and second. The date may be adjusted by use of the 2/1 icon. Select that icon and the date will be displayed. Set the time for an alarm with the alarm icon. The digital time begins at 12:00 A.M. Be sure to go around once to the P.M. if you want an alarm in the afternoon.

To activate the alarm, move the "switch" to turn it on. The switch is the bell to the left of the "set time." Click it to turn the bell upside down (the alarm is on). Click it again to cancel the alarm. When the alarm goes off, the Macintosh will beep at you. If you fail to respond to the alarm, the Apple menu item icon will alternate between an apple and a screaming alarm clock. It will keep flashing back and forth between the icons until you go into the alarm clock and turn off the alarm.

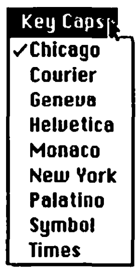
CALCULATOR

Select the Calculator from the Apple menu and a working calculator icon will be displayed on the screen. This calculator is very handy. You can open it any time, in any program. It works just like a handheld calculator (and it doesn't get lost in piles of paper). Point and click to select a number. (You can also key in numbers and operators by using the keyboard.) The number will be displayed in the calculator's screen. Use the plus and minus, multiply, and divide symbols, the Clear button, and total column button just like a regular calculator's buttons for simple mathematical functions. To get rid of the icon, click the close box on the calculator.

MISCELLANEOUS DESK ACCESSORIES

Key Caps

Key Caps is a desk accessory to show you the character set available for a given font. Choose Key Caps from the Apple menu. Once selected, you choose the font by clicking the Key Caps menu shown here:



Once you've selected the font, you can see the characters' various key combinations generated by viewing the keyboard. When the option key is pressed, the character set shown in Figure 5-3 appears. If you click any one of these characters, it appears in the window beneath the words Key Caps. You can cut, copy, and/or paste these characters into your documents by highlighting them in this window. Since Key Caps is a desk accessory, you can access it while you are running any program.

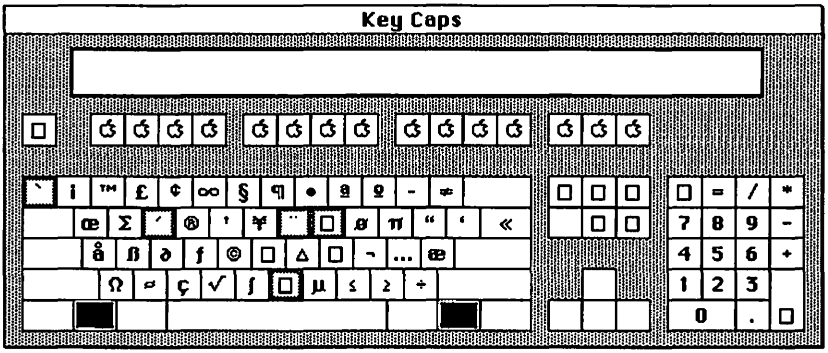


FIGURE 5-3
Key Caps character set

Note Pad

Note Pad, shown in Figure 5-4, is a desk accessory to keep notes to yourself. Launch it from the Apple menu. If you click the lower left corner (the corner is folded up), you advance to the next page. Use the close box to return to the first page of your notes. Each Note Pad page can hold up to 256 characters.

Puzzle

Puzzle is a desktop accessory to move squares around the screen to create the Apple logo. You move these squares by clicking them. This desk accessory is designed for color monitors, as the logo it creates is in color. It is mostly a time waster, but sometimes you need to waste time.

Scrapbook

Scrapbook is a desk accessory where you can store picture files in *pict* (short for picture) format. You can store a number of pictures in the Scrapbook for future retrieval. It stores these pictures in the Scrapbook file. While the Clipboard serves the same function, it only stores the last item in memory. Text and bitmapped art can also be stored.

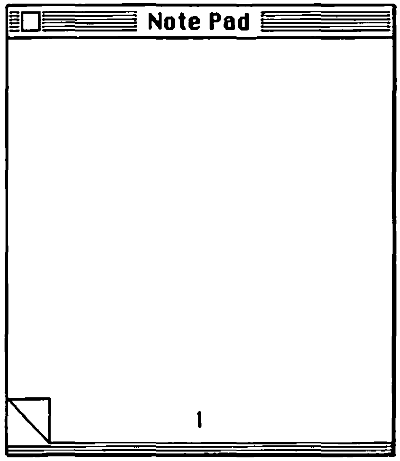


FIGURE 5-4
The Note Pad

CHOOSER

Chooser is the means to create a pathway for external hardware (printers or network devices) to connect and work with the Macintosh. Even if the hardware is connected properly, if the Chooser isn't activated, the hardware won't work.

To access the Chooser, go the the Apple menu and open the Chooser menu item (drag your pointer down to it and let go). You will see a screen like the one shown in Figure 5-5.

On the left side of the screen are the items to connect to your Macintosh (peripheral devices like printers and so forth, and network options). These items include the file server labeled AppleShare (software on a Macintosh for users to store, retrieve, and share files and programs over a network) and the printers labeled AppleTalk ImageWriter, Autographix 2.2, ImageWriter, LaserWriter, LQ AppleTalk ImageWriter, LQ ImageWriter, Personal LaserWriter SC, Personal LW LS and the StyleWriter. (AppleTalk is Apple's rules for connecting different computers, peripherals, and software.) Click the device you want to access. Once you click a device (the StyleWriter in Figure 5-5), it asks you which port you want to use. You need to specify the port where the device plugs into the back of the Macintosh.

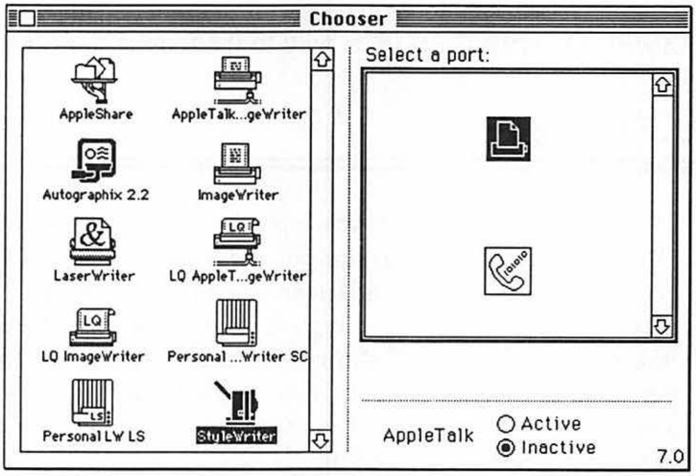


FIGURE 5-5
The Chooser

In Figure 5-5, the printer port is selected (the one that looks like a printer is darkened) and the StyleWriter is selected (it's darker, too). This means a StyleWriter should be connected to the printer port on the back of the Macintosh. The StyleWriter can't run over networks, so, the box in the lower right-hand corner of the screen says the AppleTalk network is inactive. (If the Active button were selected, you would need to click the Inactive button to let the connection work.)

The Chooser must know the following three things to allow a connection to be successful: device type, port, and whether AppleTalk is active or inactive. Only one device may be added at a time. Each time you want to add a new device you must use the Chooser. (It only sounds complicated. It's much easier than the mumbo-jumbo you go through to add a device to a PC-DOS machine.)

EXTENSIONS

The Extensions file folder in the System folder contains files that extend the capabilities of the Mac system software. They include all those items pictured in the Extensions folder, as shown in Figure 5-6. The items include INITs and Chooser resources (things the Chooser needs to work). Under System 7, when you drag an INIT or Chooser into the System folder, it will automatically find its way to the Extensions folder.

CONTROL PANELS

The Control Panel lets you customize various parts of your Macintosh. (These are discussed throughout the book.) To access the Control Panel, click the Apple menu. Hold the mouse button down and drag your pointer to the Control Panel item. Let go of your pointer and the Control Panel will be displayed. Figure 5-7 shows Control Panels files for System 7. Each file performs a specific function. Most work with a thumb-slide adjustment or a selection of buttons to click. You can change the speaker sound or the desktop background pattern.

Don't be shy about moving around the Control Panels. Familiarize yourself with their functions and what is in each section of the Control Panels menu. You can't break anything—well, at least you can't do anything which cannot be undone. It's a good place to get the hang of the Macintosh system.

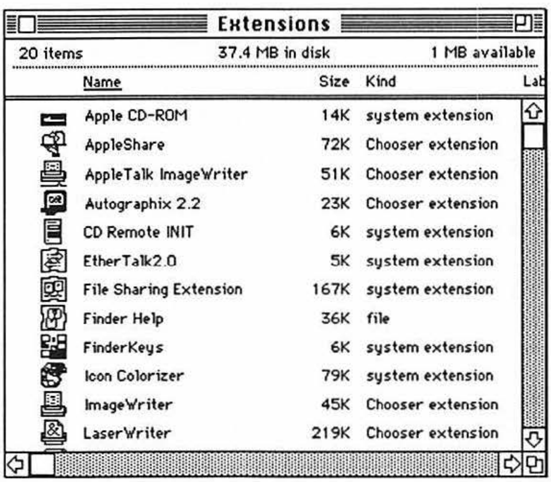


FIGURE 5-6
The Extensions file folder

ABOUT THE ...
Preferences Folder

The Preferences folder in the System folder is one of two places where the specific user-designated settings are kept for various customizable elements of the Macintosh. Every time you create a specific group of settings for an application, you create a *preference.*

Savvy System 7 applications store their preferences files in the Preferences folder. Those that are not savvy store the preferences file in the System folder.

Don't move files stored in the System folder to the Preferences folder. The applications that store their preferences files in the System folder are not System 7 savvy enough to recognize they could be stored in the Preferences folder. As a result, if you place these files in the Preferences folder, the application won't be able to find them.

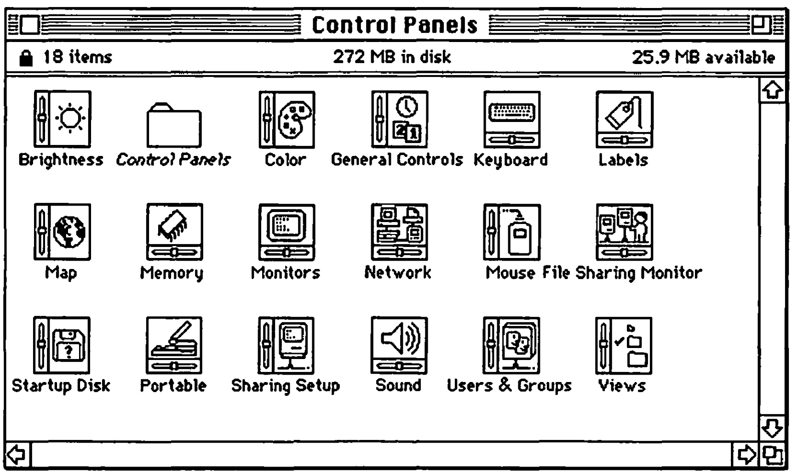


FIGURE 5-7
The Control Panel

GENERAL CONTROLS

The General Controls panel shown in Figure 5-8 has six functions:

- The box in the upper left sets the background pattern on the desktop.
  The square you see in the left of this box contains a magnification of the desktop pattern. You can change this pattern with your pointer. Click existing dots in the magnification and the dots disappear. If you click in a white space, dots will appear. On the right side of the box, you can select predetermined desktop patterns. Click either the right- or left-facing arrow. New desktop patterns appear each time you click one of these arrows. To put a desktop pattern into effect, double-click the pattern you created.
  The desktop pattern is modifiable when you click one of the seven squares below the words "Desktop Pattern." Again, double-click the pattern you've chosen to put the new color into effect.

- The Rate of Insertion Point Blinking box allows the pointer to blink at one of the three selectable speeds. Click one of the three circle boxes, and your pointer will blink at the rate flashing on screen.

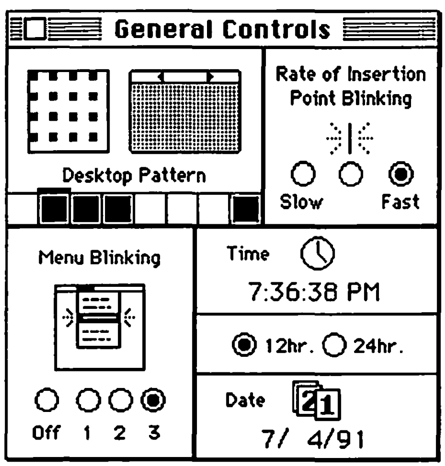


FIGURE 5-8
General Controls

- Menu Blinking causes the menu item, once chosen, to blink anywhere from zero to three times.
- The time you set appears in the Time box. To change the time, click the hours, minutes, seconds or A.M./P.M. indicator. Two arrows (one facing up and one facing down) appear to the right of the time. You can increase or decrease the time by clicking on either the up or down arrows.
- The next time box allows you to look at the time with either a twelve or a twenty-four hour clock. When you change the setting in this box, it changes the clock you see in the box above it.
- Change the date by clicking on the month, day, or year. Two arrows appear (one facing up and one facing down). Click the direction in which you want to change the date, and it will change the month, day, or year, independently. To confirm the date is reset, press the numbers "21" above the date.

Sound Control Panel

On most Macintoshes the Sound control panel (shown in Figure 5-9) controls two things: Speaker Volume and the Alert Sounds. Speaker Volume ranges from 0 to 7. Click the crossbar on the "thermometer" (called a *thumb-slide* control), hold your mouse button down, and drag the crossbar to where you want the volume set. Alert Sounds are the different sounds

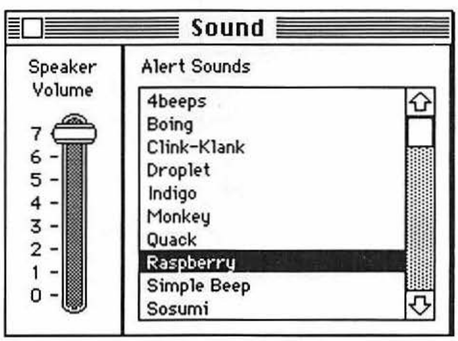
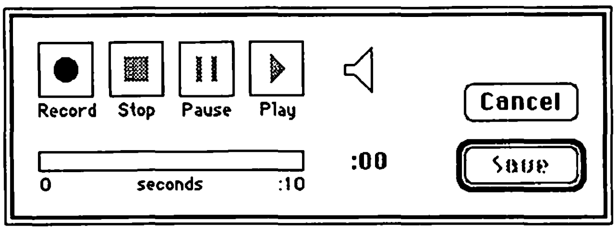


FIGURE 5-9
The Sound box

you have in your Macintosh (Chapter 11, "The Noisy Mac," has more information on this). The sounds are loaded into the System 7 System file by dragging them into the System folder.

Figure 5-10 shows the sound control panel on Macintoshes which use the standard microphone (the Macintosh LC or IIsi, Quadra 700 and 900, or PowerBook 140 and 170). Load new sounds with the microphone input in the bottom of this box.

When you click the Add button beneath Alert Sounds, you see the box shown in the following illustration. Click the Record button to commence recording; the Stop button to stop recording or playing; the Pause button to pause from either recording or playing; and the Play button to play back the sound just recorded.



Once you have input a sound, the Save button is activated. When you push this button, you can name the sound you just recorded, and it is added to the Alert Sounds list. You can remove a sound from the Alert Sounds by clicking it and pressing the Remove button.

INPUT DEVICE CONTROL PANELS

The following control panels adjust the input devices connected to your computer. These include the keyboard and mouse.

Keyboard Control Panel

The Keyboard control changes three things: key repeat rate, delay until repeat, and keyboard layout.

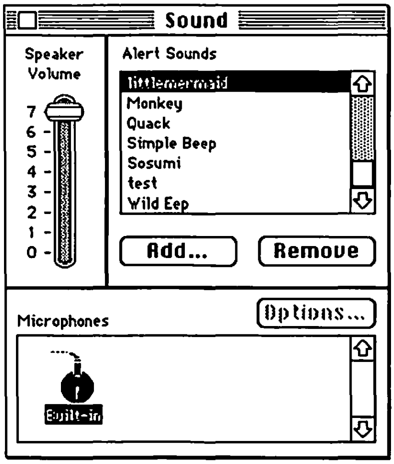
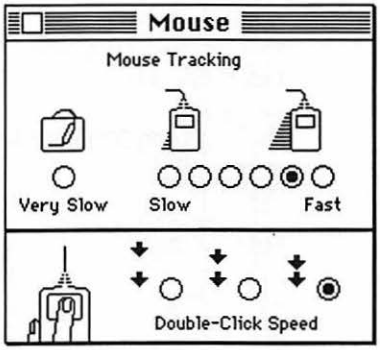


FIGURE 5-10
Sound control panel for the LC or IIsi

Key repeat rate	Sets how fast a key will repeat when you hold it down.
Delay until repeat	Determines how long you have to press a key before it begins to repeat.
Keyboard layout	Select a keyboard layout based on the one you use (If you use a U.S. keyboard, select US Keyboard layout; if you have a Kanji keyboard, select Kanji, and so on. Of course, you must have the right software. Kanji is not an option unless you have Japanese System software.)

Mouse Control Panel

The two adjustments you can make with the mouse control panel, shown here, are Mouse Tracking and Double-Click Speed:



Mouse Tracking speed is the speed at which the pointer follows the movement of the mouse. Set Mouse Tracking to Very Slow if you want the mouse to take a while to follow the movement of the mouse. Fast is immediate tracking. Any of the intermediate speeds is set with the other five adjustments.

Double-Click Speed is the speed you must click, in succession, to create a double-click. There are three settings for this option. When you push any one of the radio buttons, the diagram on the left will become animated. It demonstrates the speed one must click to achieve a double-click.

Easy Access Control Panel

Easy Access, shown in Figure 5-11, controls the action of the keys on your keyboard. With it you can do the following:

- ▶ Use sound to confirm your actions. This is achieved with the check box in the upper left-hand side of the Easy Access panel.
- ▶ Use the keypad in place of the mouse with the Mouse Keys. When this option is on, you can use the numeric keypad to move your pointer around the screen.
- ▶ Set Initial Delay between the time you push a mouse key and when the pointer on the screen moves. This delay ranges from long to short (with five gradations).
- ▶ Set Maximum Speed for the pointer to move. Use the Mouse Keys option. There are eight different speeds, from slow to fast.
- ▶ Use the Slow Keys option to slow down the acceptance of a keystroke. If you push a key down with Slow Keys turned on, it takes a while for

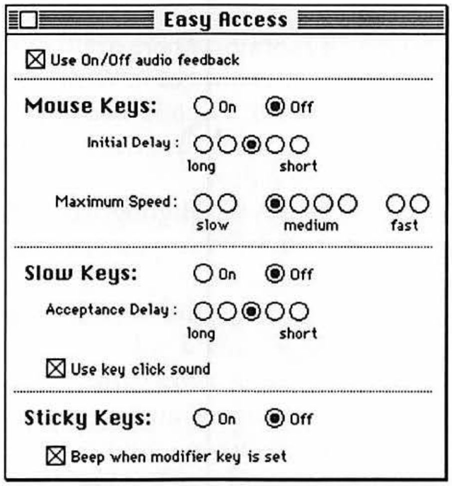


FIGURE 5-11
Easy Access control panel

the keystroke to register on the screen. Slow Keys helps prevent you from typing a wrong key. If you are slow to lift your fingers from the keyboard, this feature will aid you greatly. The Acceptance Delay option determines how long or short a time before the keystroke registers on the screen. If you turn on "Use key click sound," you hear an audible tone when the key registers on screen.

- Use Sticky Keys to eliminate the need to hold down two or more keys at once to achieve some action. For example, if you want to quit a program and you'd normally press Command-Q to do so, when you use Sticky Keys, you don't have to continue to hold both keys down. You can push one, then the other. The Macintosh knows they are being pushed in tandem. When you turn on "Beep when modifier key is set," you hear an audible tone once your sequence of accepted keys is entered.

BACKGROUND AND VISUAL CONTROL PANELS

The color and monitor characteristics control panels are directly related to the screen view.

Color Control Panel

The Color control panel establishes the settings for the colors displayed on your Macintosh monitor. There are two options in this control panel, Highlight color and Window color. With Highlight color, you choose the color of highlighted text. Highlighted text occurs when you click your mouse button, hold it down, and drag it across text. Window color is the color of the external window.

One of the options in the Highlight color choices shown in Figure 5-12 is Other. When you click Other, you see a color wheel like that shown in Figure 5-13.

The color wheel displays the current color in the bottom half of the box located in the upper left-hand side of the screen. The upper half of the square is the new chosen color. You need a color monitor to see the difference between the lower and upper halves of this square. The *hue* (current mixture of red, green, and blue) and the *saturation* (the average intensity of red, green, and blue) can be changed by clicking either a spot in the color wheel or one of the arrows which corresponds to the hue and/or saturation choices. The hue may also be changed with one of the arrows next to the red, green, and/or blue choices. You can change the color combinations this way if you know the exact numbered mix that appears in the color you want.

Brightness (the amount of light given off) may be changed with either the scroll bar to the right of the color wheel or with one of the arrows next

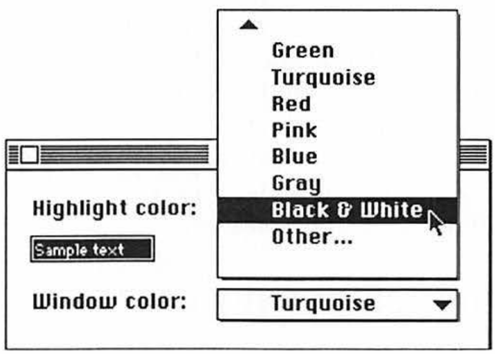


FIGURE 5-12
Highlight color options in the Color control panel

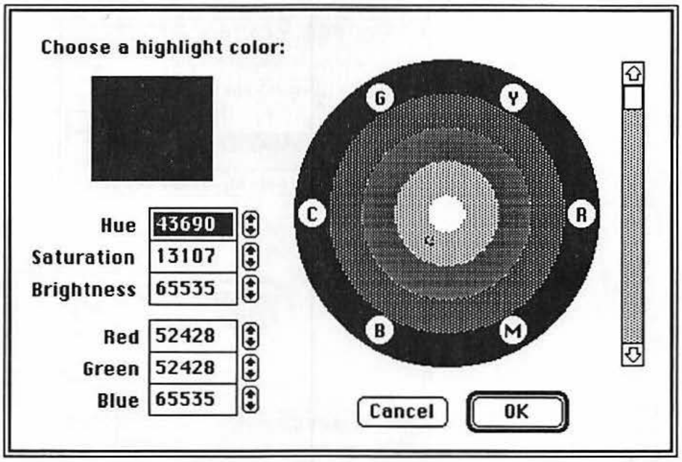


FIGURE 5-13
The Color wheel is displayed when you choose Other from the Highlight color options

to the brightness choice. To incorporate the changes, click OK under the color wheel.

Monitor Control Panel

The monitor is controlled by a panel like the one shown in Figure 5-14. Change the characteristics of a monitor with the settings in the panel. If you have a monochrome (Grays) or color (Colors) monitor, check the radio button that corresponds to your monitor. The choices Black & White, 4, 16, and 256 determine the number of colors or shades of gray in the box. When you click the Options box, you see the screen shown in Figure 5-15. This screen shows you the type of video card in use. In the example, there is a Macintosh II Built-In Video card.

You can set the number of colors/grays in this screen the same way you can in the previous screen. Memory is allocated by the system based on your choice.

You see an icon with the number 1 in it in Figure 5-14. This shows you one monitor is attached to the system. If you had two or more, a number and icon would appear in this screen for each one of them (the second

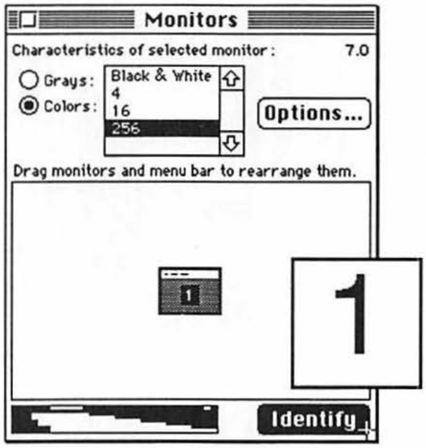


FIGURE 5-14
Monitors control panel

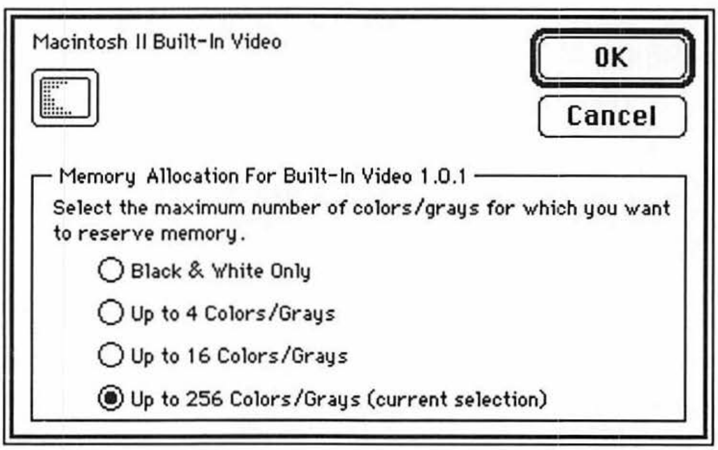


FIGURE 5-15
The Monitor Options box

monitor would have a 2 in it). You choose the monitor you want to use (if you have multiple monitors) by clicking the monitor icon in this window. To determine the monitor, click the Identify button. When you do, the corresponding number appears in the middle of the monitor's screen. The grid to the left of the Identify button shows the available colors or shades of gray.

ABOUT THE ...

System 7-Specific Control Panels

View Control Panel

The View control panel, new to System 7, is used to manipulate a lot of the things you see on screen. The "Font for views" selection lets you choose the font type and size of the text underneath icons on your screen. Click the font or arrow next to the size and hold your mouse button down. You now see a list of fonts or sizes to choose from. Move your pointer to the font or size you want and release the mouse button. All of the fonts and their respective sizes loaded in your System appear in this choice. "Fonts for views" does not change the text you see in the title bars of windows; they are always Chicago 12 point.

When you use the "Clean up window" feature, the window can either align in a straight or staggered grid. Choose the radio box. If you want to automatically align icons without the "Clean up window" selection, click the "Always snap to grid" option in the Icon Views choice.

The List Views choice allows you to use icons of one of three sizes and augment your view with eight pieces of information: folder size, disk information, file size, kind, label, date, version, and comments. Everything except the file's comments are visible on the screen.

Label Control Panel

The Labels option isn't new to System 7, but its customization is new. You can highlight any of the text you see to the right of the labels and change them to encode as you see fit. The Labels feature is most useful if you have a color monitor; the different labels can be displayed in varying colors.

SPECIALIZED FUNCTIONS CONTROL PANELS

The following control panels are very specialized. They include memory alteration, networking, and file sharing security levels.

Memory Control Panel

The Memory control panel allows you to adjust memory allocation. For more information on why you would want to fuss with this, refer to Chapter 7, "Disk and File Management." The Memory control panel deals with three things:

- *Cache size* This is the amount of memory used to store frequently accessed information. Cache improves the Macintosh's performance with the information stored in it readily available. Cache is sort of a holding tank for frequently used information. Set the amount of memory used for the cache (anywhere from 16K to 3584K depending on machine and memory installed) with the arrows to the right of it. Once you set the cache size, the changes won't take effect until the computer is restarted.
- *Virtual memory* This allows you to use space on your attached hard disk(s) to create random access memory. You augment the RAM chips in your Macintosh with this feature. For example, if the Macintosh has 5 megabytes of random-access memory chips, you could add an additional 3 megabytes with the virtual memory option.

  With the aid of the arrows to the right of the Virtual memory option, you scroll to add 3 megabytes to RAM. The 8 megabytes becomes available when the Macintosh reboots. Remember, you are still constrained by the amount of virtual memory you can use by the amount of free disk space on your Macintosh hard disk(s). Virtual memory will work only with a special Macintosh chip installed in the system, called the *Paged Memory Management Unit* (PMMU) chip.
- *32-bit addressing* The Macintosh organizes its memory with certain addresses. A Macintosh can use more memory if it can handle more addresses. Sixteen-bit addressing is common (the addresses are 16 bits long). Thirty-two-bit addressing means the addresses are 32 bits long. The larger the addressing ability, the more potential memory available.

To reset the defaults (established by Apple) click the "Use Defaults" box at the bottom of the Memory Control screen.

Network Control Panel

The Network control panel lets you select a network connection. In the example shown in Figure 5-16, there is only one option—the Built-In LocalTalk connection. (For more information on networking, refer to Chapter 23.)

System 7's File Sharing Monitor Control Panel

The File Sharing Monitor (pictured in Figure 5-17) is only active if you are using file sharing (the ability to share files with other Macintosh users on your network). If you have activated file sharing from the File menu in the Finder menu, you can select those files, folders, or storage devices you want to share with other users. This monitor shows you those items designated as shared and those users who are connected to those items. In our example, only System 7.0 is a shared item. As you can see from the bar indicator below the shared items, there is no activity. You can connect and disconnect users with the button under the Connected Users box. If a user is connected, you can push the Disconnect button to disconnect him.

Sharing Setup

The Sharing Setup control panel shown in Figure 5-18, has three settings: Network Identity, File Sharing, and Program Linking. Network

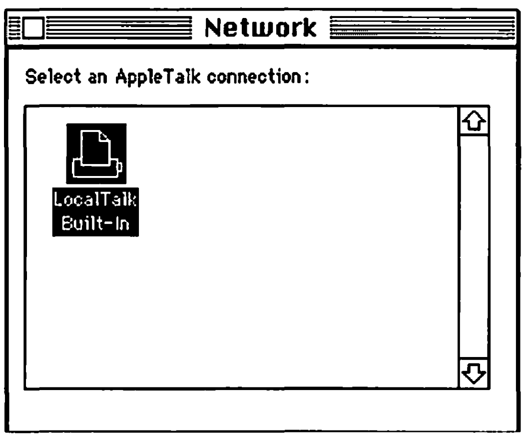


FIGURE 5-16
Network control panel

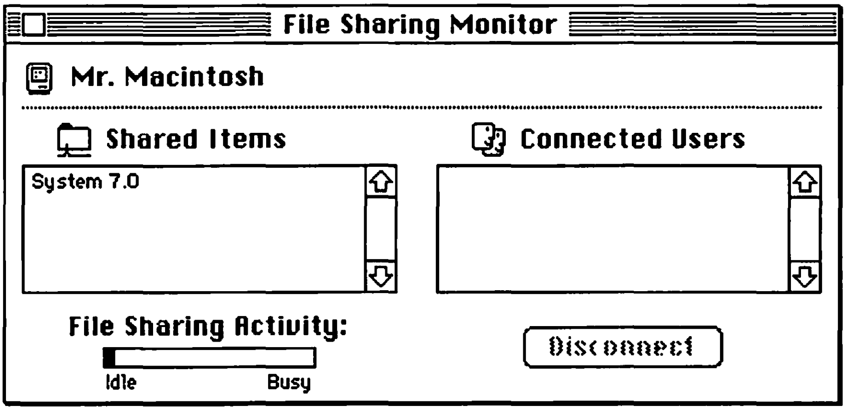


FIGURE 5-17
File Sharing Monitor control panel

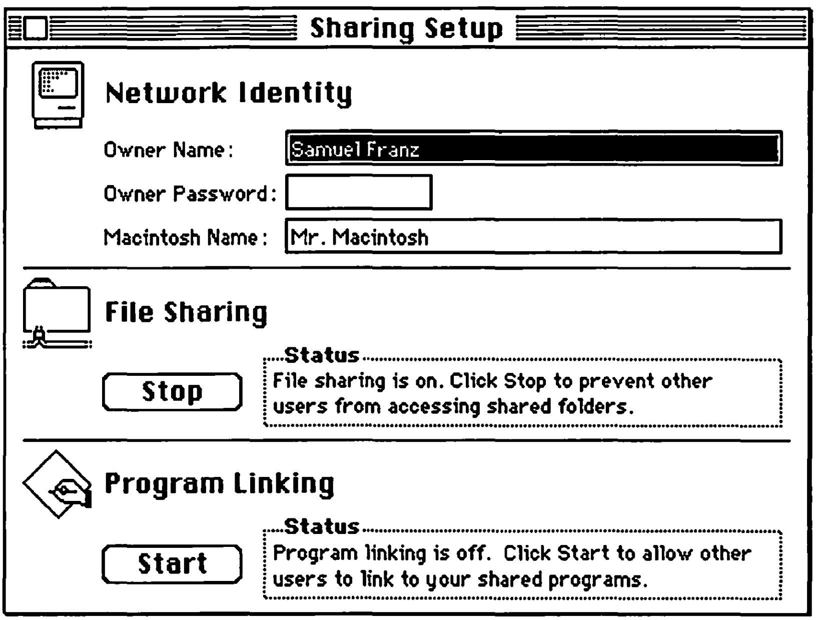


FIGURE 5-18
Sharing Setup control panel

Identity items identify the Macintosh to other users on a network. Owner Name is the name of the person who uses the Macintosh. Owner Password is the password to access a system remotely, over a network. Macintosh Name is the identifying name of this Macintosh for other non-owners to use when they access information from this Macintosh. File sharing is started through this option. You must have previously designated files, folders, or devices to be shared, but you activate file sharing from this option.

Program Linking takes advantage of a new feature in System 7 to link programs across a network. When a change is made to one program or file, it automatically updates the linked program.

Startup Disk Control Panel

The Startup Disk option lets you to select the disk the Macintosh will start from (see Figure 5-19). The Macintosh uses the System folder from this disk to start. You change the startup disk by clicking the hard disk you want. In the example, the Macintosh HD is the startup disk. If you change the startup disk, it won't take effect until you restart your system.

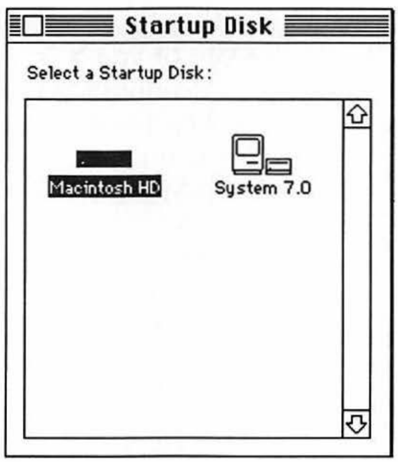


FIGURE 5-19
Startup Disk option

ABOUT THE ...
Control Panels, Portable-Specific

An option is available to control features specific to the Macintosh Portable and PowerBooks. It controls items such as System sleep (a feature to conserve the battery of the Portable), and when it reawakens, screen contrast, the setup of RAM, and the modem configuration.

The Battery icon is a desk accessory only used by the Macintosh PowerBook and Portable computers. It isn't the battery, itself, but a vehicle to check on the amount of charge left in the battery. The Battery desk accessory can put the Macintosh Portable in a mode called "sleep" where it conserves the drain on the battery.

Users & Groups Control Panel

The Users & Groups control panel determines who may share files and access your Macintosh. In Figure 5-20, you see three faces labeled <Guest>, Samuel Franz, and Lisa Day.

The <Guest> identifier may be used by anyone to access information from your Macintosh. When the person attempts to connect to your Macintosh (they type in the information necessary from the File Sharing control panel), they can identify themselves as <Guest>. <Guest> may or may not have a password. If you want to protect your Macintosh, you should give the <Guest> identification a password. In the example, Samuel Franz is the owner of the Macintosh. Therefore, he shows up as a user. Lisa Day is a user as well. Every time Lisa Day signs in, she will be recognized as an accepted user of this Macintosh.

Figure 5-21 shows the vehicle used to establish levels of security for your allowed users and groups. You can set these levels by double-clicking the specific user or group to whom you want to assign an identity. With the File Sharing options, you can allow or deny the following:

- who may connect to your Macintosh
- who may change a password
- who may view your entire disk, not just shared information

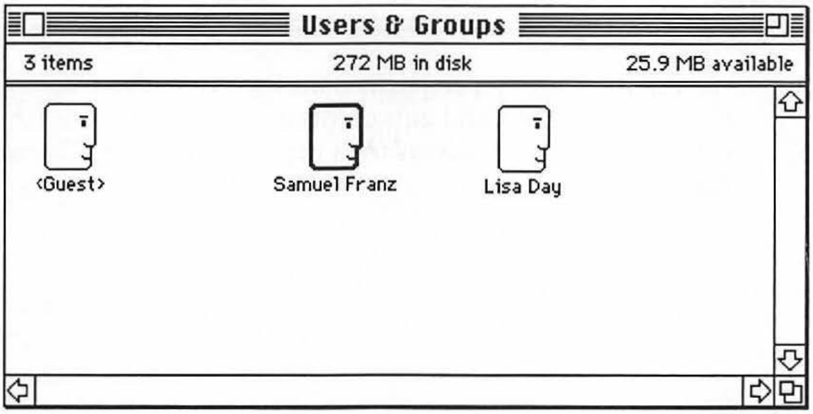


FIGURE 5-20
Users & Groups icons

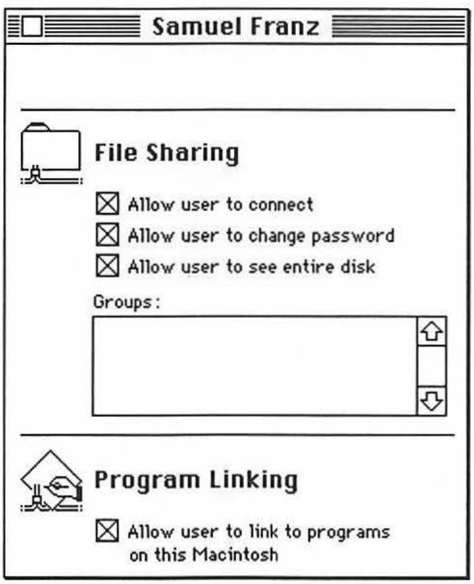
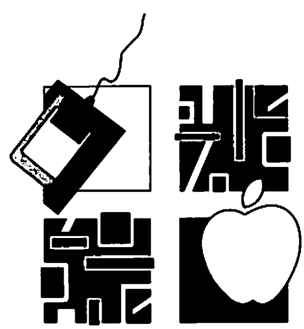


FIGURE 5-21
Security levels

CONCLUSION

From the user's perspective, the System folder, Chooser, and Control Panels are the heart and guts of Macintosh software. Understanding these is the critical key to success for a happy, productive relationship with the Macintosh.



C H A P T E R 6

OPERATING SYSTEMS AND UTILITIES

Since the introduction of the first Macintosh operating system (OS) in 1984, the system has undergone many changes. The operating system controls the basic operation of the Macintosh, while the Finder is an application that controls the desktop-based activity. The original operating system—the "System whose creation date is May 2, 1984"—is the granddaddy of them all. The next major system change was released on June 4, 1986.

Each change was to improve and refine the operating system. Some of the changes are more radical than others, but most stayed within the basic framework. The latest version, System 7, is the first major leap. System 7 is different.

ABOUT THE ...
Another Operating System!

Apple A/UX operating system version 2.0.1 is Apple Computer's implementation of the UNIX operating system, developed and licensed from AT&T. The UNIX operating system is an industry standard. It is an operating system which is *multitasking;* it can perform more than one operation at a time. The Apple implementation of this operating system can run off-the-shelf Macintosh, UNIX, or X Window applications. The X Window System, developed at the Massachusetts Institute of Technology, provides a network-transparent and vendor-independent operating environment. It provides network "windows" and graphics standards to many UNIX-based applications, especially those in the scientific area.

THE OPERATING SYSTEM

The OS is a collection of software which is interdependent. It controls the system resources and the way these resources are used in the system. The Macintosh has two key parts to its system: the Finder and MultiFinder.

THE FINDER

The part of the OS which creates the desktop is called the Finder. It is always available to you as a Macintosh user. As initially conceived, the Finder environment manages documents, applications, stores, and retrieves information from disks. Originally, the Finder was only able to perform a single task (such as keeping a single application open). With the addition of a program called Switcher, the Finder was able to move between one application and another. Switcher was a way to keep an application open and move on to another application to use it. The number of applications you could keep open at any one point in time was constrained by the amount of active physical memory (RAM) in the system. Generally, Switcher *switched* between two active applications.

THE MULTIFINDER

In 1988, Apple introduced MultiFinder as the first multitasking operating system available on the Macintosh. MultiFinder gave users three powerful features:

- Multiple applications could be open and available at the same time. You couldn't use two applications at once. (That function is called *multiprocessing*.) Yet, you could keep multiple applications active at once.
- Switch between applications to cut and paste information between applications.
- Print documents in the background while you work on another application in the foreground.

The first two features were previously a part of Switcher. Background printing was new with the introduction of MultiFinder. With MultiFinder the user can switch between applications in one of three ways. The first is to select an application by clicking inside any open window of the application. The second is to select from the Apple menu. The third uses the Finder. Double-click an application.

It wasn't until the introduction of System 7 that Apple incorporated MultiFinder capabilities into the Finder itself. The Finder in System 7 contains the same capabilities as MultiFinder.

UTILITIES

Computer users are a lot like car nuts. The first thing they want to do is soup up the engine and paint pinstripes down the side. In the computer world, that's what utilities are for. *Utilities* are programs to personalize your system and keep your Mac revved-up and running smoothly. Some of them come with the computer. Others are sold by third-party software publishers. Many more are shareware or public domain programs available from user groups and online services. The following utilities are divided into the kinds of jobs they do, listing several (but by no means all) of the major programs in each category. First, the stuff you probably already have: the utilities that came with your Macintosh.

ABOUT THE ...
System Software and Finder Versions

Here is a list of all of the Macintosh system software versions, starting with System 3.2, and their accompanying Finder versions:

Disk Set Name	System Version	Finder Version
System Software 1.0	System 3.2	Finder 5.3
System Software 1.1	System 3.2	Finder 5.3
System Software 2.0	System 4.1	Finder 5.5
System Software 2.0.1	System 4.1	Finder 5.5
System Software 5.0	System 4.2	Finder 6.0
System Software 5.1	System 4.3	Finder 6.0
System Software 6.0	System 6.0	Finder 6.1
System Software 6.0.2	System 6.0.2	Finder 6.1
System Software 6.0.3	System 6.0.3	Finder 6.1
System Software 6.0.4	System 6.0.4	Finder 6.1.4
System Software 6.0.5	System 6.0.5	Finder 6.1.5
System Software 6.0.7	System 6.0.7	Finder 6.1.7
System Software 6.0.8	System 6.0.8	Finder 6.1.8
System Software 7.0	System 7.0	Finder 7.0
System Software 7.0.1	System 7.0.1	Finder 7.0

The Macintosh operating system has evolved through these many versions with enhancements along the way. The fundamental operating system and desktop manipulations described in chapters 4 and 5 were developed in 1984 with the inception of the Macintosh. Most of the enhancements, except System 7, were tweaks of the system to adapt it to new Macintosh hardware or to make it more easily used. To better understand these additions, the major features and additions for most levels of the system software are described in this chapter.

APPLE "BUNDLED" OR DISTRIBUTED UTILITIES

The "bundled" utilities are provided with your Macintosh, or are available from Apple Computer. They are designed to make your "life with Mac" more pleasant and rewarding.

Apple File Exchange

The Apple File Exchange (AFE) is a handy program which converts files created by MS-DOS computers into a form your Macintosh can read, and vice versa. If you have a SuperDrive, you can also use AFE to read and write MS-DOS and Apple II ProDOS disks. It's not as versatile as some of the commercial products (see "MacLink Plus/PC" later in the chapter), but the price is right. Several programs, including Software Bridge from Systems Compatibility, provide additional translation modules that work with AFE.

Disk First Aid

Disk First Aid can correct a number of disk errors. It is the first line of defense against damaged disks. For something a little more powerful, look at the file recovery tools listed later.

Extensions Manager

Extensions Manager by Ricardo Batista doesn't come with System 7, but it should. Apple distributes it online and through user groups. It is a small Control Panel device that lets you enable and disable other Control Panel devices and INITs. The only other way to do this is by moving the CDEVs and INITs out of the System folder, and that can get pretty tiresome.

Font/DA Mover

This old war-horse has been put to pasture by Apple with the release of System 7. You won't need it to install fonts and desk accessories into the System any more, but it is still handy for the font suitcases System 7 won't open (and thanks to a known bug in System 7, there are a lot of those). Although Apple doesn't distribute Font/DA Mover with System 7, you can get it from the usual sources—user groups, online data bases, a friend, and so on.

Map

Map isn't really a utility (unless you frequently need to calculate the longitude and latitude of cities around the world). It's just one of many Control Panel devices bundled with your System. Map deserves recognition as one of the coolest CDEVs around. What other computer can instantly tell you the time of day in Caracas, Venezuela?

Memory

The Memory Control Panel device contains a setting for the disk cache. People pay up to $100 for MS-DOS disk caches. Apple includes it free with the Macintosh. That's the good news. The bad news is Apple's doesn't work nearly as well as the MS-DOS cache programs on the market, and by giving it away, Apple has killed the market for third-party disk caches.

A disk cache sets aside a portion of the computer's random-access memory where it stores the data it reads from disk. If the computer needs the data again, it can retrieve it from speedy RAM instead of from the slower disk. This can make a real difference in how fast the computer works. The trade-off is that it also takes up precious RAM. If the cache size is set too high, the computer will waste time searching through it for data. Between 128K and 192K seems to be the optimal size on the Mac.

TeachText

Let's not overlook TeachText. It was originally written so Apple could distribute updated documentation on disk. TeachText has proven useful for browsing any text file. Don't erase this program after you install your system. It will be useful long after you're no longer a novice. The System 7.0 version is a big improvement. It handles PICT graphics as well as text.

THIRD-PARTY UTILITIES—MULTIPLE DISK UTILITIES

Here are some of the ways third-party developers have found to improve on Apple's offerings. If you don't want to spend a lot of time collecting utilities one of these is probably all you'll ever need.

911 Utilities

Microcom's 911 Utilities is oriented toward recovering deleted or damaged files.

ABOUT THE ...
Typical Utility Functions

Defragmentation When a disk is used a lot it tends to become *fragmented*: files stored on it are spread all over the drive forcing a lot of extra head movement. Defragmentation programs, sometimes called disk optimizers, reorganize the disk so that all files reside on contiguous sectors for quicker access.

Partitioning Partitioning software divides large hard disks into smaller hard disks, limiting fragmentation and helping you organize your data.

File recovery File recovery programs help you restore files accidentally erased. They can also do a pretty good job of recovering files that have been damaged. The best of them can even recover a hard disk that has been inadvertently formatted.

Security Security programs let users password protect files, folders, and disks to keep them from prying eyes. The most sophisticated of them use the Data Encryption Standard used by the government to protect its secrets. Just don't forget your password!

Backup If your hard disk crashes and the other utilities can't recover it, you'd better have a copy of the data somewhere else. Backup programs make this easier. Some save your data to floppies, others to tape or second hard drives. All the best programs work quickly, copying at least one megabyte per minute, and have error correction to protect against losing data on damaged diskettes.

Mac Tools Deluxe

Mac Tools Deluxe by Central Point Software is a comprehensive disk management and recovery package. It includes backup, defragmentation, disk security, hard disk partitioning, and file recovery programs.

Norton Utilities for the Macintosh

This Norton Utilities package from Symantec is heavily influenced by its MS-DOS cousin, but is completely Mac-like in operation. The Norton Utilities include defragmentation, searching, and file recovery utilities.

SUM II

Norton's older brother, from Symantec, includes partitioning, encryption, backup, and defragmentation software. Look for SUM and the Norton Utilities to be merged into one big package soon.

THIRD-PARTY UTILITIES—SINGLE DISK UTILITIES

Single disk third-party utilities are more specific. They usually have only one function. Some are commercial, some are shareware. You can find them through your local user group if the computer store doesn't carry them.

DiskExpress II

DiskExpress by Alsoft only does defragmentation, but it does it very well. It is a good idea to back up your hard disk before using any defragmentation program, though.

Silverlining Hard Disk Manager

Silverlining Hard Disk Manager by LaCie is the ultimate utility for hard disk drives. It can format nearly any hard disk, partition it, and back it up. You may say, "My hard disk already comes with similar software." Not like this, it doesn't.

Tidy It Up!

The shareware program, Tidy It UP!, is from Guy Feimus of Belgium. It does something you may not have known you needed: it cleans up the appearance of your System folder. It's for the fusspot in us all.

BACKUP UTILITY PRODUCTS

More information on backup is in Chapter 7, "File and Disk Management." File backup is an important but dull part of computer data security. These products make it easier to carry out the dreary duty.

ABOUT THE ...
Japanese Macintoshes

What a challenge, but it works! The Japanese Macintosh must deal with over 6,800 characters in four character sets in order to work. It operates with a special version of the Macintosh operating system to do so. An INIT called KanjiTalk translates keystrokes on the keyboard and converts them into Japanese. Input modules, dictionaries, and font files are used in conjunction with this INIT to ensure the successful operation of KanjiTalk. Even though there is a special version of the keyboard for Japan (the Kana characters are silk-screened on the key caps), KanjiTalk can use input from a U.S. keyboard.

In fact, the Japanese Macintosh system software (version 6.0) can use any Macintosh system that has at least 2 megabytes of RAM. The major difference between the U.S. version and the Japanese is that features have been added to coincide with the Japanese dates and sorting system.

Most U.S. applications that abide by the Human Interface Guidelines (see chapters 22 and 23) will work with the Japanese Macintosh system software. Two bytes are required to represent a Kanji character, so applications that don't take this into account may experience some problems.

FastBack II

The crème de la crème of backup programs is FastBack II by Fifth Generation Systems. FastBack is fast, works with a variety of backup devices, and has a number of features to make regular backups easier.

Backmatic

Backmatic by Magic Software automatically backs up files to floppies, hard drives, or network servers, and it does it while you work. Many network users wouldn't be without it.

FILE COMPRESSION UTILITIES

File compression was first used by telecommunicators to reduce the length and cost of file transfers. Now anybody who wants to save hard disk space can use a compression program. Good file compressors can reduce some files' sizes by 70 to 80 percent. Compressed files must be decompressed before you can use them. (More information on file compression is in chapters 7 and 12.) The three most popular compression utilities for telecommunications are:

CompactPro, shareware by Bill Goodman

Stuffit Classic, shareware by Ray Lau

Stuffit Deluxe, by Aladdin Software, also written by Ray Lau

Most online services and BBSs use either CompactPro or Stuffit to shrink their files.

DiskDoubler v3.0

This is the software of choice for people who want to conserve disk space. DiskDoubler by Salient Software will compress files when you save them and decompress them when you want to use them again, all in the background. True to its name, DiskDoubler can double your disk space.

FILE TRANSLATION UTILITIES

File translation utilities are a way for the Macintosh to read files from one program to another—say Microsoft Word to WordPerfect—and a way to translate a PC-DOS file into a Macintosh file.

MacLink Plus/PC

It's a fact of modern office life that Macs and MS-DOS PCs have to coexist. MacLink Plus by DataViz helps you exchange all kinds of files with PCs, including spreadsheets, word-processing documents, and databases. MacLink Plus is a little easier to use than Apple's AFE, and a whole lot more powerful.

VIRUSES

The virus scare is probably a little overblown, but if you have ever had a virus you know how disruptive it can be. Computers in schools and businesses that come into contact with a lot of strange disks are particularly at risk. For those who would rather be safe than sorry, there are a number of commercial virus-protection programs available. All of them can scan your files for virus infection. Most can remove the offender, and several have one form or another of permanent protection to keep you from getting infected again.

The best commercial programs include SAM from Symantec and Virex from Microcom. Both of these programs are updated regularly to include newly discovered viruses. Highly recommended is a free program written by John Norstad at Northwestern University, called Disinfectant. Disinfectant can scan for all known viruses, remove the infection completely, and prevent reinfection. It is updated regularly. You can get Disinfectant from most Macintosh user groups, BBSs, and online services. (For more information on virus software see Chapter 7.)

FONTS

There are a number of different font utilities. Some are covered in Chapter 20, others are in Chapter 9.

Adobe Type Manager

If you can take the speed and memory hit, Adobe Type Manager by Adobe really improves the quality of fonts on screen and on QuickDraw printers like the ImageWriter. It uses so-called *outline* fonts to eliminate the jaggies from your text. It works with all Type 1 fonts. Apple's support of the competing TrueType technology may make this program obsolete.

MasterJuggler and Suitcase II

Alsoft's MasterJuggler and Fifth Generation Systems' Suitcase II are very similar. Both let you install a large number of fonts, DAs, sounds, and FKEYs without modifying the System file. Both are somewhat outmoded by System 7, but if you add and remove fonts a lot, these programs can save you grief. They are still the best way of handling sounds and FKEYs.

DESK ACCESSORIES (DA) UTILITIES

DAs are additions to the regular desktop. They enhance or add to existing tools, or are new, extra tools.

Desk

Desk by Zedcor includes seven full-powered applications in a desk accessory form. The applications include: DeskPaint, DeskDraw, Desk-Write, DeskSecretary, DeskComm, DeskCalc, and DeskFile. The package is expensive, but takes the place of many full-featured applications.

Disktools Plus

Disktools Plus by Electronic Arts includes Finder DA, calculator, calendar manager, phone pad, and a file document launcher. It's a must.

MockPackage Plus Utilities

MockPackage by CE Software includes a group of utilities called MockWrite, MockTerm, MockChart, and EZMenus. They are enhancements to the existing desktop tools.

SOUND UTILITIES

Sound utilities allow you to record, edit, and save sounds. (Sound is covered in Chapter 11.)

Sound Manager Package

The programs in this package from Ettore Software let you extract sounds from various formats, edit them, and save them as beep sounds or HyperCard sounds.

Soundmaster

This fun Control Panel device, which is shareware from Bruce Tomlin, lets you customize the beep sound and add sounds to just about any Macintosh event. How about a toilet flush when you empty the trash? Or sounds of upchucking when the Mac ejects a disk? We said it was fun; we didn't say it was in good taste!

SYSTEM CUSTOMIZER UTILITIES

The true hot-rodders among us will want these customizer utilities. They don't really improve performance, but they sure can make your Mac *look* faster.

Click Change

Customize the look of cursors, buttons, check boxes, scroll bars, and other parts of the Macintosh user interface with Click Change by Bubl-Click Software. This looks best in color.

Now Utilities

The collection of utilities by Now Software changes how your Mac works, in most cases making it easier to use. People who get used to navigating folders using SuperBoomerang often can't go back to the old way of doing things. The collection also includes the StartUp Manager INIT which lets you control which programs install at startup; Profiler, to analyze your system hardware and software; an alarm clock; and a disk and folder customizer, to name a few.

Personality

Like Click Change, Personality by Baseline Publishing customizes the Macintosh look, but not quite as nicely.

ResEdit

Apple's free Resource Editor is intended as a programmer's tool, but even nonprogrammers can use it to customize program resources like text, menu commands, and icons. The best advice for ResEdit hackers, though, is to always work on a copy of programs, not the originals. Apple distributes this program to registered developers, but you can also get it online or from user groups.

KEYBOARD MACRO UTILITIES

Even though the Macintosh is a mouse-oriented system, users often want to automate repetitive keystrokes. If you find yourself repeating steps over and over, try one of these programs. Both let you record keystrokes for later playback.

QuicKeys 2 by CE Software

Tempo II Plus by Affinity

PRINTING

Tired of waiting around while your document prints? Get back to work! Your document can print in the background. Apple's PrintMonitor prints in the background with LaserWriters, but SuperLaserSpool works with other printers, including Hewlett-Packard's DeskWriter. SuperLaserSpool is faster, too. Use SuperSpool for ImageWriters and other dot-matrix printers. SuperSpool and SuperLaserSpool are from Fifth Generation Systems.

MISCELLANEOUS CONTROL PANEL DEVICES AND INITS

Among the miscellaneous utilities are screen blankers, specialty utilities, icon generators, and text locators.

After Dark 2.0

If you leave the same image on your screen too long the phosphors will burn in and you'll see a ghost of that image forever. The simple solution for this problem is to *blank* the screen after several minutes of inactivity. After Dark by Berkeley Systems is one of many screen blanker utilities now available.

HandOff II

Are you tired of getting the "Application Not Found" message when you try to open documents created by missing programs? HandOff by Connectix finds an alternate program that can open the file and calls it instead.

Icon-It!

Icon-It! by Tactic Software takes the icon interface even farther. It allows you to create icon menu bars to run programs and open documents.

On Cue

You can tell who the On Cue users are from the little rocket icon to the right of their menu bars. On Cue by ICON Simulations is the fastest way to move from program to program without returning to the Finder each time, but it is becoming obsolete.

On Location

On Location by ON Technology searches for specified text in multiple text files. It works for keeping hundreds of recipes, for example, in WriteNow files on the hard disk. When you want to find a recipe, use On Location to search for it among all your text files. When On Location finds the recipe, it opens it in WriteNow. On Location is so fast you don't need a database program.

SuperClock

SuperClock, freeware by Steve Christiansen, is a time of day clock/alarm/timer. It is a permanent addition to the right side of the menu bar. It works with almost everything and is a must for many Mackers.

SuperGlue II

Print any file to disk for later viewing using the SuperGlue II Glue DA. SuperGlue II is from Solutions.

CONCLUSION

Depending upon your computing needs, you can choose to use one Macintosh operating system or another. If you are not particularly innovative, or constrained by your Macintosh hardware, choose a version of System Software 6. If you are equipped and innovative, experiment with System 7. You'll also want to investigate some of the utilities available for the Macintosh.

There aren't as many utilities for the Macintosh as there are for other computer systems. That's partly because the Macintosh is younger, partly because there is less need to tweak the system. Whenever users want to work smarter, faster, or more easily, some programmer will write a utility that will help. You'll find many more utilities at your favorite software store and online with your favorite BBS. User groups also offer a wide variety of utilities. Keep your eyes open—you never know when you'll need to save a hard disk or paint pinstripes down your screen.

C H A P T E R 7

DISK AND FILE MANAGEMENT

Disk and file management is an important part of any computer system. The Macintosh is no exception. The many elements to disk and file management include file storage, maintaining the Desktop file, backing up your work, compressing files, and security.

FILE STORAGE CONCEPTS

A blank disk—fresh from the box, right from the store—is not ready for data. The disk must be prepared through a process called *formatting*, or *initialization*. The Macintosh will check to see whether a disk has already been prepared or whether it has been formatted for some other computer operating system. If it hasn't, the Mac will format it for you. (This is not the case on those old Apple IIs or on any of the DOS-based machines; they require that you first format the disk manually.)

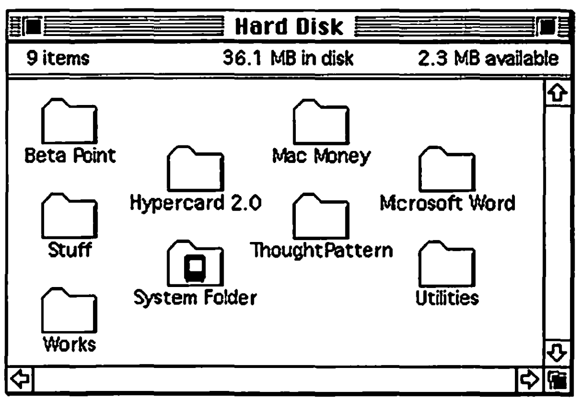
When a disk is formatted, the Macintosh creates concentric rings known as *tracks*, which resemble the concentric grooves in a record you play on your stereo. Tracks are further divided into slices called *sectors,* or *blocks.* A sector holds 512 bytes (characters) of information.

Sometimes the Macintosh doesn't see that the disk is either in the disk drive or that it hasn't been formatted. This is an error that rarely happens. When it does, you can pop the diskette out of the drive by holding down the mouse button while you reboot. (You must hold the mouse button down through the entire process.) You can also use a sturdy paper clip, straighten it out, and shove it into that tiny hole on the right side of the floppy disk drive unit. This should eject the diskette.

HOW FILES ARE SAVED AND DELETED

On an empty or new disk, files are stored in sectors one right after the other. Since most files contain more than 512 bytes, each file is spread through a number of sectors. If you delete a file, the sector will be freed up. Each time you delete a file, the disk space used by that file is made available.

This disk maintenance is done routinely by the Macintosh. It requires no extra effort on your part. The screen you see when you click on your hard disk is called the *disk window.* This window displays the amount of disk space used and the amount left available, as shown here:



At the top, right under the title bar, is the specific data on the number of items contained in the window, the amount of storage space on the disk, and the amount of space still available.

FILE FRAGMENTATION

When you delete a file, a gap is left on the disk (whole sectors are freed). If you add information and it's smaller than the amount previously deleted, a gap can be left. If the information you add is larger than the space to be filled, then a little piece is put somewhere else. Each piece of data is indexed with a *pointer* (a map holds all of the pointers), and the disk drive follows the pointers all over the disk.

The result of gaps is called *fragmentation*, which means that a file is not saved on disk space in a continuous fashion. Fragmentation is caused by a lack of continuous places in which to put information. For example, imagine that you have an 800K file to save. Although your hard disk may have 5MB of disk space available, only 600K of space might be in a continuous group of sectors. Your Macintosh may save 600K of the file there, then look around for other disk space to store the rest of the file. It might find 120K of space from a file you deleted last week and put 120K of the file there. Searching further, the Mac might find 100K of space from a file you deleted yesterday, and the remaining 80K of the file could be stored there. The result is that the file is split into three fragments on your disk.

Fragmentation causes wear and tear on the Mac's drive assembly, and slows it down. It takes more effort for the Macintosh to open and save fragmented files because the disk drive must find all of the places where a file is located, which takes time. The more fragments a file is broken into, the more the drive unit must hunt to find and assemble the fragments.

There is a way to fix a fragmentation problem. The solution is called optimization or defragmentation.

OPTIMIZATION

Optimization, or *defragmentation*, moves the contents of a disk so that the files are stored on sectors located next to one another. This process takes all available disk space and positions it in a contiguous block. Optimization speeds file access and minimizes the wear and tear on the drive.

There are two ways to optimize a disk, manually or with special software.

Manual Optimization

Manual disk optimization is a time-consuming process, especially for hard disk drives with a lot of storage space. To optimize a disk manually, follow these steps:

1. Copy the contents of the fragmented disk to another disk (or series of disks). Be sure to include all files.
2. Format the fragmented disk.

Make sure to format the disk with proper formatting software. For Apple hard disks, the formatting software is called Apple HD SC Setup. You can find this application on the Disk Tools disk of System 7 or on the System Tools disk of System 6. The Initialize button will start the formatting process. (For other manufacturers' hard disks, use the software and instructions that come with the disk drive.)

Do not try to erase the disk's contents by dragging files to the Trash icon and then emptying it; this does not really delete or erase files (for more information, see the section "The Truth About the Trash"). Formatting the disk wipes it clean and creates new tracks and sectors.

3. Copy all System files, applications, and data files back to the clean disk.

Your best bet is to copy the files in the following order: System files, applications, and then data files. System files and applications are less likely to be edited and resaved, so they can remain in contiguous sectors at the start of the disk. This helps minimize future fragmentation.

Optimization Software

A convenient alternative to manual optimization is to use software programs designed for this purpose. These products work in one of two ways: they optimize your disk at your command, or they constantly maintain the disk as you work. (Those that maintain the disk as you work reside as INIT/Extensions or Control Panels and load each time you turn on your Macintosh.)

Which one of these two types to use is a matter of personal choice. Some people like to have programs resident—to constantly fix any possible fragmentation. Other people like to have more control—to run the program once in a while, at their choosing.

The following is a small sampling of some commercially available optimization software.

DiskExpress II DiskExpress II, by Alsoft, is a Control Panel hard disk optimizer. It automatically defragments and optimizes a computer's hard drive(s) when the computer or drive is not in use. You can also request drive optimization. Figure 7-1 illustrates DiskExpress II's Control Panel. The rabbit character indicates which disk is currently in the process of optimization. A Volume Info button in the Control Panel appears when you click a drive that is not being optimized. When you click the button, it graphically displays the disk's fragmentation, as shown in Figure 7-2.

DiskExpress II monitors hard disk activity to determine which files are used the most, and it attempts to group frequently used files together. Because DiskExpress II optimizes one file at a time, it can be interrupted at any time without risk. There is no danger of losing data if the system goes belly-up for some reason. Very little free disk space is necessary to successfully defragment the disk. DiskExpress II runs with all of the System versions.

Speed Disk Norton Utilities for Macintosh, by Symantec/Peter Norton Computing, includes Speed Disk, a hard disk optimization application. Speed Disk is the optimization program. You can run it at your convenience.

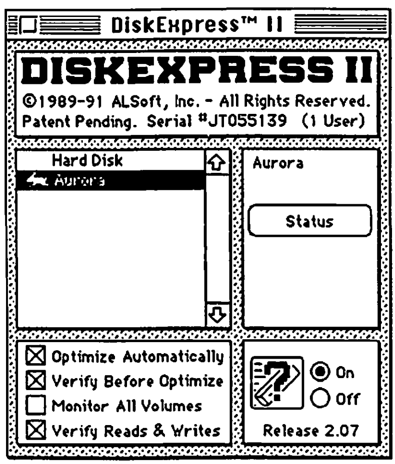


FIGURE 7-1
Disk Express II's Control Panel window

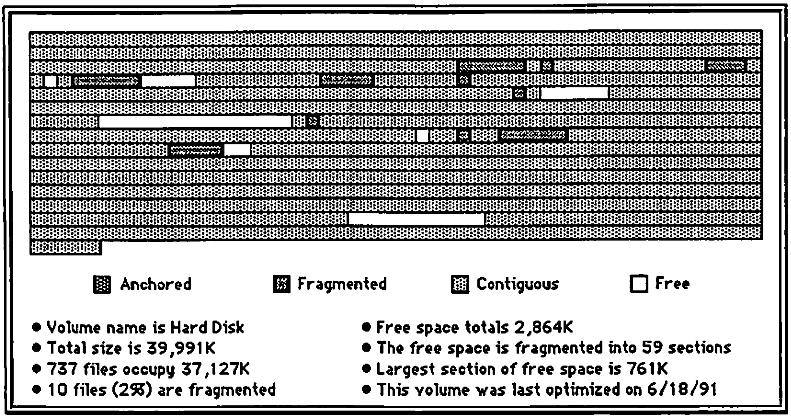


FIGURE 7-2
Disk Express II's Volume Info window

You can choose your level: Easy or Expert. Easy instructs you to click a Check Drive button. The program checks the disk and, more often than not, recommends optimization.

The Expert level also uses a Check Drive button to scan the disk. (It includes file prioritization and media and data verification.) Disk changes are shown on a color picture of a disk's contents, as in Figure 7-3. (The program will run in black and white if the Turbo Charge option is turned on.) A cute little magnifying glass icon is there to let you examine the disk's sectors to identify their contents. Speed Disk works with System 6 in the background under MultiFinder.

Optimizer MacTools Deluxe, by Central Point Software, has an Optimizer utility. (As shown in Figure 7-4, Optimizer has other options as well.) An Analyze button instructs Optimizer to scan the selected disk and prepare a graphic representation of the fragmentation. The program gives an estimate of how long the optimization will take. Optimizer will run under any System version, in the background under MultiFinder.

THE TRUTH ABOUT THE TRASH

When you drag a file icon to the Trash icon and select Empty Trash from the Special menu, the file is deleted, right? Wrong. This process only removes the file from the disk's file directory. The data remains on disk

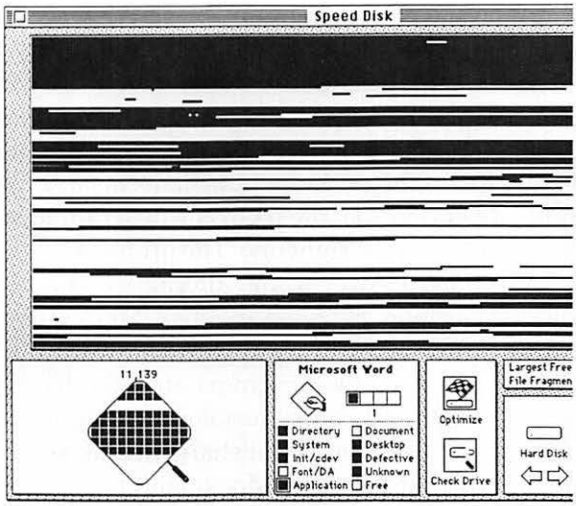


FIGURE 7-3
Speed Disk's optimization window

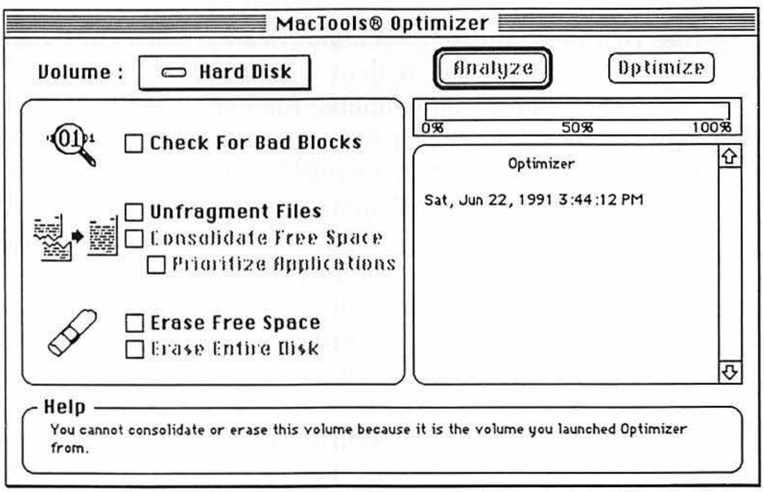


FIGURE 7-4
Optimizer's options window

until the computer writes new data over it. The file could remain on the disk for days, weeks, or months. You can even recover a deleted file—provided you have the right software tools.

The file structure on the Macintosh is very complex, unlike a DOS-based machine. This makes recovery of erased files difficult. With many of the file recovery schemes, a phantom file is created for every deleted file (it isn't seen on the desktop, but still exists in a large buffer). To recover a mistakenly erased file, the recovery program looks through the phantom files and pulls out the right one. The problem with this is that it can become a memory hog. However, the alternative is a program that must grind through a complex maze on the disk, taking up to half an hour or more. It's not only inconvenient but often unrewarding.

These phantom file programs are valuable if you use your trash can frequently and make some mistakes now and then. Another good reason to have phantom files is if you share the Mac with your kids. Children like to trash files, and they often do so with no regard to their value.

On the other hand, if you rarely, if ever, inadvertently trash anything without checking and double-checking, you'll probably never need these tools.

FileSaver and Unerase Norton Utilities for Macintosh includes two file recovery programs, FileSaver and Unerase. FileSaver is an INIT/Extension that monitors files as they are deleted. It creates invisible (phantom) data files that hold information about deleted files. Unerase is a file recovery application that works with or without FileSaver.

Three options are available for file recovery (shown in Figure 7-5). "Quick Unerase" uses FileSaver data to provide a list of deleted files. The file's chances for recovery are rated from excellent to poor. Excellent means that the entire file is still intact; nothing has been written over it. Poor means that the file is a goner. Select the files to unerase and click the Unerase button. The files are recovered.

"Scan for specific File Types..." chooses a particular kind of file from a scrolling window (such as a program file, a picture file, a word processing file, a database file, and so on). Again, ratings of excellent to poor are used to determine recoverability.

The "Text Search..." option lets you put in a text string from the deleted file. Unerase searches the entire disk for a matching string. A list of files that match the string is provided (again, rated excellent to poor). These methods do not require the installation of the FileSaver INIT/Extension.

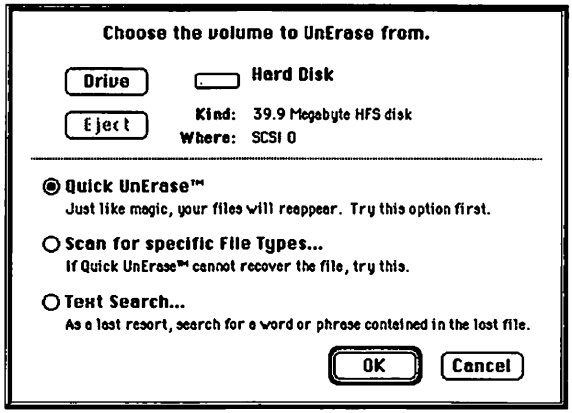


FIGURE 7-5
Norton Utilities for Macintosh's Unerase options

FileSaver and Unerase run on System 6. Norton Utilities for Macintosh also has a Format Recover option to recover data from a crashed or formatted disk.

Mirror and Rescue MacTools Deluxe, by Central Point Software, includes Mirror and Rescue. Mirror is a Control Panel that allows you to install and run a DeleteTracking file on the disk. This file keeps track of all deleted files. With DeleteTracking properly installed, you can recover files with the Mirror Control Panel. A list of deleted files can be retrieved. When you select the files to recover, they are recovered.

Rescue is an application to use if DeleteTracking is not installed. There are two methods to identify and recover deleted files: Floppy Scan and File Scan. The Floppy Scan method scans diskettes for recoverable files. The File Scan is for high-density floppies and hard disks. It searches the disk for identifying codes and then provides a listing of recoverable files. Mirror and Rescue run with any System version. Rescue also offers an option to recover data from reformatted hard disks.

Complete Undelete Complete Undelete, by Microcom, tracks deleted files. It can recover files or portions of files. A preview option lets you see the contents of files prior to recovery. Complete Undelete is sold bundled with Microcom 911 Utilities or separately. System 7 uses two files, Desktop DB and Desktop DF. It runs with any System.

THE DESKTOP FILE

The Desktop file is an invisible file that exists on every Macintosh disk. Within it is all of the information that the Finder needs to keep track of files, folders, and icons on the disk. (It can also keep track of the comments you attached to files in System 7, as discussed in Chapter 4, "Using the Macintosh.")

In any System, you may add a comment to a file. Select the file icon and choose "Get Info" from the Finder's File menu. An example of the window is shown in Figure 7-6.

Type your comment in the Comments box. When you close the Info window, your comments are written to the Desktop file rather than to the file itself.

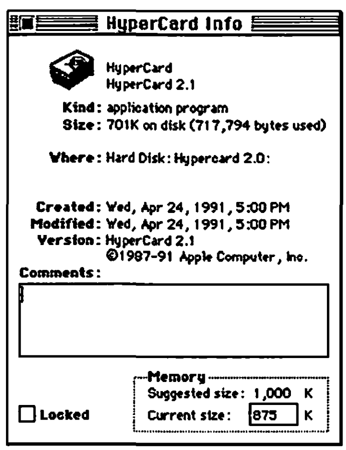


FIGURE 7-6
Finder's File menu

The Desktop file also includes information about deleted files—at least until the trash is emptied. Every time you change the contents of a disk—even by just repositioning an icon in a window—the change is recorded in the Desktop file. A disk's Desktop file is updated on these occasions:

1. Each time the computer is started (if you use a hard disk or start-up disk), or, if it's on a floppy, when it is inserted into the floppy drive
2. When the Finder is accessed
3. If the computer is shut down using the Shutdown command in the Finder's Special menu

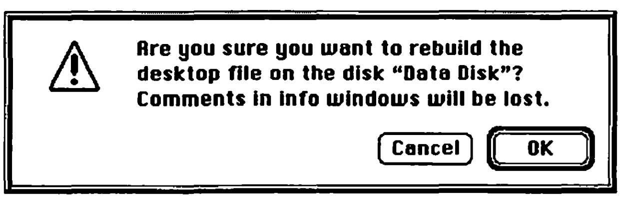
Operation of the Macintosh can slow down if you don't follow these precautions:

- ▶ Shut the System down properly before turning it off and on. The System won't correctly write to the Desktop file if you don't, and you can damage it.
- ▶ Purge unneeded data from the Desktop file so it does not get clogged with unnecessary information.

REBUILDING THE DESKTOP FILE

Rebuilding the Desktop file purges unnecessary and incorrect information. The more often you change the contents of a disk by adding and deleting files, the more often you should rebuild the Desktop file. Some people recommend a rebuild of the Desktop file every two months (but then, some people change the oil in their cars every 1,000 miles, too).

To rebuild your hard disk's Desktop file, hold down the Option and Command keys on the keyboard while the computer boots. You'll see a message like the one shown here:



As this dialog box warns, the contents of Info or comments windows (on all Systems) are removed when the Desktop is rebuilt. If you rely on this feature, you have been forewarned. If you don't, this isn't a big concern. Click OK.

Rebuilding the Desktop file takes a few moments. The Finder scans every file on disk, reads needed information, and then writes it to the Desktop file.

To rebuild the Desktop file on a floppy disk, hold down the Option and Command keys as the disk is inserted. The same dialog box will appear. Click OK. The rebuild on floppy disk takes considerably less time. (There are fewer files to read.)

BACKUP FILES

Good disk and file management includes making backup copies of important files. It is time-consuming and bothersome, but there are software tools that make backing up a less dreary chore.

WHY DO IT?

Imagine spending hours, days, or weeks at your Macintosh working on an important project. As you work, you save all of the files—lengthy word processing documents, complex spreadsheets, hand-drawn graphics files, giant databases, and so on. They're all safely stored on your hard disk. One night, when you're peacefully sleeping at home, your office burns to the ground. The good news is that you're fully insured; the bad news is that the computer is destroyed. It's all gone. The entire project, all that work, is irretrievable.

This is a sad story, but it wouldn't be a nightmare if you kept backups and stored them in a safe place away from the computer.

Computer disasters are not always related to fires, floods, thefts, or earthquakes. Your computer's hard disk can be wiped out by any number of things. These include power problems, computer viruses (discussed later in this chapter), and simple, but dangerous, malfunctions. Less dramatic, but still annoying, is when a single file becomes corrupted and impossible to open. Your data recovery ability depends on how often and how effectively you've backed up the files on your Macintosh.

It's not all that important to back up those personal memos, letters, faxes, and other oddball files (you know, the ones that seem to collect on the disk). Some files, like tax returns and business letters, can be printed on paper as a simple backup. The really important files—business-related, spreadsheet, checkbook, and project manager data (the ones that are a real pain to lose) should be backed up. Your application files are available on the original program disks should you ever need to reinstall them.

If you never back up anything and have a cavalier attitude about it, just remember: one bad loss is usually enough to convince anyone. If you've been lucky so far—knock on wood, whistle in the dark, and hang a rabbit's foot on your Macintosh.

BACKUP MEDIA

The most common, least expensive backup media are floppy disks. They're cheap, but unfortunately, they're not so easy. You would need up to 50 800K disks, or 29 1.4MB disks, to back up your entire hard disk. Hand-feeding them one at a time into the computer (as requested by the backup software) is extremely tedious.

Almost everyone starts out backing up data to floppy disks, but the task is both redundant and dull. As a result, while the floppy routine is theoretically effective, in practice you won't use it. The solution is a dedicated hardware backup device. This might be difficult to sell to the boss, because dedicated hardware backup devices can cost several hundred dollars or more. It doesn't make the Macintosh run any faster or add a byte to your current online storage capacity. It is used to make copies of data that you hope never to see.

The dedicated backup hardware device is the only option for serious personal computer applications that require daily backup. It reduces the process to three steps: starting the backup program, putting in the tape, and waiting.

In many cases, this hardware backup can be maximized to run unattended on an automated nightly schedule. This way, you can start the work day by taking the storage media out and storing the previous night's archive.

There are a number of "industrial strength" backup units on the market. These use a variety of media, in a variety of sizes.

ABOUT THE ...

Tips: Backup System Hardware

It should be no problem to hook a backup system to your computer. The problem is in the individual device-to-device compatibility of the data. There are many different systems.

Devices come and go. Some are technically elegant. Others just have a great sales pitch.

Vendor stability is an important factor in choosing a backup device. (After the fire is not the time to learn that the manufacturer of your backup device is out of business and the device isn't compatible with anything else on the planet.)

The more widely used and popular your selected system is, the more successful you'll be in the event of some catastrophic event. You should be able to carry a pocket-sized tape or optical disk into a computer store, hand it to the dealer, and say, "I need a computer to put this on."

The variety of available devices gives rise to a chaos of data "standards." Since there are so many standards, there are effectively *none*. As a result, carefully consider the selection of a device based on its popularity. Ask around.

Speed is relative. You can't get something that is too fast—no matter how fast the selected device is, that speed will become the minimum acceptable speed for you. Once you're accustomed to a certain level of performance, that becomes the minimum for you.

Backup speed isn't crucial. The ideal backup situation is one that can run unattended. The whole reason for the device is to relieve you of an active role—or else you'd still be shoving floppies in the disk drive. There are exceptions, however. If the nature of your busines is such that you need hourly backups or can't afford to lose *any* data, you probably need a mirrored disk or hard-disk-to-hard-disk backup. By copying one hard disk to another of similar size, you can safeguard your data against the most common disaster—a hard disk failure. While this offers no protection against the ill-will of another person or natural disasters, it does provide a very fast backup.

Hardware backup systems offer easy and reliable solutions to a tedious task. There are a number of different choices, each with its own faults and features. Price should not be the sole consideration; your individual needs should be.

Tape Backup

Tape backup undoubtedly provides the biggest bang for the buck in backup technologies. It is slow, however, and the media itself is fragile.

Data is stored on tape in a sequential, linear fashion. (Almost all other backup technologies operate like the disk drive in that they provide a storage medium in which any file can be located quickly.) Tape units must wind through the data serially until the desired file is found.

Tape backup is a mature technology, the least expensive of all backup hardware, and common. Nine-track, half-inch, reel-to-reel tapes have been used on mainframe computers as storage for decades—they even predate hard disks.

Magnetic tape is ideal for applications that require storage of massive amounts of data on a single media unit and is the classic prerequisite for unattended backup of hard drives in today's capacities.

These are some popular tape drive formats:

- Half-inch magnetic tape
- Quarter-inch magnetic tape cartridge
- Four-millimeter digital audio tape cartridge

Half-Inch Magnetic Tape Half-inch, open-reel, magnetic tape drives are perhaps the oldest tape drive storage devices available. Developed for mainframe applications in the 1950s, these tapes made numerous appearances in grade-B science fiction movies. They almost came to symbolize computers in television and movies. (You probably remember those refrigerator-sized metal boxes with a glass door over the top half and huge spools of tape racing back and forth.)

The media is a half-inch-wide ribbon of plastic film coated with iron oxide. They typically come in 2400- or 3600-foot lengths wound on 7-inch or 10 1/2-inch-diameter hard plastic spools. (The complete spool is about the size of a medium pizza.)

Quarter-Inch Magnetic Tape Quarter-inch tape cartridges were patented in 1971 by Robert von Behren of 3M Corporation. These cartridges are common in tape backup devices.

Magnetic tape is an inherently fragile medium. A long strip of plastic film is coated with ferrous oxide for magnetically recording data. It must be notably thin to be able to store any quantity of tape in a useful size. The problem is that the tape itself can stretch in the process of spooling through a reading device, which can damage stored data.

Common audio cassettes use a capstan drive that turns the cogged center of the tape spools. As more tape is wound on a spool, the same axial rotation speed at this hub tends to increase the linear speed of the tape as the outer diameter of the take-up spool increases, which creates problems. In data applications, it is necessary to hold the relative speed of the tape constant. It is also important for the tape media not to be stretched unduly. A fairly complex drive mechanism is required to manage this dilemma.

The 3M data cartridge solves this by driving the outer diameter of the spool rather than the inner hub. The speed of the tape is constant, regardless of the amount of tape on either side of the spool.

Quarter-Inch Tape The 3M quarter-inch tape cartridge was originally developed for data logging in long-term collection of seismological or telemetry data. It is very good for tape backup—so good that 3M has licensed two other vendors, Sony and DIE, to produce a quarter-inch tape under their patent. In general, these tape brands can be used interchangeably (although drive manufacturers will certify only one brand of cartridge with their units).

Quarter-inch tape is readily available. Almost all computer stores and mail-order computer-supply houses carry a selection in a variety of dimensions and tape lengths.

DAT DAT (digital audio tape) was developed by Sony as an audio recording technique that delivers higher fidelity than conventional audio cassettes.

DAT digitizes audio data. Since the data is stored digitally, any noise or hiss caused by oxide-media anomalies is eliminated. The digital nature of the data is much less sensitive to variable tape speeds. As a result, the quality of the sound on the tape is almost solely a function of how accurately it was digitized in the first place. The tape media itself has little effect on the sound quality.

For data backup, DAT devices offer the advantage of a large data capacity. The drive units can back up over a gigabyte of data on a cartridge that is 3/5 the size of a standard audio cassette tape, at speeds of up to 10MB per minute. They are expensive.

There are two DAT sizes: 8 millimeter and 4 millimeter. The 8 millimeter cartridge is identical to a standard Video 8 video cassette. While it can store as much as 2.2GB, the size is not popular.

ABOUT THE ...

Cartridge Sizes

Several quarter-inch tape cartridge sizes have been introduced. By convention, cartridge names begin with the acronym DC, for data cartridge, followed by a numeric designation that seems to have no explanation. (The DC600 cartridge contains 600 feet of tape. One would think, then, that the DC1000 would offer 1,000 feet of tape; actually, it contains 185.) This standard, originally proposed by 3M, has been adopted by the American National Standards Institute (ANSI).

Available tape formats include the following:

- DC600
- DC1000
- DC2000
- DC2000XL

DC600 The DC600 cartridge is approximately 4 inches wide and 6 inches long. The cartridge holds about 600 feet of tape. This is the largest capacity commonly available in DC tape. It was subject to design experimentation before the Quarter-Inch Cartridge Drive Standards Organization was formed. It's the least standard cartridge format, and a popular one.

DC1000 The DC1000 was the first of the "mini" cartridges. It measures 2 1/2 inches wide and 3 inches long. The cartridge contains 185 feet of tape.

DC2000 and DC2000XL These are popular quarter-inch tape cartridges that have a standard format; they share the mini-cartridge dimensions of 2 1/2 by 3 inches. The DC2000 contains 205 feet of tape. The DC2000XL has 300 feet of tape.

Both DAT sizes use a type of recording called *helical scan*. This was first developed for videotape recorders. The tape travels around the partial circumference (usually about 90 degrees) of a drum spinning at about 2000 rpm. The drum is mounted at an angle to the tape (5 to 6 degrees). As a result, as the drum spins, the data is recorded in long diagonal stripes across the tape as it passes, to create sections of a spiral helix of data on the tape surface.

The spinning drum contains two read and two write heads. In this way, two tracks can be laid simultaneously. To reduce "crossover" between tracks, the heads are actually angled on the spinning drum differently. Each track has a different azimuth angle. The two tracks comprise a "frame" of 8KB of data. The result is an efficient use of the tape surface—about 60KB per inch with substantial data storage capacities. There are two primary 4-millimeter data formats in use: digital data storage (DDS) and Data/DAT.

DAT technology is still young. There are some standardization problems and a hefty price tag. It is effective for installations that require exceptional backup capacities in excess of a gigabyte. As the technology matures and prices drop, it will become a viable alternative.

The leader in the market may well be ARDAT's Archive Python DAT drive. The standard DAT drive features up to 2 gigabytes of data storage in a small, compact external unit. The company sells its drive exclusively to OEMs. (OEM stands for *original equipment manufacturer*, a company that puts parts from other companies together and sells the resultant product under its own brand name.)

One OEM of the Archive Python DAT is Alliance Peripheral Systems. Their product is exclusively for Macintosh machines—all makes, any system. It is bundled with retrospect backup software. The price is around $1,500. This company sells direct; contact Alliance Peripheral Systems at 816-478-8300.

Optical Drive

Optical drive technologies are the best hope for the future of backup hardware devices. Their rugged, removeable media is impervious to damage from dust, magnetic erasure, mishandling, and the gradual degradation of magnetic media by age.

Optical devices use lasers to read and write data. The lasers can be focused precisely from any distance. As a result, the platter can be spun at any rate, with the heads safely removed from the media. The devices use light instead of magnetic fields. As a result, data can be recorded at higher densities—there can be as much as 650MB on a single platter smaller than a floppy disk. With the use of an automatic disk changer, archival storage is unlimited. Hundreds of gigabytes can be available online.

Like the magnetic disk drives, and unlike sequential-access tape devices, optical units read and write data in a random-access fashion. This allows quick access to backup data. In some cases, optical drive access speeds approach hard disk access rates, with an average on some advanced units below 30 milliseconds. They are, however, very expensive.

There are three primary optical device types:

- Compact disk read-only memory (CD-ROM)
- Write-once-read-many (WORM) optical drives
- Erasable optical drives

CD-ROM The earliest optical data devices were compact disk read-only memory (CD-ROM). These were based on the popular compact disk audio technology.

The basic drive operates mechanically like a regular magnetic hard drive. The media rotates like a phonograph record, with the read/write head positioned over the rotating media. To record data, a laser beam burns a small charred spot on a reflective media, simply raising a bubble on it to make it nonreflective. Data bits are represented by shiny spots on the media that alternate with these flat spots.

The problem with CD-ROM is that it is read-only. This makes CD-ROM unusable as a daily backup device. A number of service bureaus will archive existing historical data on CD-ROM. This remains expensive. Additionally, CD-ROM access times are slow, at 300 to 500 milliseconds. The CD-ROM has evolved into a publishing medium. Thousands of large databases are available in this format.

WORM WORM (write-once-read-many) devices operate like CD-ROMs, but they contain a write laser. The write laser can write a data bit by burning a deformity into the blank disk. The lasers are not so powerful as those used to master CD-ROMs, and the media is easier to write to.

Erasable Optical Drives The optical backup technology is called *erasable optics* (EO). Several vendors have developed a solution to the biggest optical problem: the inability to erase or write over information on the optical disk. In the process, some vendors have lowered the average access time to the point where erasable optical drives could conceivably be used as primary storage devices.

Erasable optical drives use both lasers and magnetic technologies to record data. A laser beam heats a tiny area of substrate to a temperature at which a magnetic sector can be easily aligned. A magnetic write head then adjusts the sector to magnetize the area.

When the spot cools, this magnetic alignment becomes stable. When a laser is aimed at the spot, the reflection will exhibit a detectable polar rotation based on the polarity of the magnetic media. (This takes advantage of an anomaly of physics called the Kerr Effect.) To erase the spot, a laser reheats it without writing to it. This resets, or demagnetizes, the zone. The vendors claim that this erase/write cycle can be performed up to a million times before the area begins to wear.

These drives are noticeably slower in writing data than they are in reading it, limiting their usefulness as data storage devices.

BACKUP STRATEGIES

Everyone needs or has some method of data backup. For example, some people make a habit of moving important files from the hard disk to a floppy every day before they shut down the machine. Other people make multiple paper copies of everything and consider this enough backup. A few of the software backup techniques are

- Mirror or global backups
- Incremental backups
- Archival backups
- Selective backups

Mirror or Global Backups

A mirror or global backup makes a copy of the entire disk. All file hierarchies—the relationships of files and folders stored within folders—are maintained. Data restored from the backup is exactly the same as the original. The main drawback of mirror backups is that they require lots of storage space. You'd need a lot of floppy disks to perform a mirror backup of an 80MB hard disk.

Incremental Backups

An incremental backup copies the files you have updated (changed) since the last backup. The backup software compares the date and time of the last backup to the dates and times of all or selected files on the disk. It then backs up only files changed or added. The software also looks for files deleted since the last backup.

Archival Backups

An archival backup adds the files you have changed since the last backup. It does not delete previous versions of changed files or deleted files. This is useful if you ever need to go back to previous file versions for some historical information. (It can also be used as an audit trail, useful for some businesses.) One drawback of this method: more and more backup media is needed, since nothing is ever deleted.

Selective Backups

Some backup software allows you to select which files or folders you want to back up. This way you can back up only those files that really need to be backed up.

BACKUP SOFTWARE

Backup software is available from a number of sources. It is occasionally bundled with other disk-related utility software. It is frequently bundled with tape drives. All 4mm DAT drives come with software.

Retrospect and Retrospect Remote

Retrospect, by Dantz Development, is an archive utility that is also an excellent backup utility. It gives you the ability to back up any disk, including those accessed through a network. An Archive option removes seldom-accessed files from the hard disk, storing them on backup media for later retrieval. There are two ways to restore backed up files. A Restore option lets you restore an entire disk. A Retrieve option lets you retrieve one or more files from a Backup or Archive. Figure 7-7 shows the Backup Select window.

Retrospect Remote, a special, more costly version, is needed for network backup.

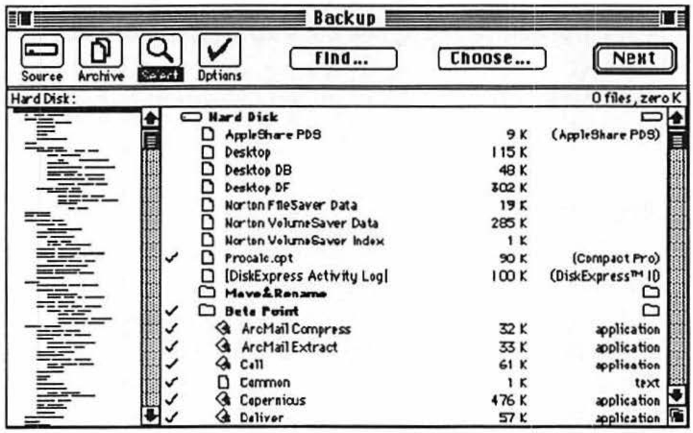


FIGURE 7-7
Retrospect's Backup Select window

Retrospect and Retrospect Remote run on any System version. A wide variety of backup media is supported; actually, the widest variety of any software is supported. Scripts allow unattended use.

Fastback II

Fastback II, by Fifth Generation Systems, is a backup utility. The Fastback II Express window, illustrated in Figure 7-8, prompts you through each option in the backup process. Pull-down menus let you select the option of backup or restore files, what files to back up, and your source and destination disks. The Short and Full menus have more options. These require use of Fastback's menus instead of the Express window.

Fastback II allows you to select certain files for backup. The Choose Backup Files window is shown in Figure 7-9. Fastback II has macro capabilities that let you automate unattended backups. Data compression is available to reduce backup time and the quantity of backup media needed. A wide range of backup media is supported. Fastback II runs under any System version.

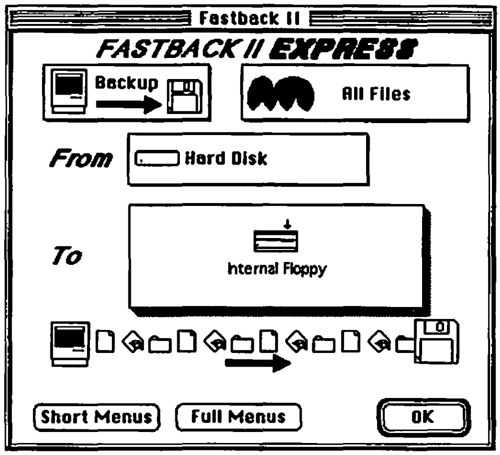


FIGURE 7-8
Fastback II's Express window

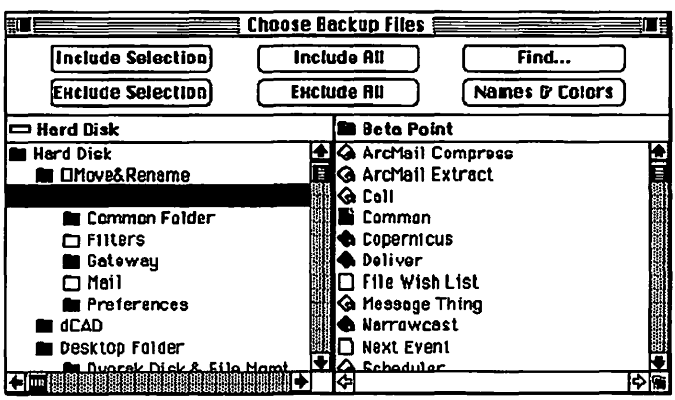


FIGURE 7-9
Fastback II's Choose Backup Files window

Redux

Redux, by Microseeds Publishing, is another backup utility. Two kinds of backups are offered: Backup and Copy. The Backup option stores files in a special format only Redux can read (not an uncommon feature in backup utilities). These files must be restored using the Restore command part of the Redux package. The Copy option works the same as dragging files from a disk window to a floppy disk.

Redux's File List window, shown in Figure 7-10, gives you the ability to select the files to back up. Click check boxes on or off to select or deselect files or folders for backup. You can open folders and select or deselect their contents and select files by type or last modification date. A script language called BackTalk lets you automate the backup process. The Power User Preferences window, illustrated in Figure 7-11, has a number of other options. Redux runs under any System version.

Backup

MacTools Deluxe, by Central Point Software, includes Backup, a file backup and recovery utility. Backup features a simple interface. On startup, it immediately presents a file selection window like the one shown in Figure 7-12. Click files or folders to select or deselect them.

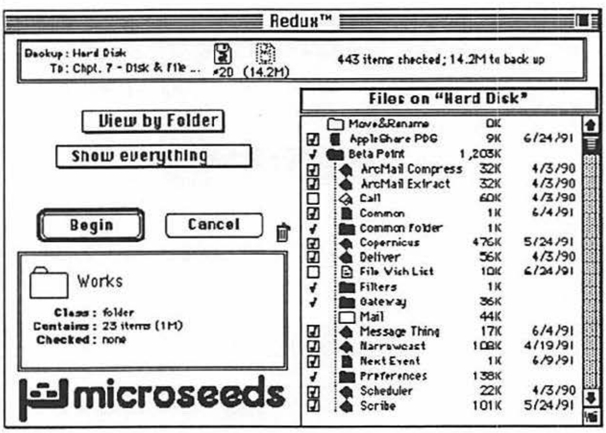


FIGURE 7-10

Redux's File List window

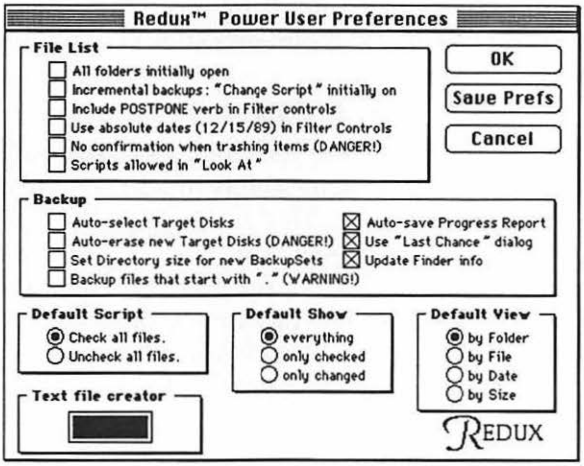


FIGURE 7-11
Redux's Power User Preferences window

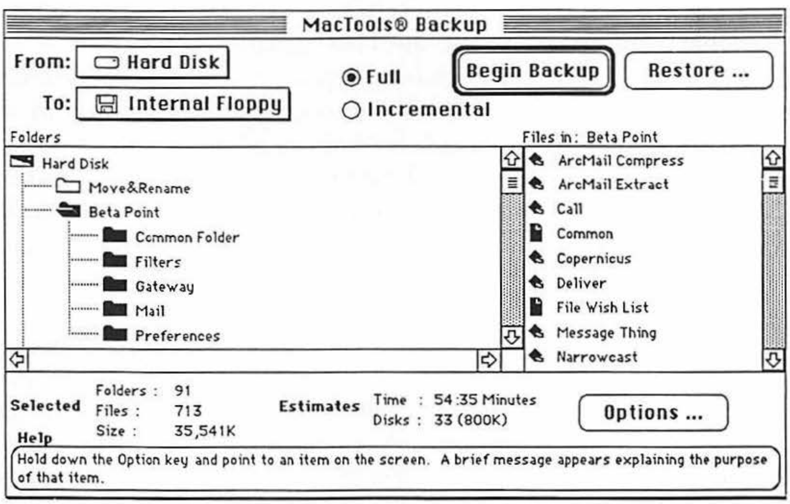


FIGURE 7-12
MacTools Deluxe's Backup window

Backup offers full or incremental backups. Its file compression option can compress files up to 50 percent. Backup runs under any System version, and it can run in the background under MultiFinder.

DiskFit and Network DiskFit

DiskFit, by SuperMac Technology, is a file backup utility. It offers full or incremental backups, the ability to select files or folders for backup, and Finder-readable format. This makes it possible to recover specific files without going through extensive recovery procedures.

Network DiskFit backs up disks on AppleShare or Tops networks (discussed in Chapter 12, "Telecommunications"). It preserves access privileges. DiskFit and Network DiskFit run under any System version, and they support a variety of backup media.

FILE COMPRESSION

File compression was developed as a way to send large files of data over slow modems. Big files take a long time to transmit, and the longer the transmission time, the more likely that errors will occur. To speed up the process, compression schemes were developed to make files smaller. File compression is also used for backup.

File compression encodes repeated information with shorter versions of the information (much like shorthand's dashes and blips represent common English words). It removes unneeded information and reduces the number of bits needed to store graphics and sound information. With less information in the file, the file is smaller. Some applications, especially those that work with high-resolution graphics and animation, have file compression built right in. Files are compressed as they are saved and decompressed as they are opened.

Two ways to compress files are with file compression software or with a combination of file compression hardware and software. File compression software is designed specifically to compress files. A good file compression application will compress different types of files with different methods. This ensures that files are compressed quickly into the smallest possible size. File compression hardware includes additional processors or accelerators that speed up the compression process. This hardware is not necessary to meet the file compression demands of the average Macintosh user.

ABOUT THE ...
Tips for Backing Up Files

Performing the following backup routines could save you time, money, and grief.

1. Back up regularly.

If there were a golden rule of backing up, "Back up regularly" would be it. But what does *regularly* mean? If you use your Macintosh on a daily basis, you might consider file backups every week. If you're working on an important project with data files changing daily, you might want to back those files up each day. How much time would it take to re-create a file? The answer to this question should determine how often you back up. The more work needed to re-create a file, the more often you should back up the file.

2. Store backups away from your computer.

If you store your backups next to your computer, it won't do much good if the room is destroyed by a hurricane, cleaned out by a thief, or demagnetized by a UFO hovering over the building. Store backups at home (if your computer is at work), or in a safe. If you use your Macintosh at home, keep your backups in a separate part of your home or bring them to your workplace.

3. Use more than one set of backup media.

Use two or three sets of backup disks or tapes and rotate among them. This technique further safeguards your data. It provides more than one backup in case one set is destroyed or corrupted. In addition, if your computer becomes badly infected by a virus, you may be able to use an older backup set to restore the system to its pre-virus state.

FILE COMPRESSION METHODS

Different compression methods are used for different file types, although some methods work on all file types. The objective is to have the smallest file possible and to be able to decompress the file (restore it to full size) in the shortest period of time.

Text/Data Compression Methods

Each character in a file is represented by an 8-bit code from the ASCII (American Standard Code for Information Interchange) character set. For example, lowercase *e* is represented as 01100101—the binary equivalent to the decimal number 101.

An average one-page document of 60 lines and 80 characters per line would be stored as 38,400 (60 by 80 by 8) bits. The more characters, the larger the file. Format instructions add to the size of the file.

Compression methods effective for text and data files are Huffman and Lempel-Ziv. Both work by encoding characters or words based on their frequency in the document. The encoding process substitutes one set of bits with a shorter set. These methods are also effective for PICT and PostScript image files, which use mathematically described objects or text-based descriptions.

Huffman Encoding Huffman encoding replaces each 8-bit ASCII code with a shorter code. The length of the code is based on the number of times the character appears in the document. The letter *e* is quite common, so Huffman encoding represents it as a short string, perhaps 001. In this example, each occurrence of the letter *e* would take 3 bits to represent rather than 8. Each time the letter *e* occurs, 5 bits are saved. The same procedure applies to all of other characters in the document. Some variations of Huffman encoding use a standardized frequency table. Others perform statistical analysis on the file and create a customized frequency table.

Lempel-Ziv (LZ) or Lempel-Ziv-Welch (LZW) Encoding LZ or LZW encoding replaces redundant strings of ASCII code with a single, fixed-length code. For example, often repeated characters such as *the* are encoded, while unique words such as proper names are not. The Lempel-Ziv method always creates customized code tables.

Bitmapped Image Compression

Bitmapped image files are large because they contain information about the location and color of each pixel (picture element). The amount of information needed to describe the image is based on:

- Image size
  The larger the image, the more information that needs to be stored.
- Image resolution

Resolution is defined by the bits per pixel and dots per inch (dpi). Black and white images are referred to as low-resolution because they need only one bit to describe each pixel—on (black) or off (white). Color and grayscale images are higher-resolution images; they use 4 to 24 bits per pixel to describe the color or shade of gray. The number of dots per inch describes the resolution of the monitor or printer. Each dot represents a pixel. Some programs store images at only 72 dpi, while others can store images at higher resolutions.

For example, a line drawing needs only 1 bit per pixel—remember, a pixel is either on or off. A 256-color or grayscale image needs 8 bits per pixel—the 256 possible colors require 8 binary digits (00000000 to 11111111) to describe. The higher-resolution, 8-bit image would take up eight times as much disk space as the 1-bit image, because eight times as many bits need to be stored.

Two main compression techniques for image compression are Group III Facsimile compression and Joint Photographic Expert Group (JPEG) lossy compression.

Group III Facsimile Compression Group III fax machines compress files with text and line art while they send them over a telephone line. They encode the frequency and duration of transitions from white to black on each line. Imagine a sheet of paper that is completely blank except for a vertical line down the page. When you feed the page into a fax machine, it generates codes for each line; for example, for *x* distance it's white, then for *y* distance it's black, and then for *z* distance it's white again. Repeated lines and sections of the page, such as blank lines, are also encoded to shorten the amount of information needed. This is illustrated in Figure 7-13. The more complex the image, the less compression is possible. More transitions from white to black must be described.

Joint Photographic Expert Group (JPEG) Lossy Compression JPEG lossy compression is used to compress high-resolution grayscale and color

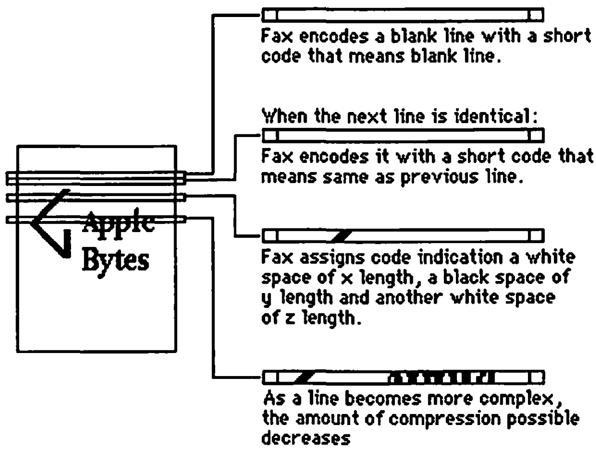


FIGURE 7-13

Group III facsimile compression
(Source: Apple Computer, Inc., File Compression stack on the Advanced User Techniques CD-ROM disk.)

graphics images. The term *lossy* refers to a method that discards the color information that humans cannot perceive. For example, whereas 8-bit color has up to 256 colors, 24-bit color can have over 16 million colors. The human eye cannot distinguish more than 10 million colors. Lossy compression removes the unneeded color information on a video screen.

JPEG is a standard compression method for any application that stores, manipulates, and transmits large color images. The color image is broken down into luminance and chrominance information. *Luminance* represents light intensity or brightness. *Chrominance* represents color information. The image is then broken down into 8-by-8-pixel blocks. An algorithm identifies color frequencies in each block and removes repeated values. Another algorithm discards some high-frequency information—the colors you cannot see. Huffman encoding converts the differences from one block to the next into numbers. Finally, a method like Group III Fax compresses the lines of numbers. The result is a compressed file.

Sound Compression

The size of a digitized sound file depends on three factors:

- Sampling rate
- Resolution
- Duration

To record a sound, a digitizer records samples or short pieces of the sound. The sampling rate, which is expressed in kilohertz (KHz), refers to the number of times each second the digitizer records a sound sample.

The information describing the sound is expressed in bits. Sound resolution refers to the number of bits used to describe each sample. The more bits, the higher the resolution, and the more information is recorded for each sample.

The duration refers to the length of the sound in seconds. For example, a one-second sound sampled at 22,000 times per second (22 KHz), with 8-bit resolution requires 22K of memory and disk space.

Sound compression uses an algorithm to condense the sampled information into fewer bits. This reduces the sound resolution and frequency and may decrease its quality. The amount of compression is expressed as a ratio of the sound's resolution before and after compression. For example, a ratio of 3:1 means every 3 bits of uncompressed sound is compressed to 1 bit.

Video Compression

Video files are usually the largest of all file types. They can contain graphics, animation, and sound, each of which requires extensive description. Files become so large that they would be nearly impossible to store without compression.

Most video applications include their own internal compression and decompression algorithms. The speed of decompression is important if the video is to be played back at a normal speed. To allow the computer to maintain the necessary decompression speeds, many video applications require special hardware to be installed in the computer.

Video coprocessors and accelerated color display cards are special-purpose hardware devices to help the computer process the compression algorithms more quickly. (These devices are unnecessary unless you work extensively with high-resolution animated graphics and sound.)

File Compression Packages

Many file compression software products are available, which allow you to compress multiple files into one compressed file known as an *archive*, or file package. This is useful for:

- Transferring multiple files by modem or network
- Storing files for archival purposes

Rather than setting up each file for separate transmission, one larger file can be created and sent. This is also handy to attach multiple files to an electronic mail message.

Compression of related files is an excellent way to organize and prepare them for long-term storage.

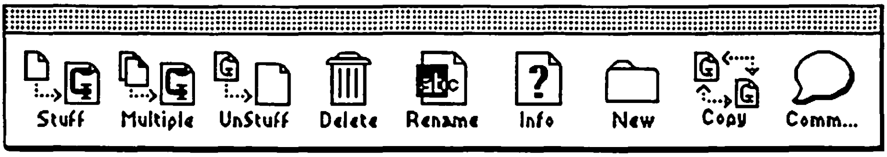
FILE COMPRESSION SOFTWARE

There are a number of file compression and decompression software packages available for Macintosh users. Each has its own features and benefits. Some are sold at retail stores, and others are shareware. (A decompression-only version of the software may be freely distributed to ensure that recipients of compressed files will have the ability to decompress them.)

StuffIt

StuffIt, by Raymond Lau, is a shareware file compression package released in 1987. Two versions of StuffIt are available—StuffIt Classic and StuffIt Deluxe. The Classic is available as shareware through bulletin board systems (BBSs) and online services. The Deluxe is a commercial version marketed by Aladdin Systems. "Stuffed" files (files compressed by StuffIt) can be identified by the three-letter DOS-style extension .SIT or .SDX.

The StuffIt packages let you create archives for multiple files. Archives can be standard or self-extracting. (Standard archives require one of the StuffIt packages or UnStuffIt Deluxe (freely distributed) software to decompress files. Self-extracting archives can be decompressed without special software.) Here is StuffIt's Archive Palette:



The Archive Window in Figure 7-14 shows the contents of an archive or folder within an archive. Uncompressed file size and percentage of compression are also displayed in this window.

Compact Pro

Compact Pro (formerly Compactor) is a shareware file compression program by Bill Goodman. It has an efficient compression algorithm that produces small files. "Compacted" files can usually be identified by the .CPT extension appended onto the filename.

With Compact Pro, you can create standard or self-extracting archives containing multiple files. Standard archives can be decompressed with either Compact Pro or Extractor (a freeware program by Bill Goodman).

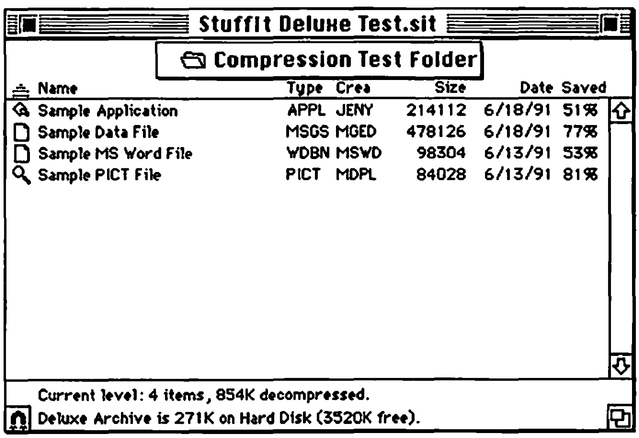


FIGURE 7-14
StuffIt's Archive window

A Catalog window, shown in Figure 7-15, displays the contents of an archive or folder within an archive. Information such as the uncompressed and compressed file size and percentage compressed are displayed in this window. A program called SitToCpt, also by Bill Goodman, converts StuffIt Classic archives to Compact Pro archives.

DiskDoubler and DoubleUp

DiskDoubler, by Salient Software, is another file compression software package. It includes an application and INIT/Extension. The application compresses files, folders, or entire disks. The INIT/Extension allows you to open compressed files from within applications. When you select a compressed file from an Open dialog box, DiskExpress automatically decompresses it for use. When you save it, DiskExpress compresses it again. Files are stored on disk in a compressed state, but can still be accessed by all applications.

DoubleUp, also available from Salient Software, is a compression card for Macintosh. This piece of hardware is installed in one of the Macintosh's expansion slots. It can make DiskDoubler run up to ten times faster than normal. Both DiskDoubler and DoubleUp run under all System versions.

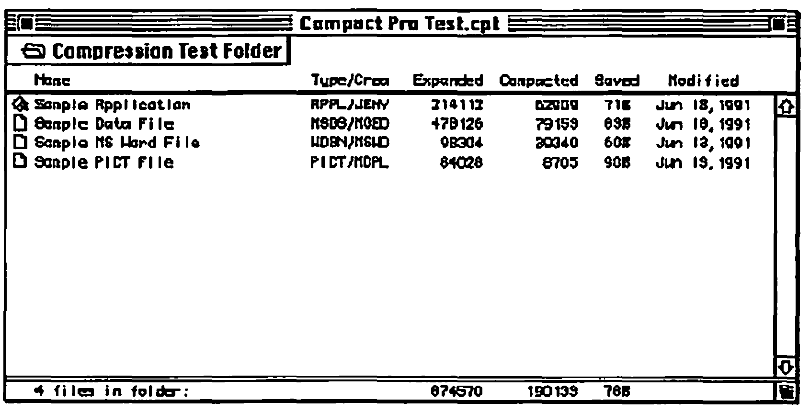


FIGURE 7-15
Compact Pro's Catalog window

DECOMPRESSING DOS ARCHIVES

If you exchange files with IBM-compatible DOS systems, you may find yourself with a text file compressed with a DOS file compression program. There are several applications to decompress DOS-compressed files. You can identify the compression scheme by its three-letter extension at the end of a DOS filename. Two examples are XXFILENAME.ZIP and XXFILENAME.ARC (for the common compression programs ZIP and ARC).

MacArc

MacArc is a freeware program by Leo Laporte and Ray Terry. It is found on many BBSs and online services. With it, you can decompress files with .ARC extensions. Files with .ARC extensions are a type of DOS-compressed file developed by SEA.

UnZip

UnZip is a freeware program by Peter Maika, based on various non-Macintosh programs by Samuel Smith, Darin Wayrynen, and R. P. Byrne. UnZip can be found on BBSs and online services. It will allow you to decompress files with .ZIP extensions. These files are a type of DOS-compressed archive developed by PKWARE.

LHarc

LHarc is a freeware program by Kazuaki Ishizaki, which enables you to compress and decompress files with .LZH extensions.

SECURITY

Computer security has been an ongoing concern since the start of the information age, more than 40 years ago.

In the early stages of computer security, access to entire computer facilities was restricted. This "fortress" mentality was imposed through the use of distinctive double doors, sophisticated locks, and specially trained security guards.

In the late 1960s, IBM came up with a more sensible approach to computer security: secure the computer from the inside. IBM's model 360 mainframe was one of the first computers to use a special password-security system as standard equipment.

ABOUT THE ...
Data Sensitivity

The first thing to determine is the "sensitivity" of your data. If your Mac is used for daily computer games and an occasional letter to Aunt Frannie, there's not much to lose in the way of an unsecured, or open, system (except maybe those high game scores). If you are a government-employed contractor with information on classified data, though, you have a lot to lose.

If you don't fall into either of those extremes, ask youself several questions:

- How do I feel about the privacy of my data?
- If my computer contains data used by my company, what security precautions are required?
- Does my computer contain sensitive information about my clients or employees?
- Do state laws require me to secure such data?

Many types of business records hold sensitive information, for example, personnel evaluations, attendance records, medical information, business plans, and customer records. These matters are confidential. Lawyers, doctors, counselors, brokers, and other professionals risk serious legal and financial liability if they don't ensure confidentiality.

If your Mac is for personal use, you may think that there is little or no sensitive information on it. If you prepare your taxes on your computer, use a home banking service, or manage a spreadsheet to calculate a budget or balance a checkbook, however, you may wish to keep this kind of information private. Is it worth securing your computer to do so?

This depends on who you are. Does your occupation or lifestyle invite the possibility of such an intrusion? Even if you aren't a public figure, some kind of minimal security is useful.

Now, anyone with a computer can understand how vulnerable we are to snooping. If you work with sensitive or otherwise private data, security might be an important concern for you. This section is about the kinds of security measures available for Macintosh users.

DO YOU NEED SECURITY?

Who has access to your computer when you are not around? What kind of information do you store on the hard disk? As dramatic as it may sound, there is a brisk business in the sale of company secrets. Even if you only use your computer at home for online banking and insurance recordkeeping, security is an issue.

SECURITY MEASURES

If you are concerned about having your computer hardware or software spirited away, there are hardware devices available to secure your computer to a desk or tabletop. (See Chapter 13, "Hardware and Peripherals.") If you are more concerned about unauthorized access to your programs and data, software tools are available. These range from usage logging to data encryption.

Logging Activity

Several programs track a computer's activity in logs or audit trails. Logs list the date and time that a computer program was started and shut down. Some logs list more information about the activity that transpired in each session. Logging programs work in the background, building text files that are readable with any word processing program. Logs do not keep unauthorized users out of your computer, but they do provide information about computer use.

Audit trails have other uses. For example, perhaps your company suspects that a certain employee spends a good portion of his or her day playing computer games, but no one can catch him or her in the act. A logging program is the evidence needed for disciplinary action.

Screen Locking

Screen locking keeps unauthorized users from any of your data. It blocks out the screen; nothing can be seen. This protects your screen from burn-in (screen images permanently burned onto the monitor) and from curious eyes. Screen-locking programs require the user to enter a password to display the screen.

Screen-locking software works as an INIT/Extension or Control Panel. When you start the computer, the software loads. It waits for a specific length of inactivity (when no keystrokes or mouse movement are made) or your command to blank out the screen. Screen locking is not a high-security measure.

Disk Locking

Disk-locking software prevents access to the hard disk until a password is entered or a key disk is inserted. (Some schemes include hardware such as magnetic card readers.) On shutdown or power loss, the disk is automatically relocked.

ABOUT THE ...

Password Selection

The right choice of a password is important. The password will determine the integrity of your system. People who illegally access computers know the most common types of passwords people choose. To foil them, *don't* use any of the following:

- Your name
- Your spouse's, child's, or dog's name
- Your birthday
- Your street name
- The word "Mac"
- Your telephone number or extension
- Anything about your company
- The word "secret" (this is probably the worst of all)
- Love (common choice of ex-hippies)
- Anything spelled backwards

The best passwords are those which are not obvious and are hard to guess. Pick a word out of the air, like *gerbil*. Choose your mother's middle name or maiden name, your grandmother's first name, or your long-dead Aunt Hildegard's pet name for you as a child, or your child's teddy bear's name. You could even use a word that describes your secret fetish—unless it's common knowledge.

Benefits of disk locking are that it keeps intruders out when you are not around and it's not bothersome. Once you unlock your disk, however, it will remain unlocked until shutdown. If you leave the computer unattended, the data is no longer secure. A combination of disk locking and screen locking is a reasonable security solution for computer users who often leave their computers unattended. If someone tried to bypass the screen-locking software by starting the computer with another System disk, the disk-locking software would keep them out.

Encryption

File encryption encodes or scrambles separate files, folders, or disks. Even if an unauthorized user has access to a disk full of data, a password is required to access the encrypted data on it. This is useful if there are only a few sensitive files on the disk.

The most common method of encryption is called DES (which stands for Data Encryption Standard). DES is a defense department-approved encryption scheme. It cannot be broken without supercomputers and encryption specialists because it thoroughly scrambles data. DES encryption is time-consuming.

Many encryption software packages offer additional, quicker methods. Files encrypted with methods other than DES may not be as secure, but they would probably meet the needs of most security-conscious Macintosh users.

These are the *disadvantages* to encryption for data protection:

- If a password is lost or forgotten, the encrypted file will remain encrypted—forever. (Back up data before encryption and store it in a secure off-site location.)
- Encrypted files and folders can be moved, copied, backed up, or transmitted by modem. They require the same encryption program to decrypt them. This limits the ability to transfer files to other authorized users.

Erasing Deleted Files

People never think that their garbage is anything more than trash, but even your Trash file can be worth protecting.

On the Macintosh, the Trash icon is where you dump files when you want to delete them. It doesn't immediately delete them, however. The data remains on disk until new data writes over it. In the meantime, anyone with a good file recovery software package can recover the file and gain access to it. A number of security programs completely erase deleted files by writing meaningless numbers over the data. Many of these programs do this in the background and require no additional effort.

SECURITY SOFTWARE

The following sections discuss some of the security software products available. Many of them offer more than one type of security to keep your data safe.

QuickLock

QuickLock, by Kent*Marsh, is a screen-locking utility. Once installed, QuickLock locks the screen with a password that you select. Move the mouse pointer to a hot spot on your screen or press a key combination on your keyboard, and the screen locker is activated. Inactivity also blocks out the screen.

Empower ScreenLock

Empower ScreenLock, by Magna, is a screen-locking utility. It automatically locks the Macintosh screen after a specified length of time, which you specify. You may also lock it with a keystroke; a password is then required to access the screen again.

DiskLock

DiskLock, by Fifth Generation Systems, is a disk-, folder-, and file-locking utility. Once installed, you must enter a password to access protected data. Double-click the icon you want to open. If it is locked, DiskLock will prompt you for a password. Incorrect passwords are logged so that you can check on unauthorized attempts to access protected files. A LockWhenIdle feature activates a screen locker when the computer is idle for more than a certain length of time. DiskLock automatically locks the disk on shutdown or in the event of a power outage, using one of three methods of data encryption, which you select.

The NightWatch

The NightWatch, by Kent*Marsh, is a disk-locking utility that prevents access to a protected disk without a password. There is no limit to the number of users and passwords allowed. A log keeps track of unsuccessful access attempts. User names and passwords are protected with DES encryption. Using a different start-up disk does not circumvent The NightWatch's protection. A Control Panel called The Connection enables you to integrate use of The NightWatch with the QuickLock screen locker.

A.M.E.

A.M.E., for Access Managed Environment, is a powerful, full-featured security software package by Casady & Greene. A.M.E. lets you limit access to files, folders, programs, and disks. Disk locking is available to keep intruders out of disks—even those connected to a network. A timer signs you off automatically after predetermined periods of inactivity. An Activities Log keeps track of all activities on the Macintosh. A.M.E. features a number of encryption schemes, including one that requires a key disk to unlock. Its True File Erase feature completely wipes out deleted files. Virus protection software is built in.

Empower I, Empower II, and Empower III

These three levels of Empower, by Magna, offer three types of computer security. Empower I incorporates a screen locker, password protection of the computer, and access logging. Empower II adds protection for System and application folders, the ability to set access privileges for specific files and folders, and several encryption methods. Empower III is a network security package that enables a system administrator to set privileges for all computers on the network. Optionally, Empower III can activate features like screen locking in other Empower versions in remote computers.

Sentinel

Sentinel, by SuperMac Technology, is a file-security and data-encryption utility. With it, you can password-protect and encrypt documents or entire folders with one of three encryption methods, including DES. You can group documents together in a WorkSet so that one password protects all of them. Once the document is encrypted, its icon appears with a lock and chain around it (or, if you prefer, you can make the document invisible). Double-click a file and enter a password or use the Sentinel Panel to unlock it.

ObjectClear and DeClass

ObjectClear and DeClass, both from OITC, are data-eradication utilities. Both products completely erase previously used disk storage areas by overwriting them with zeroes or meaningless data. Even temporary files created in print spoolers are erased. ObjectClear and DeClass go a step further than most file erasure utilities by clearing the computer's main memory. Both products work as INIT/Extensions. They work transparently in the background.

ABOUT THE ...

Evaluating Security Software

There is no security package that is best for everyone. When you evaluate security software, consider these three things:

1. Can unauthorized users find a way around the security measures? If so, how easily?

Security software is supposed to keep unauthorized users out of sensitive data. If security software can be disabled (by booting from another disk or accessing the computer disks through a network), the security measure is not effective.

2. How much will the security measures inconvenience you? Will they greatly reduce your productivity?

How many times a day do you have to enter a password? How many passwords do you have to remember? Would you be locked out of your own computer if a key disk became corrupted or you left a magnetic card at home? If possible, find a security solution that works without productivity interference. Complex password protection and encryption schemes may protect your information, but they may also become a nuisance. If passwords are lost or forgotten, data could be lost for good.

3. How much does the security software cost to purchase and install?

The level of security you choose should be comparable to the risk. Should you spend $1,000 to protect a computer full of shareware and personal memos? It's probably not worth the money.

COMPUTER VIRUSES

Computer viruses and other forms of maliciously produced computer software can damage application, data, and System files with destructive program code. Even a so-called "harmless" virus can cause problems and become a nuisance, because it occupies RAM and disk space needed by other applications and interferes with normal System operations.

Fortunately, the computer virus epidemic can be kept under control with specialized software and other protective measures.

VIRUSES, WORMS, AND TROJAN HORSES

A *computer virus* is a program designed to attach itself to other applications or files. Once an infected file is inside a computer, it can spread to other files. Viruses spread from computer to computer through shared infected software or computer networks.

Many computer viruses attack program resources. (Resources are parts of a program like windows, menus, icons, and dialog boxes.) Some viruses alter or delete resources of the programs they attack.

Viruses can be classified as mischievous or malicious. *Mischievous* or "harmless" viruses replicate, but do not intentionally do anything destructive. For example, a mischievous virus may beep or display a message on the computer screen.

Malicious viruses replicate and intentionally damage files. They can delete files or reinitialize hard disks. Fortunately, malicious viruses are rare among Macintosh computers.

A *worm* is another malicious program. Like a virus, it also replicates and spreads, but it does not attach itself to files. Worms usually spread over computer networks and take up computer resources. They fill the disk space with meaningless data.

Trojan horse is the term, used by some experts, for a virus that doesn't spread. A Trojan horse looks like a benign program, but hidden inside is havoc in the form of code.

COMMON MACINTOSH VIRUSES

To fight computer viruses, they must be identified, researched, and understood. As computer viruses are discovered, they are given names and dissected by the programmers who write antiviral software programs. Some of the common, known Macintosh viruses are Scores, nVIR, INIT 29, ANTI, WDEF, CDEF, ZUC, and MDEF.

ABOUT THE ...
Virus Symptoms

Symptoms that might be caused by a computer virus are

- System problems—frequent crashes, bombs, or hang-ups
- Application problems—increased load time or beeps when started
- Printing problems
- Frequent error messages
- Decreased available RAM or disk space
- Increased disk activity
- Change in file size or modification date for no apparent reason
- Disappearance of files

Keep in mind that many of these symptoms might also be caused by corrupted System files or INIT/Extension conflicts. Virus-detection software can usually determine if these problems are, indeed, caused by viruses.

Scores

Scores is also known as NASA, Eric, Vult, or San Jose Flu. It was designed by a disgruntled programmer to attack programs under development by his employer. (Luckily, the more damaging versions were never released to the general public.) Scores has a serious conflict with Apple's System version 6.0.4, because they both use resources with the same type and number. When Scores infects the System file, it must be replaced; it cannot be repaired.

The Scores virus can be seen in the System folder. Look at the icons for the NotePad and Scrapbook files. In System versions prior to 7, they look like little Macintoshes. In System 7, they are either a notepad or a sheet of paper with screwy shapes on it. (On a Scores-infected computer, they may look like regular document icons: blank sheets of paper with the corners turned down.)

Scores gets its name from an invisible Scores file it creates. It does not infect or modify document files, only applications and System files. Two days after a system becomes infected, Scores spreads to each application you run. Some applications are immune.

Scores does not intentionally do damage, but it does occupy memory and disk space. In addition, the virus itself has errors that cause System crashes and other unexplained behavior. To get rid of Scores, use a virus-removal program. If you run System 6.0.4, you should also replace the System file if it gets infected.

nVIR

There are three strains of the nVIR virus: nVIR A, nVIR B, and nVIR C.

The nVIR virus infects the System file but does not change the appearance of file icons or create an invisible file. It begins to spread to applications immediately, whenever an application is run. Document files are not modified, and some applications are immune to infection.

At first, nVIR replicates. When the System file is first infected, a counter is set to 1,000. This counter is reduced by one each time the system is started up and reduced by two each time an infected application is run. When the counter reaches zero, nVIR A may either beep once or twice or say "Don't panic" (if MacInTalk is installed) whenever the system is started up or an infected application is run. nVIR B may beep once or twice.

The nVIR virus got its name from an "nVIR" resource it adds to infected applications. Like Scores, it occupies memory and disk space. The only way nVIR can be detected is by opening the file's resources with ResEdit or with virus-detection software. (ResEdit is Apple Computer's Resource Editor. It is discussed in more detail in Chapter 24, "Programming the Macintosh.") Many virus clones are based on nVIR.

INIT 29

The INIT 29 virus is extremely virulent and spreads rapidly. It can infect almost any kind of file. Although document files can be infected, they are not contagious. INIT 29 can only be spread by System and application files.

INIT 29 infects files in one of two ways. If a file has a CODE resource, INIT 29 installs itself as a CODE resource. It uses the next available ID number. It then modifies the CODE 0 resource to jump to the new CODE resource. If a file doesn't have a CODE resource, INIT 29 installs itself as an INIT resource with an ID of 29 (hence, the name INIT 29). Any legitimate INIT 29 resource is removed.

INIT 29 does not intentionally do anything other than spread. It can, however, cause print problems, system crashes, MultiFinder problems, and INIT conflicts. One side effect of the virus reveals its presence. If you insert a locked floppy disk into an infected system, the following alert will appear: "The disk (*diskname*) needs minor repairs. Do you want to repair it?" Otherwise, INIT 29 can only be detected when you open file resources with ResEdit or by using virus-detection software.

ANTI

ANTI only infects applications and programs that resemble applications (like the Finder). An application can become infected with ANTI even if it is never run. ANTI spreads through its modification of resources in applications. It attaches itself to the main code resource found in CODE ID 1, and then adds 1,344 bytes to the resource. ANTI cannot spread when MultiFinder is in use.

ANTI does not intentionally cause any damage other than to spread. As with other viruses, this in itself can cause problems. ANTI can be detected by virus-detection software. Removal of ANTI, however, can damage the infected application. It is best to replace any infected applications with fresh copies from locked disks.

WDEF and CDEF

WDEF and CDEF only infect the invisible Desktop file used by the Finder. The infection spreads when a floppy disk is inserted into an infected computer or when an infected floppy disk is inserted into an uninfected computer. There are two strains of WDEF: WDEF A and WDEF B. WDEF B beeps when an infection occurs. WDEF A does not. WDEF is a widespread virus.

CDEF is similar to WDEF. It creates a CDEF in the Desktop file. WDEF and CDEF do not intentionally do any damage other than spread, but errors in the virus code have caused numerous problems. For example, a Macintosh IIcx, IIfx, or Portable crashes almost immediately after the insertion of a WDEF-infected floppy. WDEF causes other Macintoshes to crash more frequently. The virus also causes problems in displaying fonts. CDEF generally causes fewer problems.

WDEF and CDEF can be detected with virus-detection software. Remove either of these viruses by rebuilding the Desktop file of the infected disk.

ZUC

The ZUC virus—named for its reported discoverer, Don Ernesto Zucchini—only infects applications. Applications can become infected even if they are not used. ZUC infects applications by attaching code to the CODE ID 1 resource of an application. It adds 1,256 bytes to the resource, but does not change the modification date of the application. In addition, ZUC has an internal list of applications to avoid, such as antiviral products. Because of these two factors, it is difficult for virus-detection software to detect.

ZUC was originally timed to activate on March 2, 1990, or two weeks after an application becomes infected. About 90 seconds after an infected application is run, the cursor begins to behave erratically whenever the mouse button is held down. The cursor moves diagonally, bouncing off the sides of the screen. When the mouse button is released, the cursor returns to normal. Except for the cursor behavior, ZUC does not intentionally do any damage. There are two side effects, however. The desktop pattern of some infected Macintoshes may change, and there is often a long delay and additional disk activity when an infected application is run.

The best way to remove ZUC is to replace the infected application. Otherwise, some antiviral applications may be able to remove it.

MDEF

The MDEF virus, also known as the Garfield virus, infects applications and System files. System files are infected as soon as an infected application is run. Applications are infected on an infected System.

MDEF just spreads and infects files. It causes old models of Macintosh computers to crash. In addition, MDEF reacts badly with some antiviral software packages. As a result of this interaction, application and Finder menus may not work, even if there is no obvious infection present in the application.

Although WDEF, CDEF, and MDEF have similar names, they are different. They affect different resources. MDEF can be detected and removed with some virus-protection software.

ABOUT THE ...

Seven Ways to Protect Your Computer Against Viruses

Protection of your computer against viruses is not difficult. Obtain and install virus-protection software, and update it quarterly. (Viruses change—and so does virus-protection software.)

1. Lock the original program disks of applications before you insert them in a disk drive.

Viruses cannot spread onto locked disks. This is a foolproof method to prevent the contents of a disk from becoming infected.

2. Never start up a computer with an internal hard disk from a floppy disk that has not been checked for viruses.

If the floppy disk has a virus in its System file, the virus may spread to the hard disk. You should keep a locked, virus-free start-up disk on hand for each computer.

3. Test all files, particularly those from noncommercial sources, for viruses before you copy them to a hard disk.

Programs and files from commercial sources are much less likely to contain viruses than shareware, freeware, and other files distributed on online services and BBSs. Despite this, all files should be checked with virus-detection software. Be especially careful of software that is not provided in sealed packaging.

4. Before you test a floppy disk for viruses on a computer with a hard disk, drag the hard disk icon to the Trash icon.

When you drag a disk icon to the Trash icon, it *unmounts*. When a disk is not mounted, the Macintosh cannot write information to it. This protects the hard disk from infection when you insert a floppy disk to be tested.

5. Check new software for viruses on a test computer that is not connected to a network.

ABOUT THE ...

Seven Ways to Protect Your Computer Against Viruses (continued)

Some viruses can spread over networks. Checking for viruses on a computer that is not connected to a network eliminates this risk.

6. Do not use hacked or pirated software.

Hacked or *pirated* software usually refers to commercial software products altered to remove copy protection or to change the way the program operates. These products are in violation of copyright laws. They are much more likely to contain viruses than their legal counterparts.

7. Perform backups regularly.

You can use backups of your data files to restore your system to its pre-virus state in case of a virus infection. In fact, you might want to combine your backup procedure with a scan for viruses. Scan first, then back up files. This ensures that your backups do not get infected.

ANTIVIRAL SOFTWARE

Antiviral programs are usually designed for one of three tasks: protection, detection, or removal. Most products include programs to handle more than one of these tasks.

Virus protection or prevention software usually consists of an INIT/Extension or Control Panel that goes to work when you start your computer. It works in the background to identify unusual activity, which may signal a virus attack. It then either blocks the attack or alerts you and asks for instructions.

Virus-detection software works in one of two ways. A vaccination method modifies applications to perform self-tests that check for changes to program code. Unfortunately, some viruses are designed to disable vaccination schemes. A *snapshot* method records System information at startup. This snapshot is then compared to System information periodically, and at shutdown. With either method, if a virus is detected, the software notifies you.

Virus removal, eradication, or repair software scans for the symptoms caused by specific viruses. It sometimes monitors System activity. When a virus is detected, the software requests permission to remove the virus or recommends procedures to remove the virus. Virus-removal software does not work automatically.

A number of programs have been developed to defend against computer viruses. A few of the more popular ones are described here.

SAM 3

SAM, short for Symantec Antiviral for the Macintosh, is distributed by Symantec/Peter Norton Computing. SAM has two parts—a Control Panel, called SAM Intercept, and an application, called SAM Virus Clinic. SAM Intercept loads when the computer starts up. It scans for viruses. You can configure it to scan the hard disk or System folder of the start-up disk at startup or at shutdown. You can also instruct it to scan floppy disks as they are inserted. All configuration options are available from the Main Control Panel window, shown in Figure 7-16.

SAM also scans System activity while you work. If a suspicious activity occurs, SAM stops the application, displays an alert, and waits for you to tell it what to do. For example, if you launch an infected application, SAM alerts you. It then lets you either stop the launch or proceed. In other cases, if suspicious activity not related to a known virus occurs—for example, an alteration of SAM itself—three options are given: Allow, Deny, and Learn. Allow lets the activity take place, Deny stops the activity, and Learn instructs SAM to record the activity and ignore it on any subsequent occurrences.

With the SAM Virus Clinic, you can scan all of your disks, including those accessed over a network, for viruses. You have the option of scanning folders or files. SAM reports any problems. If a virus infection is found, SAM Virus Clinic will attempt to repair the damaged file.

Disinfectant

Disinfectant is a freeware antiviral software package by John Norstad that can be found on most BBSs and online services. Disinfectant is made up of two parts, an INIT/Extension and an application. The application

FIGURE 7-16
The SAM Intercept Control Panel

lets you scan for viruses on any disk, including those accessed through a network. A Scan menu lets you select specific items to scan. A Disinfect button removes a virus.

The Disinfectant INIT/Extension is installed by Disinfectant from the application's Protect menu. The INIT/Extension scans System activity for evidence of known viruses only. If a virus is found, an alert box tells you about the infected program and virus. Instructions are provided to remove the virus.

Rival

Rival, by Microseeds Publishing, is an antiviral software package that works as a Control Panel. Rival can scan disks for viruses. When it finds infected or damaged files, it beeps and displays a list of the problem files. It can repair infected files.

Rival can also be configured to automatically scan for viruses at System startup and application or document launch. It can install vaccines against specific viruses. Vaccines are available through online services and Microseeds.

Virus Detective

Virus Detective is a shareware Desk Accessory by Jeffrey Shulman. It searches through files for specific resources identified with viruses. Virus Detective can search whole disks, folders, or files. It can keep a log of all the files it scans. Unlike other antiviral software packages, Virus Detective lets you add or remove resource strings to search for. (This feature—for experienced users—allows you to keep Virus Detection up-to-date.)

CHAPTER 8

PRINTERS AND PRINTING

You could use the Macintosh without a printer, but, what's the point? Printing is a fundamental part of word processing, desktop publishing, and computer design work. A printout is also useful when you work on an electronic spreadsheet, accounting, or tax program.

PRINTERS

Apple sells its own versions of dot-matrix, laser, and ink-jet printers for the Macintosh. However, they don't offer extra-fast or two-side-printing laser printers, color printers, or plotters, which will be discussed later in the chapter. These specialty printers can be bought from other vendors.

APPLE'S IMAGEWRITER PRINTER SERIES

Apple calls its dot-matrix printer family *ImageWriters*. Since the first Macintosh was introduced, the ImageWriter has been Apple's low-cost answer for a printer. The ImageWriter II and ImageWriter

LQ can print documents from almost every Macintosh application program.

Both models can print on multi-part, continuous, or fanfold computer paper, and they can print on hand-fed single sheets or envelopes. Options include an automatic sheet feeder (for the LQ) and a four-color ribbon (for both). An internal LocalTalk interface board can be added to both printers. The interface allows other Macintosh users to share the printer over an AppleTalk local area network. (See Chapter 12, "Telecommunications," for information on LocalTalk and AppleTalk.)

ImageWriter II

The Apple ImageWriter II, shown in Figure 8-1, is a 9-pin dot-matrix printer. It uses a 9-wire printhead to form characters. The ImageWriter II prints at 3 different speeds: Best, Faster, and Draft. The Best mode has a print speed up to 45 characters per second (cps), and a *near letter quality* (NLQ) printout. The Faster (or Correspondence) mode runs at 180 cps. Draft mode is fast, at 250 cps, but print quality is sacrificed. The higher the speed, the lower the quality with a dot-matrix printer.

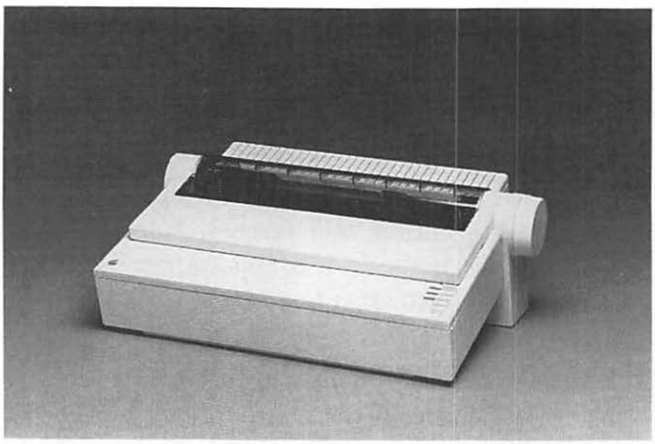


FIGURE 8-1

Apple ImageWriter II dot-matrix printer (courtesy of Apple Computer, Inc.)

ABOUT THE ...
Dot-Matrix Mechanics

The basic printing mechanism of a matrix printer is a printhead with one or more vertical rows of tiny metal rods called *pins*. Each pin is carefully positioned in a tubelike track. The pins are spring-loaded. They are held back from the ribbon and paper by electromagnets. When the current is turned off, the pin is released. A spring forces it to crash into the ribbon, creating a spot on the paper.

The printhead is mounted on a track, and it slides back and forth. A character is formed when the rows of rods color in a pattern area. The tiny dots combine to look like a solid character.

The ImageWriter II has a standard-size print carriage (the width of a standard typewriter's carriage). The ImageWriter II prints up to 8-inch lines on up to 10-inch-wide paper on the standard carriage.

ImageWriter LQ

The ImageWriter LQ is a 27-pin dot-matrix printer. The higher pin count lets the printer run at higher speeds in the Best mode. The LQ can produce NLQ hard copy at 90 cps, twice the speed of the 9-pin ImageWriter II. The extra pins on the ImageWriter LQ form high-quality dot-matrix characters. The LQ produces a better printout than the ImageWriter II, but it is also a lot noisier.

The ImageWriter LQ has a wide carriage. It prints a 13 1/2-inch line on up to 15 1/2-inch-wide paper.

APPLE'S STYLEWRITER INK-JET PRINTER

The design of the ink-jet printer is similar to a dot-matrix printer. Instead of the pin impact on a ribbon, the ink jet shoots ink at the paper. Like a dot matrix, the ink jet makes characters and numbers with a pattern of dots printed very close together. The resolution is actually finer than a dot-matrix printer's, and the quality is almost as good as a laser printer. The technology used in the ink jet is found in many color printers. The ink jet is a compact, lightweight, portable printer. This makes it a good choice if you need one printer to use both at home and at work.

Ink jets are quiet and good for printing graphics as well as text. They produce pages with laser-like quality, and most print on plain paper.

What are the disadvantages? They are slow. The StyleWriter, Apple's ink jet shown in Figure 8-2, crawls when compared to a dot-matrix or laser printer. The StyleWriter in Best mode prints at rates of 1/3 ppm (page per minute) for NLQ text. Printing at higher Draft mode at about 2/3 ppm isn't much quicker.

What you get with an ink jet is expensive-looking laser-like quality at a relatively low dot-matrix printer price. Ink-jet printers are excellent for occasional low-volume, high-quality personal printing. Their light weight and small size also make them good carry-along printers. Table 8-1 lists the StyleWriter's printing capabilities.

APPLE'S LASERWRITERS

Apple calls its family of laser printers *LaserWriters*. LaserWriters come in two varieties—one type works with Apple QuickDraw and the other with Adobe PostScript. The higher-priced PostScript model, shown in

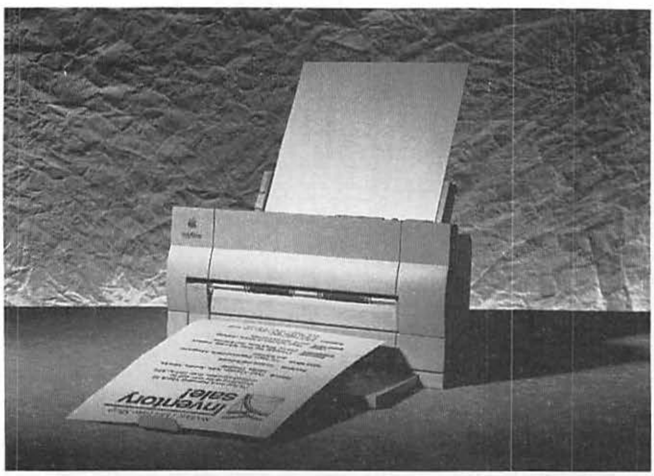


FIGURE 8-2

Apple's StyleWriter ink-jet printer (courtesy of Apple Computer, Inc.)

Printer Engine	
Technology	Thermal ink jet, 64-nozzle
Print line	8-inch-wide printable line
Ink source	Replaceable nozzle cartridge
Cartridge life	500 pages minimum
Print Speed	
Draft mode	2/3 ppm
Best (NLQ) mode	1/3 ppm
Resolution	
Draft characters	180 by 180 dpi
NLQ characters	360 by 360 dpi
Graphics	360 by 360 dpi
Supplied Fonts	
Number and type	Four TrueType-scalable fonts
Font families	Courier, Times, Helvetica, Symbol, Genera, Chicago, and New York
Paper Feed	
Mechanism	Auto sheet feeder
Page Sizes	Letter/legal and A4, envelope (manual feed)
Interface	
Type	Serial RS 422
Speed	57.6 Kbps
Physical	
Size (h by w by d)	12.5 in. by 13.25 in. by 5.6 in.
Weight	7.5 lbs.
Power	23 watts

TABLE 8-1
Apple StyleWriter's Printing Capabilities

Figure 8-3, also has a LocalTalk interface. PostScript LaserWriters can support multiple Macs on an AppleTalk network.

LaserWriters offer a high-quality printout for text and graphics. Images and graphics can be printed in shades of gray to solid black. Lasers have print quality of 300 dots per inch (dpi), far superior to anything a dot-matrix printer can produce. Also, laser printers are quiet.

A laser printer (also called a page printer) uses technology similar to a copier. Heat bonds dry ink (toner) images to paper. Plain paper is automatically fed into the laser printer from cassettes or trays. A single toner cartridge will print about 3,500 to 4,000 pages. Laser printers can print on labels, envelopes, and a wide variety of specialty papers—from neon colors to marbled designs.

LaserWriters print at different speeds. Apple's Personal LaserWriter models print at up to 4 ppm rates. The LaserWriter II family prints at 8 ppm. Table 8-2 lists the different capabilities of Apple's QuickDraw LaserWriter LS and LaserWriter SC.

QuickDraw and PostScript QuickDraw and PostScript software describe to printers the formats and fonts you have chosen for your document. The software turns computer text and graphics data into information the

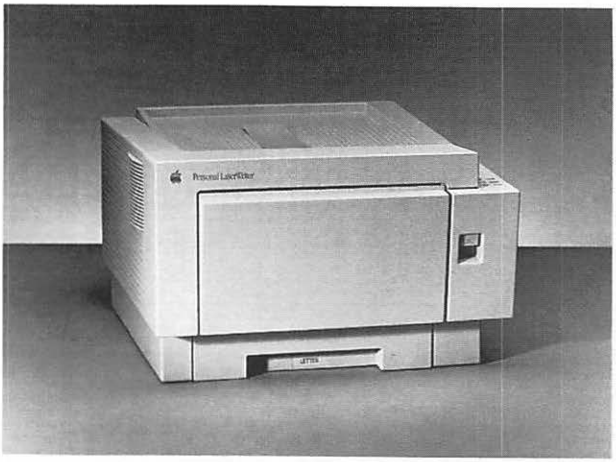


FIGURE 8-3

Apple's PostScript LaserWriter printer (courtesy of Apple Computer, Inc.)

	Personal LaserWriter LS	Personal LaserWriter SC
Laser Engine		
Speed	4 ppm	4 ppm
Resolution	300 dpi	300 dpi
Min. toner life	3,500 pages	3,500 pages
Min. engine life	150,000 pages	150,000 pages
Imaging and Fonts		
Imaging	QuickDraw	QuickDraw
Built-in fonts	Four TrueType fonts	Four TrueType fonts
Controller		
Processor	12 MHz 68000	7.5 MHz 68000
RAM	512K to 1MB	1MB
Interfaces		
Serial	909 Kbps high speed	None
LocalTalk	None	None
SCSI	None	Standard
Paper Feed		
Standard cassette	Multipurpose 50-sheet letter or 5-envelope	Multipurpose 50-sheet letter or 5-envelope
Optional cassettes	250-sheet letter and legal 15-envelope	250-sheet letter and legal 15-envelope
Physical		
Size (h by w by d)	9.8 in. by 15 in. by 18.3 in.	9.8 in. by 15 in. by 18.3 in.
Weight	32 lbs.	32 lbs.
Standby/run power	170/900 watts	170/900 watts
Comments	Requires Mac with hard disk drive	

TABLE 8-2
Apple QuickDraw LaserWriter Printers

printer can understand. QuickDraw is used to map out what's on the Mac's display screen, and it is adequate for most printing work.

PostScript is a richer page-description language for printers. It lays out and formats complex text and graphics needed for desktop publishing or other graphic-intensive printer applications.

All Macintosh printers handle QuickDraw work. A PostScript printer is required to print the output of PostScript applications such as freehand work and illustrations. You can adapt a QuickDraw (or any non-PostScript printer) to print PostScript jobs with an interpreter program. An interpreter (such as Freedom of Press from Custom Applications) translates the PostScript code into print data that a non-PostScript printer can understand. (See Chapter 9, "Fonts," for more details on PostScript.)

NON-APPLE MACINTOSH-COMPATIBLE PRINTERS

There are some non-Apple printers that work with your Macintosh.

LaserWriter Alternatives

Alternatives to Apple LaserWriters include the Hewlett-Packard (HP) LaserJet printer series. (HP is a leading supplier of laser printers for the PC market.) The company offers Macintosh interface and PostScript options for its family of 4 ppm, 8 ppm, and 16 ppm LaserJet printers. HP even provides a "D" series duplex laser printer. (*Duplex* means that the printer can print on both sides of a piece of paper—automatically.) Additional vendors that market laser printers for the Macintosh include Texas Instruments, QMS, Okidata, Kodak, Abaton, and NEC. Other laser printers can hook up to the Macintosh with a specialized set of printer drivers. GDT SoftWorks JetLink Express is one such set of laser printer drivers, and it is the best.

Ink-Jet Alternatives

Macintosh-compatible ink jets are available from HP, Kodak/Diconix, GCC, and Canon. These are a bit faster than Apple's StyleWriter, but even the best of these desktop models print no faster than 2 ppm.

An ink-jet printer makes an excellent pair with a laptop computer. On-the-road models such as the Diconix 150 or GCC are a good choice.

ABOUT THE ...
Laser Printer Paper

Laser printers use an electrical charge to hold the toner to the characters on the paper. Then they heat and press these characters to fuse the toner onto the paper. Quality laser paper has special electricity- and heat-resistant properties, similar to copier machine paper.

All paper's electrical resistance is different. Paper makers add chemicals to change factors like moisture content—a key to the variations in electrical resistance. This has a profound impact on the print quality and *curl,* which will also vary with humidity. The more moisture in the paper, the more it will curl. If a page curls too much, it will jam. (Store paper carefully—reclose the package on partially used reams. Unprotected paper will absorb humidity on wet days and dry out on dry days.)

Paper has two distinctly different sides. This difference isn't obvious to the eye or to the touch. The top is the *felt* side, the bottom is the *wire* side. As a rule, you should print on the wire side first. The label on the ream wrapper has an arrow to show which side is the wire side. Load the paper trays with this in mind. (Check whether your printer's tray loads face-up or face-down.)

Paper *weight* is an important variable. The standard measure is based on 500 sheets of paper. Most paper is rated at 20 pounds; higher-quality paper is 24 pounds or more. If paper is too light, it will jam, and if it is too heavy, it will jam. Paper made specifically for laser printers is usually marked explicitly; for example, Hammermill's Fore DP is labeled "for Hi-Speed Xerograph Copiers/Offset Duplicators/Laser Printers." Cheap paper can leave lint inside your printer, which may ruin print quality and shorten the engine's life.

Weight isn't the same as thickness and stiffness. The three measures may seem to mean the same thing, but they don't. *Stiffness* measures a page's resistance to bending. *Thickness* is the physical "depth" dimension. Three sheets of 20-pound paper can vary. One can be thicker, while another is much stiffer, and the third can be thinner and floppier, but with the same 20-pound rating.

Cotton bond paper has cotton fibers mixed with the wood pulp. It *feels* like high-quality paper. Most cotton bond has a watermark of the manufacturer's name. (Much of the world's currency uses high-quality, high-cotton bond, or linen bond paper.)

Other factors that affect print quality are listed in the following table.

ABOUT THE ...
Laser Printer Paper (continued)

Factor	Quality
Brightness	Brilliance and whiteness of the paper
Wax pick	Strength of the paper's surface
Opacity	Degree that print shows through to the back of the page
Smoothness	Texture of the page (A rough surface doesn't take toner evenly. On the other hand, toner won't fuse very well to smooth surfaces; the print may flake, smudge, or rub off.)

Dot-Matrix Alternatives

A number of dot-matrix printers will work with the Macintosh using a customized print driver. The GDT Softworks PrintLink Collection offers one such set of drivers that support the operation of PC-type printers on the Macintosh. You load the GDT driver software on your Macintosh, reset a few switches on the printer, and attach the printer to the Macintosh with a cable.

GDT includes a printer-to-Macintosh cable and supplies Macintosh driver-cable options for both serial and parallel interfaced PC printers. This is important. Printers usually attach to PCs through a parallel or Centronics hardware interface. Apple connects dot-matrix printers through the serial port on the Macintosh.

COLOR PRINTERS

Apple does not offer a high-quality color printer of its own. An ImageWriter with a color ribbon can highlight characters, text, and simple graphics, but to produce finer, high-quality color work, you'll need a printer built by another vendor.

Your first option is a color ink-jet printer. HP, Sharp, Tektronix, and Howtek offer inexpensive to moderately priced models. Print quality and image resolution are better than color copy produced by a dot-matrix printer. Color ink jets can also be used to print regular black-and-white text and graphics.

If you can afford a more expensive option, a thermal transfer printer will likely be your best bet for color printing. The printer uses a matrix printhead composed of tiny electric heating elements and a wax-coated ribbon or roll. The elements are heated to melt the wax. This forms colored dots of liquid ink, which are transferred onto the paper to create the image.

The quality is better than what ink jets produce, but this comes at the higher cost of the printer, the wax-coated rolls needed to run it, and the special print paper. Tektronix, QMS, CalComp, and others market thermal transfer printers to work with the Macintosh. Although thermal transfer printers reproduce good solid colors, don't expect picture-perfect quality. Neither they—nor the color ink jets—can reproduce the fine shades and subtleties of a color photograph. You'll need a specialized thermal transfer printer—called a *dye sublimation* printer—for that.

A dye sublimation printer works similarly to a thermal transfer printer. The difference is the use of special dye instead of wax-coated rolls. The solid dye doesn't melt. It turns into a gas (sublimates) when heated. A variation in the printhead temperature regulates the amount of dye deposited on the paper and fine-tunes the intensity and shades of the printed colors.

Copy quality is terrific, far surpassing other printer technologies. Everyone should have one of these! The only drawback is the price—in the $10,000 to $20,000 range—and the dye-coated roll and paper material also cost a lot. Each letter-size color print can cost you $3.50 or more. Still interested? Look at the Kodak SV6500 or XL7700 color printers.

PLOTTERS

A *plotter* generates hard copy output for computer-aided design (CAD) applications. Plotters are graphic printout devices that produce charts, floor plans, line drawings, or schematics. They use little ink pens to trace over paper, vellum, or clear plastic surfaces to form continuous line images. Plotters have an advantage over printers in fine line work. They can draft precise, continuous line drawings over large areas. Page sizes are not confined to the letter, legal, or even ledger sheet dimensions of printers. Plotters can also trace in a number of different colors. Plotters are slow with text, however, because each character is plotted out as a collection of lines.

Plotters come in two varieties: flatbed and drum. The *flatbed* versions draw on paper sheets, moving the tracing pen both horizontally and vertically. *Drum* plotters draw on paper rolls. The pen tracks side-to-side in one direction as the drum moves the paper up and down in the other. Both types plot in colors with multi-pen assemblies. Individual pens are indexed up and down to ink the paper with the desired color as the plotter tracks.

HP and other vendors offer moderately priced desktop plotters for the Macintosh. Palomar Software's PLOTTERgeist plotter driver software and cable set will interface other makers' plotters to the Macintosh driver.

HOW TO PICK A PRINTER

Some of the factors to consider when picking the "right" printer to go with your Macintosh include your usage and quality needs, printout volume, the number of users supported, and price.

PRINTER USAGE AND QUALITY

What type of printing will you be doing?

Basic Printout Any printer will work for basic text and graphics. A low-cost, ImageWriter-style, dot-matrix printer produces readable printout at respectable speeds at a reasonable price.

Quality Printout Look at the StyleWriter, HP DeskWriter, or another ink-jet printer, if you can stand to wait. You'll get laser-like copy at a cost almost as low as a dot-matrix printer's. Want higher speeds with the same quality? Consider a non-PostScript laser printer such as Apple's Personal LaserWriter LS.

Quality Printout and Layouts You'll need a PostScript laser printer for high-quality page layouts with sophisticated text and graphics. Choices here are the Personal Laser-Writer NT or LaserWriter II NT/NTX, or their non-Apple PostScript equivalents.

PRINTOUT VOLUME

How many pages per day do you expect to print?

Up to 25 Pages Per Day Any printer will work for low-volume usage. From lowest to highest cost, the choices are the ImageWriter, the StyleWriter, the Personal LaserWriter LS or SC, and the Personal LaserWriter NT.

100 Pages Per Day If you will be printing 100 pages per day, your choices narrow down to 4 ppm personal laser printers. They include the Personal LaserWriter LS or SC, for straight QuickDraw work, and PostScript laser printers such as the Personal LaserWriter NT to print pages with more complex formats.

250 Pages Per Day At a volume of 250 pages per day, you'll need a higher-speed, 8 ppm laser printer. The LaserWriter NT and NTX are Apple's answers. Both are PostScript models. You might consider a lower-cost, non-PostScript, 8 ppm laser printer from another vendor, particularly if QuickDraw printout will do.

500 Pages Per Day Apple doesn't have an answer for high-volume printing. Consider a Macintosh-compatible, 16 ppm laser printer from HP, Kodak, or another vendor.

NUMBER OF USERS SUPPORTED

How many Macintosh users will the printer support over an AppleTalk network?

Two to Five Macintosh Users Pick the Personal LaserWriter NT or an equivalent, AppleTalk-interfaced 4 ppm laser printer when total printout volume averages out at 100 pages per day. The LaserWriter NT is required for 250 pages per day.

Five to Ten Macintosh Users For five to ten users, your single printer solution is a LaserWriter NTX or a higher-speed 16 ppm laser printer. Buy two laser printers if your Macs are dispersed over a wide area or if your print volume exceeds 250 pages per day. That way, you won't have to walk a mile to get your copy, and you won't have to wait while another job is printing. Two printers also give you some "printout insurance"—one printer is available if the other should fail.

Eleven or More Macintosh Users Multiple laser printers is the only way to go if you have 11 or more users. Try a mix of low- and high-speed models. You can assign users to a specific printer based on their volume of printing. If a printer breaks down, a user can be reassigned to another printer.

PRINTER PRICES

How much can you pay for your printer?

The following table summarizes the printer selection features and includes a "relative price" column, based on the retail prices asked at computer stores or dealers for Apple printers. Retail prices vary from day to day; relative price differences remain fairly constant.

Printer Model	Printer Usage	Printout Format	Volume (per day)	Number of Users	Relative Price
ImageWriter II	Basic print and multipart forms	QuickDraw	25	1	1x
ImageWriter LQ	Basic print and wide multipart	QuickDraw	25	1	2.5x
StyleWriter	Quality printing	QuickDraw	25	1	1.2x
Personal LaserWriter LS	Quality printing	QuickDraw	100	1	2.2x
Personal LaserWriter SC	Quality printing	QuickDraw	100	1	2.6x
Personal LaserWriter NT	Quality printing	QuickDraw PostScript	100	1 to 5	5.5x
LaserWriter II NT	Quality printing	QuickDraw PostScript	250	1 to 5	7.2x
LaserWriter II NTX	Quality printing	QuickDraw PostScript	250	1 to 10	9.8x

The per-unit price of an ImageWriter II is the base price unit of "1x" in the relative price column, and the relative prices of other Apple printers are based on this per-unit cost. For example, a StyleWriter costs 1.2 times the price of an ImageWriter II. This way you can judge a printer's *price-performance*—the price paid for the performance features of one printer when compared to another.

ABOUT THE ...

Factors to Consider When Purchasing a Printer

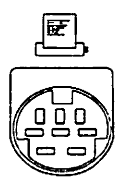
Printer controller memory and speed are important. Printers with a large memory can store more fonts and handle bigger, more densely packed pages. Printers with a fast microprocessor can process print data and instructions quickly. Memory and microprocessor speed—as well as the mechanical print speed—determine how fast a laser printer will print. These are factors to consider when comparing laser printers with identical print speeds—when you're matching one LaserWriter against another, or with a compatible laser printer provided by a non-Apple vendor.

SETTING UP A MACINTOSH PRINTER

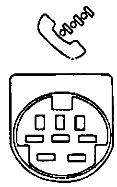
There are two basic steps to hooking up a printer to your Macintosh: physically connecting it, and letting the Mac system know that it's hooked up.

CONNECTING THE PRINTER

Most printers connect to the Macintosh through the serial printer port. Information is transferred serially from the Macintosh to the printer single-file, one bit after another. AppleTalk connections for sharing a printer over a network are also made through the printer port. You will find the printer port on the back panel of the Macintosh with a printer icon above it, as shown here:



Printers can also connect through the modem port. It is a serial port, usually reserved for modem communications. (You cannot connect with AppleTalk or a network printer through the modem port.) The modem port and its icon, also located on the back panel of the Macintosh, look like this:



A few printers (such as Apple's discontinued LaserWriter SC models) connect through the SCSI port on the Macintosh.

Loading Printer Driver and Port

Once you have established the physical connection between the Macintosh and the printer, you must load the correct printer driver. The printer driver is selected in the Chooser. Apple printer drivers (at least the Apple printers which existed when your Mac was made) should already be in the System folder. Look in the Chooser to see if the type and model of your printer is listed. If it is, click the correct one.

If it isn't, you'll need to load (or install) the printer driver program into the Macintosh to get its icon displayed in the Chooser window. Place the printer driver disk that came with your computer into the disk drive or use the installer. Click Customize and select the printer software you need. Open the disk (once it's displayed on the screen) and drag the icon for your printer into the System folder on your startup hard disk or disk. This will add the information your Mac needs to communicate with the printer.

Use the Chooser to select the printer driver that corresponds to your printer. (The icons on the Chooser window show the printer drivers stored in the Macintosh System folder.)

For printers directly connected to the Macintosh, you must also select the port to which the printer is attached. Specify whether the printer is connected through the printer port or the modem port by clicking the appropriate icon. This will activate the correct port, as shown in Figure 8-4.

The screen icons in Figure 8-4 indicate the printer drivers loaded in the System folder and the printer and modem ports. The ImageWriter driver and modem port have been selected in this figure. In addition to Apple

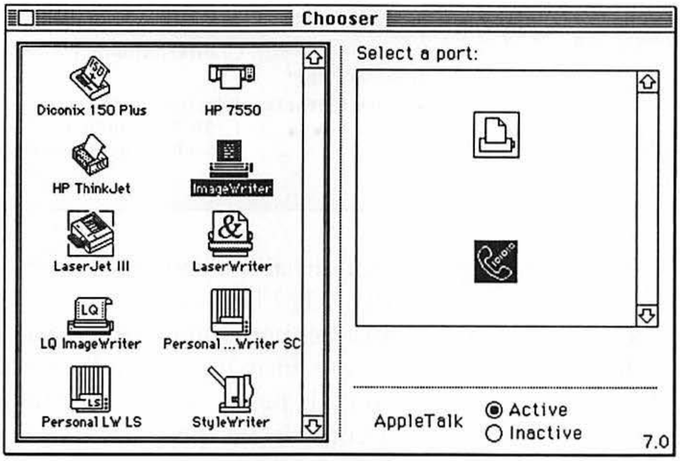


FIGURE 8-4
Chooser window printer driver and port selection icons

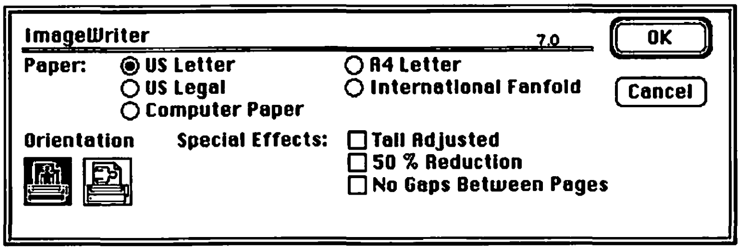
printer drivers, the Chooser window shows that drivers for a Hewlett-Packard (HP) ThinkJet printer, LaserJet III printer, and 7550 plotter, and a Kodak Diconix 150 Plus ink-jet printer, are also stored in the System folder.

An AppleTalk laser printer is chosen in a similar way. Click the appropriate icon. The names of all of the printers connected to the AppleTalk network appear in a list on the Chooser window. Select a printer to use by clicking its name in the list. Your printout jobs are then sent over the network to printer.

CHANGING PAGE SETUP

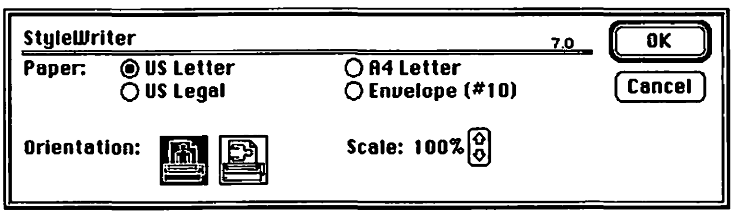
Each time you select a different type of printer, you must go through each application's Page Setup again. To do this, use the Page Setup dialog box. Select it from the File menu. The dialog box allows you to select paper size, page orientation, and other page printing options specific to your printer. The options are turned on or off by clicking the dialog box buttons or pop-up menus. Some application programs also have additional setup options in the Page Setup dialog box. Selections remain in effect until you change them. You can change them each time you print, or at any other time.

Here is the Page Setup dialog box used with the Apple ImageWriter II:



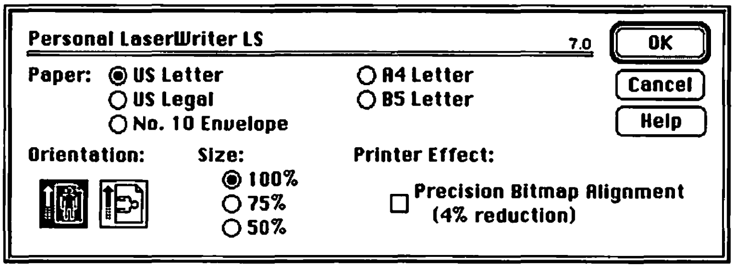
The dialog box paper buttons allow you to set the page size to print on 8 1/2 by 11-inch U.S. letter, 8 1/2 by 14-inch U.S. legal, or 8 1/2 by 11 2/3-inch A4 (European-size) letter paper, and on continuous or fanfold papers. The Orientation mode icons format printout to portrait (tall, vertical) or landscape (wide, horizontal) pages. Special Effects buttons adjust page images. Tall Adjusted corrects the proportions of graphics printed in portrait mode, the 50% Reduction setting prints page images at half size, and the No Gaps Between Pages button eliminates gaps between pages during continuous form printing.

The StyleWriter only prints on single sheets or envelopes. Its dialog box therefore eliminates the continuous and fanfold options found on the ImageWriter Page Setup dialog box, as shown here:



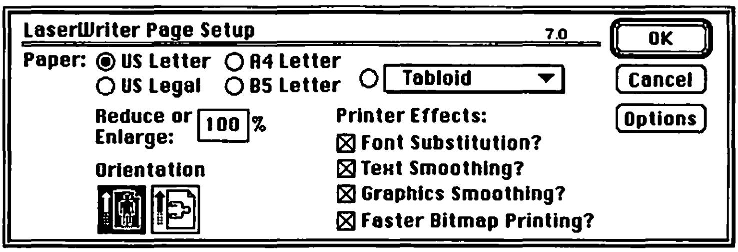
A new paper selection button is included to adjust printout for a business-size (#10) envelope. The scale control allows you to reduce printout image sizes from 100 percent down to 20 percent of the original, in 20 percent increments.

The Personal Laserwriter LS dialog box adds a B5 Letter option to the paper selection buttons:



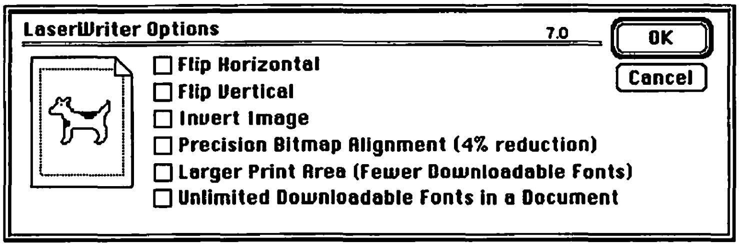
The B5 Letter option adjusts printout images for a 6 by 10-inch European letter page size. Size options provide for printout at 100 percent, 75 percent, or 50 percent of original. The Precision Bitmap Alignment button improves the quality of graphic images by reducing the printout to 96 percent of normal size. This eliminates minor printout distortions caused by differences between the image resolutions of the display screen and the laser printer.

The LaserWriter dialog box adds a Paper pop-up menu box:



You use the box to select additional Tabloid, Envelope, and other paper size options. Image Reduce or Enlarge settings can scale printout from 25 to 400 percent. The Printer Effects buttons enhance print quality and printer speed. Font Substitution replaces certain Mac fonts with LaserWriter-stored font equivalents. The substitution speeds up printing because the fonts reside in printer memory. Smoothing improves the printout appearances of fonts and graphics for some application programs, but it might have to be turned off when you're printing scanned images. Faster Bitmap Printing speeds up almost all printout jobs. It should only be turned off in rare instances when the page won't print. The Options button calls up another dialog box.

The LaserWriter Options dialog box provides you with a number of other printout options:



The Flip Horizontal button reverses the page image left to right. Flip Vertical reverses the page top to bottom, or turns the page upside-down. (If you want a 90-degree flip, change the Orientation option on the main dialog box to landscape.) The Invert Image button prints a negative, a white-on-black and black-on-white reverse image. Precision Bitmap Alignment reduces the image size 4 percent for better quality. The Larger Print Area button expands the printout area, but also limits the number of fonts you can use. The printer uses more of its memory for the page image and less for fonts. The page therefore may print more slowly if it contains a number of different fonts. The Unlimited Downloadable Fonts in a Document button uses more of the memory for fonts and less for page image. Using this option may slow printing down for big or heavily formatted page images.

Other Apple or non-Apple Macintosh printers and plotters will have similar Page Setup dialog boxes.

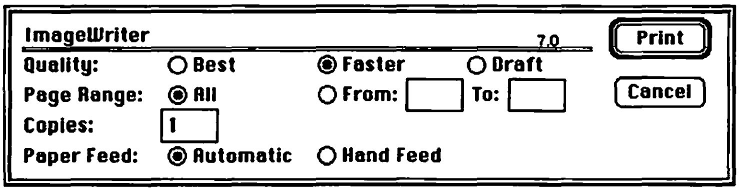
PRINTING DOCUMENTS FROM THE FINDER

You usually print from within (while using) an application program. But you can also print documents directly from the Finder. Printing from the Finder allows you to print without the delay of starting the document application.

Choose the Print command from the File menu to print from either an application or the Finder. The Print command opens up a Print dialog box that corresponds to the type of printer used. Specify printing options such as the number of copies to print, the range of pages to print, and so on. (You'll see this dialog box often—if you print often.)

If you are printing graphics, you should click on Black & White, which will turn off Color/Grayscale.

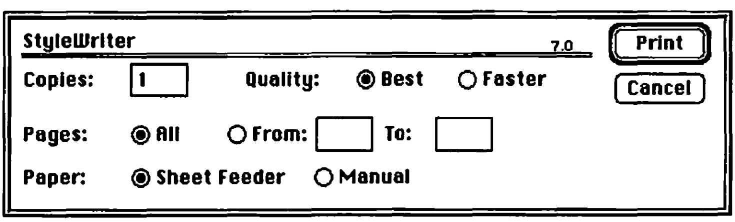
The Quality buttons options in the ImageWriter Print dialog box, shown here, allow you to print in Best mode for the highest-quality printout; printout speed in Best mode will be slow, however.



The Faster mode prints at a higher speed with medium resolution. Draft mode prints the quickest, but it uses only one font and size, and printout quality is the poorest. Page Range options let you print all of the pages in a document, or a range of pages. (If you want to print just one page, enter the number of the page that you want to print in both the From: and To: boxes.)

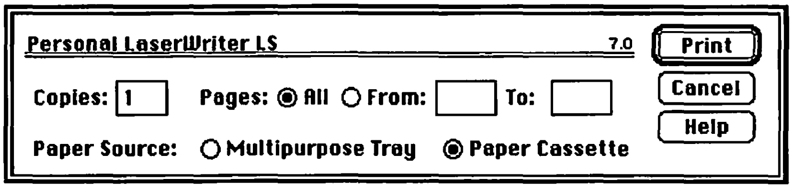
Enter the total number of document copies you want to print in the Copies box. The Paper Feed buttons set the printer for Automatic paper feed using continuous or fanfold paper or an option automatic sheet feeder. Select the Hand Feed button for manually feeding single sheets of paper or an envelope. After making your selections, forward the document to the printer by clicking the Print button or pressing the RETURN or ENTER key on the keyboard.

The StyleWriter has two Quality buttons, as shown in its Print Dialog box:



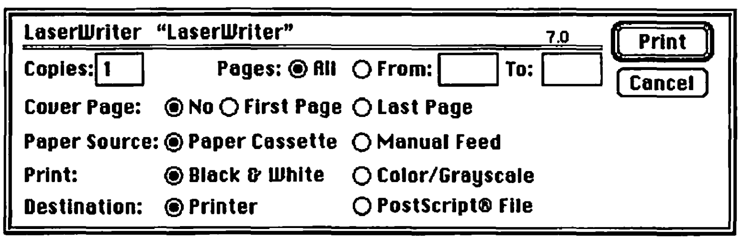
Clicking the Best button produces laser-like quality printout but does it slowly, at about 1/3 ppm. Using the Faster mode doubles printout speed at the expense of copy quality. Paper buttons set the ink-jet printer to print on sheets fed from an automatic sheet feeder or on hand-fed sheets or envelopes.

You can select the number of printout copies, the pages to be printed, and the paper feed source using the basic Personal LaserWriter dialog box:



You might encounter other print options if you are printing from within an application program. For example, while using a word processing program, you might see buttons that give you the option to print in last-page-first, first-page-last, or reverse order. A flip tray on the LaserWriter delivers finished pages face-up or face-down. Selecting reverse-order printing on the Print dialog box delivers printout in correct first-page-first order when the printer tray is in the face-up position.

You have a number of new options on the LaserWriter Print dialog box, shown here:



You can print a cover page with your document. The cover page contains information such as the name of the document, who printed it, when it was printed, and for whom it was printed. Select Color/Grayscale to print in shades of gray on the LaserWriter. You can also print in colors on a PostScript color printer that employs a LaserWriter driver. If you send a color document to the LaserWriter, it will produce a black-and-white halftone image. The image will approximate color shades with a varying pattern of dots. The Black & White setting prints in monotones, and printing is faster. Destination options send the print images to the printer or to a PostScript file. The file can be stored on a disk and printed later.

Other printers and plotters have similar Print dialog boxes.

BACKGROUND PRINTING

A large or complex document can take time to print, tying up your Macintosh. Usually, the print job must finish before any other work on the Mac can be done. Background printing is a way to speed things up and continue to work.

In order to use background printing, you must have a utility program called PrintMonitor in the Extension folder. The Extension folder, in turn, must be in the System folder of your startup disk or diskette.

The PrintMonitor is found on the Printing disk supplied with your system software. Install it by dragging the PrintMonitor icon, shown here:

to the Extension folder. With the PrintMonitor installed, turn on Background Printing by clicking the button in the LaserWriter Chooser window. Background Printing will now take effect whenever you print with the LaserWriter.

MANAGING YOUR PRINTING

With background printing turned on, the PrintMonitor alerts you if the printer is out of paper or if it needs a paper change for a special print job. It will also inform you if the Macintosh is too low on memory to perform a print job.

The PrintMonitor application has an option to control printing operations. (Because the PrintMonitor works in the background, many Macintosh users don't even know it exists.)

With the PrintMonitor, you can do the following:

- find the name of the document currently printing and the LaserWriter it's in the process of printing to

- find the names of other documents waiting to be printed (in the print queue), their print order, or the time they're scheduled to be printed
- change the print order of documents (you can even bump yours ahead of others)
- discontinue a document's printing or delete it from the schedule
- set or change the time the document will be printed

You can access the PrintMonitor by clicking its icon in the Extension folder (the System folder, for System 6 users). Alternatively, you can choose it from the Application menu after you have started to print a document. The PrintMonitor window, as shown in Figure 8-5, is used to monitor or control printing operations.

FONTS AND THE PRINTER

Fonts are automatically transferred from the Macintosh to the printer along with the document at the start of a print job. A LaserWriter will start to print sooner if the document fonts are already in memory. Some

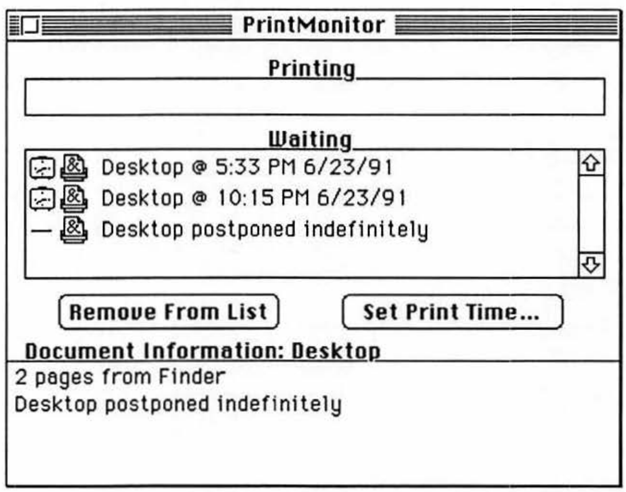


FIGURE 8-5
PrintMonitor window

LaserWriters come with fonts built into ROM, but all of the fonts shown in the Mac Font File may not be in the printer's ROM. Speed things up by manually downloading additional fonts to printer RAM before you print.

Manual Font Downloading

If you manually download fonts to the printer, the fonts remain in RAM while the printer is on. When you turn it off, these fonts are lost. The next time you want to print these fonts, you'll need to download them all over again. The fonts use up RAM the printer might need to store document text and printout instructions.

Manual downloading to RAM makes sense when you print a number of documents with the same fonts or when a single document is printed repeatedly for proofing revisions.

Hard Disk Drive for Fonts

Font loading on the LaserWriter II NTX is improved with an optional hard disk drive. The drive will increase the space available at the printer for font storage. Fonts are stored on the disk permanently (or until you remove them), so you won't need to download fonts each time the printer is turned on. Storing fonts on an optional hard disk drive also frees up more disk space on the Macintosh for your application programs and files.

Use the LaserWriter Font Utility program to download fonts from the Macintosh to printer memory or disk.

Adobe, one of the leading font manufacturers, offers a hard disk drive especially for fonts. This drive, called the Adobe Font Folio, contains all but the very newest Adobe Fonts (there are over 200 fonts to choose from). The price is high—in the $16,000 range.

CHAPTER 9

FONTS

If you want to learn about Macintosh font technologies, this is the chapter for you. Two basic font technologies are available to Macintosh users: bitmapped and outline. Interpreters (like QuickDraw, PostScript, TrueType, and Adobe Type Manager) make them work. This chapter covers font installation in Macintosh systems running either System 6 or 7. It's also about how to take advantage of TrueType technology without installing System 7.

A BRIEF HISTORY OF TYPE

Until the fifteenth century, books and other documents were copied painstakingly by hand. This could take years to produce.

In the mid-1400s, a goldsmith named Johannes Gutenberg developed a method for casting characters in metal. These individual metal letters could be set by hand in lines of text. Trained *compositors* (people who set type) could produce a quarter of a line each minute. The box of type was inked and pressed against paper as each page of lines was completed. Then the type was sorted and put away so it could be used for another page. Only a limited number of characters were available. Gutenberg's invention of movable type was a major advance over handwritten manuscripts. Although tedious by today's standards, movable type remained the dominant method of printing for over 400 years.

The Linotype, introduced in the late 1880s, was the next major typesetting innovation. The Linotype mechanized composition. It used a keyboard to enter text. Molds moved into place in a row as characters were typed on the keyboard. The row of molds was filled with molten metal when a line of text was finished. An entire line of type was cast at once. When the line of type was finished, the molds automatically returned to their places in a storage case so that compositors never ran out of characters. The Linotype increased the speed of the typesetting process. A good compositor could set about seven lines a minute.

In 1949, the *Photon* was introduced. The Photon replaced metal type with a film master incorporating the type design. Light flashed through the master and exposed an image of the characters onto photographic paper. An enlarging lens changed the size of type as desired. When the Photon went into commercial use in 1954, the publishing industry began a shift toward this method, called photocomposition. It was the fastest of the available technologies and could produce 50 lines a minute.

Digital phototypesetters, introduced in 1972, use a digital representation of the type design rather than a film master. Characters are generated with dots of light and projected onto photosensitive paper. Letters can be retrieved faster than with any other typesetting method and the masters never wear out. A full magazine page could be set in 15 seconds. This innovation advanced typesetting still further.

Macintosh computers use a variety of digital type technologies to produce quality textual images on screen and paper. Thousands of typefaces are available. But before we go any further, let's take a moment to understand fonts.

FONTS VERSUS TYPEFACES

Although the terms *font* and *typeface* are often used interchangeably, there is a difference between them. The word *font*, which has its roots in the word *foundry* (the place where type was cast), refers to a collection of type of the same size and style. A *typeface*, on the other hand, is a family of fonts that share a common design but vary in size, weight (that is, darkness), and style. Times Roman, Times Bold, Times Italic, and Times Bold Italic are each fonts. Together, they make up the Times typeface.

Modern typesetting makes it easy to vary a font's characteristics. The original meaning of the word *font* has become somewhat irrelevant. Still, each font is separately identified in the Macintosh's System file.

FONT TYPES

There are two basic types of fonts used on a Macintosh: bitmapped and outline. Outline fonts are further broken down into two types: PostScript and TrueType. Since your Macintosh may use almost any combination of these fonts, you should know more about them.

BITMAPPED FONTS

Imagine the Macintosh screen as a grid made up of tiny dots called *pixels* (short for picture elements). Each square inch of the screen is 72 by 72 pixels. Images are displayed by turning these pixels on or off. A *bitmap* of a character maps out which pixels need to be turned on or off, as shown in Figure 9-1. This is the simplest way to digitally record a character.

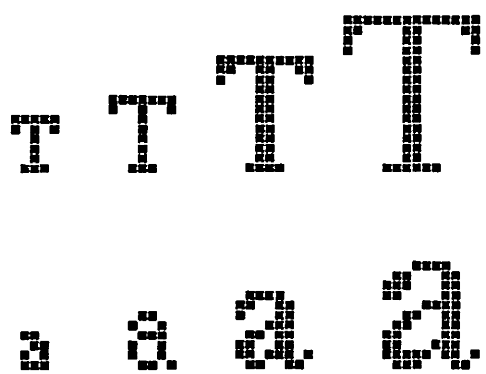
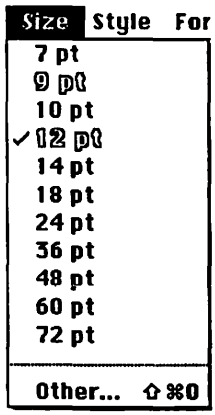


FIGURE 9-1

Bitmaps of two Times font characters at 9, 12, 18, and 24 points

To display characters clearly on a Macintosh screen using bitmapped fonts, each desired font size must be installed in the System file. These fonts are hand-tuned, pixel by pixel, to be as readable as possible on the screen while retaining the typeface characteristics. Figure 9-1 shows the bitmaps of the same two characters in four different sizes. The application software typically indicates which font sizes are available by highlighting them in the font size menu like this:



If the necessary font size is not available, the Macintosh generates the desired characters by performing calculations on the next closest size. Since a bitmap records the specific dot layout necessary to form a shape, it cannot be resized with good results. The resulting characters have ragged edges, a condition commonly known as the *jaggies*. Here is an example of a 24-point bitmap resized to 72 points:

Bitmapped fonts were designed primarily to display text on a screen, which is why they are also commonly known as *screen fonts*. Bitmapped fonts are also used to print on QuickDraw printers, which rely on the Macintosh's built-in imaging software to generate bitmapped characters for printing. Because printer resolution, measured in *dots per inch* (dpi), is greater than the Macintosh screen, some printers use larger bitmaps to print. For example, the LaserWriter IISC has a resolution of 300 dpi—approximately four times the Macintosh screen resolution. To print clearly on a LaserWriter IISC, the Macintosh looks for a font four times the desired size. It compresses the font without reducing the number of dots. The printed characters are the same size as the screen font, but there are four times as many dots per inch. Resolution is better. The same basic concept applies to the ImageWriter II, which has a resolution of 144 dpi. Other printers get bitmapped images from either PostScript or TrueType fonts.

Very large bitmapped fonts are not easy to come by. When these fonts are found, they require large amounts of disk space to store. (The Times font supplied by Apple with the LaserWriter IISC printer in 12 point sizes from 9 to 96, for example, takes up 368K of disk space.) The alternative is to let the Macintosh generate its own versions of large fonts the same way it can for screen display. The result, again, is the jaggies. A *text smoothing* option (available in the Page Setup or Print dialog boxes of many applications) may slightly improve the appearance of the printed font.

There is another alternative for clear screen and non-PostScript printer output. *Adobe Type Manager* (ATM) uses PostScript outline fonts to produce bitmapped fonts on demand. But before looking at ATM, let's see what outline fonts are all about.

OUTLINE FONTS

Outline fonts use mathematical equations—rather than maps or pixels or dots—to define the boundaries of each character. The pixels whose centers fall within the boundaries are turned on while the others remain off. The outline formula can be scaled to generate characters of virtually any size. Only one outline per character is required on disk.

Determining which pixels to turn on or off is not always a clear-cut matter. The problem becomes worse on devices with resolutions of 300 dpi or less, such as a LaserWriter printer or Macintosh screen. That's where hints come in. *Hints* are rules or instructions for adjusting a character's outline to create the best possible image at low resolutions. The outline changes as necessary, and different pixels are turned on or off. The hints, when present in the font definition, are processed with the rest of the font information by the font interpreter.

The main outline font technologies are PostScript and TrueType.

PostScript

PostScript was developed by Adobe Systems in 1985. PostScript fonts and graphics are described mathematically as outlines based on Bezier curves. The ability to handle both text and graphics is what makes PostScript a powerful desktop publishing tool. With it, an illustrated document can be created in a page layout program without treating text and graphics as separate elements.

To print PostScript fonts, the font must be made available to the printer in one of three ways:

- *Built-in* Most PostScript printers include a variety of built-in fonts. They are permanently stored in the printers read-only memory (ROM). ROM-resident fonts are accessed almost immediately by the printer.
- *Stored on printer's hard disk* Some printers have hard disks for the storage of fonts. Fonts are loaded into the hard disks with special utility software and remain there until removed. The fonts are loaded from the printer's hard disk to the printer's RAM as needed. Fonts stored on the printer's hard disk are accessed quickly, but not as quickly as ROM-resident fonts.
- *Downloaded to printer's RAM* Fonts can be manually or automatically downloaded from the Macintosh to the printer's RAM as needed. When manually downloaded with font utility software, fonts remain in RAM until the printer is restarted. When automatically downloaded by the Macintosh, fonts remain in RAM only until printing is done, usually one page at a time. The fonts must be downloaded again for each page. In either case, downloading fonts to the printer is the slowest way to make them available. Each font download can take up to 20 seconds.

PostScript fonts are also commonly known as printer fonts. They are normally used by the printer rather than the computer. Bitmapped versions of PostScript fonts are still required for screen display (and the jaggies are still possible). In fact, if at least one bitmapped version of a font is not included in the System file, the font cannot be accessed from a Font menu.

Type 1 and Type 3 There are two types of PostScript fonts: Type 1 and Type 3. The names were assigned by Adobe Systems as each separate technology evolved. Type 2 did exist for a short while, but it was abandoned by Adobe.

Type 1 fonts are generally higher quality fonts. They usually contain hints to improve images on low-resolution printers. Until 1990, Type 1 specifications were a proprietary secret of Adobe. All other font producers were forced to use the older, lower quality Type 3 technology. Since the release of the specifications, however, font producers have steadily converted their Type 3 fonts to Type 1.

Type 3 fonts are still required for use with some older printers such as the original Apple LaserWriter. They were designed before the development of Type 1 technology. They may also be required for use with some older font editing applications. Generally speaking, Type 1 PostScript fonts are the preferred format.

Adobe Type Manager Adobe Type Manager (ATM) is a product of Adobe Systems. ATM uses the PostScript language to automatically generate bitmapped fonts of any size based on PostScript Type 1 fonts. With ATM, the Macintosh can clearly display a screen font without a bitmapped font of that size installed in the System file. (At least one size of the bitmapped fonts must reside in the System file for the font to be accessed.) The same clarity is available for fonts printed on non-PostScript printers. ATM prevents the jaggies without adding bitmapped fonts to the System file.

TrueType

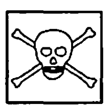
TrueType is a new outline font technology developed by Apple Computer as an integral part of System 7. In March 1991, it was made available separately from System 7. Apple released it with two low-cost Apple printers, the StyleWriter and Personal LaserWriter IISC. TrueType is available for System 6.0.7 as an INIT to add to the operating system. (An *INIT* is part of the operating system, which gets loaded when the system is *initialized*.) For System 7 it's part of the operating system.

TrueType outline fonts are based on quadratic curves, which are defined by quadratic equations. The Macintosh calculates these more quickly and easily than other outline font equations. Other curve types, like PostScript's Bezier curves, are easily translated to quadratics. Font vendors are rapidly converting their font libraries to TrueType format with conversion software. New font utility applications enable Macintosh users to do their own conversions. Font conversion software is discussed in greater detail later in this chapter.

A major benefit of TrueType fonts is that they do not require separate screen and printer fonts. TrueType handles both duties. This cuts the amount of disk space needed to store fonts. It also eliminates the need for additional utilities like ATM (although the TrueType INIT is still required for System 6.0.7 users).

WHICH FONTS SHOULD YOU USE?

By now, you probably want to know which type of font you should install and use on your Macintosh. There are differences between these font types, both on screen and when printed, as shown in Figures 9-2 *a, b,* and *c.* It appears that bitmapped screen fonts still have an advantage over the two types of outline fonts. Yet, there is no clear winner for best printouts on a 300 dpi laser printer.



Differences in character thicknesses from one font type to the next can change the appearance of your document when printed with a different font type. For example, say you create a document with a bitmapped screen font. Later you print it with the TrueType version of the same font. You may notice differences in word wrap. (This is illustrated later in the chapter in Figure 9-6.) This might also occur if you create a document at home with a screen font, and then bring the disk containing the document to work to print it. If you used tabs the document would be a mess. Spaces can be misaligned as well, although they're usually better than tabs.

Fortunately, you do not need to decide on any one font technology. You can use any or all of these font types if you like. As we have seen, your Macintosh screen clearly displays bitmapped fonts (if the desired sizes are installed), PostScript fonts (if ATM is used), and TrueType fonts (under System 7 or with the TrueType INIT). PostScript printers clearly print both PostScript and TrueType fonts. Non-PostScript printers clearly print TrueType fonts, as well as ATM-interpreted PostScript fonts.

Not all typefaces are available in all font formats. Until they are, you can mix and match font types as necessary to meet your specific needs.

ABOUT THE ...

A Word About Interpreters

None of these font types could work without their respective interpreters. Let's take a closer look at the differences between them.

Up until System 7, the Macintosh operating system relied on QuickDraw to display fonts on the screen. QuickDraw is limited in its capabilities. It can pull required bitmaps from the System file, scale them to different point sizes if necessary (with questionable results, as you have already seen), and display them. QuickDraw can also generate the styles found in many Font Style menus: bold, italic (actually oblique, as you'll see later), shadow, and outline. To print on QuickDraw printers such as the ImageWriter II and LaserWriter IISC, QuickDraw performs the same basic chores. All this is done within the computer.

PostScript, on the other hand, resides in the ROM of PostScript printers. PostScript is a *page description language,* able to produce an entire page of information at a time. A PostScript printer or imagesetter is actually a computer in itself. It contains a microprocessor and at least one megabyte of RAM. Here, it stores page images prior to printing. PostScript uses a *raster image processor* (RIP) to convert the font outlines within the printer's memory to the bitmaps ultimately needed for printing. ATM is a subset of the PostScript interpreter. It does its work within the Macintosh rather than in the printer. It produces smooth bitmaps at any size based on the outline fonts. These bitmaps can then be used by QuickDraw.

TrueType, available either as an INIT for System 6.0.7 users or incorporated into System 7, works much like ATM. TrueType interprets font instructions within the Macintosh and scales them on the fly. The resulting bitmaps are then sent to the printer to print.

TrueType fonts can also be printed on PostScript printers. When a job is sent to a PostScript printer, the printer driver checks the printer's ROM, RAM, and hard disk (if present) for PostScript fonts. If no PostScript fonts are found, the driver then checks the Macintosh's System folder for PostScript fonts to be downloaded to the printer. If PostScript fonts are still not found, the Macintosh sends TrueType fonts to the printer in a format the printer will understand. The printer's PostScript interpreter scales the fonts as necessary and prints the job. All of this takes place independent of the user.

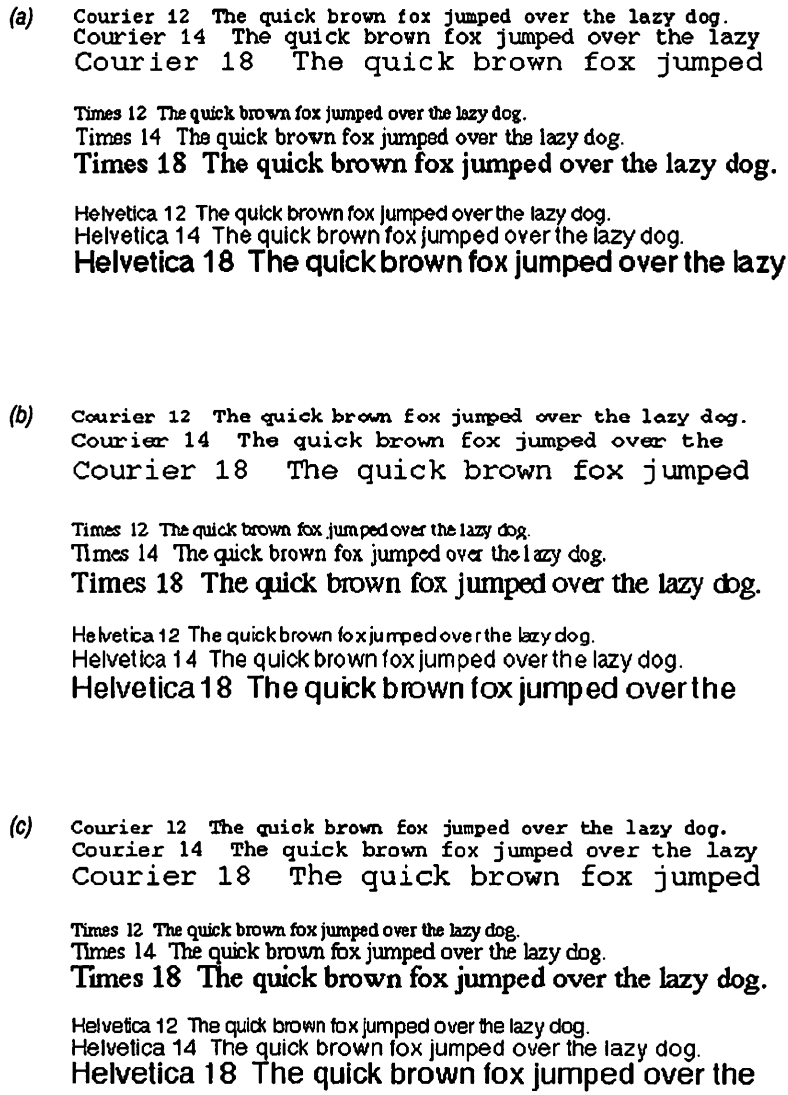
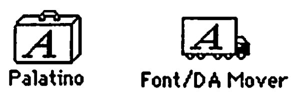


FIGURE 9-2

Comparison of (a) bitmapped, (b) PostScript (with ATM), and (c) TrueType fonts on screen

BITMAPPED AND TRUETYPE FONT INSTALLATION

Bitmapped and TrueType fonts come in suitcase files. A *suitcase file* is a document created with a program called Font/DA Mover. Suitcases normally contain a number of fonts or desk accessories. The suitcase and Font/DA Mover icons look like this:



Since the Macintosh was first introduced, fonts were always installed from suitcase files into the System file. Installation was with a program called Font/DA Mover. Apple provided Font/DA Mover as part of the System software. With the release of System 7, this changed. Now Macintoshes running System 7 can install fonts directly into the System file without additional software.

When you use Apple's System Software Installer, as described in Chapter 3, "Putting Your Mac Together," some fonts provided by Apple are automatically installed into your System file. Additional fonts are available through commercial and shareware sources. To use them, you need to know how to install them in your System file. This section provides step-by-step instructions for bitmapped and TrueType font installations for both Systems 6 and 7.

SYSTEM 6

A System version prior to 7 requires more work to install fonts than the System 7's counterparts. Any bitmapped or TrueType fonts must be installed with Font/DA Mover. If you plan to use TrueType fonts, you also need to install the TrueType INIT. Neither of these steps is difficult.

Font/DA Mover

Font/DA Mover is required to install bitmapped or TrueType fonts in the System file of any System version prior to 7. This program is used to open font suitcases. It also copies the font files from the suitcase into the System file. It is used to delete fonts from suitcases or the System file.

Finally, it may copy or delete desk accessories, as discussed in Chapter 6, "Operating Systems and Utilities."

If you plan to use TrueType fonts with System 6.0.7, you must use version 4.1 of Font/DA Mover. Version 4.1 is provided on the two-disk TrueType disk set distributed by Apple. Earlier versions of Font/DA Mover cannot recognize TrueType fonts.

Installing Font/DA Mover on Your Hard Disk Font/DA Mover is provided by Apple on the System disks. If you expect to install and delete fonts and desk accessories frequently, you may want to copy the Font/DA Mover application to your hard disk.

1. Locate the disk with Font/DA Mover on it. Insert it in your disk drive. Open it by double-clicking it.

For System 6, you can find Font/DA Mover on the Macintosh Utilities disk 2.

2. Drag the Font/DA Mover icon from the Utilities disk window to the hard disk icon or into the hard disk window.

Dragging the Font/DA Mover icon from one disk to another copies the file. A message appears on the screen to show the progress of the copy. When it disappears, the copy is complete.

3. Drag the Utilities disk to the Trash icon to eject it. Store the disk in a safe place with the rest of your System software disks.

Now that Font/DA Mover is installed on your hard disk, you do not need to use the Utilities disk to install fonts.

In addition to these steps, you may want to create a separate folder for utilities and drag Font/DA Mover into it.

Installing Fonts The following instructions copy the bitmapped fonts from a suitcase called Palatino to the System file.

1. Double-click the Font/DA Mover application icon to start it.

To start Font/DA Mover, either double-click its icon or double-click a document that it created—like a font suitcase. There is a difference between these methods. When you double-click the Font/DA Mover application icon, Font/DA Mover starts and opens the System file. When you double-click a font suitcase icon, Font/DA Mover starts and opens that suitcase rather than the System file.

When Font/DA Mover starts, the screen looks like the one shown in Figure 9-3.

The scrolling window on the left displays the fonts currently installed in your System file. (Your list may not look exactly like the list shown here because your System file may have different fonts installed in it.) Beneath the window is the name of the open file, System, followed by the name of the disk it is on, Aurora.

Notice the two *radio buttons* for Font and Desk Accessory at the top of the window. Font/DA Mover starts with Font selected by default. To work with desk accessories, simply click the Desk Accessory button.

2. Use Open to find and open a font suitcase containing the fonts that you want to install.

Click Open, which is located under the scrolling window on the right. The Open dialog box will appear. Use this dialog box to locate the font suitcase file you need.

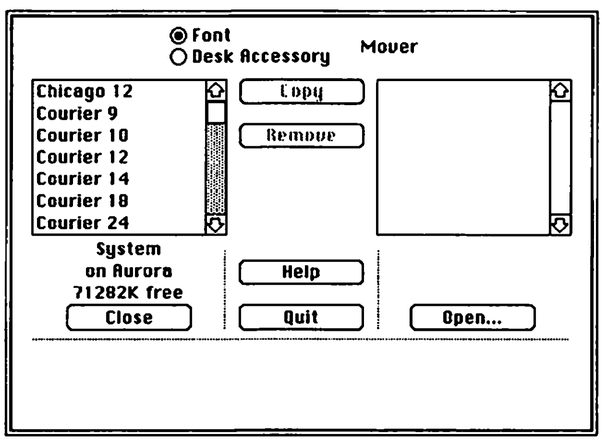


FIGURE 9-3
The Font/ DA Mover dialog box

To open the file, double-click the filename or select the filename and click Open. The Font/DA Mover dialog box shown in Figure 9-3 reappears with its right window filled with the names of the fonts included in the suitcase you opened. Notice that each font size is listed separately.

3. Select the fonts you want to install.

To select the fonts you want to install, click them. When you click a font, a sample of it appears in the bottom of the window.

To select more than one font, hold the SHIFT key and click. The total size of the selected fonts appears in the space between the two scrolling windows.

4. Click Copy to copy the selected fonts from one file to the other.

Click Copy to install the fonts you selected into the System file. If MultiFinder is active, the fonts you are installing may not be recognized by your software until you restart. Your Macintosh will display a message box telling you this; if this message appears, click OK.

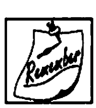
The mouse pointer may momentarily turn into a wristwatch. When the pointer reappears, the copy is complete. Scroll down in the left window of the Font/DA Mover dialog box. You will see that your fonts have been installed.

5. Click Quit.

Clicking Quit will remove you from the Font/DA Mover dialog box. If MultiFinder is active, you have to restart your Macintosh in order to use these newly installed fonts.

Removing Fonts Font/DA Mover is also required to remove fonts from the System file or a suitcase. Follow these steps:

1. Double-click the Font/DA Mover application icon or a font suitcase to start Font/DA Mover.



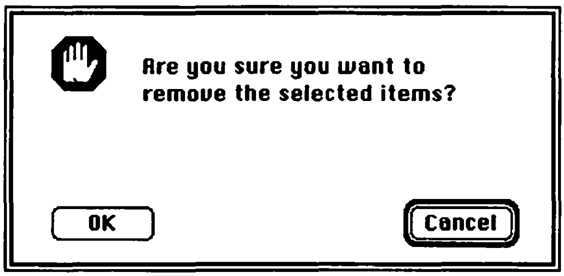
When you double-click the Font/DA Mover application icon, Font/DA Mover starts and opens the System file. This is convenient if you plan to remove fonts from the System. It may be more convenient to double-click a suitcase if you want to remove fonts from that suitcase.

2. Select the fonts you want to remove.

To select the fonts you want to remove, click them. Remember to hold the SHIFT key while clicking to select more than one font.

3. Click Remove to remove the selected fonts from the System file or suitcase.

Clicking Remove will delete the fonts you selected. But first, you'll see the following dialog box:



Click OK to remove the fonts; click Cancel if you change your mind.

If MultiFinder is active, you cannot remove fonts from the System file. Your Macintosh will display a message box to inform you of this; if this message appears, click OK and quit Font/DA Mover. Restart the Macintosh with Single Finder rather than MultiFinder and try again.

4. Click Quit.

Quit Font/DA Mover. When you remove fonts through this process, they are actually deleted. If you do not have a copy of the font stored on disk, the font is lost. Instead of deleting your only copy of a font, consider copying it to a new file. To do this, use the installation procedure outlined above. Click New in the Open dialog box to make a new suitcase file for the copies.

TrueType INIT (System 6.0.7 Only)

The TrueType INIT allows Macintosh users running System 6.0.7 to use TrueType fonts. It is distributed on the TrueType disk set by Apple.

This two-disk set is available at Apple dealers, through online services like America Online, CompuServe, and GEnie, and through authorized computer bulletin board systems (BBSs). The disk set contains the TrueType INIT, version 4.1 of Font/DA Mover. Some TrueType fonts and various printer drivers and tools are also included.

The following steps guide you through the TrueType installation procedures. (If you are using System 7, these steps are unnecessary; TrueType is already incorporated into System 7.)

1. Insert the TrueType Fonts & Software disk into your disk drive and double-click to open it.

Inside the window, there are five items including the TrueType INIT, Font/DA Mover, and a font suitcase.

2. Drag the TrueType INIT icon to the System folder.

3. Replace your existing copy of Font/DA Mover with the version on the TrueType Fonts and Software disk.

If an earlier version of Font/DA Mover is on your hard disk, it must be replaced. Drag the Font/DA Mover icon on the TrueType Fonts and Software disk to the disk or folder containing your current copy of Font/DA Mover. You should get a message that asks you if you want to replace existing items with the new items of the same name. Click Replace to replace the old version with the new one.

4. Use Font/DA Mover to install the TrueType fonts to the System file and remove any unneeded fonts.

Follow the font installation instructions listed previously. You should notice one major difference. Because TrueType fonts do not come in a variety of sizes, there are no sizes listed beside each TrueType name.

In addition to installing the TrueType fonts, you should remove the bitmapped versions that are no longer needed. Again, the same instructions provided earlier apply. When you are finished, quit the Font/DA Mover dialog box.

5. Insert the TrueType Printing Tools disk into your disk drive and double-click its disk icon to open it.

This disk contains printer drivers and other utilities necessary to take advantage of the features of TrueType.

6. Drag the appropriate printer driver icon (or icons) to your System folder.

If you use any type of ImageWriter printer, drag the appropriate icon (or icons) from the TrueType Printing Tools disk window to your System folder. If you use any kind of LaserWriter or other PostScript printer, open the LaserWriter software folder and drag the contents to your System folder.

7. Restart the Macintosh.

Restarting activates the TrueType INIT. The TrueType fonts are now recognized and used by the System.

SYSTEM 7

System 7 dramatically changed the way fonts are installed in the System file. Font suitcase files can now be opened to display their contents, and fonts can be dragged in and out of them. Installing bitmapped or TrueType fonts is as simple as dragging them to the System folder. The System software automatically installs the fonts into the System file. The System file can also be opened to remove or view fonts.

Opening Suitcases

Under System 7, you can open a font suitcase by double-clicking it. The separate font files are displayed. An example is shown in Figure 9-4.

A close look at the icons for each file shows a difference between the TrueType and bitmapped font file icons. The TrueType font icon has the letter *A* repeated on it. The bitmapped font icon has only one letter *A* on it. The names of bitmapped font files also reflect the size of the font.

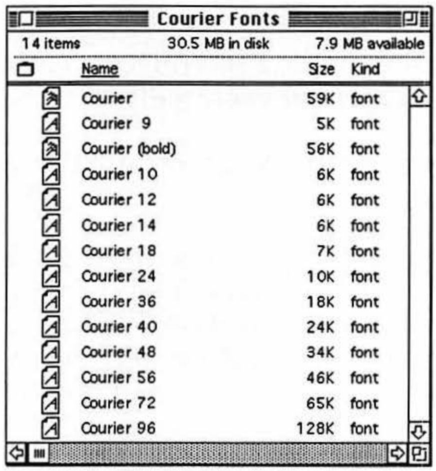


FIGURE 9-4
Open suitcase file window

Opening Font Files

Under System 7, you can open font files to view the fonts they contain. Double-click the icon for a bitmapped font. A window like the one shown in Figure 9-5 appears. In this figure, the font size is 9 point, so the font is displayed in that size. A TrueType font file displays a number of sizes when double-clicked, as shown in Figure 9-6. In either case, instructions for installation are included in the bottom of the window.

Installing Fonts

Bitmapped and TrueType fonts can be installed in a System 7 System file in a number of ways:

1. Drag the font suitcase containing the fonts to be installed to the System folder.

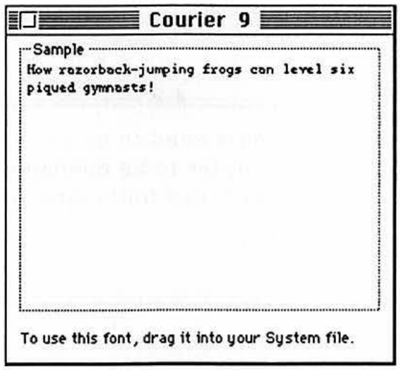


FIGURE 9-5
Open bitmapped font file window

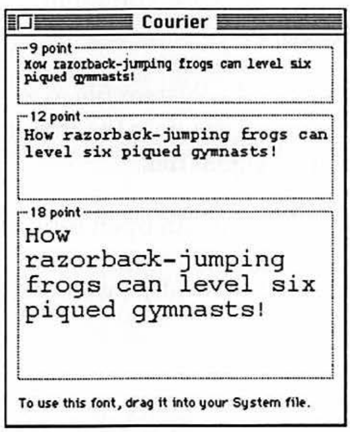
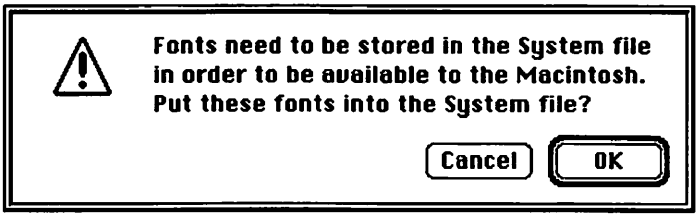


FIGURE 9-6
Open TrueType font file window

When you drag a font suitcase to the System folder, the Macintosh knows it must "unpack" the fonts and install them in the System file. The following message appears on your screen:



When you click OK, the Macintosh performs the installation.

2. Drag a font file from an open font suitcase to the System folder.

When you open a font suitcase and drag one of the font files to the System folder, the Macintosh knows to install it in the System file. A message box similar to the one just shown appears, asking if you would like the specific font put into the System file.

3. Drag the font suitcase containing the fonts to be installed onto the System file.

A closer look at the System file icon reveals it is a suitcase itself. When a font suitcase is dragged onto the System file icon, fonts are automatically installed into the System file.

4. Drag a font file from an open font suitcase onto the System file.

Again, this automatically installs the font into the System file.

Removing Fonts

Removing fonts is just as easy as installing them. Double-click the System file icon to open it, and then drag the unwanted fonts out. Font files can be stored in a separate folder for later use or dragged to the trash to be deleted.

If Another Application Is Open

You cannot change the contents of the System file if another program is running. System 7 always runs under MultiFinder. If another application is open when you try to install or remove fonts, a message box will appear to tell you that this is not possible. If this message appears, click on OK. Close all open applications before trying again.

INSTALLING POSTSCRIPT FONTS

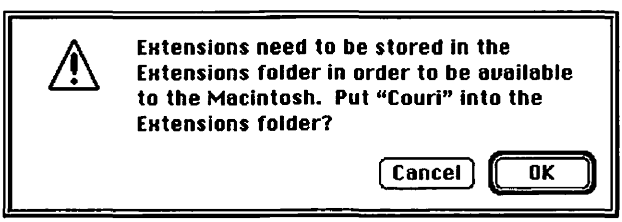
PostScript fonts do not come in suitcases. Instead, their icons look like this:

Adobe PS Font Icon   Other PS Font Icon

Installation of PostScript fonts is the same no matter which System software you are using. PostScript fonts are not installed in the System file. Instead, they are installed in the System folder.

1. Drag the PostScript font icon (or icons) to the System folder.

If you are running a System version prior to 7, installation of the printer fonts is complete. If you are running System 7, the following message appears on your screen:



Click OK.

2. Install bitmapped versions of PostScript fonts into the System file as outlined above.

Without a bitmapped or TrueType version of a font in the System file, the font cannot be accessed. If both TrueType and PostScript versions of a font are installed, the Macintosh uses the TrueType version.

INSTALLING ADOBE TYPE MANAGER

ATM consists of two files: an INIT/CDEV called ATM and a driver file. Driver files provide important instructions to printers and other output devices. Two driver files are included with ATM—they are ATM 68000 and ATM 68020/30—but only one needs to be installed. Use the ATM 68000 file for a Macintosh Plus, Portable, SE, or Classic. Use the ATM 68020/30 file for a Macintosh SE/30 or any Macintosh II computer.

Installation is generally straightforward, but there is a difference between installation for System versions 6 and 7.

System 6

Follow these steps to install ATM in any System version prior to 7:

1. Drag the ATM and ATM 68000 (or ATM 68020/30) files into the System folder.

2. Access ATM from the Control Panel option under the Apple menu.

Enter your name and organization, as prompted, to personalize your copy of ATM and click OK.

3. Restart the Macintosh.

ATM begins working immediately with the PostScript Type 1 fonts installed. Install other PostScript and corresponding bitmapped fonts as outlined in the previous sections.

System 7

Installing ATM in System 7 is a bit trickier. Follow these steps:

1. Drag the ATM and ATM 68000 (or ATM 68020/30) files into the System folder.

When you drag the ATM and ATM 68000 (or ATM 68020/30) files into the System folder, a message box appears telling you that some of the ATM files need to be stored in special places in the System folder. When you click on OK, the Macintosh puts each item into its proper location in the System folder and displays a message telling you where it has placed the items.

2. Move any PostScript Type 1 fonts that are inside the System Extensions folder to the System folder.

For ATM to work correctly, the PostScript Type 1 fonts it uses must be in the System folder. They cannot be within the System Extensions folder inside the System folder (where the Macintosh automatically places them under System 7).

3. Access ATM from the Control Panel option under the Apple menu.

Enter your name and organization as prompted to personalize your copy of ATM and click OK.

4. Restart the Macintosh.

ATM begins working immediately with the PostScript Type 1 fonts installed. Install other PostScript and corresponding bitmapped fonts as outlined above.

FONT CHARACTERISTICS AND SIZING

Typography is both an art and a science. It takes the skills of a talented artist to create a useful and aesthetically pleasing typeface. Still, the style elements that go into designing a typeface can be specifically identified, classified, and measured. This section defines many of the terms used in typography, most of which are illustrated in Figure 9-7.

CHARACTER PARTS

Characters are positioned on an imaginary horizontal line called the *baseline*. Another imaginary line called the *mean line* falls along the tops of

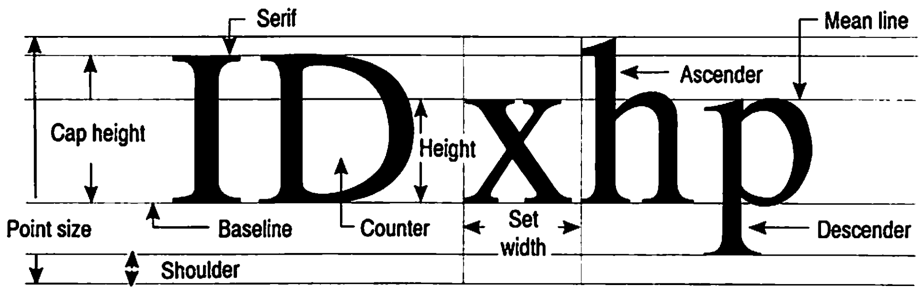


FIGURE 9-7
Illustration of character parts and measurements

lowercase characters like the *a*, *c*, and *x*. A *descender* is the part of a character like the *g* or *y* that falls below the baseline. An *ascender* is the part of a character like the *b* or *t* that falls above the mean line.

Most typefaces have serifs. *Serifs* are small crossbars that cap the ends of a character's main strokes. These strokes probably originated from the characters drawn by Middle Ages monks and scribes with their wide-nibbed pens. Serif type is usually preferred for long passages of text. The serifs help carry the eye from one letter to the next, making the text easier to read. Some examples of serif typefaces include Times, New Century Schoolbook, Bookman, Alexandria, Bodoni, and Bernhard Modern.

Sans serif (without serif) typefaces have a more modern look. They are commonly used for headlines and captions. They are effective as a contrast to serif type when used for accented text such as section headings. Examples of sans serif typefaces include Helvetica, Avant Garde, Geneva, Monaco, Micro, and Optima.

Counters or counterforms are the enclosed areas in characters like *D*, *e*, and *g*. They make the characters more recognizable to readers.

FONT SIZE AND MEASUREMENTS

A font's *point size* is measured from the top of the tallest ascender to the bottom of a fixed space below the longest descender. There are 72 points in an inch. The *x-height* is the height of lowercase letters without ascenders or descenders, like *x* (or the distance between the baseline and the mean line). X-height is an important measure that is often overlooked by font novices. Look at the two font examples in Figure 9-8. Although both fonts are printed in the same point size, Alexandria certainly appears larger. A closer look reveals that Calligraphy has unusually long ascenders and descenders in relation to its x-height. The characters appear smaller because the x-height is smaller. Point size can be deceiving.

Cap height is measured from the baseline to the top of a capital letter. *Set width* is the total horizontal space a character occupies on a line. This includes additional space before or after the character which helps determine character spacing.

The fixed space between the descender of one line and the ascender of the next is known as the *shoulder*. The shoulder exists so that the tops of ascenders do not touch the bottoms of descenders. In the days of manual typesetting, *leading* (which rhymes with *wedding*) also referred to this area. The term *leading* can be traced back to the strips of lead, usually one point in thickness. They were inserted between rows of manually set type. Nowadays, leading usually refers to the distance between one baseline and the next. Leading is often used interchangeably with the phrase *line spacing*.

Type that is set with no additional space between lines is called *set solid*. Set solid type makes dark blocks of text that can be difficult to read. In

This is 18 point Alexandria.

This is 18 point Calligraphy.

FIGURE 9-8
Comparison of Casady & Greene's 18-point Alexandria and Calligraphy fonts

typesetting notation, a 12-point font that is set solid is abbreviated 12/12 (read "twelve on 12"). The notation 12/14 means a 12-point font set at 14-point line spacing.

FONT STYLES

The plain or normal style of a typeface family is known as *regular* or *roman*. The term *roman* usually refers to a font with no stylistic changes to weight, slant, or spacing.

Weight refers to the darkness of individual characters. Weights can range from ultra-light to extra-black. Weights like light, book, regular or medium, demibold or semibold, bold, and heavy fall somewhere in between. Not all fonts come in a variety of weights, but bold can be simulated by the Macintosh through the selection of the Bold option in the Font Style menu.

Italics are normally used to emphasize a word or phrase. Most Font Style menus have a command to generate italic characters. These characters are often not true italics, however. They are actually *oblique*, created by slanting the regular or roman font. True italic characters also appear slanted, but they have special design characteristics that help them work well with the roman font.

FONT AND CHARACTER SPACING

There are different kinds of spacing, some of which is incorporated into the design of the typeface itself. An example of this is nonproportional and proportional type. In a *nonproportional* (or monospaced) typeface, each character takes up the same amount of space. The letter *i* and the letter *m* have the same set width, and the characters of each line are lined up vertically. An example of a nonproportional font is Courier, which resembles the typeface of many typewriters.

The vast majority of Macintosh typefaces are proportional. In a proportional typeface, each character takes up only the amount of space it needs; the set width varies from character to character. Proportional type is generally more pleasing to the eye and easier to read. One example is the Times font.

Spacing can also vary with uniform changes in character width. Condensed or compressed fonts are narrower than roman; extended or expanded fonts are wider than roman. These effects can sometimes be simulated by applications software. Microsoft Word, for example, allows you to compress or expand text by changing the amount of space between characters. This is known as *tracking*.

Kerning is another spacing term. When characters are kerned, the horizontal spacing between them is adjusted for a better fit. Some applications provide for manual kerning. Others recognize kerned pairs. These are frequently used pairs of letters—such as *th*—that should always fit together.

USING FONTS TO COMMUNICATE EFFECTIVELY

There are thousands of fonts available to Macintosh users. No one font is best for all purposes. A font can express in printed communication what your tone of voice expresses in verbal communication. In other words, your choice of font may influence the way your message is read. Keep this in mind when deciding what font to use to express yourself.

TYPEFACE CLASSIFICATIONS

Typefaces can be broken down into groups based on their primary function. General-purpose fonts are categorized as text, display, or decorative. There are no precise rules for what makes a font belong in one category rather than another. Some fonts can smoothly cross category lines. Special-purpose or specialty typefaces are a fourth, very different category.

Text Typefaces

For letters, reports, newsletters, or books, where readability is vital, use a highly legible typeface. Unusual or ornate character shapes may give your document a special look, but these characters can be distracting. The same concept applies to sans serif fonts. While they provide a modern look, their monotonous characters can tire the reader. Still, there are a number of sans serif typefaces that can be classified as text faces.

Display Typefaces

Display typefaces are suitable for headlines, titles, and advertisements. Their job is to catch the reader's attention, to stand out from the surrounding text. Legibility is not as important for display typefaces because they are not designed to be used for long passages of text. Many display faces are sans serif faces. Bold or oblique versions of some text typefaces also make good display faces.

Decorative Typefaces

Decorative typefaces are designed to add a special touch to informal documents or advertisements. Ornate flourishes and design elements are more important than legibility. Many decorative typefaces are actually difficult to read at point sizes smaller than 18 points. If used incorrectly—as display typefaces or inappropriately in serious documents—decorative typefaces can distract the reader. The intended message may not be communicated. There seems to be a virtually limitless supply of display typefaces, many available as freeware or low-priced shareware.

Specialty Fonts

Specialty fonts are fonts designed for a special purpose. Many of them do not even remotely resemble text fonts. Picture fonts, like Zapf Dingbats, have pictures for each character. Foreign language fonts are available for those languages that do not use the standard English character set. Fonts are also available for bar codes and universal product codes.

SPECIAL CHARACTERS

Special characters are available in virtually every Macintosh font. They include the bullet (•), copyright symbol (©), trademark symbol (™), registered symbol (®), curly quotes (“ and ”), ligatures ({ and }), and a variety of Greek characters used in mathematics and science (Σ, Ω, and Φ). Not all fonts have all characters. Table 9-1 shows the special characters available in the Times font.

To type a special character, press the OPTION key with another keyboard character. Because they require the use of the OPTION key, these characters are sometimes referred to as *optional characters*. If you want a copyright symbol, for example, hold down the OPTION key and press the G key on the keyboard. A (©) would appear at the cursor position. More special characters are available when you press SHIFT and OPTION together with another keyboard character.

Other characters require two separate keystrokes. For example, if you wanted to type the letter *i* with an acute accent over it (í), you would first press OPTION-E and then type the letter i by itself. The OPTION-E combination

	Modifiers			Modifiers	
Keystroke	**Option**	**Shift-Opt**	**Keystroke**	**Option**	**Shift-Opt**
a	å	Å	y	¥	Á
b	∫	ı	z	Ω	¸
c	ç	Ç	1	¡	⁄
d	∂	Î	2	™	¤
e	´	´	3	£	‹
f	ƒ	Ï	4	¢	›
g	©	˝	5	∞	ﬁ
h	˙	Ó	6	§	ﬂ
i	ˆ	ˆ	7	¶	‡
j	∆	Ô	8	•	°
k	˚		9	ª	·
l	¬	Ò	0	º	‚
m	µ	Â	-	–	—
n	˜	˜	=	≠	±
o	ø	Ø	[	“	”
p	π	∏	]	‘	’
q	œ	Œ	;	…	Ú
r	®	‰	'	æ	Æ
s	ß	Í	,	≤	¯
t	†	ˇ	.	≥	˘
u	¨	¨	/	÷	¿
v	√	◊	\	«	»
w	∑	„	`	`	`
x	≈	˛			

TABLE 9-1
Special Characters Available in the Times Font

is known as a dead key because nothing appears to happen when it is pressed. But when the *i* is typed, an accent appears over it.

Key Caps

Key Caps is a desk accessory provided by Apple as part of the System software. The purpose of Key Caps is to show you the standard and optional characters produced when modifier keys like the SHIFT and OPTION keys are pressed.

To access Key Caps, select Key Caps from the Apple menu. (You may also double-click the Key Caps icon if you are using System 7.) The screen in Figure 9-9 appears. The keyboard layout that appears on your screen matches the layout of your keyboard. This is true whether it is an extended keyboard (like the one illustrated here) or a standard keyboard. The tops of the keys represent the characters in a particular font. You can change the font by selecting another one in the Key Caps menu now in your menu bar.

Holding down the OPTION key highlights the available optional characters in the Key Caps keyboard. Holding down the SHIFT and OPTION keys together displays more characters.

When you type characters in Key Caps, the characters appear in the edit box near the top of the Key Caps screen. This allows you to experiment with character combinations and fonts. You can also use Key Caps to type characters, words, or phrases that you want to paste into documents. Type in the characters you want to copy. Drag the mouse pointer over the text in the edit box to select it. Choose Copy from the Edit menu. The selected text is copied to the Clipboard. Then position your cursor in the document where you want the text to go. Choose Paste from the Edit menu to paste a copy of the text into your document.

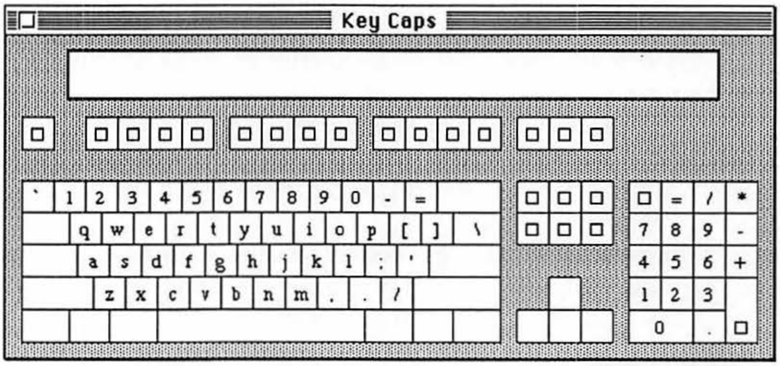
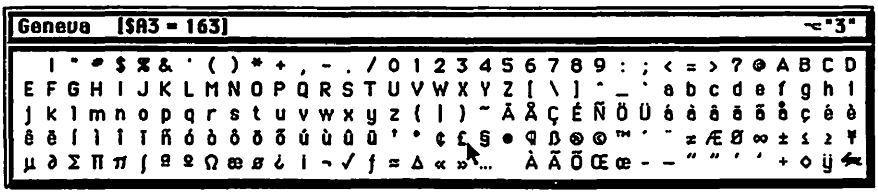


FIGURE 9-9

Layout of the Key Caps keyboard

PopChar

PopChar is a freeware control panel device by Gunther Blaschek that is available on many online services and BBSs. With it, you no longer need to remember key combinations or Key Caps to look them up. Install PopChar in your System folder (System 6) or Control Panel folder (System 7). Position your mouse pointer in the upper left corner of the screen, and press your mouse button down. A display of all characters in the current font appears, as shown here:



You can now select the character from the display with your mouse pointer. When you release the mouse button, the character is automatically inserted in your document.

MIXING FONTS

Most Macintosh applications enable you to mix fonts of different sizes, styles, and even typeface families within a single document. You can be as creative as you like to get your message across.

Changing Fonts in a Document

To change a font, select the text to be changed and choose a command from a Size, Style, Format, or Font menu (depending on the application). The following example illustrates some font changes in a MacWrite II document. The techniques used are generally the same among all Macintosh applications that allow font changes.

1. Select the text to be changed by dragging your mouse pointer over the text to highlight it.
2. To change the font, choose a new one from the Font menu.

The Font menu lists all the fonts installed in the System file. Choosing one changes the selected text.

3. To change the size, choose a new size from the Size menu.

The Size menu lists all the font sizes available. If you are using bitmapped fonts rather than TrueType fonts, the installed bitmapped sizes are listed. You can choose any size to change the selected text.

4. To change the style, choose a new one from the Style menu.

Style options normally include bold, italic, underline, outline, and shadow. Other styles may be available. You may combine almost any of these styles by selecting them one at a time. To deselect a style, select it again.

Your change takes effect immediately when you choose an option from any of these menus. A check mark appears in the menu beside the option you select. Remember, text must be selected before it can be changed.

The Art of Mixing Fonts

Mixing fonts from different typefaces can be a tricky business. There are no concrete rules for using one typeface with another, but a poor combination of typefaces can ruin the appearance of your document. Unless you know (through experience or training) what fonts to mix, it's a good idea to take a conservative approach. You might take advantage of the style and weight variations available within one typeface family.

Publishing Packs Publishing Packs, by Adobe Systems, are another solution for the type mixing dilemma. Each of the three packs includes a group of typefaces that work well together for a particular application. The typefaces, supplied in PostScript format, were selected by experts in typography and design. Packs are available for newsletters, forms and schedules, and displays and presentations.

ABOUT THE ...

Fonts for Faxes

If you plan to fax your documents, your choice of font and size is important. Unless you have a fax modem (which generally sends higher quality faxes than standard fax machines), you may have to sacrifice style for legibility. Consider these points when selecting a font for faxed documents:

1. Select a point size of at least 12 to 14 points.

Larger text is generally easier to read. Even the worst fax machine cannot blur large letters together.

2. Choose a simple font.

In the case of faxes, sans serif fonts are easier to read. There is less to be distorted by the fax machine.

3. Choose a font with moderately heavy, regular line weights.

Heavier, regular line weights prevent parts of the letters from fading out when faxed.

4. Choose a font with large counterspaces.

The openings in the letters help identify letters. Larger openings are less likely to get filled in if the fax machine blurs the characters.

CREATING AND MODIFYING FONTS

Sooner or later, you may want to modify one of your fonts to suit your needs. You could add characters like fractions, special symbols, your company logo, or even create a font of your own from scratch. Or you may have a PostScript font you want to convert to TrueType format. There are a number of font utility software packages available that let you do any of these things.

FONT MODIFICATION AND CONVERSION UTILITIES

Font utilities are available to perform almost any creation, modification, or conversion task you want done. This section covers some of the packages currently available.

ResEdit

ResEdit, short for Resource Editor, is a utility program from Apple that lets you change a program's resources. Resources include things like windows, menus, icons, and dialog boxes. Fonts are resources used by the System file.

A word of warning is necessary here. ResEdit is intended for programmers and developers, not computer novices. It's mentioned here simply for your information. It is not as user-friendly as most Macintosh programs and comes with very little documentation. Using ResEdit improperly can seriously damage program files. ResEdit should never be used on the only existing copy of a file.

Use ResEdit to edit bitmapped fonts. Open a bitmapped font file or suitcase with ResEdit. Select the NFNT (short for New Font Numbering Table) resource to edit. A window opens like the one in Figure 9-10. The mouse pointer becomes a pencil tool on the bitmapped image of the letter. Click pixels on or off to edit the font. Save your changes when you close the font file and quit ResEdit. You can then install the edited font in your System file.

PostScript and TrueType fonts are more difficult to edit with ResEdit. They are based on outline formulas rather than bitmaps. When you open their resource files, you won't see a graphic representation of the font characters. Unless you know what you're doing, do not use ResEdit on these fonts.

FontStudio

FontStudio, by Letraset, is a full-featured font creation, modification, and conversion software package. It works with PostScript, TrueType, and LetraFont (Letraset's own version of PostScript) fonts.

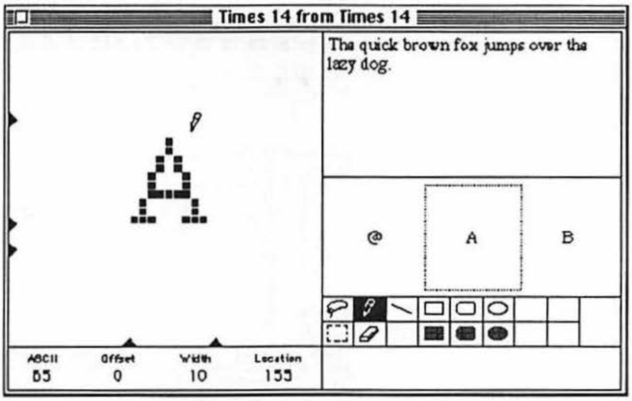


FIGURE 9-10
Using ResEdit to modify a bitmapped font

With FontStudio, you can create customized fonts from scratch or from existing fonts, using a variety of tools. Many changes can be applied to either one character or a group of characters at a time. FontStudio lets you edit outline shapes by manipulating curve control points, as shown in Figure 9-11. In this illustration, the effect of repositioning two of the character's control points is illustrated in a top window. The character is scaled by TrueType to a number of sizes. FontStudio offers automatic and manual hinting.

You can create any number of kerning pairs with FontStudio, or use its autotrace feature to create outlines based on imported scanned text or artwork. The Interpolate Font feature gives you the ability to automatically create a font with a weight between two others. FontStudio also enables you to create *anti-aliased* bitmaps (bitmapped fonts that use up to 256 levels of gray to enhance the image). When you are finished with your font, you can save it as a PostScript or TrueType font complete with bitmaps if needed.

FontMonger

FontMonger, by Ares Software Corporation, combines font modification and conversion capabilities in a single package. FontMonger can make

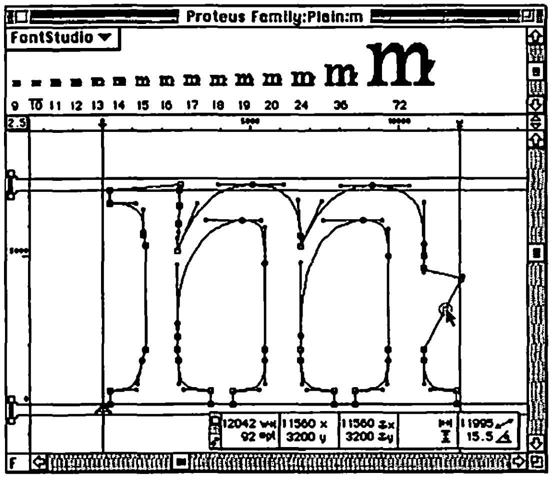


FIGURE 9-11
Manipulating curve control points with FontStudio

batch conversions of fonts among the three outline formats: PostScript Type 1, PostScript Type 3, and TrueType. To convert a font, use the Convert Batch command to open the bitmapped or TrueType version of the font to be converted. You can open a Helvetica bitmap, for example, inside a suitcase file. The PostScript Type 1 version of Helvetica, in the same folder, will convert to TrueType format when Convert is clicked. You can convert large batches of fonts at once with this feature.

FontMonger's font modification capabilities let you scale, slant, compress, and combine existing font characters. Changes can be applied globally to an entire font to create custom fonts. FontMonger also lets you create fractional characters in two styles for inclusion in modified fonts.

Metamorphosis Professional

Metamorphosis Pro, by Altsys, is a font conversion utility. With it, you can convert fonts to PostScript and TrueType formats. You can also save fonts as EPSF, PICT, and Fontographer files.

Use the Convert Font command to open a suitcase, and then select the fonts you want to convert from the file list that appears. Add as many font files to a Fonts to Convert list as you like. Choose the format for the conversion and click Convert. The fonts you selected are converted to the desired format, and a separate font suitcase is created for each font style.

ATF Type Designer

The ATF Type Designer, by Kingsley/ATF Type, is a type creation tool. It includes all the tools necessary to produce outline and bitmapped fonts, complete with kerning information and other important data. You can draw or scan in the characters. Straight lines and curves define the outlines of characters, and screen fonts of any size can be generated from the outline font. A bitmap editor provides the ability to edit bitmapped fonts in small point sizes.

The Art Importer

The Art Importer, by Altsys, creates Macintosh font characters from existing artwork. With it, you can turn logos, signatures, and symbols into characters that can be accessed right from the keyboard. When you import a graphic from almost any Macintosh drawing program, Art Importer automatically generates an outline font character, as well as bitmapped characters for screen display. Screen fonts can be fine-tuned with a bitmap editor, which is included as part of the program.

Fontographer

Fontographer, by Altsys, is a font creation and modification software package. With its graphics editor, Fontographer enables you to create fonts, typefaces, foreign character sets, logos, and other PostScript artwork. Tools include automatic tracing and hinting, Bezier curves, and a bitmap editor. Fonts can be created in Type 1 or Type 3 PostScript formats or saved as EPSF files.

FONTastic Plus

FONTastic Plus, by Altsys, is a font editor that enables you to edit existing fonts or create new ones. It works with bitmapped fonts only.

FONTastic's character editing window is similar to the one in ResEdit. The following tools are included to help you position and draw characters: scrolling hand and arrows, pencil, line tool, box tool, circle tool, eraser, selection box, and width tool. You can change a font's style, flip it, or rotate it. A small picture in the upper left corner of the window shows the character and any changes you make to it.

FONTastic also gives you the ability to scale bitmapped fonts to the sizes that you need. Unfortunately, the Scale Entire Font option does not have any hinting capabilities. The characters that result often require manual editing.

TYPE MANIPULATION SOFTWARE

Type manipulation software gives you the ability to turn text into graphics. These graphics can be used for headlines, logos, film and video titles, and product packaging.

LetraStudio

LetraStudio, by Letraset, is a full-featured display type design. With it, you can turn text into a custom graphic. Type a character onto the screen and apply one or more special effects to it. Figure 9-12 shows the word *Macintosh* in Palatino font with a line effect and two different envelope effects applied to it. You can also change font, style, size, rotation, kerning, spacing, tracking, character height, width, letter overlap, and justification.

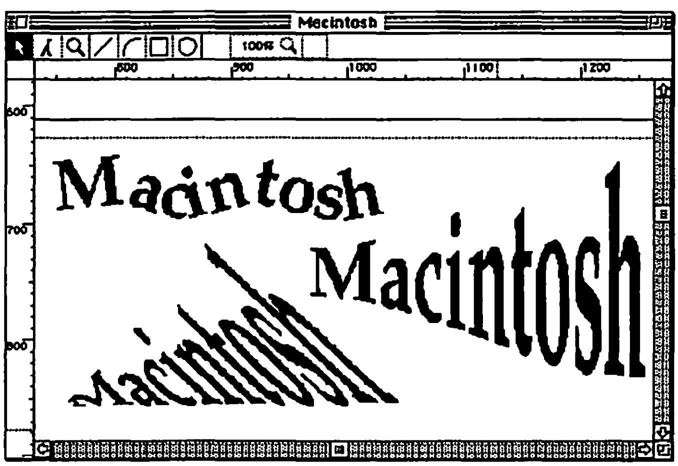


FIGURE 9-12
Examples of some of the simpler visual effects possible with LetraStudio

Once a graphic is completed, it can be saved as a LetraStudio, EPSF, PICT, or Illustrator file. It can then be used in a page layout or graphics presentation program. Graphics can also be printed in black-and-white, in color, or as color separations.

TypeStyler

TypeStyler, by Broderbund Software, is a full-featured text manipulation program. It converts PostScript Type 1 fonts into its own SmoothFont format for manipulation. Enter text in a dialog box and modify it with TypeStyler's distortion and styling tools. TypeStyler provides control over kerning, spacing, and leading. A style library contains effects that can be customized. Copy completed graphics to the Clipboard for pasting into other documents or save them as EPSF, PICT, or Illustrator files.

TypeAlign

TypeAlign, by Adobe Systems, is a simple type manipulation program. It works as an INIT/Extension accessible from a desk accessory and requires ATM and ATM-compatible fonts. To use TypeAlign, access the desk accessory. Use a line-drawing tool to draw a path for the text to follow. The drawing tool turns to a text tool so that text can be entered. Once text is entered, you can change it just as you would change text in any word processor. To further distort type, select it and drag the handles that appear around it. When the graphic is done, use the Clipboard to paste it into other applications. You can also save it as a PICT, EPSF, or Illustrator file.

OTHER FONT UTILITIES

A number of other font utility packages are available to help manage, provide information about, and catalog fonts. Here is a sampling of them.

FONT MANAGEMENT UTILITIES

The larger a font collection is, the more likely it is to get out of hand. Adding fonts to the System file makes your System file bigger and your font menus longer. Identification number conflicts could cause one font to appear when you chose another. These problems occur, but there are utilities to solve them.

Suitcase II

Suitcase II, by Fifth Generation Systems, is a font, desk accessory, F-key, and alert sound management utility. With Suitcase II, you can access fonts in suitcase files without installing them in your System file. You can keep your System file small by opening only those fonts that you need as you need them. Suitcase performs the same function for desk accessories, F-keys, and alert sounds.

Suitcase works as an INIT/Extension. To install it, drag it to your System folder and restart your Mac. When Suitcase first runs, it creates a desk accessory available under the Apple menu. Figure 9-13 illustrates the desk accessory window with the Fonts radio button clicked.

The scrolling window displays all of the fonts currently installed. Clicking Suitcases allows you to choose which suitcase files you want to open. You can specify whether you want to open the suitcases now or every time you start your Macintosh. The Show button shows you a sample of the currently selected font.

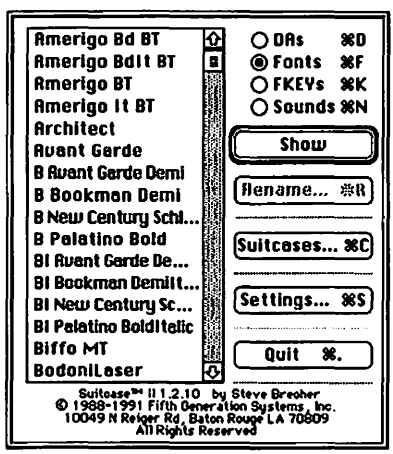


FIGURE 9-13

Suitcase II desk accessory window

MasterJuggler

MasterJuggler, by Alsoft, is a font, desk accessory, F-key, and sound management tool. With it, you can access an unlimited number of these special files. MasterJuggler lets you open font files without installing fonts into the System file. It also has a pop-up window to let you start applications or open documents without using the Finder.

Font Porter

Font Porter, by Adobe Systems, is an INIT/Extension that comes with ATM. Font Porter is installed in the System folder. When the Macintosh is started, Font Porter automatically opens as many as 12 font suitcases in the System folder. This makes the fonts they contain available to applications. Font Porter was designed to eliminate the need for Font/DA Mover in System versions prior to 7. Font Porter is compatible with System 7.

Adobe Type Reunion

Adobe Type Reunion, by Adobe Systems, is an INIT/Extension that arranges typeface names in alphabetical order within a Font menu. Each font within a typeface family is listed in a submenu under the typeface name. Figures 9-14 *a* and *b* illustrate the same font menu with and without Type Reunion. As you can see, the menu with Type Reunion loaded is less cluttered, and fonts are easier to find. Adobe Type Reunion works with PostScript and TrueType fonts.

Font & Sound Valet

Font & Sound Valet is another font utility application provided with Suitcase II. It "packs" (compresses) fonts and sounds stored in a suitcase so that they require less disk space for storage. Suitcase II automatically unpacks the fonts and sounds as they are loaded into memory. All fonts and sounds packed with Font & Sound Valet remained compressed until unpacked with the program. Font & Sound Valet cannot be used without Suitcase II.

MISCELLANEOUS UTILITIES

Font information and cataloging utilities are available to help keep track of fonts. With them, you can print out preformatted font sample pages and get important information about your fonts.

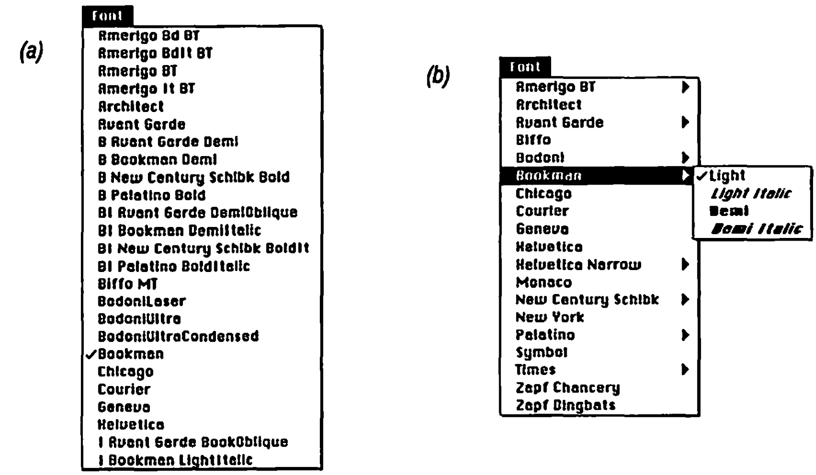


FIGURE 9-14

Font menu (a) without Adobe Type Reunion and (b) with Adobe Type Reunion

Varityper Toolkit

Varityper Toolkit is a multipurpose font information application by Tegra, distributed as freeware by Varityper. It has a number of useful functions.

The Display Font Characters feature displays a grid containing all the characters of a font. Clicking a character displays the character name and keystroke combination. Scan PostScript Files for Font Names scans PostScript files on disk. It reports all fonts used within them. Show Font Statistics displays a scrolling window with technical information about all fonts. Show Font Family Samples displays a scrolling window full of font samples like the one in Figure 9-15. You can specify the sample text shown with the Preferences option. The result of most commands can be printed.

The TypeBook

The TypeBook is a freeware font cataloging utility by Jim Lewis. It prints font sample pages. The font size and spacing sample pages shows each character identified by its keystroke and a complete character set. In each version, the font name is printed at the top of the page. The TypeBook also calculates the number of characters per *pica* or *cicero* (traditional

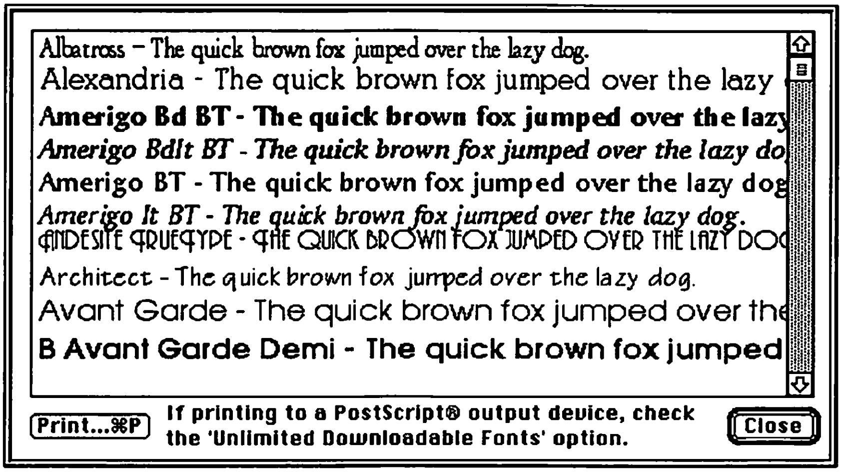


FIGURE 9-15
Varityper Toolkit's Show Font Family Samples window

typesetting measurement units) and the approximate point size of a dozen cap heights. The TypeBook works with PostScript and TrueType fonts.

TypeSpec

TypeSpec is a shareware font sample display application from Big Rock Software. To use it, select the font you want displayed. A 48-point sample of all uppercase and lowercase characters, numbers, and common symbols appears in a window on the screen. The Print option prints the displayed sample, along with three samples of a quote set solid at 18, 14, and 12 points. The sample text cannot be changed.

A MORE TECHNICAL LOOK AT FONTS

Font users seldom need to dig deeply into the components of a font. This section is for people who thrive on the technical information that makes less seasoned Macintosh users shudder.

FONTS, FONDS, and NFNTS

As mentioned earlier, fonts are made up of resources. The original font resource was called, logically, a *FONT*. Everything the system needed to describe a font was included in a FONT resource: information about height, width, and kerning, and a bitmapped image of each character of the font. A separate FONT resource was needed for each font size. Other size and style variations were generated by the Macintosh as needed. Each FONT resource was identified by a unique ID number. There were 256 of these numbers, and Apple reserved the first 128 for its own use.

When PostScript was released, users began to demand true style variations (rather than computer-generated bold and italic styles). Apple needed to change the way fonts were stored, so they developed a new resource called the *FOND* resource. The role of the FOND resource is to tie together all parts of a font within a typeface family: the FONT resources and the PostScript file (if available). It does this by listing all FONT resources in a Font Association Table within the FOND. Any number of font sizes and up to 47 font styles are supported. FONT resource IDs were tied to the FOND resource ID in a complex numbering scheme.

Unfortunately, Apple's numbering scheme limited the number of possible combinations to identify font components. Font developers soon ran out of unique ID numbers. Apple came up with a new resource to solve the problem, an NFNT (New Font Numbering Table). It was designed to replace the old FONT resource and contains the same basic information. The NFNT, however, cannot exist without a corresponding FOND resource. It relies on the FOND to provide a name so it can appear in font menus. But the NFNT's ID number is no longer tied to the FOND ID number. Over 32,000 ID numbers are possible. The NFNT resource has become the preferred format for bitmapped font resources.

FONT ID CONFLICTS

With 32,000 possible ID numbers, you may think there are enough numbers to go around. Not so. Since FOND ID numbers were not centrally assigned until recently, many fonts share the same ID number. Version 3.8 (and later) of Font/DA Mover solved this problem by first automatically detecting ID number conflicts as new fonts were installed in the system, and then by renumbering the new fonts accordingly. System 7 performs the same function automatically when fonts are installed in the System file. Programs like Suitcase II and MasterJuggler, however, enable us to use fonts without installing them in the System file. This makes font ID conflicts possible.

Symptoms of font ID conflicts include:

1. Documents look one way on your computer but different on someone else's.

Fonts in documents are identified by the system in one of two ways: by name or by ID number. The application programmer chooses the method. Apple recommends that programmers identify fonts by name rather than by ID number. Many programmers prefer using numbers because they save space. When an application's document says to use font 1600, for example, the Macintosh uses that font. It does not matter if a number represents Helvetica on your computer and Bookman on another. This problem is possible even if neither computer uses a utility like Suitcase II or MasterJuggler; Font/DA Mover and System 7 assign random ID numbers to resolve internal conflicts.

2. When you select one font from a font menu, another font appears. When you check the font menu, the one you selected is checked.

This problem is likely to occur when two FONDs have the same resource number. When you have more than one font suitcase file open, the System searches the most recently used font file first when looking for a particular font. If it does not find it, it continues the search through the rest of the font files in reverse order. If you have two fonts with the same ID, the one the System displays will be the one most recently accessed. So it might get it wrong sometimes, but not all of the time.

3. When you change the size or style of a font, the font changes as well, although there is no change in the font menu selection. When you change the size or style back to what it was, the font returns to the original font.

In this case, the resource ID for a given size and style is the same as another size and style used in a different font. This problem is rare.

Font Harmony

Font Harmony is a font utility application provided by Fifth Generation Systems with Suitcase II. Its main function is to resolve font number conflicts by looking at up to 99 font files at once and changing ID numbers as necessary. Font Harmony also checks for defects in suitcase files and fixes them. It can merge the members of a font family into one listing to unclutter font menus.

ADOBE FONT METRICS (AFM) FILES

AFM files are text files that often come with PostScript Type 1 fonts. An AFM file contains a duplicate of the information normally found in the FOND resource of a bitmapped font. This information includes the font and typeface family name, weight, angle, underline thickness, font measurements, tracking data, character listing with character name and measurements, and kerning pair data. Measurements are expressed in thousandths of an inch. You can open an AFM file with any word processor and examine its contents.

Only two applications use these files: Interleaf and FrameMaker. Unless you have either of these programs, do not install AFM files with your PostScript fonts.

LOOKING AHEAD

Since 1984, Macintosh fonts have evolved rapidly. First there were a few simple bitmapped fonts. Then PostScript was released and two types of outline fonts made text picture-perfect on PostScript-equipped laser printers. (TrueType is the most recent innovation.) The number of available fonts has multiplied.

What does the future have in store for Macintosh fonts? One new technology on the horizon is Multiple Master typefaces.

MULTIPLE MASTER TYPEFACES

Multiple Master typefaces, recently introduced by Adobe Systems, will let the user create an infinite selection of fonts. These fonts are based on a design matrix of one or more variables in weight, width, size, and style. The user can generate any font desired based on a custom combination of the variables. Multiple Master typefaces are based on PostScript Type 1 fonts and will be completely compatible with PostScript printers and ATM.

Adobe has several Multiple Master typefaces in development. One of them is a sans serif design that has two variables or axes: weight and width.

There are four master designs: light condensed, black condensed, light expanded, and black expanded. A companion sans serif italic typeface has the same axes. The user will be able to generate any combination of the weight and width of either the sans serif or sans serif italic.

Another Multiple Master typeface under development is a serif design with three axes: weight, size, and width. There are eight master designs. The user will be able to create a font anywhere within the three-dimensional matrix. A Multiple Master font creator interface will provide the means for the creation of fonts with Multiple Master typefaces. Each of the axes will be changed with a sliding scale tool. Adobe encourages developers to incorporate Multiple Master capabilities directly into application software. They want to do away with a separate font creator utility.

CONCLUSION

Typesetting has come a long way since Johannes Gutenberg set his first row of type over 500 years ago. Macintosh users have the tools to create documents that are neater and more expressive than ever, and they can be created quickly.

C H A P T E R 10

SCANNING AND OCR

Scanners are copy-machine-like devices. They take a page, drawing, or picture and convert it into a digital image. The digital image can be saved as a Mac file and viewed on the screen. You can alter the file: retouch or resize it, paint or draw on it, slice or crop it, and edit or add to it. You then copy and paste the edited image or text into other documents or drawings.

A scanner is handy for publishing, presentation, mapmaking, graphics design, and computer modeling work. Scanners are input devices for document storage systems. These documents can be condensed into small images for storage on optical disks.

Scanners digitize images. *Optical character recognition* (OCR) software translates character images into ASCII ("ask-ee") code or text that the Macintosh can understand. (ASCII is kind of like a digital alphabet computers use to create words and numbers with.) OCR is valuable for word processing, desktop publishing, and other applications that require stacks of printed text to be entered. With OCR and a scanner, you can avoid re-keying a document (provided it's typed or typeset and in good condition).

SCANNER BASICS

Scanners bounce light off a document (very much like a copy machine) and measure the results. Photoelectric sensors are used. These sensors measure the light reflected from tiny areas (pixels) of a document. The sensors convert the brightness of the reflected light into electrical signals, which are then turned into digital bit values.

If the reflected light from an area falls below a certain intensity or threshold level, the pixel defining the area is given a bit value corresponding to black. The greatest intensity areas are given a bit value for white. All of these pixel values combined form a composite bit image (a bitmap) of the document. (The *bitmap* is the digital equivalent of the visual image, which is what you see on the screen.)

PIXELS AND SHADES

A two-level black-and-white scanner uses a single data bit to define a pixel. The pixel image is made up of either a single black dot or a single white dot. Scanners can see shades of gray or color with more data bits per pixel. Gray or color shading is needed when you want to scan continuous tone images (like a photograph) and convert them into halftones. (A *halftone* is a way to simulate continuous tone or color images with combinations of dots.)

A scanner which reads 16 shades (levels of gray) uses 4 bits per pixel. The 4 bits map a 4-dot high by 4-dot wide pixel cell containing 16 dots. This pixel cell can define all black, all white, and 14 different shades of gray with the 16 combinations of black and white dots. Figure 10-1 shows examples of 16-level grayscale shading and 16-dot pixel cells.

Color scanners work in a similar way, but they record pixels for each of the three primary colors.

The image output of simple 1-bit black-and-white scanners are tweaked to show illusionary grayscales for photographs and images. Software does this trickery by *dithering* the image during scanning (turning various combinations of pixels black or white). Even true grayscale scanners may dither about to provide shades of gray. This saves you time in scanning and disk space when storing the image. Once dithered, however,

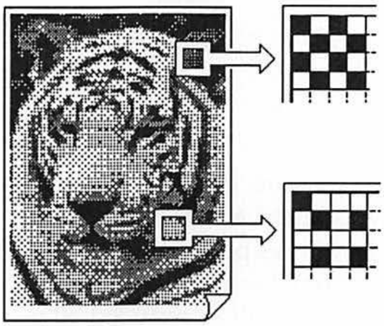


FIGURE 10-1
Examples of 16-level grayscale halftones with a 16-dot pixel cell

the image is fixed. You'll have troubles changing it after the scan. Multi-bit scanning produces fully editable grayscales.

RESOLUTION

Scanners read at various resolutions or dot densities, expressed in dots per inch (dpi). The number of dots per inch determines how many distinct points the scanner reads in both a horizontal and vertical inch. These dots define the pixels.

The higher the resolution a scanner has, the more detailed an image. A high-resolution scanner can resolve finer lines, more subtle shades of gray or tones of color, and smaller printed or typed characters. A resolution of 300 or 400 dpi is typical for most scanners. (This equals the resolution of most laser printers, such as the LaserWriter.) Scanners as high as 600 dpi are on the market. The scanned images and printed pages will have similar detail and shading. Here is an example of the difference in the resolution between 75 and 300 dots per inch:

If the resolutions don't match, the image sizes won't look the same. (It's like the original and the faxed copy. If the original has large, simple print, the copy looks pretty close. If the original has fine lines and intricate lettering, the copy is a muddy mess.) For example, an image scanned at a 150 dpi resolution will be reduced 50 percent (150 dpi divided by 300 dpi times 10) in both dimensions when printed at 300 dpi on the laser printer, to look the same as a 300 dpi scan. The area of the printed image then turns out to be 25 percent (50 percent times 50 percent, divided by 10) of the scanned document area.

The opposite holds for scanned images on your display. The standard Macintosh monitor has a resolution of 72 dpi. If the document is scanned at 150 dpi, the screen packs slightly less than one-half as many dots into an inch. Each dimension of the displayed image will appear enlarged to 48 percent, and the total image area will be magnified 23 percent on the monitor screen. You won't be able to view all of the image details as they would print at 150 dpi. Also, depending on the physical size of the original document and your display, the entire scanned image might not be displayed on the screen.

Printing at 300 dpi an image scanned at 600 dpi would produce the same effect. Only 50 percent of the dots per inch are printed at a time, and the printed image area is magnified 25 percent. Depending on the page size of the printer and the size of the document, not all of the scanned image might be printed. In most instances, a high-resolution scanner requires the use of a printer with an equal or higher resolution.

Scanner Types

All scanners turn images into bits in a similar way. Scanners differ in their overall physical shapes and sizes. There are different schemes to move documents (or objects) past the sensors (or to move the sensors past the document). Most handle letter- or legal-size pages. A few may scan ledger-size pages. There are also some specialty scanners. Printhead, handheld, flatbed, sheetfed, overhead, video, and film scanners can all be used with the Macintosh.

Printheads A printhead scanner is a low-cost scanner. It works as an enhancement to an Apple or Epson dot-matrix printer. The scanner is designed to fit into the ribbon cartridge slot of these printers. The scanner has no moving parts; instead, it relies on the printer to lend the mechanical muscle to move the document over the scanner's sensors. If you already own a printer, this is a good money-saving scheme. This contraption is slow, however. (Lines are scanned one at a time.) A letter-size page may take 15 minutes or more, which is a real drawback if you plan to do much scanning.

Thunderware markets the ThunderScan Plus, a scanner cartridge for Apple's ImageWriter printer series. Epson offers a printhead scanner for some of its LQ series dot-matrix printers.

Handhelds Handhelds are low-cost scanners. The scanner light source and sensors are packed into a compact, handheld device. You read a document by picking up the scanner and sliding it down the page. Hand scanning takes some practice.

Hand scanning often results in image distortions caused by variations in how steady and straight you're able to roll the scanner down the page. Many handhelds have internal "speedometers" to compensate for minor speed changes. Jerky scanning will still produce screwy images, though.

Handhelds have a limited column scan width (2 1/2 to 5 inches, depending on the scanner make and model). To image a full page involves a couple of swipes. This produces two or more columns. You can match and patch the columns together with special software. (Sometimes this stitch job works and sometimes it doesn't.)

Handhelds are portable, take up little desk space, and scan documents or odd objects. You can scan the family bible, the spots on a Dalmatian, or a poster on the wall. Some models will scan grayscales or color, as well as the basic black and white. These scanners are excellent if you need to scan bits and pieces of articles from books and magazines. They aren't a good choice for a primary scanner if you have great volumes of scanning or many single, full-page documents.

Flatbeds Flatbeds are good all-purpose scanners. They look and operate a lot like copier machines. You flip up the hinged scanner lid, align the document face down on a flat glass surface, and close the lid. Everything else is automatic. Scanning sensors move down the page as a bar of light traverses the document. In less than a minute, a bitmapped image is delivered to the Macintosh. (It takes a few minutes more for full color.)

This is the largest class of scanners on the market. The prices vary greatly depending on the configuration. Buy a budget model for halftone and grayscale work, or bust the budget to purchase a mega-color scanner (which costs kilo-bucks more than the Macintosh itself).

The Apple Scanner, shown in Figure 10-2, is one example of a flatbed scanner.

Flatbed scanners offer a flexible mix of features, including some or all of the following:

- read ledger-size pages (11 by 17 inches)
- resolve images at 600 dpi or greater
- distinguish over six million tones of color

Flatbed scanners are large and heavy. They aren't portable in any way. The only constraints of flatbed scanners is the glass surface—they can only scan what can lay flush against the glass, in the same manner as a copier. They are, however, an excellent choice if you need to scan many pages of documents. They are quick and easy to use.

Sheetfeds Sheetfeds use a mechanism similar to a fax machine's document reader. The sensors and light source are stationary. It's the document that moves. Rollers grab and move the page past a fixed linear scanner head for a line-by-line scan. This scheme eliminates most of the motorized hardware, which lowers the price.

Sheetfed scanners are able to handle extra-long documents. The only page constraint is its width. You can't feed anything wider than the linear scanning head. Sheetfeds are easily equipped with automatic page feeders to read stacks of pages.

One annoying problem involves page alignment. If the paper goes in crooked, it can jam. If line art is bitmapped from sheets fed at an angle, the art will appear jagged. Extra small or irregularly shaped pages might not feed at all. Also, a sheetfed scanner cannot scan bound publications or thick documents.

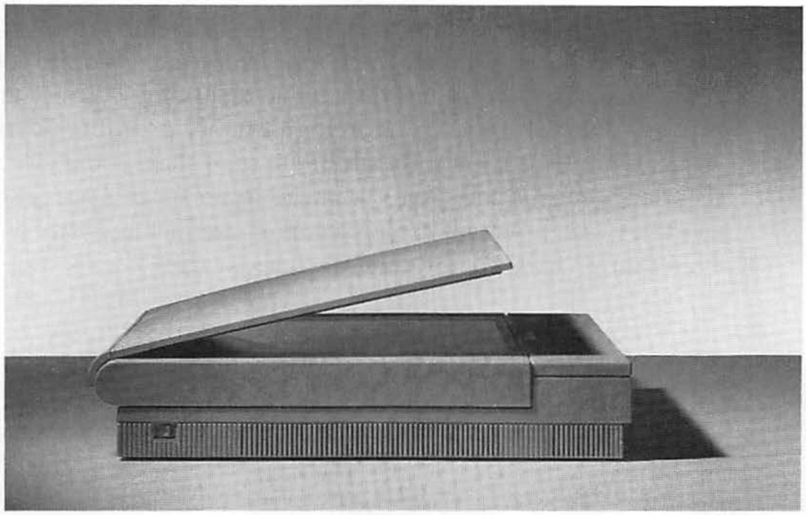


FIGURE 10-2
The Apple Scanner is a flatbed scanner

Overheads Overhead scanners look like a photographic enlarger and operate in much the same way. You position the document face up on a scanning table, and the scanning head is aimed at the table.

Overhead scanners will scan almost anything: pages, poster boards, cereal boxes, or other three-dimensional objects. Books might need a paperweight (a glass plate or a book holder) to keep open at the correct page to scan. The document size might be limited to letter- or legal-size proportions due to a scanner's table size and focal lengths.

Video Another type of scanner is a video or image scanner. This is really a TV-type camera and a special video device called a *frame grabber.* The frame grabber "grabs" an individual TV frame and turns it into a suitable bitmap for the Macintosh. A camcorder will function as the scanner when coupled with the frame grabber. Even a VCR can supply input to the frame grabber.

Video scanners have the ability to build picture grayscale and halftone images fairly well, but resolution presents a problem. Video scanners can't resolve images fine enough to generate detailed bitmaps of line art or characters. Video scanned images can't be used for OCR work.

Film This dedicated breed of scanner—the film scanner—reads 35 mm color slides. These scanners aren't for everyone. They are costly, can't scan a full page, and are more of a niche-technology. Users are commercial printers or artists who work on high-quality print publications.

If your needs call for the ability to scan slides, consider a color flatbed scanner. Some models have special adapters for this purpose. Don't expect a cut in price, however. Color scanners are just as costly as film scanners even though they are for general-purpose use.

OCR: HOW TO MAKE YOUR MACINTOSH READ

Scanners are good for graphics, but the Macintosh may not know what to do with scanned text. OCR is a lot tougher than it appears. The OCR program must first recognize a group of adjacent pixels within a scanned image as a character. Then it must decide which character it is. Even if all of the characters use the same font and have the same size, the job isn't easy. When the text is printed in a variety of type sizes and styles, recognition gets really complicated. As for handwritten documents, forget it. The OCR program is completely unable to decipher scrawl.

That's not all. Pages come printed in multiple columns with figures and pictures intermingled with text. Some text has side bars, boxes, or irregular columns. In addition, not all the text may be letter perfect. Third-generation copies, the junk you get out of a fax, and folded, stapled, and stained pages can be a real challenge to an OCR program.

Deciphering bitmapped text images into letters, numbers, and punctuation marks is extremely difficult, but it's not impossible.

CHARACTER FLAWS

Just a few years back, OCR software offered scanned text with a 3 to 5 percent error rate. A 3 percent error rate meant that 60 characters out of a 2,000-character page were wrong. In typists' terms, 60 words on each page were wrong. (Fire that typist!) OCR software has improved to the extent the error rates are now fractional percentages. Programs running on the Macintosh read text from scanned images at an accuracy of 99.5 percent or better. This is less than 10 errors or misspelled words per page.

Some of these errors can be caught with a spell checker. Others must be found by reading the document. It might seem labor-intensive, but the actual work involved in searching for these errors is less than typing in the whole document (and you will still have to spell check and proofread the document).

OCRs make substitution errors. The program assumes it has read a character correctly when it hasn't. It then compounds the error by coding the wrong character. Most of these mistakes can be corrected with a spell check program.

Sometimes the OCR will make a character substitution error which will pass a spell check undetected. (Is a *but* a *but* or is it a *hut?*) Numerical substitutions can't be caught at all. (Think of the problem if your tax return was scanned and the number *3* came out as an *8*. Your modest $33,000 per year in wages could be read as $38,000, $83,000, or $88,000.)

OCR SOFTWARE

There are three types of OCR software programs: untrainable, trainable, and automatic.

Untrainable Programs

Rudimentary, untrainable OCR programs recognize a small and fixed number of type fonts, styles, and sizes. Early versions read one or two typewriter fonts (such as Courier and Elite in 10- and 12-pitch), while current editions can recognize a variety of common fonts and sizes.

Untrainable programs are low-cost, but they are unable to read any text they are not designed for. They are reliable, but limited.

Trainable Programs

Trainable programs can, as the name implies, be taught to read a new text. They are slow learners. The process may take an hour or more for each new type font or new style of document. The program asks you to verify or correct characters it is unsure of. Trainables build up character pattern libraries for future reference.

This training pays off in the long run if you scan the same type of page frequently, or a document with hundreds of pages.

Automatic Programs

Automatic programs are self-teachers. In addition to built-in pattern libraries, these programs can recognize characters or entire words based on context and rules of grammar.

Automatic OCR programs have special look-up dictionaries of technical, legal, or medical terms. Special lexicons of character ligatures, double character pairs, and word beginnings and endings are available. The OCR checks the character and word. It makes a "guess" based on these look-up dictionaries and lexicons to fine-tune recognition capabilities.

Automation is a curse as well as a blessing. You have little control over teaching automatic software unrecognizable letters. Automatics also demand power hardware. They won't run on anything less than a Macintosh II with 4MB or more of memory (5MB for System 7.0).

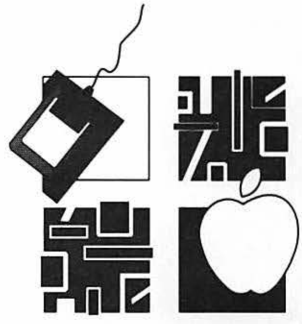
CONCLUSION

What's the best? Recognition accuracy and speed have no class boundaries. It all depends on the text and page formats. Trainable software can be as good or as bad as automatic.

Considerations involve the source of the text image and the output formats of the recognized text. Some OCR programs will only read scanned text images. Others can recognize text from image files produced by other programs as well as from their own scans.

All OCR programs convert text images into ASCII code. Many trainables and automatics will build formatted files. That way you won't need to reformat bold, italic, and underlined characters after the text is moved to a MacWrite, Word, or WordPerfect word-processing document. Or, you won't have to rework rows of numbers to get them back into the proper columns of an Excel spreadsheet.

What's best is what works with your needs and what quirks you're able to live with.



C H A P T E R 11

THE NOISY MAC

From simple System beeps to complex musical pieces, the wide variety of sounds that the Macintosh can produce is impressive. You can customize this audio interaction—an endearing and unique feature of the Mac.

THE SOUNDS OF THE MACINTOSH

Macintosh computers can play digitized (or recorded) sounds; all have a built-in speaker and audio output jack. (The built-in speaker is like the one in a table-top radio.) You can connect headphones or extra speakers with the audio output jack, but there is no need for any additional hardware for you to hear sounds. The most basic interactive sound the Macintosh makes is the System beep.

THE SYSTEM BEEP

When the Macintosh wants your attention, it makes a noise. This is the *System beep*. You'll hear it when you make an error or when a dialog box appears on the screen. (The dialog box is the "Yes, No, or Cancel" question selection that shows up when the Mac wants you to verify something.)

Early Macintosh operating systems had only one built-in sound—a simple beep. System 6 gives you a choice of four: Simple Beep, Clink-Klank, Monkey, and Boing. System 7 has added a larger menu: Droplet, Indigo, Quack, Sosumi, and Wild Eep. These sounds are stored in the System file. They can be accessed in one of two ways: through the Sound Control Panel or by directly accessing the System file.

The Sound Control Panel

For System 6, the sound controls are located in the Control Panel, which is located under the Apple icon at the top of your screen. Pull down the menu and select Control Panel.

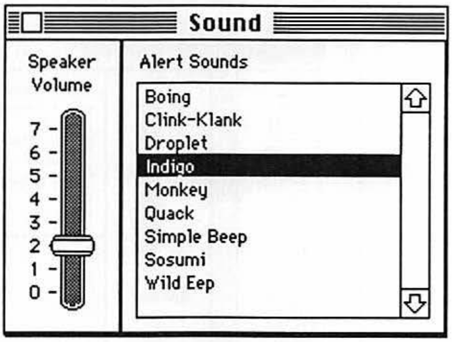
The Control Panel has a number of different things to play with (desktop pattern, volume, the speed for your cursor to blink, and other things). On the left side is a selector. When you first open the Control Panel, you'll have "General" already selected and open. You can scroll down the optional selections—Color, Keyboard, Monitors, Mouse, and Sound. (If you've installed some software that adds selections to these panels, they will appear, too.)

Click an icon to select it. (Each one has something to adjust.) The sound icon looks like a blaring speaker—although icons are like a Rorschach test—everyone has his or her own interpretation. Select the icon and the Sound Control Panel appears.

This panel will let you hear samples of System sounds (just select them and they will play), and you may select one for the System beep. Or you can adjust the volume of the System beep. If your Macintosh is running System 6, the Control Panel window looks like Figure 11-1.

The icons on the left side of this dialog box represent installed Control Panels. To the right of the icons is a scroll bar. Use the scroll bar to scroll down until the Sound icon appears. Click it. The Control Panel window looks like Figure 11-2.

If your Macintosh is running System 7, you won't have a menu selection. Instead, a Finder window for the Control Panel folder opens. Among the icons there is the Sound icon. Double-click it to open the Sound Control Panel. Its window looks like this:



No matter which version of System software you use, the Sound Control Panel works in the same way. When you click the name of the sound in the right side of the window, the sound is played. In addition, because that sound remains highlighted, it becomes the current System

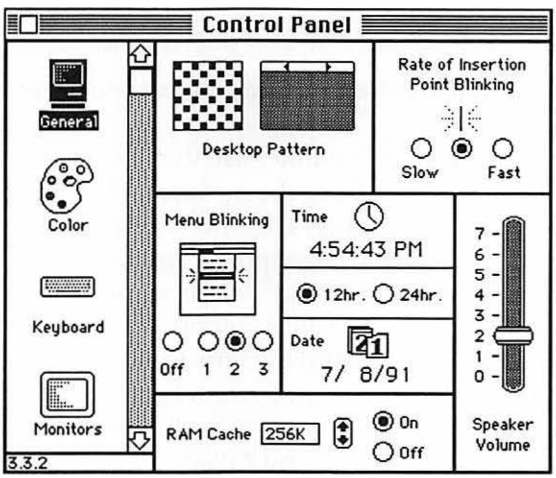


FIGURE 11-1
The System 6 Control Panel

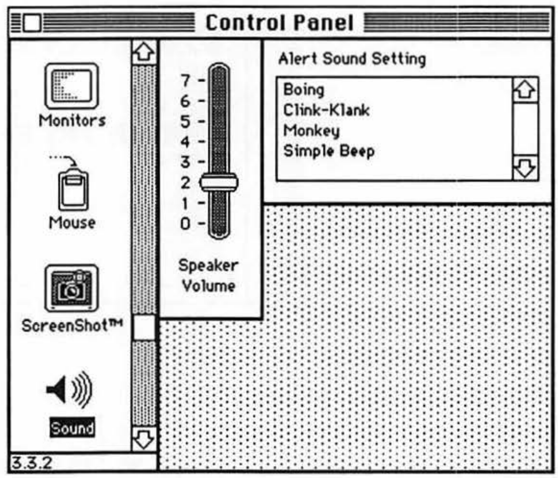


FIGURE 11-2
System 6 Sound Control Panel

beep sound. Click another sound name to hear it and select it as the System beep sound.

To change the volume, use the Speaker Volume control to the left of the sound names. Drag the horizontal bar up to increase the volume and down to make it softer. The lowest setting, 0, turns the sound off. Instead of making a System beep sound, your menu bar will wink and blink to get your attention. You might want to use this setting if you work in an extremely quiet place (or if you secretly play one of those computer games at work and don't want the boss to know).

When you've set the System beep sound and volume, click the close box in the upper left corner of the Control Panel window. Your settings are immediately activated and saved.

Sounds Inside the System File

With System 7 installed on your Macintosh, you can open the System file to access sounds. Open the System file with a double-click. (This can take several minutes if you have lots of sounds and fonts.) A window opens to display all of the installed fonts and sounds contained in the System file.

(You can change or rearrange the look of this window with the View menu.) Sound icons look like this:

Double-click a Sound icon to hear the sound it contains. (This will not change the selected System beep. You must use the Sound Control Panel to select a new System beep.) If the icon has more than one sound (as it can in System 7), you won't hear anything.

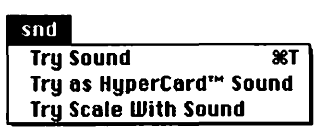
THE MACINTOSH "SND " RESOURCE

Resources (discussed in greater detail in Chapter 24, "Programming the Macintosh") are parts of a program that can be used again and again within the program. A "snd " resource (the space after the letters is part of the resource name) is a special kind of resource that contains a sound. *snd* is just an abbreviation for sound. (These snd resources can be examined, for those so inclined, with ResEdit, Apple's Resource Editor. ResEdit is covered in Chapter 24.)

There are two kinds of snd resources: Format 1 and Format 2. Format 2 snd resources are used by HyperCard; all other programs use Format 1.

Opening snd Resources

To open a file's snd resources with ResEdit, use the Open command from ResEdit's File menu. A window of the resource icons will appear. As an example, Figure 11-3 shows the resources for Columns, a game application file. Double-click the snd resource icon. A list of the snd resources appears, as shown in Figure 11-4. The snd resource ID number, size, and name (in quotes) is displayed. Click one of the sounds in the list and choose Try Sound from ResEdit's snd menu, shown here:



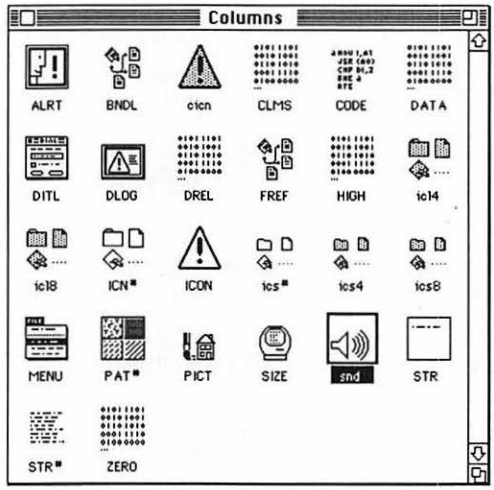
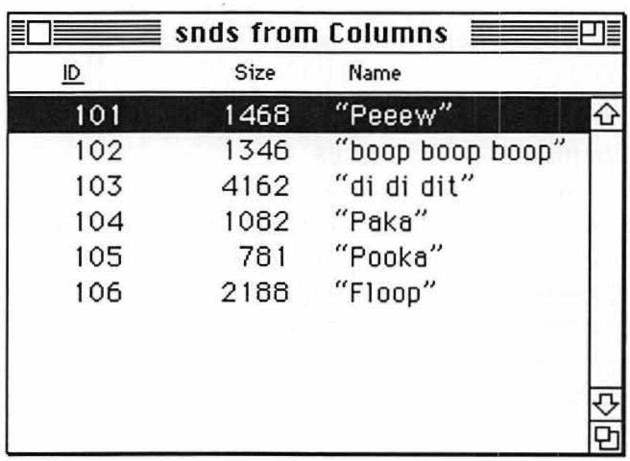


FIGURE 11-3
Resources in Columns file



ID	Size	Name
101	1468	"Peeew"
102	1346	"boop boop boop"
103	4162	"di di dit"
104	1082	"Paka"
105	781	"Pooka"
106	2188	"Floop"

FIGURE 11-4
snd resources in Columns file

The sound plays. You can also play the sound as a HyperCard sound or rising scale.

Copying snd Resources

Although you cannot easily edit sounds in ResEdit, you can copy sounds from one file to another. For example, say you want to hear a particular sound from your favorite computer game in place of the Macintosh System beep. Follow these steps:

1. Use ResEdit to open the computer game.

Select Open from ResEdit's File menu and use the dialog box to find the computer game. Select it and click Open.

2. Open the snd resources.

Find the snd resource icon in the resource window and double-click it. A list of all of the snd resources appears in a scrolling window.

3. Select the sound you like.

If there is more than one sound and you don't know which one you want, use the Try Sound command from the snd menu to play each one. When you find the one you like, click it to select it.

4. Copy the resource.

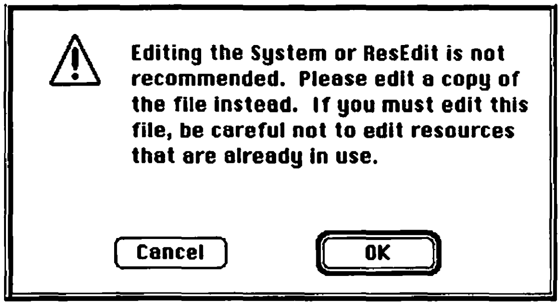
With the snd resource still selected, choose Copy from the Edit menu. The snd resource is copied to the Clipboard.

5. Close the computer game file.

Select Close from the File menu.

6. Open the System file.

Select Open from ResEdit's File menu. Use the dialog box to find the System file. Select it and click Open. You'll see the following dialog box:



This warning is not to be taken lightly. ResEdit can permanently damage files if not used correctly. If you are unsure of what you are doing with ResEdit, work on a backup copy of a file rather than the original. In this case, we are just pasting a sound into the System file, so click OK.

7. Open the snd resources.

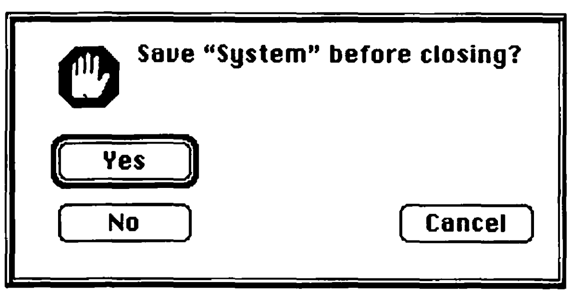
Find the snd resource icon in the resource window and double-click it. A list of all the snd resources appears in a scrolling window. You should see all of the familiar system sounds: Simple Beep, Monkey, and so on.

8. Copy the resource.

Choose Paste from the Edit menu. The snd resource is pasted from the Clipboard into the System file.

9. Save changes and close the System file.

Select Close from the File menu. The following dialog box appears on the screen:



Click Yes.

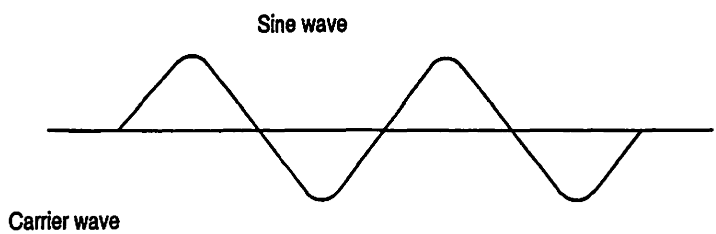
10. Use the Sound Control Panel to make the new sound beep.

Access the Sound Control Panel as discussed earlier in this chapter. You'll se the new sound listed with the others! Select it to hear it play and to make it the new System beep.

WHAT IS SOUND?

Sounds are produced by vibrations that send ripples through the air. The ripples, called sound waves, travel away from the sound source in all directions (like the wave patterns you cause on a still pond of water when you toss a stone into it). When sound waves reach you, they cause your eardrums to vibrate. Your eardrums send information to your brain, which interprets these vibrations as sound.

Sound waves can be represented graphically as a waveform. An example is shown here:



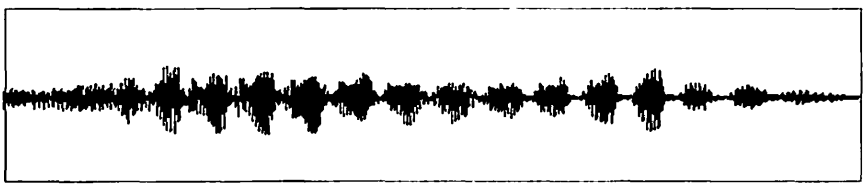
The top of a wave is called the *peak;* the bottom is called the *trough.*

Amplitude is the strength of a sound (more commonly known as loudness, or volume). It is measured as the distance between the peak and trough of a waveform. The taller the waveform, the louder the sound. Loudness is measured in decibels (db). On the decibel scale, 0 db is no sound, 20 db is the sound of rustling leaves, 70 db is the sound of street noise, and 120 db is the sound of nearby thunder. Exposure to sounds louder than 120 db can be painful; prolonged exposure will damage a human eardrum's ability to hear.

The horizontal distance between two successive peaks is a *cycle* or *period.* The number of cycles in a second is called the *frequency.* Frequency is measured in hertz (Hz) or kilohertz (1,000 hertz; abbreviated KHz). For example, the tone produced by a piano's middle C key has approximately 261 cycles per second; its frequency is 261 Hz. Humans can hear sounds with frequencies of 16 to 20,000 Hz. Frequencies greater than the human ear can hear are called *supersonic* or *ultrasonic.*

Pitch is closely related to frequency; in fact, the two terms are often used interchangeably. *Pitch* is the highness or lowness of the sound you hear. The higher the pitch, the higher the frequency. Pitch is also expressed in terms of its *wavelength.* A wavelength is equal to the speed of a sound divided by the sound's frequency. Middle C's wavelength is equal to the speed of sound (1,100 feet per second) divided by the frequency (261 cycles per second), or 4.2 feet.

Because sound waves vary by amplitude and frequency, a waveform changes shape over the duration or length of a sound. An example of this is the waveform for the Macintosh's Monkey sound, shown here:

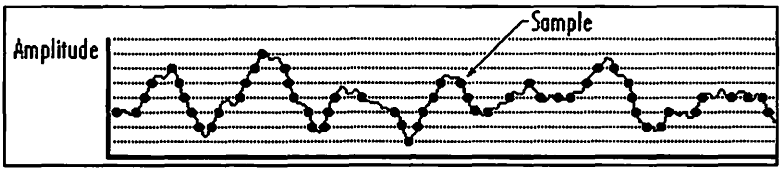


ANALOG VERSUS DIGITAL SOUND

Sound is an analog phenomena. *Analog* refers to constant variation—the very nature of sound waves. Sound vibrations cause continuous changes in air pressure.

Computers are *digital* devices. They store and process information with on and off switches called *binary digits* (bits). These on and off switches are activated by electrical impulses—a sort of Morse code. The on and off electrical impulses are like the pins-and-needles sensation you get when your foot falls asleep—something you can describe (and complain about) but not hear. A computer cannot store information to express sound's continuous analog variations without converting them into a digital format.

A device called an *analog-to-digital converter* changes continuous analog signals to the digital numbers a computer understands. It takes a sample of the sound at periodic intervals—usually many times each second. (This is similar to the way a movie camera films multiple still frames of moving subjects.) Each sample is assigned a number that represents its amplitude. When played back with a digital-to-analog converter, the samples create an illusion of smooth, constantly changing (analog) sound. A waveform can be constructed by connecting the sample points, as illustrated here:



DIGITAL SOUND QUALITY

The quality of a digitized sound depends on two important factors: sampling rate and resolution.

The *sampling rate* is the number of samples taken each second. The more samples, the better the sound quality. Like frequency, sampling rate is also expressed in kilohertz (KHz). The Macintosh supports sound sampling rates of up to 22 KHz—22,000 samples per second. For comparison, consider that an audio compact disk has a 44.1 KHz sampling rate.

The *sampling resolution* is the number of bits that can represent each sample. The more bits, the more dynamic levels of amplitude that can be represented. For example, a 4-bit digitizer can record samples with only 16 different levels of amplitude (24). A 16-bit digitizer can record samples with over 65,000 different levels of amplitude. The Macintosh supports 8-bit sampling resolution—256 possible levels of amplitude per sample. An audio compact disk has a 16-bit (or more) sampling resolution.

OTHER DIGITAL SOUND FACTORS

There are several other factors you should be aware of if you work with digitized sounds: aliasing, quantization, and clipping.

Aliasing

Aliasing was first discovered by H. Nyquist, a scientist. He noted that the frequency range of a digitized sound is limited to one-half the sampling rate. For example, a sampling rate of 22 KHz can record a frequency range of up to 11 KHz. Frequencies higher than one-half the sampling rate falsely appear as lower frequencies.

A visual example of aliasing occurs in motion pictures when wheels seem to spin too slowly or even backwards.

Quantization

Quantization happens when the volume (amplitude) of a sample falls between two values. These values are limited to whole number (integer) values. If the values fall between two integers, they are rounded to the nearest whole number. This gives the reconstructed waveform a stepped, staircase shape rather than the smooth, curved shape of the original analog signal's waveform. These rough edges make harsh, choppy noises. The lower the resolution and the less available integers, the greater is the noise due to quantization.

Clipping

A sound is *clipped* when the volume of a sample exceeds the quantization range. For example, clipping can result when a loud sound is recorded with a sensitive recording device. The maximum amplitude of the device may not be as high as the sound's amplitude. In that case, the sound's amplitude is reduced to the maximum amplitude that the recording device can quantify, and the result is a waveform with flat tops and bottoms. The sound is distorted. Most recording devices have controls to adjust the quantization range to fit the sound amplitude.

MONOPHONIC VERSUS STEREOPHONIC

Until the 1930s, all recordings were *monophonic*. Monophonic (or mono) recordings take input from one source. A single microphone connected to a tape recorder creates a monophonic recording.

In 1933, research into *stereophonic* sound reproduction began. Stereophonic (or stereo) recordings take input from two sources or channels. Stereo sound is richer and more natural. You hear in stereo because your two ears are positioned on opposite sides of your head. Not all Macintosh computers can record or play stereo sounds. If a Macintosh model is unable to play a stereo sound in stereo, it may play only one channel of the sound. This is a problem. Imagine sitting between two people who are having a conversation and only being able to hear one of them. This is what it's like to hear one channel of stereo sound—information can be missed. Table 11-1 summarizes the stereo capabilities of different Macintosh models.

SOUND SIZES

Sound quality depends on the sampling rate and resolution. The higher each of these factors is, the higher the sound quality is. The *size* of a sound is directly related to the sampling rate and resolution, as well as to the sound length or duration. The more information to be recorded, the bigger the sound size is. Changes in the sampling rate and sound duration can change the physical size of a sound as stored on your Mac in the following manner:

Sampling Rate	One Second	Thirty Seconds	One Minute
22KHz	22K	660K	1320K
11KHz	11K	330K	660K
7KHz	7K	210K	420K
5KHz	5K	150K	300K

Macintosh Model	Recording Capabilities	Built-in Speaker	Audio Output Jack
512K	Mono	Plays one channel	Mono
Plus	Mono	Plays one channel	Mono
SE	Mono	Plays one channel	Mono
II	Stereo	Plays one channel	Stereo
IIx	Stereo	Plays one channel	Stereo
SE/30	Stereo	Plays both channels	Stereo
IIcx	Stereo	Plays both channels	Stereo
IIci	Stereo	Plays both channels	Stereo
IIfx	Stereo	Plays both channels	Stereo
Classic	Stereo	Plays both channels	Stereo
LC	Mono/stereo	Plays both channels	Mono
IIsi	Mono/stereo	Plays both channels	Stereo

TABLE 11-1
Stereo Capabilities of Macintosh Models

Noncompressed Sound

Noncompressed sounds are sounds recorded at—or converted to—a sampling rate of up to 22 KHz. The sound isn't altered to make it smaller. Noncompressed sounds are played by the Macintosh operating system and most sound applications.

Downsampled Sound

Downsampled sounds are recorded at—or converted to—a sampling rate of up to 11 KHz. Downsampling reduces the size of the sound. It also reduces the frequency range (because of aliasing) and sound quality (because a lower sampling rate is used). Downsampling does not change the sound resolution. Downsampled sounds are played by the Macintosh operating system and most sound applications.

Compressed Sound

A *compressed* sound is smaller. The number of bits per sample is reduced. This also decreases sound quality (because of lower resolution). Compression is expressed as a ratio; commonly used ratios are 8:1, 6:1, 4:1, and 3:1. The ratios represent a comparison of the noncompressed sound size to the compressed sound size. For example, 4:1 compression means that, for every four bits, only one bit is stored. Only specialized sound applications are able to play compressed sounds. (Sound compression is covered in Chapter 7, "Disk and File Management.")

PRACTICAL APPLICATIONS

The ability to play digitized sounds on your Macintosh is more than just a neat trick. Sound is a key ingredient in business and educational multimedia presentations. The term *multimedia* has a variety of meanings. In this instance, it conveys the idea of more than one method of communication. This includes—but is not limited to—text, graphics, still pictures, animation, and sound. (See Chapter 20, "Graphics, Presentation and Multimedia Programs," for more information.)

Sound is useful to teach concepts that may be difficult to grasp through written words and pictures. Computer-based encyclopedias and dictionaries often include sound entries. They enable you to hear what a song, instrument, or spoken word sounds like. Correct pronunciations of foreign or specialty languages (like "computerese") are easier to hear and repeat than to try to decifer phonetically.

Sound can also liven up those deadly dull presentations. An audience will take notice when there is an unusual sound or catchy tune wafting from the computer's speaker. If used correctly, sound can be a highly effective communication tool. (Incorrectly used, it can become a source of pain.)

RECORDING DEVICES AND SOFTWARE

The Macintosh can play digitized sounds, but until recently, you couldn't record sounds on a stock (off-the-shelf) Mac. With the release of the Macintosh LC and IIsi, all this changed. Now, if you're thinking of purchasing a new Mac, you can get one that lets you record your own customized sounds. This is a real hit with grade-school kids. Instead of a boing or a beep, they can have a belch, a retch, or other, more repulsive noises as their System beep sound—a favorite is "Hey! What d'ya think you're doing?" as the System beep sound. (No kidding.)

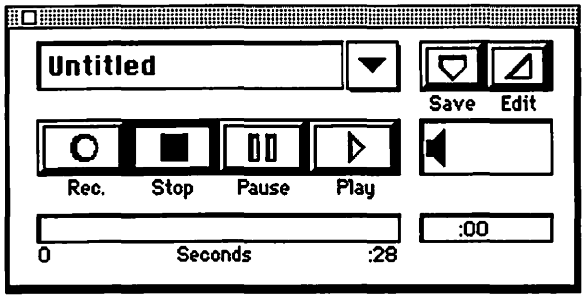
If you don't have one of these Macintosh models, don't feel left out. All Macintosh models can record sounds. Several third-party recording devices and software are available. Check around. They're a frivolous add-on, but fun.

Apple Microphones (LC and IIsi) and HyperCard 2.0

Macintosh LC and Macintosh IIsi computers have built-in sound input circuitry. Each computer is shipped with a small microphone and cable. With the microphone, you can record 8-bit mono sound. A plastic holder lets you attach the microphone to the front or side of your monitor for easy access. You can record using special controls in the Sound Control Panel.

HyperCard 2.0 by Claris (which is bundled with the System software for all new Macs) also provides the necessary software for sound recording. (HyperCard is discussed in greater detail in Chapter 14.) "Addresses With Audio" and "Appointments With Audio" are two *stacks* (HyperCard files) that use the sound features. Figure 11-5 shows a card from the Appointments With Audio stack. Notations can be noted in text or with sound. Audio commands are in the Edit menu.

To add a sound to a card, select Add Audio Memo from the Edit menu. An Audio window appears, like the one shown here:



The buttons in the window work like the buttons on a tape recorder. Click Rec. to record a sound, Stop to stop recording, and Play to hear the recorded sound. If you don't like a recorded sound, you can click Rec. again to re-record it. When the sound is just right, click Save and give the sound a name. A sound button, like the one to the left of the 11 A.M. memo in Figure 11-5, appears in the upper-left corner of the card. Hold down the OPTION key and drag the button to move it wherever you like on the card. When you click the button, the sound plays. ("Hey! What d'ya think you're doing?")

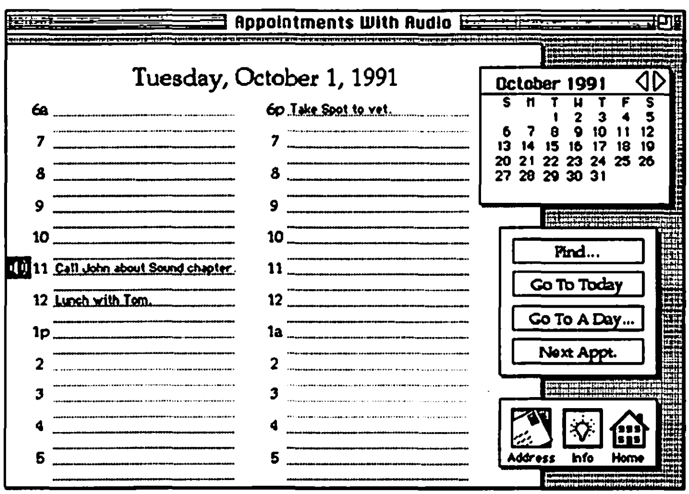


FIGURE 11-5

HyperCard's Appointments With Audio stack

You can also edit audio memos. Click Edit in the Audio window. The window expands to illustrate two versions of the waveform for the memo. Figure 11-6 shows the expanded Audio window for the sound "How are you?" The bottom illustration is the entire waveform. If you examine it carefully, you can see each of the separate words and syllables. The top illustration shows only the portion of the waveform that fits inside an adjustable frame in the bottom illustration. You can move or resize this white frame to change the view of the waveform in the top illustration. In the Figure 11-6 example, the word "you" is framed. You can also select portions of the waveform in the top illustration. Selected parts of the waveform can be edited by using the Cut, Copy, Paste, or Clear command in the Edit menu. Save changes with Save.

MacRecorder, SoundEdit, HyperSound, MacRecorder Driver, and HyperSound Toolkit

The MacRecorder, by Farallon Computing, is a sound digitizer. It has a built-in microphone, external microphone and line-in jacks (to connect microphones and other devices), and input level knob. Plug it into the modem port on your Macintosh. Install the SoundEdit application soft-

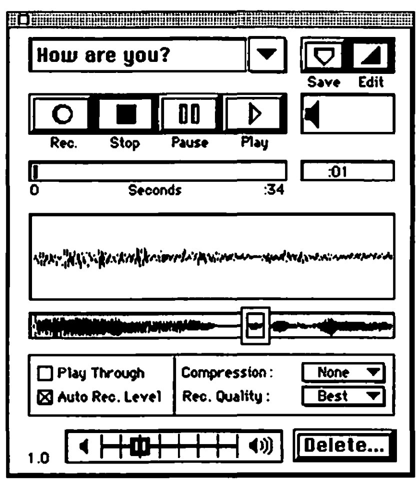


FIGURE 11-6
Editing sounds with HyperCard

ware or HyperSound HyperCard stack, also by Farallon, and you're ready to record. Or install the MacRecorder Driver, and a MacRecorder can take the place of an Apple Microphone to record sounds with HyperCard 2.0. The MacRecorder Driver is an INIT/Extension. You install it in your System folder (System 6) or Extensions folder (System 7). With it, the MacRecorder can work with the Sound Input Manager used by HyperCard 2.0 and included in System software versions 6.0.7 and 7.

SoundEdit is sound digitizing and editing software. It graphically displays sound waves as dots or lines. Use its Input Level Meter in conjunction with the input level knob on the MacRecorder to obtain the correct input volume and prevent clipping. Raise or lower the MacRecorder's input level until the waveform just fits into the window. Click Record and speak into the MacRecorder's microphone to record. Click the mouse button to stop recording. The waveform appears in SoundEdit's window. In Figure 11-7, the phrase "This is a noisy Mac" is illustrated. To play a sound, click Play. To play part of a sound, highlight the portion of the waveform you want to hear and click the Play button.

SoundEdit offers a variety of editing features in addition to Cut, Copy, and Paste. With the Effects menu, you can do a number of special effects to an entire sound or part of a sound. You can record in stereo with one or two MacRecorders. A sound mixer lets you combine up to four channels of sound. You can also select sampling and sound compression rates before you record to minimize the recorded sound's size. Once a sound has been created or edited, it can be saved in one of four formats: SoundEdit format,

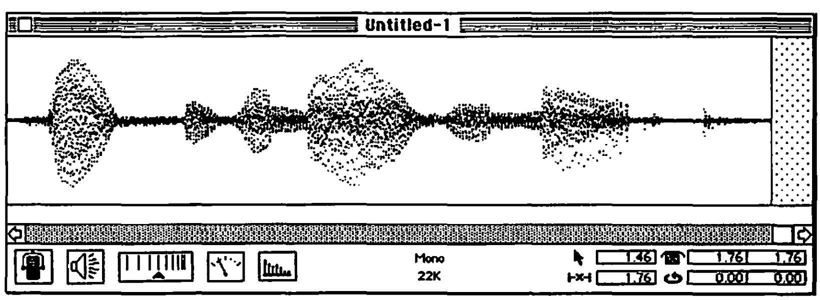


FIGURE 11-7
SoundEdit displays the sentence "This is a noisy Mac"

Instrument format (used by music applications), Audio Interchange File Format (AIFF, a standard audio file format), or snd resource (in either Format 1 or Format 2).

Farallon's HyperSound stack is a HyperCard stack that you can use to record and play sounds. It is included in the MacRecorder/SoundEdit package. Like SoundEdit, HyperSound lets you record sounds at a variety of sampling rates and compression ratios, but HyperSound supports only mono recording. Once a sound is recorded, HyperSound's buttons (illustrated in Figure 11-8) make it easy to copy sounds into HyperCard stacks. You can also copy sounds into SoundEdit for editing. For more advanced HyperCard users, Farallon also provides HyperSound Toolkit. It provides a set of HyperTalk external commands and functions that let you use sounds in your own HyperCard stacks. (For more information about HyperCard and HyperTalk, consult Chapter 14, "HyperCard.")

VoiceLink and DesktopMike

VoiceLink is a package by Articulate Systems that includes a unidirectional microphone, a digitizer, and sound-processing software. The hardware includes a built-in sound compression processor and line-in jack that lets you attach another microphone or external device. You attach the

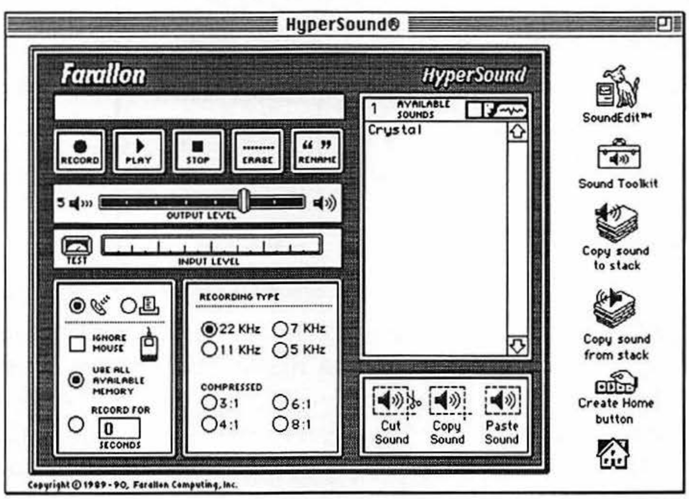


FIGURE 11-8

HyperSound's recording screen

microphone and digitizer to the side of your Macintosh or its monitor, record sounds with the Voice Record desk accessory, and edit them with the VoiceLink software. The VoiceLink software can save and open sound files in a variety of formats.

DesktopMike, also by Articulate Systems, is a microphone replacement for Macintosh LC and IIsi owners. It features a freestanding, unidirectional microphone at the end of a flexible "gooseneck." The gooseneck lets you position the microphone close to your mouth rather than holding it or clipping it to your clothing to record. DesktopMike can be used with Articulate's Voice Record desk accessory or VoiceLink software.

Sound Notes Macro for Excel

Sound Notes is a freely distributed Excel macro by Microsoft Corporation. It can be found on many bulletin board systems (BBSs) and online services such as America Online, CompuServe, and GEnie. Microsoft retains the copyright of the macro code but does not support it in any way.

Open the Sound Notes macro. It adds the following sound menu to Excel's menu bar:

Place your cell pointer in a cell you want to add a sound to and select the Record Sound command. A dialog box appears with buttons like those found on a tape recorder. Click Record and speak into a microphone connected to your Macintosh to record a message. Click Stop when you are finished and click Save to save the sound. The message can then be played from the Sound menu.

The Sound Notes macro works with System 6.0.7 or System 7. Although it was written for Excel 2.2, it also works with Excel 3.0.

SOUND UTILITY SOFTWARE

A variety of software tools exists to help you manage and use sounds. Let's take a look at some of them.

Suitcase II and Font & Sound Valet

Suitcase II is an INIT/Extension by Fifth Generation Systems. It is primarily known for its font and desk accessory management capabilities. (See Chapter 6, "Operating Systems and Utilities," and Chapter 9, "Fonts," for more information about fonts and desk accessories.) Suitcase also enables you to manage sounds. With Suitcase, you can use sounds stored in files other than the System file for System beep sounds. Access the Suitcase II desk accessory from the Apple menu and click the Sound radio button. A list of all the sounds installed in the System file appears in a scrolling window. The Play button plays a selected sound and Rename lets you give the sound a new name.

The Suitcases button lets you open other files and add their sounds to those available. Click Suitcases and then click Open File(s). An Open File dialog box appears. Use it to select a file that contains sounds. (Make sure that the Show All Types check box is checked or the file you want may not appear.) The Inspect button shows a list of all of the sounds included in a selected file. The Open button adds the sounds from a selected file to those available to the system for System beeps. You can then use the Sounds Control Panel to reassign the System beep to one of the new sounds.

Font & Sound Valet is a utility by Fifth Generation Systems that works with Suitcase II. It lets you "pack" fonts or sounds into suitcase files that can be opened by Suitcase II. The packing process reduces the size of the resources packed so that sounds take up less space on disk. Suitcase unpacks the resources as applications need them and automatically repacks them when they are not needed.

MasterJuggler

MasterJuggler is an INIT/Extension by ALSoft. MasterJuggler is known primarily for its font and desk accessory management capabilities. With MasterJuggler, you can assign sounds stored in files other than the System file to nine different events.

When you install MasterJuggler, it adds its menu to the Apple menu. This menu is illustrated in Figure 11-9. Choose MasterJuggler from the MasterJuggler menu to open files containing sounds you want to use. If you use MasterJuggler to open an application containing sounds, MasterJuggler warns you not to run that application; doing so causes a system bomb. The Sound List command from MasterJuggler's menu provides a list of all available sounds.

HotSounds, a part of MasterJuggler, lets you assign available sounds to System events. These events include disk inserts and ejects, application launches, shutdown, and restart. The Hotsounds window provides buttons to set, remove, or assign random sounds to these events. This window also lets you set the sound volume.

SoundShrinker

SoundShrinker is an application by James Cook which is distributed as *postcardware* (if you like it, you are supposed to send the author a postcard). It reduces the size of sound files by converting them to a lower sampling rate. For example, SoundShrinker can convert a 22 KHz sound to 11 KHz, making the sound half its original size. Even though a file made smaller with SoundShrinker can still be played, the sound quality is reduced because the sampling rate is lower.

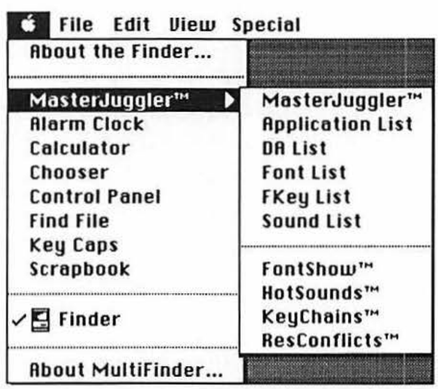


FIGURE 11-9
MasterJuggler's menu

SoundMaster and SoundPlay

SoundMaster is a shareware Control Panel device by Bruce Tomlin available on BBSs and online services. SoundMaster lets you assign a sound to each of over 20 different System and Finder events.

Open SoundMaster's Control Panel, illustrated in Figure 11-10. From the scrolling window on the left pick the event to which you want to assign a sound. Use the file window on the right to select a sound to assign. SoundMaster can read sounds saved in a number of different formats and sampling rates. Sounds must be saved as sound files; SoundMaster cannot read resources. To hear a sample of a selected sound, click the sound icon button. A volume control lever in the window's upper right corner lets you raise or lower the volume. When you've made your selections, click the close box. SoundMaster warns you that your changes won't take effect until you restart.

SoundPlay is a public domain desk accessory, also by Bruce Tomlin. It lets you play any sound file on your computer. SoundPlay does not recognize snd resources; it only recognizes sound files like those created with SoundEdit. SoundPlay is also available on BBSs and online services.

SuperPlay

SuperPlay is a shareware application by John Raymonds that is available on BBSs and online services. It lets you play sound files or resources

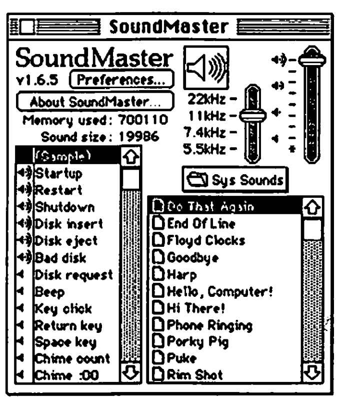


FIGURE 11-10
SoundMaster's Control Panel

on your Macintosh. Start SoundPlay and use the File menu's Open command to open a sound. Select Play from the File menu to hear the sound. Another option lets you play all of the sounds in the folder.

WHERE DO YOU GET SOUNDS?

Macintosh's sound capabilities are great. If you want to take advantage of them, but don't own a Macintosh LC or IIsi and aren't ready to invest in sound-recording hardware, what can you do? Are you left out of the fun? Of course not.

Prerecorded sounds are available from many sources, including BBSs and online services. You may not own sound-recording hardware, but other Macintosh owners do. These people record sounds from television shows ("beam me up, Scotty"), movies, and sound effects records and they share their sounds with other Macintosh users. (This is illegal, but widely practiced.)

If you need high-quality sounds and sound effects to use in multimedia presentations, you might want to obtain sound libraries from commercial sources. These sounds are usually recorded under optimal conditions for the highest-quality output.

Desktop Sounds and SoundStack

Desktop Sounds by Optical Media International is a CD-ROM disk that contains about 400 sounds. Sounds are stored in snd resource format. SoundStack, a HyperCard stack included on the disk, lets you search for and play sounds. You can incorporate sounds into HyperCard stacks, applications, and multimedia presentations.

THE MACINTOSH SPEAKS

Your Macintosh's sound capabilities go beyond that of a simple tape recorder and player. With the right software, your Macintosh can actually talk to you.

A voice or speech synthesizer is highly specialized software that enables a computer to produce spoken words from text. Recorded sounds are not used. Instead, a speech synthesizer's program code includes instructions that tell the computer how to use the speaker to pronounce letter combinations. The resulting speech is understandable, although it sounds somewhat like a robot.

MACINTALK

MacinTalk was an early Mac speech synthesizer. It doesn't work in System 7. It is a system file that works as a speech driver. To use it, copy it into your System folder. MacinTalk does nothing by itself; to hear your Macintosh talk, you still need software that uses MacinTalk. A number of products (some of which are summarized below) use the MacinTalk speech driver.

MacinTalk was created for Apple Computer by a third-party developer in 1984. It was an interesting piece of software, so Apple made it available to developers. Although Apple contracted for the development of a speech driver, the program's source code was not included in the contract and Apple did not get it. Without the source code, the program cannot be changed.

Unfortunately, MacinTalk was developed when the Macintosh was in its infancy. It works with the computer's hardware—specifically, the hardware of the Macintosh Plus. MacinTalk knows nothing about the Apple Sound Chip found in the Macintosh II series and some other Macintosh models.

The Apple Sound Chip and the System software's Sound Manager work together to allow MacinTalk to work on newer Macintosh models. The Sound Manager watches for activity by MacinTalk. When it detects activity, it allows MacinTalk to access the sound hardware it needs. But while MacinTalk is working, the Sound Manager cannot work. No other sounds can play until the application using MacinTalk is shut off. This problem is further complicated by MultiFinder and System 7's ability to run more than one application at a time. A program that uses MacinTalk can limit the abilities of a program running at the same time. It is unlikely that MacinTalk will continue to work with future Macintosh hardware.

MacinTalk is part of the System software, but is not distributed on any of the Macintosh System software disks. It is available through BBSs and online services. Apple makes MacinTalk available but does not provide any support for it, not even to Apple developers. In addition, Apple discourages the use of MacinTalk in commercial applications.

If you use MacinTalk on a newer Macintosh, do so with care. Run only one program at a time and make sure that the System beep is set to Simple Beep; this is less likely to cause problems.

VOICE SYNTHESIS SOFTWARE

A talking computer is more than just another example of Macintosh fun. There are several practical applications for speech synthesis. The products discussed in this section use speech synthesis in useful ways. (In addition, Chapter 21, "Educational Software," explores the use of speech synthesis in elementary educational products.)

outSPOKEN

One of the best features of the Macintosh is its graphical user interface. Icons, dialog boxes, windows, and a mouse make the Macintosh easy to use. But imagine using a Macintosh if you could not see the screen. Impossible? Not with outSPOKEN. The software package by Berkeley Systems makes it possible for blind people to use a Macintosh. It is a Control Panel device that you install in the System folder (System 6) or Control Panels folder (System 7). It uses MacinTalk, which is included within its programming code, to describe the screen to users from the moment the Macintosh starts up. (For more information regarding products for the physically disabled contact Apple Computer's Office of Special Education and Rehabilitation at 408-996-1010.)

Start your Macintosh with outSPOKEN installed. When the startup process is completed, your Macintosh says "Welcome to outSPOKEN."

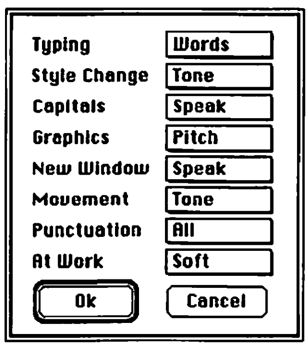
A static sound indicates that the Macintosh is working. (This is the audio equivalent to the Wristwatch icon that appears on the screen.) Mouse navigation is done with the numeric keypad. For example, the top left key is outSPOKEN's Menu key. (It, and all other keys, are described as coordinates of rows and columns; this first key is 1,1.) Press it and the mouse pointer moves to the first item on the menu bar. The Macintosh says "Menu Apple."

The Right key (6 on the keypad) moves the mouse pointer one menu to the right. The Macintosh says "Menu File." The Window key (to the right of the Menu key on the keypad) displays a list of windows that are open on the screen. The Down key (2) instructs the Macintosh to recite each window name, one at a time. The Select key (5) selects the current item.

Using outSPOKEN's keypad functions and the Macintosh's command key alternatives, you can point to, select, and open any item on the screen.

MacinTalk also announces the appearance of dialog boxes and reads their contents.

A tutorial guides you to open a TeachText document on the outSPOKEN disk. It then shows you how to read the document with MacinTalk. Text can be read by the line, word, or character. Another tutorial exercise shows how to create a new document with the menu commands. As you type text, MacinTalk reads it back to you. MacinTalk's settings can be adjusted to make its synthesized voice easier to understand or to correct pronunciation of certain words. A sample dialog box to change some of the settings is shown here:



It can be accessed through command-key alternatives or the outSPOKEN Control Panel.

The manual comes in printed text, on cassette tape, and as an outSPOKEN-readable text file on disk. Braille quick-reference sheets are included. (A braille version of the manual is available by request.) The manual clearly describes how a Macintosh works—from a blind person's perspective. Embossed sheets illustrate the keypad functions outSPOKEN uses, as well as a Macintosh pull-down menu, window, and dialog box.

SmoothTalker

SmoothTalker, by First Byte, uses its own speech synthesizer to generate spoken English text. Type in text at the keyboard or have SmoothTalker read a text file. The words are read by a male or female voice; it's your choice. (Some people have described the male voice as sounding like a Canadian and the female as sounding like a Swedish person speaking English.) SmoothTalker is useful for proofreading documents and adding verbal communication to multimedia presentations. It's also excellent for children learning to read and write; it can keep them amused for hours. They can type in words and SmoothTalker will "read" them.

ABOUT THE ...

The Mac's First Words

MacinTalk was developed specifically for the Macintosh's initial introduction in early 1984. Steve Jobs, a founder of Apple Computer, was the leader of the Macintosh Division at Apple. He wanted the Macintosh to introduce itself with synthesized speech. On January 24, 1984, the Macintosh spoke for the first time in public. In front of 2,000 people at De Anza College in Cupertino, California, the Macintosh said:

"Hello, I am Macintosh. It sure is great to get out of that bag. Unaccustomed as I am to public speaking, I'd like to share with you a thought that occurred to me the first time I met an IBM mainframe. Never trust a computer you can't lift. Right now, I'd like to introduce a man who has been like a father to me—Steve Jobs."

THE MACINTOSH LISTENS

All Macintosh users are familiar with the mouse and keyboard as ways to communicate with their Macintosh. These are standard input devices. But there is another way to let your Macintosh know what you want it to do Connect voice recognition hardware and software to your Macintosh and you can *tell* it what to do—verbally.

Voice recognition has been talked about for years. "Twilight Zone" had a show that featured a computer programmer who communicated with his computer by way of a big silver announcer's microphone. In the science fiction movies of the forties and fifties, computers and robots all had voice recognition systems. On "Star Trek," computers were just spoken to—and they talked back, too. The idea of voice recognition has been part of our folklore for a long time.

In real life, voice recognition is a relatively new computer technology. Such a system consists of two components: hardware to "hear" commands and software to "understand" them. Words are spoken into a microphone attached to the computer and digitized through sampling. The software breaks each word down into its phonetic components. It then compares the words to a list of known words that correspond to keyboard or mouse commands. If it finds a match, it performs the command.

For some voice recognition systems, the list of known words must be built by the user. Not everyone has the same pronunciation and speech patterns, so the software might not recognize the same word spoken by different people. The user must record a command word a number of times to "train" the software to recognize it when it is said again. (After all, when you are tired, or depressed, or excited, you sound different. Just think how you sound when you are sick with a cold!) In addition, the commands must be spoken clearly, with distinct pauses between each word. If a command is not understood, it must be repeated. The Macintosh can listen, but it may sometimes seem hard of hearing. Unfortunately, speaking louder doesn't make it easier for voice recognition software to understand.

Voice recognition has its benefits and drawbacks. On the positive side, spoken commands can be up to 50 percent faster than mouse commands. A comprehensive voice recognition setup can let you work more efficiently. You won't need to drag your mouse all over the screen for menu commands and drawing tools.

On the negative side, background noise and the voices of other people in your work area can confuse the software. It may perform commands that were never requested. In today's cubicle-style offices, things could easily get out of hand if everyone spoke to their computers at once. As voice recognition technology improves and proliferates, these problems may be solved.

Someday it may be possible—with voice recognition and voice synthesis—for a computer to be completely interactive. Of course, there's always the possibility of drawbacks in that. You might tell the computer to do something only to have it say "No way."

VOICE NAVIGATOR II

Voice Navigator II, by Articulate Systems, is a complete voice recognition system for the Macintosh. It includes a processor that plugs into a Macintosh's SCSI port, a microphone, and voice recognition software. With Voice Navigator II, you can use voice commands and macros (strings of commands) to perform many mouse or keyboard commands.

Voice Navigator II uses "Languages" (command sets) to let you control applications. There are 30 basic Languages and 14 advanced Languages. The basic languages cover applications such as the Finder and Microsoft Word 4.0. Advanced Languages—also called VoiceWaves—include macros for specific applications. Languages can be modified or created from scratch with the Language Maker desk accessory, which is included as part of the package.

To use Voice Navigator II, you must create a Voice file to train it to recognize your voice. A Voice file contains a specific user's recordings of command words. Voice Navigator II's Voice Commands dialog box prompts you to say each command several times to train the software. There must be a separate Voice file for each user. Voice Navigator II's hardware also works with Articulate's Voice Record desk accessory and VoiceLink software (mentioned earlier in this chapter) to record and edit digitized sounds.

THE MACINTOSH PLAYS MUSIC

You've seen that the Macintosh can do many things. It can record and play sounds, speak, and even listen to your commands. It's a versatile little machine. The Mac can also serenade you with music. (But don't throw away your stereo system yet.)

MACINTOSH MUSIC BASICS

All sounds that come from the Macintosh's speaker, with the exception of MacinTalk-generated speech, are created through the use of the Sound Manager, part of Apple's System software. Programs produce sounds by instructing the Sound Manager to use its built-in routines to play resources or sound files. Some software products make it possible for the Sound Manager to play music with its internal synthesizers. Other software products use a protocol or language called MIDI (short for Musical Instrument Digital Interface) to play music on MIDI instruments. Let's look at these two ways to play music.

Sound Manager Synthesizers

A synthesizer produces music electronically. The Sound Manager can produce music with three different internal synthesizers: the Note Synthesizer, the Wave Table Synthesizer, and the Sampled Sound Synthesizer.

The *Note Synthesizer* is the simplest of the Sound Manager's synthesizers. It can be used to create simple monophonic melodies. This is the kind of music expected of computers. The music is a series of beeps and squeeks of varying pitches.

The *Wave Table Synthesizer* is more complex. It creates sounds based on the description of the wave cycle covered earlier in this chapter. The wave cycle is also called a wave table. This is because it is made up of a table of numbers that correspond to samples of the waveform. These numbers describe the tone of the sound. A music program can get a wave table from a resource or calculate it as it is needed. Up to four wave tables—or voices—can be played by the Macintosh at once. This makes it possible for the Macintosh to play chords and complex melodies.

The *Sampled Sound Synthesizer* plays back digitally recorded sounds. These sounds are normally saved by the recording application in Audio Interchange File Format (AIFF). The music program changes the pitch of the sound by varying the sample rate. This makes it possible for a computer to artificially re-create the sound of any recorded instrument, for example a harpsichord or flute. Creative uses of the Sampled Sound Synthesizer include using voices or sound effects (like dog barks) to make music. As in the Wave Table Synthesizer, more than one voice can be played at a time.

MIDI

MIDI is a standard computer protocol or language that makes communication possible between synthesizers, computers, and other electronic instruments and devices. Its specifications include information about hardware and software requirements. Although not all MIDI instruments comply 100 percent with MIDI specifications, the MIDI protocol allows at least basic communication between all MIDI devices. To use MIDI, you must have specific hardware and software.

MIDI Hardware A computer is one important piece of MIDI equipment. It lets you use the MIDI language—a computer language, really—to control MIDI devices. Floppy and hard disks hold MIDI data. Software programs like the ones discussed in the next section let you change that data in a wide variety of ways.

A MIDI interface is another important piece of hardware. This small box and cable connects a computer to synthesizers. It acts as a data translator between the computer and the MIDI devices, making sure that the information sent and received is in a format both can understand.

MIDI controllers send MIDI information to MIDI devices. Any MIDI instrument can be a controller (so can a computer that is running a sequencer program, as discussed below). MIDI instruments are not limited to keyboard instruments either; there are MIDI guitars, drums, and percussion and woodwind instruments that can act as MIDI controllers.

Samplers convert analog sounds to digital sounds. Samplers for MIDI offer high-quality sound with typical sampling rates of up to 44 KHz and up to 16-bit resolution. The sounds can be played back as instruments through the use of a sample playback device or sound module.

MIDI Software Sequencers let you process MIDI information to correct wrong notes, transpose the key, change tempo (speed), adjust rhythm, and do many other things. Sequencers are like tape recorders; they record data and play it back. But rather than recording sound, sequencers record MIDI instructions stored in the computer.

Voice editors provide an interface to let you edit the way a MIDI instrument sounds. This can be very useful when the instrument itself has few controls. Patch librarians help organize the instrument sounds on disk. They categorize sounds into groups and name them to make a specific sound easier to find when you need it.

Notation software lets you create music scores with your computer. You can view and edit these scores on screen or print them out. Some notation software programs require you to enter a score manually with the computer keyboard or mouse. Others can read input directly from MIDI instruments and transcribe them as you play.

The MIDI Manager is a part of the Macintosh System software that lets you reroute MIDI output. Under MultiFinder, you can route the output from one MIDI program to be the input of another. With the right software, you can fool MIDI software into thinking that MIDI hardware is connected to the Macintosh for output.

MUSIC SOFTWARE

There are a number of music software products. Some are easy enough for beginners, while others are targeted at professional musicians.

Practica Musica

Practica Musica, by Ars Nova, is a music instruction program designed to teach the fundamentals of music. It comes with a 190-page book called *Windows on Music* by Jeffrey Evans. The book and program work together to present theory and practice.

The program keeps track of your exercise scores and progress. (It's able to track the activities of many users, as long as they all use one computer.) There's an Activities menu to select the type of exercise you want. A pitch-reading exercise is illustrated in Figure 11-11. Use the mouse to click on the keyboard key that corresponds to the the note to play. The note will be played if your choice was correct; if not, you get an error sound. If you click the note to play on the musical staff, the correct key on the keyboard is highlighted to help you. A Staff Keyboard option, active in the figure, shows notes on the keyboard to provide further assistance. The exercise is timed. Your score appears when you are finished. You can repeat the exercise or try again with another melody.

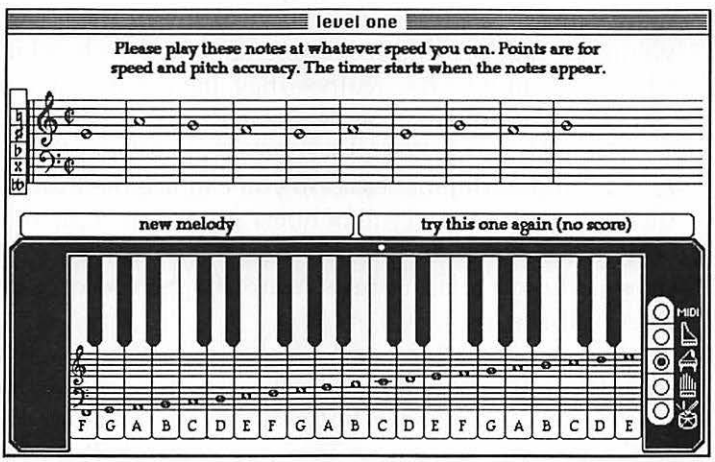


FIGURE 11-11

A pitch-reading exercise from Practica Musica

Exercises are included to provide a variety of music training. In addition, Practica Musica is MIDI-compatible if you connect a MIDI instrument to your Macintosh for input or output.

Jam Session

Jam Session, by Broderbund Software, lets you "jam" with animated musicians on your computer. As a musical number is played with digitized instrument sounds, you add additional instrumental sounds from your keyboard. The customized jam session can be recorded for future playback.

Start Jam Session and use the Open Song command from the File menu to select a musical number. An illustration of a band appears on the screen. Select Play from the Jam menu. After some applause (of course), the band commences. The illustration has some animation so that the musicians look like they're playing their instruments.

You can play right along with these musicians by hitting keys on the keyboard. To find out which instruments are available, select the Keyboard Index command from the Options menu. A keyboard layout appears. Press the SHIFT key or use the CAPS LOCK key to get different instruments. These are the instruments you can play in that particular number. Each musical number has a different collection of instruments. You can change the volume, tempo, or length of the song. A favorite band in Jam Session is the Chicken Combo—no, really—they have chicken musicians that play something resembling country swing.

If you know music and want to create your own riffs (and still want to fool around with Jam Session), you can use the Edit Riff command from the Edit menu. A staff full of notes appears, as illustrated in Figure 11-12. You can use the editing tools in the lower left corner of the window to erase, move, or insert notes or rests. Your riffs then become part of the available riffs for that song.

You can even play Jam Session's Synthesizer. It includes digitized sounds for 21 different instruments, six rhythm patterns, and five special effects. Record and Play buttons let you create and listen to your own songs. You could even write some words and get your friends to sing along!

ConcertWare+ and ConcertWare+MIDI

ConcertWare+, by Great Wave Software, has three music-making components: Music Player, Music Writer, and Instrument Maker.

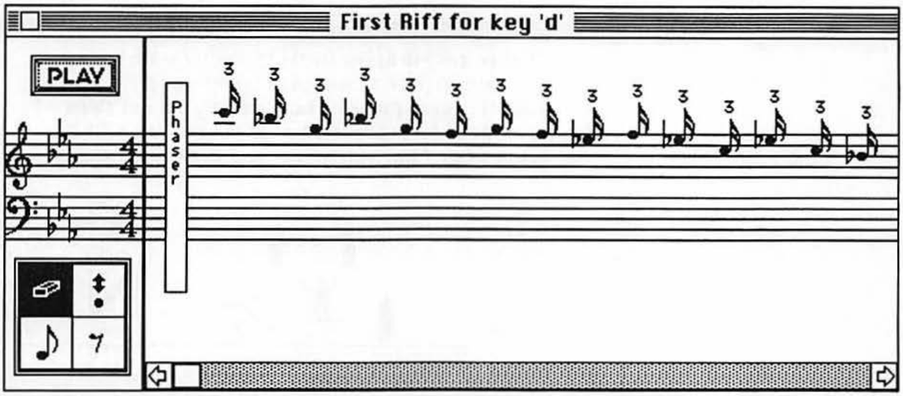


FIGURE 11-12
Editing Jam Session riffs

The Music Player module lets you play ConcertWare+ music files on your Macintosh. Start the Music Player and select Open from the File menu. Select a song from the Music folder included with the program. The Music Player window appears, as illustrated in Figure 11-13. It has a header that briefly discusses the piece, an orchestra palette of eight instruments, a playing orchestra with a conductor, a scroll display for the music, tempo and volume controls, and eight voice check boxes.

The Macintosh can only play four instrument sounds at a time. Because of this, only four musicians will cluster around the conductor and only four voices are available among the voice check boxes. Those four instruments are the ones you hear when the song starts to play. As the song plays, the music scrolls past in the lower left corner of the Music Player window. Double-click any instrument in the orchestra palette to change it. A scrolling window appears to let you select from the available instruments.

Music Writer lets you write or edit music. Use the File menu to open a song from the Music folder or create a new song from scratch. The program uses Adobe Systems' Sonata font to display musical notation on the screen. Each instrument's voice is separately displayed for editing. You can enter notes from a note palette that offers note length and pitch icons. Notes are inserted at the blinking cursor that appears wherever you click

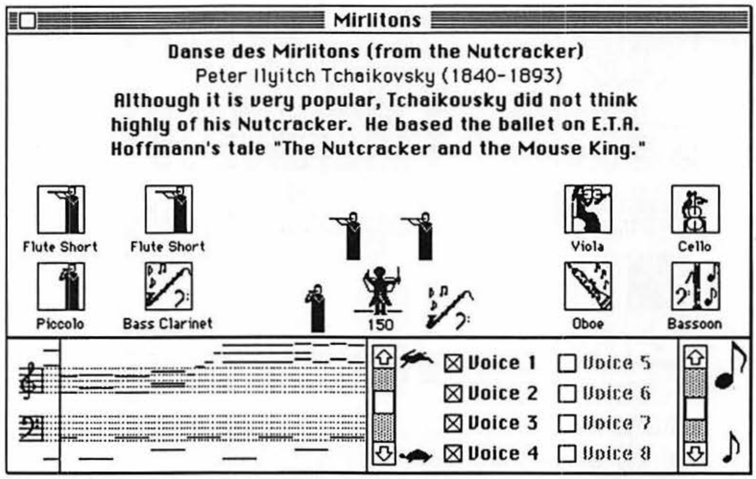


FIGURE 11-13
ConcertWare+'s Music Player window

the musical score. The usual Mac editing commands—Cut, Copy, and Paste—are also supported.

Instrument Maker lets you listen to, edit, and create instruments for ConcertWare+ music files. When you start the Instrument Maker, a dialog box appears, where you can click an instrument to select it. Press keys on the keyboard that correspond to notes you want to hear from that instrument. The notes play. Double-click an instrument to edit it. The Instrument Maker window appears. You can use this window to change a variety of things that affect the way an instrument sounds. The keyboard at the bottom of the window lets you hear a sample of the instrument with the changes you have made.

ConcertWare+MIDI is a MIDI-compatible version of ConcertWare+. It includes the same three modules, but is capable of playing up to eight voices (rather than only four). In addition, ConcertWare+MIDI lets you use one or more MIDI instruments for input and output.

Passport Products

Passport makes a variety of music software products. It provides a full range of MIDI software, with many products designed specifically for music professionals. This software isn't the light-hearted, for-entertainment-value-only stuff.

Audio Editing Software Sound Apprentice is a digital audio and sample editing program by Passport. It allows you to create and edit sampled sounds in Sound Exciter (discussed in the "Playback Software" section) and MacRecorder (discussed earlier) formats. It can also process samples from MIDI sampling keyboards. With Sound Apprentice, you can create almost any kind of musical instrument sound or sound effect. You can mix and edit sounds and digitized dialog, and assign sounds to a dedicated sampling device.

Alchemy is a more powerful digital audio and sample editing program by Passport, able to edit Macintosh 16-bit stereo sounds. It does everything that Sound Apprentice does and more.

Music Composition Software Encore is Passport's music composition and publishing software package. It transcribes and prints scores based on information entered on a computer keyboard or with a MIDI instrument. It uses Adobe Systems' Sonata font for on-screen display and printed scores. Encore can import standard MIDI files and transcribe sequences from any Passport sequencer. It also works as a 64-track MIDI sequencer that can play back a score over as many as 32 MIDI channels.

Clicktracks is a software product by Passport that helps composers to accurately synchronize music to video or film. It provides tools to lay out cues, work with tempos, and automate many of the dull, time-consuming tasks.

Playback Software Sound Exciter is an eight-voice MIDI synthesizer by Passport that works on your Macintosh. It can play up to eight sounds at once from your Macintosh, and no additional hardware is required. It can play music from any sequencer or MIDI application compatible with Apple's MIDI Manager. It can emulate sampling keyboards—the Macintosh's processors do the synthesis.

HyperMusic MIDI Player is a MIDI "jukebox" by Passport. It is a HyperCard stack that can play sets of songs recorded as MIDI sequences. HyperMusic is a useful tool for the organization of HyperCard multimedia presentations.

Sequencing Software TRAX and Audio TRAX are two desktop recording studio packages by Passport. TRAX lets you record, edit, and play back music. With it, you can create 64-track MIDI music for multimedia presentations (and home entertainment). It uses tape recorder style controls to create and refine a music sequence. Audio TRAX is for digital audio and MIDI. It has all the features of TRAX, as well as a record-digitized voice, sound effects, and music. Master Tracks Pro 4 is Passport's powerful professional-level sequencing software. With it, you can create songs, soundtracks, or any kind of musical composition on a Macintosh. It has an integrated track editor to record and play back up to 64 tracks of music. You can see the structure of music and edit it with Cut, Copy, Paste, and Mix commands. Notes are displayed as MIDI events. You can click notes and drag them to change duration, pitch, or velocity. With Master Tracks Pro 4, you can synchronize music to film, video, or multitrack audio tape.

MIDI Music on Disk MIDI Hits, produced by Passport's Music Data Division, includes many professionally recorded songs in the form of MIDI sequences.

Songs come on disk. You can arrange and play them on your own MIDI instruments using a MIDI sequencer or HyperMusic. Hundreds of titles are available in many different styles, including Jazz, Rock, Hits, Oldies, and Classical. Three songs come on each disk.

Opcode Products

Opcode Systems is another developer of music software products. It provides a full range of MIDI software, including a line of products for beginners.

MIDI Beginners Software The Book of MIDI is a huge HyperCard stack from Opcode that teaches MIDI fundamentals. It covers MIDI basics for computers, music, and synthesizers. Browse through its cards by clicking the right arrow button. Get more in-depth information by clicking the down arrow. Click an Ear icon to hear what a synthesizer or MIDI instrument sounds like. The Book of MIDI also includes reference materials:

MIDI specifications, a glossary of computer music terms, and an extensive bibliography.

EZ Vision is an Opcode program that lets you create music with your Macintosh and a MIDI instrument. You can record up to 16 instrument parts. You can change instruments and enter notes one at a time. EZ Vision's graphic editing features let you edit velocity, duration, pitch, bend, modulation, and tempo. EZ Vision includes windows for arranging and mixing music.

MIDIplay is a HyperCard stack from Opcode that lets you add MIDI music to multimedia presentations. With it, you can edit basic instrumentation and timing or play digital audio files.

Music Composition Software CUE is a software package from Opcode designed for film and video composers. It automates the calculation of tempos so that the music corresponds with picture scenes. You log timings of video events and CUE makes all of the necessary calculations and prepares cue sheets for you. In addition, CUE can play back imported MIDI sequences so you can hear the music used. CUE is designed to work in conjunction with Opcode's other package, Vision.

Sequencing Software Vision is a professional sequencing software package by Opcode. It works with CUE to simplify the creation of a film or video soundtrack. You can import a tempo map from CUE and start recording music in Vision while in sync with the picture. Once music is recorded, each note can be edited on screen to adjust pitch, duration, velocity, or start time.

Recording Software Studio Vision is a MIDI and digital audio-recording software package from Opcode. It has all of the capabilities of Vision. It lets you record CD-quality audio directly to disk with MIDI data. Record as much MIDI information and live sound as your hard disk can hold. Studio Vision samples at a rate of 44 KHz with 16-bit resolution. It works with Digidesign's Sound Tools Digital Recording System for high-quality analog or digital tape output.

Editor/Librarians Galaxy is a librarian program by Opcode. It supports over 90 different instruments and works with Opcode's Vision software. It helps musicians store and manipulate synthesizer patches. Galaxy Plus Editors combine Galaxy with MIDI sound-editing software. These editors let you access and modify a stored instrument's sounds. The Galaxy Plus

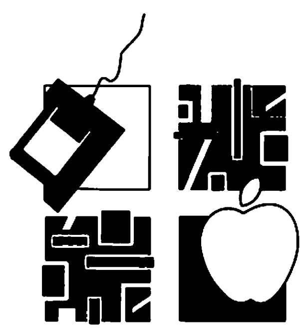
Editors package has graphic-editing features and a built-in sequencer so that you can hear the sounds as they are changed.

CD-ROM Digital Sound Series and Universe of Sounds Virtual Instrument CD Libraries

The CD-ROM Digital Sound Series, by Optical Media International, is a series of CD-ROM disks. Volume 1 contains over 1,200 sound effects and percussion sound files. Volume 2 contains over 1,500 instrument sound files. The Universe of Sounds Virtual Instrument CD Libraries, also by Optical Media, contain audio sound libraries for use with a wide variety of MIDI devices. This is the zenith of the Mac sound effects possibilities. With this package, you can really put together musical compositions to rival the pros.

CONCLUSION

The Macintosh is a noisy computer. It can beep at you or go boing or clink clank. It can talk for you, and to you. If you're patient, you can even teach it how to recognize your voice. The Mac can hum you to sleep or play a rousing heavy metal guitar riff. With the right hardware and software tools—and some time to fool around—you can really have some fun. And you thought all you were buying was a computer!



CHAPTER 12

TELECOMMUNICATIONS

When the Macintosh was first released, there was a limited supply of useful software for it, and the first telecommunications programs a Mac could use were primitive compared with what was available in the MS-DOS market. Thankfully, this is no longer true. There are now a number of exceptionally good telecommunication programs available for the Macintosh within a wide price range, and it is not difficult to find a good package.

WHEN TELECOMMUNICATIONS BEGAN

When Alexander Graham Bell invented the telephone almost a century ago, he envisioned a day when the music of symphonies and orchestras in one city would be piped to another concert hall in another city over telephone wires. As is the case for many inventions, the application has varied from the vision of the inventor.

Early telephones were expensive, used only by very wealthy people and big businesses. Today almost everyone has at least one telephone at home and two or more at the office (fax and voice), and an increasing number of people have phones in their cars.

According to the Census Bureau, over 247 million Americans make an average of six calls a day. The United States has over 118 million telephone lines. Of all American residences, 92 percent have at least one telephone line. We're a wired nation.

WHAT IS TELECOMMUNICATIONS?

In the computer field, *telecommunications* means hooking a telephone to your computer and using it to communicate with other systems. It's not difficult to telecommunicate; all you need is a telephone line, a modem, and a computer that has some modem software.

After setting up your hardware, you can send a file to another computer. It's a little like sending a fax, except that the person receiving the file gets a real computer file. The recipient can print a hard copy of the file on a printer (instead of that glossy fax copy). The person can change the file or import your data into a bunch of other data—without reentering it.

Your telecommunications setup also allows you to converse, download (bring a file your way), or upload (send a file), and search through online libraries (called databases). Modems and telecommunications can either shorten the time you spend seated in front of the Macintosh or lengthen it—it all depends on what you decide to do with them.

Modems and telecommunications give us new freedoms, one of which is the "office without walls" idea. (The idea of working outside a traditional office is not a new one, as any outside sales representative can tell you.) In recent years, the practice of telecommunicating has boomed. Studies show an estimated 25 million North Americans in all types of professions already work at home. A survey by the Link Resources Telework Group in New York found that approximately 3.5 million corporate workers have formal work-at-home arrangements with their employers, and about 16 million work at home either part-time or full-time.

WHAT CAN YOU DO ONLINE?

Electronic mail (E-mail) is a popular reason to go online. It's an easy way to send and receive messages without the intrusion of a telephone or the bother of using the postal service (get an envelope, look up the address, stamp it, then find a mailbox). It's less expensive than overnight express services, and the printed copy isn't on flimsy, thin, and too-slick fax paper. To "post" a memo, a note, or a love letter, all you have to do is stick it in the E-mail system. It's done. Before you know it, you'll have a response.

You can get the most recent news online. You can look up all sorts of obscure information or valuable and relevant data like airline flight times and the weather across the nation. You can send files to friends, the boss, or your attorney. You might even meet some interesting people in a conference. (It sounds farfetched, but some people have met online, started dating, and gotten married.)

There are bulletin boards to "visit," and many have shareware to download. A growing number of businesses offer online shopping services—from florists to grocery stores. It's a whole new electronic world out there.

ABOUT THE ...

Benefits of a Modem

A modem is a telephone for your Macintosh. Your modem and Macintosh will allow you to do all of the following:

- print or record incoming information to a disk
- send and receive files
- connect directly to other computers worldwide (if they have a modem)
- set up communications sessions to execute automatically at a set time
- download shareware programs from a bulletin board
- participate in an online conference
- hook up to a mainframe computer to access the databases on it

TRANSFERRING TEXT FILES TO AND FROM A MACINTOSH

The Macintosh, like other personal computers, uses the 7-bit ASCII standard as its native character set. However, because the Macintosh uses software (rather than hardware) character generation for its on-screen display, a programmer can invent a custom font that deviates completely from the ASCII standard. It is a relatively simple matter, for example, to rearrange the transmitted characters to support IBM's EBCDIC (Extended Binary Coded Decimal Interchange Code) standard or to write a font that supports non-English alphabets. Because the 7-bit ASCII standard defines characters only for codes 0 through 127, the codes 128 through 255 are not standardized. In fact, they can (and almost certainly will) vary not only between personal computer brands, but even among the different fonts installed on a single Macintosh.

File transfer problems also occur when the connection between computers must be made with less than 8 data bits. In this case, it is mechanically impossible to transmit the ASCII codes 128 through 255. Even with an 8-bit connection, some telecommunications programs automatically strip out the highest-order bit of each received byte, which converts characters in the 128 to 255 range into bogus characters.

It would be ideal to have completely equivalent character sets between machines. It would be sheer heaven to be able to send a file from a Mac to an IBM in a beautiful or strange Macintosh font (like Parisian or Tekton from Adobe) and have it received as an accurate rendition of the same font, or even a close facsimile. It would be nice to send Zapf Dingbats or another all-picture font like Cairo.

Character set disparities are even more basic. Some fonts transmit characters unknown to the receiving machines. The characters transmitted have no equivalent. The receiving computer may insert a blank or substitute another character. The "character" doesn't just include letters and numbers, but such things as line returns, line feeds, and spaces. If the font doesn't adhere to the ASCII standard, characters may be received (if the font is very irregular) as a jumble. (Keep in mind—font makers may not foresee a reason for their fonts to be telecommunicated, therefore they don't design them to adhere to ASCII standards.)

To avoid such character conflicts use fonts which conform to the 7-bit ASCII standard character set and use characters with codes in the 128 to 255 range. The characters in the 7-bit ASCII standard are adequate for all but the most specialized needs (mathematics, greek letters, accent marks, for example). A majority of commercial fonts do adhere to the ASCII standard. Where problems occur are in the small "homemade" fonts (a font created or altered by a user with specialty software), in all of the picture fonts, in some commercial fonts from small companies, and in some scientific or specialty fonts.

When a character is received that the Macintosh doesn't recognize it is displayed as a open rectangle. The open rectangle will also appear if you change a document from one font to another, and the font doesn't support the same character set.

CONTROL CHARACTERS

When it comes to control characters (ASCII codes 0 through 31), use of the ASCII standard becomes inconsistent among personal computer brands. Some word processors assign a meaning to almost all of the control characters, while others support only a minimal subset. The word processors currently in wide use on the Macintosh all have private data file formats and they use the 7-bit ASCII standard only for importing and exporting files to other word processors. The control characters not recognized by the Macintosh are almost always displayed as rectangles.

The following sections describe how each of the control characters is recognized and used by the Macintosh word-processing program.

Line Feeds and Carriage Returns

Perhaps one of the most aggravating aspects of trading files between Macintosh and non-Macintosh machines is the treatment of line-feed (ASCII code 10) and carriage return (ASCII code 13) characters. The Macintosh convention is a carriage return character. It implies both a carriage return (the cursor moves to the column the farthest to the left) and a line feed (which moves the cursor down one line).

Unfortunately, you'll find that a large number of non-Macintosh computers require both carriage return (CR) *and* line-feed (LF) characters to accomplish both of these cursor movements. If a file with only carriage returns is transferred to a machine that requires the CR/LF pairs, the word processor may die when it attempts to load the file. Another possibility is that the file may be displayed in some bizarre manner, with all of the text jammed onto one line.

When importing files containing CR/LF pairs to a Macintosh word processor, the Mac software will display the line feeds as garbage characters at the beginning of each line. Luckily, most of the popular Macintosh telecommunications programs have features to add LFs after CRs in outgoing text files, and to strip LFs after CRs in incoming text files. If your telecommunications software lacks these features, there are at least two public-domain desk accessories, DeskZap and McSink, and one commercial utility program, Vantage, to perform these tasks after a file has been received or before a file is sent.

A second CR/LF conflict you're likely to run into concerns the placement of carriage returns. The Macintosh convention is to treat a paragraph of text as one long line of data with a single CR at the end. The prevailing DOS standard is to place a CR/LF pair at the end of every line in a paragraph. For files outgoing from a Macintosh, this is only a minor problem, since all of the current word processors can be instructed to place the CR (often referred to as a *line break*) at the end of each line in the paragraph. Additionally, several Mac telecommunications programs can word wrap outgoing files so that these line breaks are automatically added at the proper column number as the file is sent.

The placement problem may be more severe when importing text files to a Macintosh. Unless the CRs are removed from the end of each line, the paragraphs will not reformat properly when the margin settings are changed.

Tabs

The Macintosh does not recognize or use vertical tabs (ASCII code 11). Horizontal tabs (ASCII code 9) are supported, but there are some inherent problems with their use. For tabbed (columnar) data to line up properly, it's important that the tab stops be set at precisely the same location on both the machine that creates the document and on the one to receive it. If this cannot easily be accomplished, use spaces instead of tabs to separate your columns.

Form Feeds

Most of the Macintosh word processors ignore or improperly display the form-feed character (ASCII code 12) and use multiple carriage returns to simulate this character when saving files for export. Most non-Macintosh word processors use the form-feed character to create a page break. There's no easy solution to resolve this difference. One option is to compare the number of lines each machine prints on a page of paper and use multiple carriage returns in the transmitted file to make sure that the pages line up properly. Otherwise, you'll need to manually clean up the page divisions on the receiving machine.

Character Width Conflicts

Another problem crops up when the character width is different on the sending machine than it is on the receiving machine. If a document is prepared with a *monospaced* font (each character in the 7-bit ASCII standard is of equal width) and then sent to a machine using a *proportionally spaced* font (each character may have a width different from others), the document will not display as intended.

Experts suggest, when you're preparing a file for transmission from a Macintosh to a non-Macintosh, that you use the 9-point Monaco font. On most Macintosh word processors, this is easily accomplished. Position the mouse to the left of the first character in the document and click it. Then move the mouse to the right of the last character in the document. Hold down the SHIFT key and click the mouse again. This selects the entire document so that global font and point size selection can be performed. (Another way to accomplish this is to hold down the Command key and type A. This will select the entire document, allowing you to use the Font and Size pull-down menus to make global changes.)

File Format

One of the marked differences between Macintosh files and files on other personal computers is the file storage format. Files on other personal computers have their data stored in one long, contiguous stream. In contrast, a Macintosh file may consist of two different areas of storage, called the *Data Fork* and the *Resource Fork*. One or both of these forks may be present in the single Macintosh file, and when either is present, it is a necessary element of the file.

The contents of the Data Fork are nonspecific. Software developers are free to use—for any purpose—the Data Fork of a file created by their product. The Resource Fork is more closely controlled. The Resource Fork could be compared to a database file. It is composed of grouped records, called *resources*. There are literally hundreds of different kinds of resources;

common ones are executable software code segments, icons, bitmapped pictures, and the contents of a program's pull-down menus.

Each resource is given a *type designator*, which identifies what kind of resource it is, and an *identification number*, which gives it a unique specifier among like resources types. Software developers create a program to display a predetermined picture on the screen. They can write a very simple piece of code to instruct the Mac system software to "Load the resource with picture #128," for example. The Macintosh software then extracts that resource from the Resource Fork and presents it to the program. The program, in turn, displays the picture. (This method is radically different from that of any other computer system.)

A third storage area holds a group of data called the *Finder Information Block*. This data tells the Finder what sort of icon will represent the file, how to react when a user tells the Macintosh to open the file, and other facts about the file.

Because there is no such thing on non-Macintosh computers as a Data Fork, a Resource Fork, or a Finder Information Block, it was necessary for Macintosh telecommunications software authors to establish a way to move all of the information about a Mac file as a contiguous block of data. This would allow the file to reside on non-Macintosh computer systems and then to be recognized and reconverted back to the original three file elements upon reception by a Macintosh. In 1985, a group of telecommunications software authors created what would become known as the MacBinary Format. All current Macintosh telecommunications programs use and recognize this standard.

The beauty of the MacBinary Format is its transparency to the user. The Macintosh telecommunications program knows when this format must be used and automatically invokes it. Likewise, the software recognizes when data received is in MacBinary Format and automatically performs the necessary conversion back to the file's original form and content. Because this conversion is done before the data is actually sent, and again after the data is received, the MacBinary Format is compatible and will not interfere with any of the file transfer protocols implemented widely on other personal computers (including popular PC formats such as Xmodem, Ymodem, and Zmodem).

A minor revision was made to the MacBinary Format in 1987 to account for some additional information Apple had added to the Finder Information Block. The revision also provides additional protection against a file incorrectly identified as MacBinary Format. This revision is called MacBinary 2, and it has been implemented by most of the major telecommunications programs. The revision is upwardly compatible with the original MacBinary. (This means that, if a file is uploaded in MacBinary 2 Format, it can still be downloaded by a telecommunications program that only recognizes the original MacBinary Format.)

One side effect of the MacBinary Format is that the Finder Information Block contains the original name of the file. The receiving Mac program will always attempt to use the original name. Don't be surprised if you download a file listed as GRAPH.SIT on a network and it shows up on your disk with the name GRAPHICS PICTURE.SIT.

Most telecommunications programs allow MacBinary Format use. Recognition can be turned on or off. The general rule here is to know what sort of file you are receiving. If the file was originally created on a Macintosh, the MacBinary Format must be turned on. If it was created on a machine other than a Macintosh, the MacBinary Format must be disabled.

FILE COMPRESSION

File compression is used widely by Mac telecommunicators to reduce the size of a file; the time needed to transmit the file is equally reduced. Upon reception, the compressed file is decompressed to its original size and content. Compression is also used to join several files into one long file, which reduces the amount of human interaction necessary to transfer the group.

Consider the case where someone wants to send you five files. You can download one, then the next one, and so on—each independently from the others. You'll have to "babysit" the machine, though. A compressed file, on the other hand, would contain all five files; you would just have to download one file.

File compression is also used for data backup. More information about file compression is given in Chapter 7, "Disk and File Management."

MACINTOSH COMMUNICATIONS HARDWARE STANDARDS

The Macintosh is equipped with two built-in serial ports—the *modem* port and the *printer* port. Although either port can be used for telecommunications, Apple's local area network hardware (AppleTalk) is tied to the printer port. Always use the modem port for telecommunications.

According to Apple, the serial ports are configured to both RS-232 and RS-422 standards. In reality, they are not full implementations of either standard, but they can be used for a primitive compatibility with either standard. RS-422 is a high-speed, externally clocked standard. On the Macintosh, RS-422 has seen limited use by the AppleTalk hardware and some laboratory data acquisition equipment. For telecommunications, only the RS-232 standard aspect of the serial port is used.

To refer to the Mac serial port as RS-232 is stretching the point, because Apple chose to implement only the minimum number of signals needed to make a connection with most RS-232-equipped machines. On the original 128K Macintosh, this meant a ground signal, transmit and receive signals, and one input handshake line. (A *handshake* is a standard greeting between two modems—like the one you use when you pick up your phone. You say, "Hello?" and the caller echoes, "Hello.") Starting with the Mac Plus, an additional output handshake signal was added, along with rudimentary software support for hardware CTS/RTS handshaking. (CTS/RTS stands for *clear-to-send/ready-to-send.*)

The serial controller chip (SCC) in the Macintosh does provide support for the entire RS-232 standard. There's a reason why Apple originally used only a few of the available signals. The company assumed (in 1984) that there would be little need for all of the RS-232 signals. To save production costs, the unused data lines were employed to control the mouse (an admirable example of hardware hacking). Why this questionable arrangement has endured all the way to Mac's top-of-the-line, expensive models is anyone's guess.

The proliferation of reasonably priced high-speed modems in the last few years has turned this lack of full implementation into an Achilles' heel. It's impossible to monitor the status of the Carrier Detect signal, or to properly use the Data Terminal Ready signal, while supporting hardware handshaking. Most of the current batch of high-speed modems prefer (and some even demand) hardware handshaking between the Mac and the modem. Mac telecommunications authors may continually find themselves in a position to compromise the quality of their software with these state-of-the-art modems.

To make matters worse, there has been no standardization among the dozens of modem cable manufacturers concerning the ground transmit and receive signals. As far as the input and output handshake lines are concerned, where the manufacturers decide to connect them seems to be arbitrary—if they connect them at all. It's strongly recommended that you buy your modem cable from the same company that manufactures your modem, to avoid potential problems. Macintosh serial port pinouts are shown in Figures 12-1 and 12-2.

ABOUT THE ...

Hooking a Modem to Your Macintosh

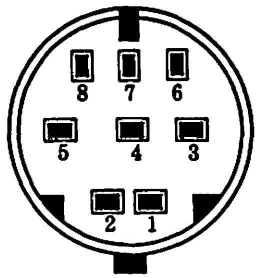
To connect a modem to your Macintosh, first find the correct port on the back of your Macintosh. The designated modem port on the Macintosh is the one marked by a telephone icon. Plug the modem cable into the port.

The cable to use is a DIN-8 (for the Mac Plus and later machines). Don't try to force it into the port. The pins are arranged so that it will fit onto the pins easily, and in only one way (the correct way). You cannot plug it in wrong, but you can bend the pins by trying to muscle it.

On the Mac 128K, 512K, and 512KE, a DB-9 serial port connector is used. This connector is a rounded trapezoid. It will connect to the port in only one way. Be gentle so that you don't damage the pins.

Plug the other end of the modem cable into the modem. It's either a round connector or a DB-25 pin connector. A DB-25 pin connector looks like a DB-9 connector except that the connector has a place for 25 pins. (The DB-9 has 9 pin points.)

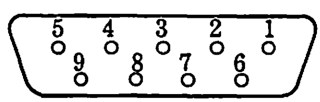
Once the Macintosh and modem are connected, locate your telephone jack and plug the phone cable supplied with the modem into it. Plug the other end of your telephone wire into the "Telco" or port line on the back of your modem. (Some modems have a little telephone handset icon; others are labeled "phone.") Plug your modem into a power outlet. Now you are ready to install communications software on your Macintosh.



Female connector

1 - Output handshake
2 - Input handshake
3 - RS-232 transmit data
4 - Ground
5 - RS-232 receive data
6, 7, 8 - Not used for RS-232

FIGURE 12-1
Macintosh serial port pinouts: DIN-8 (Mac Plus and later)



1, 3 - Ground
5 - RS-232 transmit data
7 - Input handshake
9 - RS-232 receive data
2, 4, 6, 8 - Not used for RS-232

FIGURE 12-2
Macintosh serial port pinouts: DB-9 (Mac 128K, 512K, and 512KE)

STANDARD MODEM FEATURES

Modems come in many shapes and sizes, with various speeds and features; many are the size of a standard paperback book. They have the following connections:

- A power connection provides electricity to operate the modem. Some newer modems can use power from inside the Macintosh or from telephone lines.
- A serial cable connection connects directly to your Macintosh. It is the pathway for information traveling into and out of the computer.
- One or two plugs of the standard RJ-11-type jack connect to your telephone. (These are the cheesy little plastic clips on everything from your telephone to the fax machine, shown in Figure 12-3.)

Some modems label their two jack ports "Telco" and "Phone." Some use tiny icons. Some say "line" and "to phone." Some modems have two unlabeled parallel plugs which will work with either wire in either jack. There are still others with very particular—unlabeled—jacks. These fussy jacks require you to figure out which side goes to the wall and which to the telephone. There isn't, as yet, any standardization to this scheme.

Telco/line is the plug you use to run the telephone line from your wall outlet (shown in Figure 12-4) into the modem's RJ-11 telephone jack.

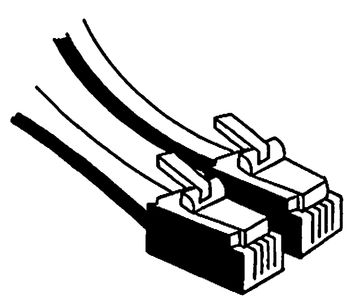


FIGURE 12-3
RJ-11 modular telephone jacks

You attach your telephone wire to the modem's phone jack. This way, you can use the telephone when your computer is not on the line. This is commonly referred to as *pass through,* which is the ability to pass the phone line signal through the modem to a telephone handset with no ill effects. (Many answering machines also have this feature.) It's a standard connection format for today's modems.

It's not necessary to have a telephone attached to your modem. If you have a dedicated modem line or if you just don't need a handset at your computer, don't hook one up.

Modems can send information across telephone lines at different speeds. The most common speeds are 1200 baud (approximately 120 characters per second), 2400 baud (240 characters per second), and 9600 baud (960 characters per second). The real transmission speeds vary with the network services and telephone line conditions.

INTERNAL VERSUS EXTERNAL MODEMS

Modems are either internal or external. Internal modems can be installed in an open NuBus slot or in the special slots in portables, laptops, LCs, and SIs. External modems can be connected to the telephone port on the back of your system.

Since there isn't much difference in how internal and external modems work, it's easy to decide which kind to get—do you have the space on your desk for another piece of hardware, and do you have a spare power outlet?

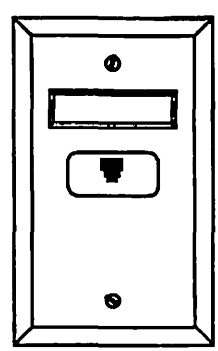


FIGURE 12-4
An RJ-11 wall jack

External modems are exactly that—external. They have their own case, power supply, and power cord. Internal modems use the computer's power and case. Your budget and the amount of space available should determine your decision.

The industry standard for modems is the Hayes-compatible standard, named for Hayes Microcomputer's modems. It is a set of standards developed by Hayes to create communications between various microcomputers.

All external modems will work with the Macintosh. The only difference between a PC and a Mac external modem is the cabling. Don't be swayed by salespeople claiming that their desktop modem is "Macintosh-specific." Compare price, features, and reputation. (The internal bus on the Mac is unlike that in any other personal computer. Consequently, you must purchase a Mac-specific internal modem.)

Whether you want an external or internal modem there are some things to keep in mind. There are choices on baud rate (the speed at which a modem transmits data) and on the combinations of compression and error correction standards. (For more information on these telecommunications specifics refer to *Dvorak's Guide to PC Telecommunications*, where each of these modem features is covered in depth.)

The hottest new modems on the market have all of the following features: 9600 baud, MNP-5, V.32, V.42, and V.42bis. Steer away from the expensive, feature-laden 2400 baud modems. If you can't afford a good 9600 baud modem, buy a plain 400 baud modem.

CABLES

Some modems are sold with serial cables to connect them to your Macintosh—it's best to check before you leave the store. If the modem doesn't come with the right cables (or any cables) for your Macintosh model, get them. Ask the dealer for the correct cable, and keep the receipt. (Nothing is a given in the computer industry.)

If you are using a Macintosh with an internal modem (Mac Portable) connect your modem to the phone line.

It can't be said often enough: when you purchase a modem, make sure you get all of the right cables to go with it.

FILE TRANSFER PROTOCOLS

To ensure that data is transferred correctly, computers use *file transfer protocols,* which are established procedures to exchange data, along with instructions to coordinate the process. Most protocols are *error-correcting.* That is, they sense when data is corrupted or lost due to noise on the connection and will automatically re-send the affected data until it is received correctly.

Of the scores of error-correcting file transfer protocols introduced since the dawn of microcomputing, fewer than a dozen have achieved prominence. Because each of the major communications programs contains a selection of these protocols, you often have a choice. There is no one best choice. Some protocols are good with some modems and awful with others; other protocols are slow and should be used only when the remote computer offers no alternative choices. Finally, some are outrageously fast, but they exist only in certain programs.

Understanding Xmodem is the first step toward comprehending more recent protocols, which are largely extensions of the original Xmodem concept. Xmodem breaks up a file into blocks (or packets) of 128 characters each. It then sends each block surrounded by *packetization* characters to show the block's beginning and end, block number, and the *checksum* (a total of all the bits sent in a block of data) of the data contained in the block. The sender waits for a response from the receiver.

The receiver returns a positive acknowledgment if the block arrived intact, or a negative one if the block was changed by line noise. To determine whether the block is intact, the receiver computes the checksum of the received data and compares it to the checksum of the block. If the two agree, the odds are great that the block is intact. When the sending modem gets a positive acknowledgment, it sends the next block. Otherwise, it will re-send the previous block again and again until the block is received correctly. Xmodem was a good beginning for those old slow modems and computers, but it has a number of limitations, including its small block size. It has become a bottleneck.

A number of variations of Xmodem are all designed to speed it up and solve other problems. These include Xmodem CRC, Xmodem Auto, IKXmodem, and Xmodem Checksum.

Kermit is another protocol, named after Kermit the frog of Muppets fame. It is similar to Xmodem, but is much more complex. Kermit can send multiple files with filenames, times, and dates, and it maintains file size data. Its error checking is more robust than Xmodem's. Most important, Kermit is designed to work with mainframe computers, which has brought about its wide acceptance. It's now installed on more mainframes than any other asynchronous protocol.

Synchronous is when a computer asks a terminal or modem "do you have data," "do you have data," "do you have data." When the terminal has data it sends it after one of these requests. Asynchoronous is when the computer doesn't ask. It waits for the modem or terminal to say "Hey computer, I have data." Then, at the end of the transfer the modem or terminal says, "I don't have any more data," and ends the communications.

Ymodem offers a larger block size than Xmodem. Its 1K capacity, in contrast to the 128 bytes of Xmodem, increases protocol efficiency by as much as 60 percent. However, if you have a poor connection, it's not a good choice. It takes longer for Ymodem to detect and re-send a damaged block. (If the line is really bad, it may never get a whole block sent.)

Zmodem is an error-checking, *streaming* protocol, which achieves about 98 percent efficiency. It sends a continuous stream, inserts error-checking codes at intervals, and pauses only at the end of each file to wait for an acknowledgment. As data arrives, the receiver compares it to received error-checking codes and immediately requests that flawed data be backed up and re-sent. Zmodem was the first protocol to introduce file recovery. If a connection is broken, the transfer can be resumed where it broke off—much better than sending the whole file over again!

Other protocols include:

- Blast (a bidirectional transfer protocol)
- HyperProtocol (exceptionally fast)
- Jmodem and BiModem
- Xmodem - 1K blocks

- Xmodem - Supercharged receive
- Ymodem - G
- Long Packet Kermit
- Sliding Windows Kermit
- Flash Protocol

COMMUNICATIONS SOFTWARE

Communications software is the brains of the whole telecommunications operation; a modem and a Macintosh alone are just two pieces of hardware. The communications software (and a telephone line) is necessary to get the hardware to communicate with other computers.

The communications software must be configured to your system. Everyone's modems operate at different speeds, and some people use different ports (some use the printer port). There are two kinds of telephone lines, pulse and tone. The software needs to be customized to your hardware.

Speed (Baud Rate)

Baud rate is the speed at which the information you send or receive travels. Different modems use different speeds. Your software will ask you to pick a baud rate (typically, less than or equal to the speed of the attached modem). Common baud rates are 1200, 2400, 9600, and 19400.

There are old modems around with baud speeds as sluggish as 300. They're cheap, but not a good deal!

Pulse/Rotary or Tone

Your communications software will prompt you to set the tone type. This is how your telephone lines are defined by the telephone company. Pulse/rotary is older than tone type—you remember, a rotary dial is that round dial with the holes. (If you're old enough, you may have had one once.) Older telephones with rotary dials send mechanical on/off impulses to define the phone number to call. They sound like clicks and are a series of on/off impulses. One on/off click happens if the dial is moved the distance of the first hole; ten clicks if the dial is moved all the way past all ten holes. *Tone* phones use computer-generated sounds to communicate telephone numbers. Each button on the telephone pad has its associated sound.

Parameters

Stop bits, parity, and data bits are all telecommunications parameters. Each of these items helps provide a strong connection from your Macintosh to another computer.

- *Stop bits* are signals sent after each character of information. They tell the system that a character has been sent.
- *Parity* is an extra signal attached in the transmission of information to check for errors.
- *Data bits* are the length (size) of the signals being sent.

You set these communications parameters in the software. There isn't any ideal combination of parameters. The rule is to find out what the other user (with whom you will communicate) is using. Identical settings will provide clean, understandable conversations and data transmissions between your Macintosh and another system.

HOW SOFTWARE COMMUNICATES WITH THE MODEM

Each modem has a set of commands. The most widely used is the AT command set originated by the Hayes Microcomputer Company when the company began manufacturing its Hayes Smartmodems. Many modems are said to be *Hayes-compatible,* which means that some part of the Hayes command set is supported.

Your telecommunications software will need to know what type of modem you're using if it isn't Hayes-compatible, or if it has a number of advanced features, so that the software can communicate with the modem.

Usually a modem will function just as it is, fresh from the factory; there are many settings you may need to adjust for better performance, though. *Modem registers* are used to configure a modem's operation. For example, registers set the modem's dialing speed and how long it waits to get an answer after dialing a number. Your modem's manual lists the modem registers and explains their use.

To set a register on the modem, you need to talk directly to the modem. This is usually done by telling the communications software that you want to "go local" (instructions for this are in the software's documentation). Use the software's local mode to give commands to the modem.

The dialing process is usually transparent. When communications software commands the modem to dial, it sends three pieces of information (called *strings*)—a dialing prefix, the telephone number, and a dialing suffix. You usually don't see this data going to the modem, although the software will let you know that it's placing the call.

The *dialing prefix* usually contains the actual command to dial. In the case of a modem that uses the Hayes or AT command set, this is usually ATDT. The *AT* gets the modem's attention, the *D* is the dial command, and the *T* tells the modem to dial using tones. If you need to pulse dial (if you're using a rotary dial instead of a pushbutton phone), use a *P* instead of a *D*. The telephone number is the number of the remote host's modem, and you enter it when you set up your communications software (and fill out the telephone book part of the program). The *dialing suffix,* usually a carriage return character, terminates the dialing command.

After the modem dials, it will wait to "hear" another modem answer the call. After the modems connect, the software will make you aware of this. You're online.

TELECOMMUNICATIONS PROGRAMS

Two of the more popular communications packages are MicroPhone II and White Knight.

MicroPhone II

MicroPhone was the first significant commercially available telecommunications product for the Macintosh. The manufacturer, Software Ventures, offered a conventional, business-oriented approach to distribute and support its software. This was at a time when its main competition was Red Ryder, a shareware program.

MicroPhone II 3.0 supports international character sets, optional password protection for documents or scripts, a buffered keyboard window, and enhanced printer support. Bundled with the program are front-end script sets for many widely used online services, such as CompuServe, Dow Jones, GEnie, and MCI Mail. MicroPhone II 3.0's user interface has a familiar Mac-like look. The software package has a set of three slickly produced manuals—a 206-page user's guide, a 404-page reference guide, and a 132-page guide to resources and utilities (mainly for the scripting language). The books are well-illustrated and clearly written. In addition, MicroPhone II comes with free trial subscriptions to five online computer services: CompuServe, Delphi, Dow Jones, GEnie, and OAG.

Other features include:

- "Watch Me" mode to automate scripts
- customized screen display
- good range of file transfer protocols, including Zmodem
- fast data throughput

The program's strength is its intelligent, friendly ease of use. Its use of the Macintosh interface, along with its excellent documentation, makes it a good choice for newcomers to Mac telecommunications.

ABOUT THE ...
Scripts

In telecommunications there are a number of procedures to get into another system. This is called the *logon*. (It's very similar to what you must go through to get a live person on a voice mail system.) First you dial the number, then you get a connection, then you hit the RETURN key, then you type in a user name; then a password. If you want to get to a certain level or section of the database, you may need to go through a few more passwords or keystrokes. If you call the system on a regular basis the logon can become tedious. To make life easier, scripts were created.

Scripts automate the procedure. With one command you can have the computer dial, log on, and move you through to the point where you can begin work. You can write your own scripts with some programs, or others will "watch" your keystrokes and create a script for you.

The downside of the script is it will not try again if there is a telephone line problem. There is very little error correction built in to any of these systems. Also, many of the larger database systems make changes to their logon screens and sequences. When they do make a change the script must be altered.

The question remains: do you need scripting? The answer: it depends on how often you call a system.

White Knight

The forerunner to White Knight was a very popular shareware program, Red Ryder. It was a shareware legend. Until 1989, the program was the leader in communications shareware for the Macintosh. It evolved from a simple program (version 1.0) to a very complex commercial one (version 10.3) and had legions of followers.

White Knight is completely different. (To begin with, it's first version number was 11.0—probably the only software in microcomputer history to begin there.) It's a total rewrite of Red Ryder, not just another version with a new name. The most recent version is 11.07.

A powerful and versatile program, White Knight may be best suited to more experienced users than a new Macintosh user. Most of its dedicated followers have a programming bent. In its favor are the low price (under $150.00) and the number of people already familiar with Red Ryder.

White Knight was born a user-supported shareware program and is still mostly marketed and supported by microcomputer hobbyists (*aka* old-timers). Registered users don't automatically receive updates or even update notices. You can learn about version update files in FreeSoft's forum on GEnie, on bulletin boards, at user groups meetings, and by word-of-mouth.

Some of the features of White Knight include:

- terminal emulation (including VT-102 terminal emulation and color extensions)
- file transfer protocols
- use of different modems
- storage of frequently called numbers in "phone books"
- use of macro keys to condense commom commands to one key
- auto scripting, which creates scripts from a sequence of actions
- ability to customize the layout of your keyboard (non-Macintosh keyboards)
- HyperCard-like facility called RCMDs (a built-in way for a programmer—with C or Pascal—to tailor the software for a specific use)
- support for color and multiple fonts
- text captures that can be added to existing files

The program supports a wide variety of common file transfer protocols. Since the program supports desk accessories (and can operate in the background under Apple's MultiFinder operating system) you can use the Mac for another task while a file transfer takes place.

The protocols White Knight supports are:

- Xmodem (Checksum, CRC.1K, and ack-ahead)
- Ymodem (standard, 1K, and G)
- Kermit (standard, long packet, and sliding window)
- Zmodem
- Flash (a new high-speed low-overhead protocol for use with error-correcting modems)

White Knight supports three *filters* for the terminal window, text transfers, and protocol transfers. As characters are received, the filters will leave them unchanged, strip out the characters, or remap them to other characters.

Other Telecommunications Packages

White Knight and MicroPhone have the lion's share of the Macintosh telecommunications market. There are other programs on the market, but none are as well known or as widely used. Two other packages are Smartcom II, by Hayes Microcomputer Products, and VersaTerm, from Synergy Software.

ELECTRONIC MAIL AND INFORMATION UTILITIES

A decade ago, many of us thought that electronic mail (E-mail) was going to make the personal computer an essential tool for everyone. It turned out that spreadsheets grabbed center stage and E-mail was, for the most part, forgotten. Then came the inexpensive fax machine, and E-mail became secondary to fax technology. (Fax has the advantage of worldwide standards and incredible ease of use.)

With the advent of local area networks (LANs) and interoffice E-mail systems, the value of E-mail has been rediscovered. This return to prominence has been helped along by systems such as MCI Mail, AT&T Mail, and all of the information utilities that carry E-mail, such as CompuServe.

WHAT IS E-MAIL?

E-mail is the transmission of correspondence (such as letters and memos) from computer to computer over a network. E-mail has its roots in telex, a worldwide system for sending messages between teletypewriters that has been going strong for close to a century. Telex transmits text at the sluggish pace of ten characters per second and frequently delivers it with garbled characters and transmission errors. Nevertheless, telex remains an important form of business communication in many less-developed parts of the world, and it is even used to carry E-mail on some international services. E-mail grew up in the 1970s with systems based on mainframes and minicomputers.

The greatest thing about E-mail is its convenience. The receiver doesn't need to be at the computer when the message is sent. E-mail's ability to store and forward messages makes it easy to communicate worldwide.

Anyone with a computer, a modem, and a telephone line can use MCI Mail to communicate electronically with others anywhere in the world. MCI Mail can be sent to other MCI Mail subscribers, electronic mail systems (EMS connected to MCI Mail), telex subscribers, postal addresses, or fax devices worldwide. You can also receive electronic mail from MCI Mail subscribers, other EMS systems, and telex terminals.

There are two main classes of E-mail service, private and public. Private E-mail serves the needs of an organization and is based on a multiuser computer system such as a mainframe or a LAN. Public E-mail services are available to individuals or organizations by subscription and are usually national or international in scope.

Public E-Mail

Public E-mail systems are commercial ventures sold by subscription. Chief examples are MCI Mail, AT&T Mail, and Western Union's EasyLink in the U.S., and Telecom Canada's Envoy 100. MCI Mail is the most popular choice for individuals. MCI Mail not only delivers messages to the mailboxes of other subscribers, but it can forward them to certain other E-mail systems, such as PT Postel in Italy, Telemail in the U.S., and Missive in Italy. It can also channel E-mail messages to telex and fax messages so they can be printed and either delivered by courier or injected into the regular paper mail system. One benefit of using MCI Mail to handle paper mail is that the printing is done at a location close to the delivery point.

ABOUT THE ...
X.400 Compatibility

Developed by the CCITT (an international standard setting committee), X.400 is a series of recommendations to set guidelines for transferring messages between electronic mail systems. The X.400 standards define, for example, the format of the messages sent between these systems so that they are transmitted successfully by all of the electronic mail systems that support X.400. This standard will serve as the technical foundation for interlinking E-mail services across all systems, worldwide.

Private E-Mail

Private E-mail is more isolated from the world. You cannot communicate to the outside world; you can only work (or gossip) on the interoffice network. The size of the E-mail system is limited by the size of the LAN.

There are a growing number of software programs that allow Macintosh users to use E-mail on their networked systems.

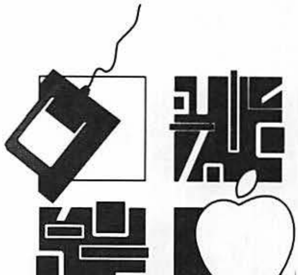
Microsoft Mail Microsoft Mail from Microsoft Corporation is an electronic mail program. It allows Macintosh users to talk to other Macintoshes, PCs, or mainframe Mail programs over a network. Mail can be integrated with Microsoft Excel (a spreadsheet program), Microsoft Word (a word processor), and Aldus Pagemaker (a popular desktop-publishing program). It lets you share in creating a single document and handles distribution of information across a network. It can run on any existing AppleTalk network. Microsoft Mail has *gateways* (doorways or paths to other computer environments) that connect to non-Macintosh E-Mail systems such as X.400, UNIX SMTP, or IBM PROFS on IBM mainframe and minicomputer systems.

QuickMail QuickMail, from CE Software, is an electronic mail system for use on AppleTalk networks that support multiple zones and servers. It has gateways to UNIX and VAX Computers, fax, Novell MHS (Message Handling System), CompuServe, AppleLink, and many other systems and services. QuickMail is compatible with AppleShare, TOPS, System 7, large screen displays, and accelerator cards. QuickMail PC is a good choice if you need your Macintosh to send mail to PCs on your network.

MAC FAX

Can your Macintosh become a fax machine? A number of devices have been designed to make your Macintosh function as a fax. They include hardware such as fax modems (which are also regular modems), software, and E-Mail gateways into fax services, as previously mentioned. Sending a fax from a Macintosh is quick and convenient, but reception is hard, slow, and low in quality—and it takes up a lot of memory.

Some of the companies offering fax hardware and software include Applied Engineering, Prometheus Products, Computer Friends, and Abaton Technology.



C H A P T E R 13

HARDWARE AND PERIPHERALS

What can you do when your Macintosh grows worn or weary? The quick answer would be to sell it, then use the money to buy a bigger, faster Macintosh. (Or you might forego the sale and donate your old Mac to grandpa, the kids, or a local school.) Instead of getting rid of your Macintosh, though, you should consider upgrading it.

MEMORY UPGRADES

Adding memory is the easiest and cheapest way to recharge a tired machine. You'll know your Mac's become run-down and in need of more RAM if the "There Is Not Enough Memory" or "Application Unexpectedly Quit" dialog boxes, as shown in Figure 13-1, appear frequently on the screen. Another indication that you're running out of memory is slow-moving applications.

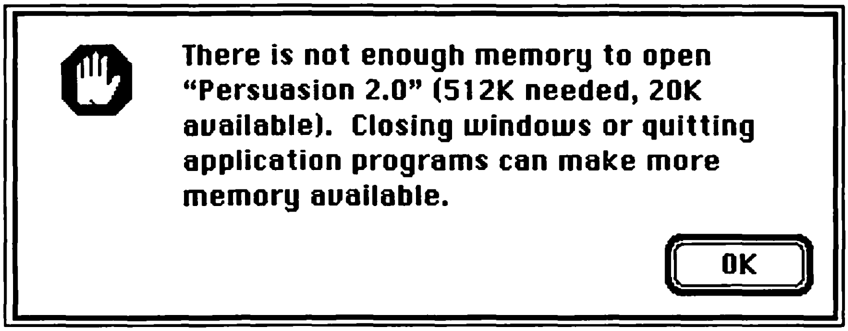


FIGURE 13-1
"There Is Not Enough Memory" panel display

These are the guidelines for memory requirements if you want your Macintosh to run well:

- One megabyte (1MB) of memory is enough to run most word processing programs, spreadsheets, or small applications in System 6.
- Two megabytes (2MB) is the minimum to run two or three applications under MultiFinder. (HyperCard, when working with another application, will also consume 2MB.)
- "Big" applications—such as desktop publishing—raise the byte count to four megabytes (4MB) or more of memory. Computer design, animations, and multicolor graphics demand more. (Four megabytes is also the minimum memory for a Macintosh IIci or IIfx running under A/UX, Apple's other operating system for the Macintosh.)
- System 7 adds a one megabyte (1MB) overhead to memory requirements. With System 7, you'll need at least 2MB of memory to run a single application, and 3 to 4MB for two or more applications.

SIMMPLE BASICS

Memory on most Macs is built with *SIMMs* (single in-line memory modules). A SIMM consists of a number of RAM chips soldered onto a tiny circuit board. The SIMM board snaps into a memory socket on the mother board. The *mother board* (Apple alternately calls a mother board the main circuit or system logic board) holds the CPU, memory, and most of the Mac's logic circuits.

Memory capacity is determined by the number and size of the SIMMs installed in the Macintosh. Memory is increased by mounting additional SIMMs in open or unfilled sockets. If all of the sockets are filled, memory can still be upgraded. This is done by replacing the existing SIMMs with higher-capacity versions—SIMMs with denser RAM chips to hold more data.

The Macintosh Classic, LC, and IIsi use fixed memory with the RAM chips soldered directly to the mother board. Memory on these models can still be upgraded. The mother board comes with empty SIMM sockets. (The exception is the Classic model. It requires the addition of an extra-cost socket board.) Memory of the Macintosh Portable is still expandable, but upgraded with special SRAM memory cards in place of SIMMs (see the section, "Portable Memory"). Memory on older Macs (the 128K, 512K, and 512Ke) is wired directly to the mother board; upgrades require a major overhaul of these models (described in the section, "Upgrading Ancient Macs"). Table 13-1 lists the Macintosh memory configurations.

Mac Model	Max RAM	Min Speed	Fixed RAM	SIMM Sockets	Possible SIMM Configurations	Total RAM
Mac Plus	4MB	150 nsec	None	Four	Two 256KB	512KB
Mac SE					Four 256KB	1MB
					Two 256KB and two MB	2.5MB
					Four 1MB	4MB
Classic	4MB	150 nsec	1MB	Three	None	1MB
					One 1MB	2MB
					Two 256KB and four 1MB	2.5MB
					Three 1MB	4MB
Mac SE/30	8MB	120 nsec	None	Eight	Four 256KB	1MB

TABLE 13-1
Macintosh Memory Configurations

Mac Model	Max RAM	Min Speed	Fixed RAM	SIMM Sockets	Possible SIMM Configurations	Total RAM
Mac II					Eight 256KB	2MB
Mac IIx					Four 256KB and four 1MB	5MB
Mac IIcx					Eight 1MB	8MB
Mac LC	34MB	100 nsec	2MB	Two	None	2MB
					Two 256KB	2.5MB
					Two 1MB	4MB
					Two 4MB	10MB
					Two 16MB	34MB
Mac IIsi	65MB	100 nsec	1MB	Four	Four 256KB	2MB
					Four 1MB	5MB
					Four 4MB	17MB
					Four 16MB	65MB
Mac IIci	128MB	80 nsec	None	Eight	Four 256KB	1MB
					Four 256KB and four 1MB	5MB
					Eight 1MB	8MB
					Four 1MB and four 4MB	20MB
					Eight 4MB	32MB
					Four 1MB and four 16MB	68MB
					Four 4MB and four 16MB	78MB
					Eight 16MB	128MB
Mac IIfx	128MB	80 nsec	None	Eight	Four 1MB	4MB
					Eight 1MB	8MB
					Four 1MB and four 4MB	20MB
					Eight 4MB	32MB

TABLE 13-1
Macintosh Memory Configurations (continued)

Portable Memory

The Macintosh Portable doesn't use SIMMs. Instead, it has special memory built with SRAM (static random-access memory). SRAM requires far less power to retain data than the dynamic RAM (or DRAM) used in SIMMs. The Portable can run on battery power for longer periods without a recharge by using SRAM in place of DRAM.

The Macintosh Portable comes with 1MB of SRAM already wired onto its logic board. Apple, CDC Enterprise, TechWorks, and PSI Integration sell SRAM modules for expanding Portable memory to 9MB. Be sure to get real SRAM. (Some places sell pseudo SRAM, which isn't as good.)

Upgrading Ancient Macs

Macintosh 128K, 512K, and 512Ke models use fixed memory, with the RAM chips wired directly onto the mother board. There are no provisions for upgrading memory directly with SIMMs. The usual upgrade path is to replace the mother board entirely, or mount another board (a *daughter board*) piggyback-style on top of it.

Upgrade boards with SIMMs and new logic can convert these obsolete Macs into a not-too-obsolete Macintosh Plus. (The Plus itself is a prime candidate for an upgrade.) The 512K or 512Ke can be upgraded to a quasi-"SE Plus" status with the addition of a new microprocessor chip. Apple, MacProducts USA, Computer Care, and the Peripheral Outlet offer Macintosh Plus conversion upgrades. Other companies offer accelerator boards or coprocessors for enhancing performance (see Table 13-2). But watch your wallet when upgrading these ancient Macs with this hardware. Make sure the price paid is worth the performance gain. The renovation often costs more than a new Classic or LC!

Model	FPUs	Accelerator Boards
Mac 128K		MacProducts USA Total Systems
Mac 512K	Quesse Computer	MacProducts USA NewLife Computer Total System

TABLE 13-2
Compact Macintosh Upgrade Products and Vendors

Model	FPUs	Accelerator Boards
Mac 512Ke	Quesse Computer	MacProducts USA
		NewLife Computer
		Novy Systems
		Silicone S&E
		Total Systems
Mac Plus	PNY Electronics	Brainstorm Products
		Computer Systems
		Dove Computer
		MacProducts USA
		Microtech
		Novy Systems
		Silicone S&E
		Total Systems
Mac SE	PNY Electronics	Brainstorm Products
	Spectral Innovations	Dove Computer
		Irwin Products
		MacProducts USA
		Microtech
		Mobius
		Newer Technology
		NewLife Computer
		Novy Systems
		Radius
		Silicone S&E
		Total Systems
Classic	PNY Electronics	Brainstorm Products
	Spectral Innovations	Dove Computer
		MacProducts USA
		Total Systems
Mac SE/30	Spectral Innovations	Dove Computer
		Fusion Data Systems
		NewLife Computer

TABLE 13-2
Compact Macintosh Upgrade Products and Vendors (continued)

SIMM CONSIDERATIONS

Macintosh SIMMs come with the following capacities: 256KB, 512KB, 1MB, 2MB, 4MB, and 16MB. Their speed—the time it takes data to move in and out of the SIMM—is measured in nanoseconds (nsec or ns), or billionths of a second. SIMMs come with speeds of 70 nsec, 80 nsec, 100 nsec, 120 nsec, and 150 nsec. The smaller the number, the faster the speed.

This size and speed information is important. Each Macintosh uses different mixes and matches of SIMMs. The CPU, ROM, and other logic built into each Macintosh (occasionally, the System software, as well) define which SIMMs are used. SIMMs that work for one Macintosh may not be acceptable for another. However, you can always use faster SIMMs—SIMMs with the speed of 70 nsec work everywhere!

The Macintosh IIfx uses a special SIMM and won't accept anything smaller than a 1MB size. Two megabyte boards can only be used on an LC or Macintosh IIsi. The ROM in the Macintosh Plus, SE, and Classic doesn't recognize anything larger than 1MB. Memory in these Macs tops out at 4MB after their empty SIMM sockets are filled. ROM employed in the SE/30, Macintosh II, IIx, and IIcx imposes similar memory constraints.

When running under System 6 (or System 7 in a 24-bit mode), all Macs are limited to an 8MB memory maximum. The LC, Macintosh IIsi, IIci, and IIfx running under System 7 in a 32-bit mode address a whopping 128MB of memory. Only Macintosh IIci or IIfx memory can be upgraded to this capacity with 16MB SIMMs, the largest SIMM size presently available. (LC and IIsi users, don't despair—it's doubtful that an application or mix of applications would use a full 128MB of memory.)

SIMM RULES

Certain complex rules must be observed when upgrading memory with SIMMs. First, the SIMMs must be mounted together in specific groups (memory banks) of either two or four. The size of the Mac's internal data path determines the grouping.

The Macintosh Plus, SE, and Classic use a 16-bit data path between RAM and the CPU. SIMMs are built with an 8-bit data path. The SIMMs on these models are mounted in pairs to feed data in 16-bit chunks (2 by 8-bit equals a 16-bit path).

All other Macintosh models use a 32-bit data path. SIMMs on the SE/30, Macintosh II, IIx, IIxi, IIsi, IIci, and IIfx are installed in groups of four (4 by 8-bit equals a 32-bit path).

SIMMs mounted within the same group must be the same size (have the same data capacity). A 1MB SIMM can only be installed in a memory bank with other 1MB SIMMs. Otherwise, different SIMM sizes can be mixed together in the same Macintosh. A bank of 256KB SIMMs can work alongside a bank of 4MB SIMMs. SIMM speed or nsec time is regulated by the CPU that controls the Macintosh. The CPU requires SIMMs used in memory to operate at a minimum speed. A 100 nsec SIMM cannot be used when an 80 nsec version is required. (The rule about speed is the opposite of what you encounter on the highways. Go slower, not faster.)

For example, the Macintosh Plus, SE, and Classic can use slower 150 nsec SIMMs. These models could be upgraded with faster 120 nsec, 100 nsec, or 80 nsec SIMMs. The faster RAM doesn't hurt, but it won't make these Macs run any quicker. Adhere to the minimum speed requirements.

SIMMs with different speeds may be mounted together. The only restriction is SIMMs installed within the same memory bank must have the same speed. An 80 nsec SIMM can't be grouped with a 100 nsec SIMM. A bank of 80 nsec SIMMs can work in concert with a bank of 100 nsec SIMMs within the same Macintosh.

ABOUT THE ...
High, Low, and Parity of SIMMs

Based on the RAM chips used in their construction, SIMMs have either a high (DIP chip) or low (surface-mounted chip) profile. Both varieties can be used to upgrade any Macintosh. If you have a choice, stick with low-profile, surface-mounted SIMMs. High profile versions can limit future expansion by interfering with the installation of other upgrade boards or internally mounted disk drives. The taller SIMMs restrict airflow across the mother board. (This can cause heatstroke in the Macintosh models that operate without the benefit of an internal cooling fan.)

Parity is another arcane SIMM fact to confound you when upgrading. Parity SIMMs are built with an extra chip for error checking and correction. These are commonly employed on IBM-type PCs and other computers. These SIMMs are required only on special Macintosh IIci and IIfx models custom-built for some government uses. They'll work like regular SIMMs on all Macintosh models, but they cost more; don't pay the price for parity SIMMs for non-parity Macs.

LOGICAL UPGRADES

Increasing memory isn't the only way to put new life into a Macintosh. There are other upgrades that boost overall performance. These include: Apple or independent-built coprocessors, replacement mother boards, accelerator boards, and cache cards.

COPROCESSORS

Coprocessors relieve the CPU of certain processing tasks. A *floating point coprocessing unit* (FPU) speeds numerical calculations. An FPU is a standard feature on the SE/30, Macintosh II, IIx, IIcx, IIci, and IIfx. Other Macintosh models are upgradable with an FPU option offered by Apple or the independent vendors. You can add an FPU to a Macintosh that lacks one (or replace an existing FPU with a faster version). This can enhance performance on math-heavy applications. An FPU also helps speed up computer-aided design or spreadsheet calculations, but it will do nothing to speed up word-processing programs.

ABOUT THE ...

PMMUs and Virtual Memory

A paged memory management unit (PMMU) is another type of coprocessor. The SE/30, Macintosh IIx, IIcx, IIsi, IIci, and IIfx come with a PMMU integrated into their 68030 CPU chip. An optional PMMU chip can be mounted in an empty socket within the 68020-based Macintosh II. With a PMMU on board and running System 7 (or under System 6 with the Virtual Init utility from Connectix Corp.), these Macs use a portion of hard disk as if it were memory. This is called *virtual* memory.

Information placed in RAM is stored in the virtual memory portion of the disk. When needed by the CPU, it is immediately transferred into RAM—a process called *paging*. (Paging is controlled by the PMMU on the SE/30 and Macintosh IIs.) Virtual memory cannot transfer data as fast as real RAM memory, but a megabyte of disk is much cheaper than a megabyte of RAM.

Virtual memory is useful if you work with extremely large documents or several small applications simultaneously. It's less effective on one very large application, which is better handled directly with RAM.

Other types of coprocessors include paged memory management units and PC coprocessors. PC coprocessors are add-in boards to run MS-DOS PC application programs on the Macintosh. (Most Macintosh users consider this a downgrade.) PerfectTek Corporation and Orange Micro make PC coprocessor boards. SoftPC, an MS-DOS software emulator from Insignia Solutions, will also allow you to run DOS-based software. (See Chapter 6, "Operating Systems and Utilities," on this.)

NEW MOTHER BOARDS

Apple sells a replacement mother board for certain older Macs that will transform the machine into a more modern model. If you turn in the old mother board to Apple when you buy a new one, you'll receive a refund. (It's like a core charge to an auto mechanic.)

An SE can be upgraded into an SE/30, a Macintosh IIcx into a IIci, and a Macintosh II or IIx into a IIfx. You end up with a true, Apple-certified, new Macintosh model.

SPEEDING APPLICATIONS WITH ACCELERATORS

Accelerator boards supercharge your Macintosh. They enhance the existing CPU with a faster, more powerful one. In addition, accelerator boards support faster and larger RAM memories. They have other enhancements to keep pace with their new processors. Accelerators include some or all of the following: a 32-bit bus to handle the traffic of the new processor; a high-speed SRAM cache memory (see the next section on cache cards); a faster SCSI port; software to convert older memory into RAM disk; Connectix Virtual software; and a PMMU coprocessor to support virtual memory. Refer to Table 13-2 for a list of Macintosh models that support accelerator boards.

In some ways, accelerator boards are similar to the mother board replacements offered by Apple. Both upgrade the old Macintosh with a new processor. The important difference is that the mother board converts an old Macintosh into a "bona fide" new Macintosh model. An upgrade with an accelerator board is analogous to "souping up" a car. You can end up with a better performer, but it's not stock—your hot-rod Mac won't be like any model known to Apple.

If you change the CPU of a Macintosh SE from a 68000 to a 68030 with an accelerator board, it won't make the Macintosh an SE/30, and a Plus doesn't become a Macintosh II just because its engine has been upgraded to a 68030. The accelerated Macintosh with a new CPU Macintosh will rarely offer the same performance when matched against an official Macintosh with the same processor.

CACHE MEMORY

A *cache card* is the memory equivalent of a coprocessor. A cache card relieves the regular memory of some information-handling tasks. Built with high-speed SRAM, the cache card works faster than RAM to keep the CPU supplied with frequently used data and instructions. Speeding the transfer of critical information boosts overall performance by 30 percent or more on some Macintosh models.

Cache memory is a standard feature on the Macintosh IIfx and an option on the Macintosh IIci. The IIci has an accessible internal slot to mount an Apple (or third-party) cache card. Apple doesn't support cache memory on other models, but other vendors do. (Cache upgrades for the Macintosh IIsi and older Macintosh II are available.)

Cache memory upgrades don't match accelerator boards as overall performance enhancers, but they cost far less and are easier to install. Table 13-3 shows the upgrade products that are available for the modular Macintosh line.

Model	FPUs	PMMUs	Cache Boards	Accelerator Boards
Mac LC	MacProducts USA			Fusion Data Systems
	Novy Systems			Total Systems
	Systems Technology			
Mac II	Computer System	PNY Electronics	Dove Computer	Computer System
	Microtech	Telecom	Newer Technology	DayStar Digital
	Shadow Technologies	Third Wave	Orchid Technology	Dove Computer
	Spectral Innovations			Radius

TABLE 13-3
Modular Macintosh Upgrade Products

Model	FPUs	PMMUs	Cache Boards	Accelerator Boards
	Telecom			Silicone S&E
				Total Systems
Mac IIx	Computer System			DayStar Digital
	Microtech			Dove Computer
	Shadow Technologies			Radius
	Spectral Innovations			Silicone S&E
				Total Systems
Mac IIcx	Spectral Innovations			DayStar Digital
				Radius
Mac IIsi	Apple		Applied Engineering	Fusion Data Systems
	PSI Integration		ATTO Technology	Sigma Designs
			IIR	Total Systems
			PSI Integration	
Mac IIci	Spectral Innovations		Applied Engineering	DayStar Digital
			Apple	Fusion Data Systems
			ATTO Technology	Radius
			DayStar Digital	Sigma Designs
			IIR	Silicone S&E
			Micron Technology	
			Total Systems	
			UR Micro	
Mac IIfx	Spectral Innovations			Radius

TABLE 13-3
Modular Macintosh Upgrade Products (continued)

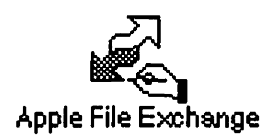
STORAGE DEVICES

Disk and tape drives are long-term storage devices. Some serve as backup storage to save a copy of the data in case the primary storage device malfunctions. Most disk and tape storage devices use read/write magnetic media. The information is stored until it's erased or overwritten. Some long-term storage devices use optical disks as media. Information is stored permanently and can't be removed on WORM or CD-ROM optical disks. On magneto-optic (MO) disks, stored information can be erased or overwritten similar to magnetic media.

THE SUPERDRIVE

Most Macintosh computers come from the factory with at least one magnetic disk drive—the SuperDrive. The SuperDrive stores information on 3 1/2-inch floppy diskettes. It can read/write onto single-sided 400KB, double-sided 800KB, or high-density double-sided 1.4MB diskettes.

In addition, the SuperDrive can read/write data in other formats with the Apple File Exchange utility. The icon is shown here:



MS-DOS and OS/2 formatting capability allows the transfer of diskette data files between the Macintosh and IBM-type PCs. ProDOS formatting allows file transfers between the Macintosh and Apple IIs, Apple's older personal computer family.

Diskette drives built into older Macintoshes read/write on either 400MB or 800MB diskettes. Macs with a 400MB drive cannot use 800MB or 1.4MB diskettes. Macs with an 800MB drive can accept 400MB diskettes but cannot use 1.4MB varieties.

Apple offers an FDHD (floppy disk, high density) kit to upgrade a Macintosh SE or II with an internal SuperDrive. The kit contains the diskette drive plus a new chip to enable these models to work with a SuperDrive. Kennect Technology and PLI offer external SuperDrive upgrades for the Macintosh Plus, SE, and II.

HARD DISK DRIVES

It's possible to live without a hard disk drive—it's just not as much fun. A hard disk makes life easier. Compared with a diskette, a hard disk stores more information, accesses it quicker, and transfers it faster. The hard disk has programs, folders, and files waiting on the desktop after the Macintosh is switched on. All of those pesky manual software launches and loads/reloads of data from diskettes are eliminated.

A hard disk isn't an expensive luxury any more. More than twenty vendors market 40MB hard drives at prices ranging from $250 to $350.

Internal and External Drives

Hard disks can reside inside or outside of the Macintosh; each location has its own advantages. An internal hard disk doesn't take up extra desk space, and internal drives are $50 to $100 cheaper than external models. (The internal drive costs less because it shares the Mac's cooling fan, power supply, and other circuit components.)

An external drive is mobile. Most are easy to detach, carry around, and attach to another Macintosh. (A portable-style hard disk drive will fit in an attache case.) An external hard disk can be locked up at night to secure confidential data. When you decide to buy a new Macintosh, you can just disconnect the hard drive from the old machine and reconnect it to the new one.

Apple offers both internal hard disk drives in 20MB, 40MB, 80MB, and 160MB capacities. They're okay, but take the time to shop around. Apple's disk prices are high compared to those of other drive vendors. Third-party drives are available with larger storage capacities and in removable or optical disk configurations not offered by Apple, as shown in Table 13-4.

True Take-Outs

The disk cartridge drive is the best of both worlds. You can take all the information on the hard drive, but leave the drive unit behind. This provides storage media mobility plus expandability. The removable magnetic disk cartridge does the traveling, while the drive remains firmly attached to the Macintosh. There is ease in expansion—when a cartridge is filled with data, you can simply remove it and insert another. There are three different types of disk cartridge drives: SyQuest and Ricoh drives use cartridges built with rigid disk media, and Bernoulli drives use a cartridge with floppy disk-type media. The cartridges are incompatible with one another and cannot be interchanged between the drives.

Disk Drive	Online Capacity	Drive Cost per MB	Media Cost per MB
Hard Disk			
Small	40 to 90MB	$ 5 to $ 10	Included with drive
Mid-range	100 to 400MB	$ 4 to $ 8	Included with drive
Large	500 to 900MB	$ 3 to $ 6	Included with drive
Massive	1000 to 1600MB	$ 2 to $ 5	Included with drive
Removable Disk			
HD diskette	1.4MB	$300 to $ 350	$ .75
Disk cartridge	40 to 80MB	$ 10 to $ 15	$1.50 to $2.50
Hard drive	500 to 1300MB	$ 6 to $ 8	Included with drive
Magneto-optic	300 to 500MB	$ 3 to $ 8	$ .22
WORM	300 to 600MB	$ 3 to $ 7	$ .20
CD-ROM	650 to 750MB	$ .70 to $1.50	Less than .01

TABLE 13-4
Disk Drive Storage

ABOUT THE ...

Advice for Moving Disks and Data

Moving an external hard drive to use it with another Macintosh is easy, but does require some cautionary advice.

The disk's SCSI address should conform to the priority number arrangements of the disks attached to the other Macintosh. This will ensure proper startup and operation when the Macintosh is configured with multiple hard disks. If the movable drive is used as the startup disk, the System and Finder files must be compatible with the other Macintosh model. Macintosh models exchange information with the hard disk at different rates. A Macintosh Plus swaps data slower than an SE or Classic does. SEs and Classics don't react as fast as other Macs. In situations where the same drive is shared among different models, the hard disk should be initialized on the slowest Macintosh.

When acquiring a hard disk, the speed at which the Macintosh moves data should be considered. Investing in a fast disk for a slow Macintosh is a waste of money. Almost any hard disk can outrun a Plus, and the majority work faster than the SCSI speeds of an SE or Classic.

Disk cartridge drives are used for backup and archive storage; important data can be protected against hard disk failure, and the cartridges can be locked up to prevent unauthorized use. (Store a copy on the removable cartridge.) Transfer old and infrequently used files onto cartridges to free up hard disk space. A single 40MB disk cartridge holds as much data as 28 SuperDrive diskettes. Backup and archiving with high-capacity disk cartridges is fast and convenient.

Disk cartridge drives can be used as primary storage in lieu of a hard disk. The drive can access and transfer data from the cartridge almost as fast as it can from a hard disk. A 40MB or 80MB cartridge size is sufficient for the application programs and related files of most users. Used in this way, individual cartridges can be dedicated to the storage of special data files or applications. One cartridge could contain personal accounts, tax records, and correspondence; another, the files related to business and customer accounts. A third could be devoted to desktop publishing, type fonts, and graphic image files. Table 13-4 has more information on removable disks.

Hard Drives To Go

A disk cartridge isn't the only magnetic disk that moves around. Another variety, a removable hard drive, offers the mobility of a removable disk cartridge, but differs in one important aspect.

This beast is like a diskette, only bigger. The removable cartridge case holds the magnetic disk media. The read/write heads, drive mechanism, and power supply are all packaged in a separate, stationary disk cartridge drive. With a removable hard drive, the drive mechanism and heads as well as the disk are sealed within a portable case. Only a cabinet with the power supply and a slot for the plug-in drive stays behind with the Macintosh.

Packing the moving parts in a sealed drive case enhances reliability. The packaging allows a removable hard drive to run faster and store more data than a disk cartridge can. One drive manufactured by Z Microsystems stores up to 1300MB versus the 80MB maximum of a disk cartridge.

Optical Take-Outs

Other disk cartridge drives use removable optical disks as storage media. The most common is the CD-ROM (compact disk read-only memory), the computer cousin of an audio compact disk. Like a compact disc player, a CD-ROM drive only plays (reads) information that has been published (stored) on a CD-ROM disk.

Why use CD-ROM when you're only able to read it? Produced in quantity, a CD-ROM disk provides a compact and economical way to distribute enormous amounts of information. A single 4 3/4-inch disk, which costs about $2 to produce and $1 to mail, contains the digital equivalent of over 300,000 pages of text.

Corporations use CD-ROM to distribute product documentation, technical specs, and service manuals to their workers and customers. Apple, for example, publishes CD-ROM disks with utility programs, foreign language versions of System 7 software, HyperCard stacks of Macintosh, and peripheral product specs. Adobe, NEC, and Agfa use CD-ROM to distribute their extensive type font libraries to desktop publishing users.

Commercial publishers market general-interest CD-ROMs to cover a range of subjects. Diverse titles—from the erudite to the X-rated—include animated encyclopedias and dictionaries; a disk of Guinness world records; the sights, sounds, and fury of the Civil War and Desert Storm; cram courses for college boards; flora, fauna, people, and places of the world. Most any topic covered in print is available on a CD-ROM.

Optical WORMs

A WORM (write-once, read-many) drive uses a removable optical disk with writing abilities. Once written, it's permanent.

The write-once (and forever) feature makes a WORM drive an excellent choice for archives and document storage tasks. Some government, legal, financial, and medical agencies require an unalterable and auditable storage medium. These are particularly good candidates for a WORM. The disk provides a permanent record of changes made to data files. Old as well as new file editions remain on the disk, to provide an electronic audit trail of all data additions and deletions.

Paper documents can be converted to digital forms and stored electronically with a WORM drive. The document pages are scanned, and then the digitized images are permanently stored on the WORM disks. To retrieve a specific document from the thousands contained on the disk is easy with the record-handling software on the Macintosh.

WORMs offer another advantage: The data stored is supposed to last for at least 100 years. (You'll have to take the manufacturer's word—WORM technology is less than ten years old.) Magnetic disk or tape is believed to be far less stable.

But writing without erasing is not for everyone. First of all, once a WORM is written up, you have to buy another. Secondly, data access and transfer move at a worm's pace. A WORM exchanges data at one-third the speed of a hard disk or disk cartridge.

Erasable Opticals

Optical drives based on magneto- ("mag-neat-oh") optic and phase change disk technologies provide write-many capabilities. The erasable counterparts of a WORM drive offer similar advantages. Erasable opticals store hefty amounts of data at low media cost and are highly reliable.

Storage prices are about 22 cents per MB for erasable optical disk, compared to $1.50 per MB for a disk cartridge. The capacity of an optical disk is 600 to 1000MB versus a 90MB maximum for disk cartridges. Optical disks are impervious to read/write head crashes and stray magnetic fields, afflictions that can strike all magnetic media. Data stored on erasable opticals is stable, with a shelf life exceeding 15 years. (Again, you'll have to trust the manufacturer's word; erasable opticals have only been around for about five years.) Like WORMs, erasable optical disk drives are applied as backup and archival storage devices. The erasables can serve as primary storage in place of hard disks if they're slow. WORM-like transfer rates are acceptable. Personal word processing or spreadsheet applications pose few problems for an erasable optical disk. But applications that require large, frequent, and fast disk-to-Macintosh exchanges are beyond the data transfer capabilities of these monster optical disk drives.

BACKUP HARDWARE

As detailed in Chapter 7, "Disk and File Management," backup isn't just for the belt-and-suspender crowd. Sooner or later a hard disk will crash, demolish some of its sectors, or catch a virus. It's also possible that someone could walk off with your Macintosh, its internal disk, and all of the data it contains. The ill effects of these and other calamities are minimized if you perform frequent backups to disk or tape.

Backup diskettes are a user's first line of defense against data loss. A high density (HD) diskette costs $1 or less (in bulk) and can store about 350 pages of word-processed text. This is enough storage space to back up almost any file you work on. If you have the patience, everything stored on your hard disk can be backed up to diskette.

Although backing up to diskette takes time, do it at least when you work on an old file or open a new one! Hard disk and disk cartridge backup

Tape Drive	Tape Capacity	Drive Cost per MB	Media Cost per MB
Teac cassette	60 or 150MB	$3 to $10	$ .15
DC 2000	40/60 or 86/120MB	$5 to $15	$ .15
DC 600	150/250 or 320/525MB	$4 to $15	$ .13
4mm DAT tape	1200 to 2600MB	$1 to $ 4	Less than $ .02
8mm video tape	2200MB	$1 to $ 4	Less than $ .01

TABLE 13-5
Tape Backup Devices

is fast. Data is written/backed up and read/restored in record time. Backup/restore from WORM and erasable optical disk drives works the slowest, but optical disks are highly stable, can take some rough handling, and are immune to magnetic fields.

Tape Backup Drives

Digital tape drives work almost as fast as hard disk or disk cartridge for backups. (An exception is Apple's extremely slow Tape Backup 40SC drive.) The digital cassette or cartridge tape media costs are the lowest of all backup devices. Table 13-5 shows some of the tape backup devices on the market and their media cost per MB.

Tape backup drives come in four varieties: Teac data cassette, DC 2000 (small data cartridge), DC 600 (large data cartridge), 4mm DAT tape (digital audio tape), and 8mm videotape. To confuse things further, Teac and DC drives come in low- and high-capacity versions, and DC drives run standard- or extended-length cartridges. (Apple's low-capacity Tape Backup 40SC is, again, an exception; the drive will only accept standard-length 40MB cartridges.)

Tape drive capacity should equal or slightly exceed the size of the hard disk backed up. Low-capacity 60MB tape drives provide adequate backup for most users, but a 150MB, Teac, or DC 600 drive doesn't cost much more, and the unused backup capacity will serve as a hedge against future hard disk expansion. You won't need to trade in the tape backup drive and discard tapes when increasing the size of your hard drive. DAT and 8mm tape drives store gigabyte files and are applied primarily as backup for networks and file servers.

ABOUT THE ...
New Technology

Write-once, read-many optical technology is applied to tape backup and document storage. LaserTape Systems has a digital optical tape (DOT) drive that is supposed to be able to store over 50 GB (that's 50,000MB!) on a single DOT cartridge. This equals about 500,000 scanned images or 25 million text pages on a tape the size of a VCR cartridge.

DISPLAY MONITORS

Apple offers anything you want for a compact Macintosh monitor—as long as it's basic black and white with a nine-inch screen. They're more generous with the modular Macs—five very good monitor options are outlined in Table 13-6. There is also a multitude of monitors produced by third-party vendors.

MONITOR OPTIONS

Monitor size is always expressed in diagonal inches—the distance from a bottom corner of the screen to an opposite top corner. This diagonal convention is far from an exact indication of size; active display area (the actual width and height of the displayable image) is a better measure.

Bowing to industry convention, monitors are grouped roughly into three sizes. (The nine-incher built into the compact Macs is an oddball size.)

Standard size monitors have 12- to 14-inch diagonals and a landscape orientation (screen width is greater than height). They can display the top two-thirds of a letter-size page. This is the most popular monitor size for Macintosh users.

Full-page portrait monitors are taller than they are wide. On average they have 15-inch screens. (An exception is DTI's SpeedView, a 21-inch

	Mac 12-inch Monochrome	Mac 12-inch RGB	AppleColor Hi-Res RGB	Mac Portrait	Two-Page Monochrome
Monitor Features					
Display diagonal	12 inch	12 inch	13 inch	15 inch	21 inch
Active display area	8.4 by 6.3	8.1 by 6	9.25 by 6.9	8 by 10.9	15 by 11.3
Color	Monochrome	Color	Color	Monochrome	Monochrome
Pixel resolution	640 by 480	512 by 384	640 by 480	640 by 870	1152 by 870
Dots per inch	76 dpi	64 dpi	69 dpi	80 dpi	77 dpi
Mac LC					
Built-in video	16 grays	256 colors	16 colors	Not supported	Not supported
VRAM card	256 grays	32K colors	256 colors	Not supported	Not supported
Mac IIsi and IIci					
Built-in video	256 grays	256 colors	256 colors	16 grays	Not supported
4 to 8 display card	256 grays	256 colors	256 colors	16 grays	16 grays
8 to 24 display card	256 grays	16.7M colors	256 grays	256 grays	256 grays
Mac II, IIx, IIcx, and IIfx					
4 to 8 display card	256 grays	256 colors	256 colors	16 grays	16 grays
8 to 24 display card	256 grays	16.7M colors	16.7M colors	256 grays	256 grays

TABLE 13-6
Modular Macintosh Display Monitors and Cards

monitor able to display a complete tabloid-size page.) Prime candidates for portrait monitors are those users who spend hours each day word-processing or publishing documents.

Broader, two-page monitors come in 19- to 24-inch sizes, and have an active display area ranging from 14 by 11 inches to 18 by 13 inches. They provide big-picture displays of facing page and tabloid layouts, engineering and architectural drawings, or other large scale computer graphics. Some users use two-page monitors to view a number of application windows side by side, or to work on large spreadsheets or project plans.

Shades of Gray or Different Colors

Monitors come in black and white or color. The number of shades or hues displayed depends on the display or video card as well as the monitor. Black-and-white monitors use a single bit or a 2-level card to map a 1-dot pixel image. A "0" or "1" bit produces a black or white dot on the screen. See Chapter 20 for more information on pixels.

Monochrome monitors display 16 levels of gray. They use a 4 bits per pixel card. The bits map a small, 4-dot-high by 4-dot-wide pixel cell on the face of the screen. The 16 dot combinations displayed are all white, all black, and 14 different black-and-white arrangements. In a similar manner, an 8-bit card generates 256 shades of gray on monochrome monitors. Mapping hues of color on a color monitor works in a similar way. A 4-bit color display card generates 16 colors, an 8-bit card 256 colors, and a 24-bit "True Color" card over 16 million colors.

ABOUT THE ...

Pivoting Screens

If you can't decide between a full-page or a two-page display, read this. Radius has its Pivot monochrome and color monitors. The Pivot's 15-inch display will position in either a portrait or landscape arrangement by pivoting the screen (hence the name). Internal circuitry automatically adjusts the image orientation to the screen position. In this way, the Pivot displays a full-page image in the portrait position, and a partial two-page spread in the landscape orientation.

ABOUT THE ...
New Compact Monitors

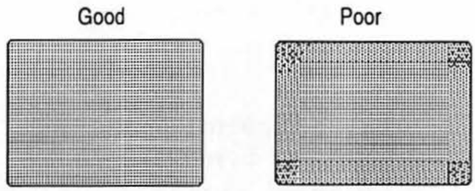
The nine-inch monitor decision Apple made for compact Macintosh users isn't etched in glass. Third-party vendors sell monitors and display cards in all shades and sizes for the Macintosh Plus, SE, SE/30, and Classic. There is one caveat, however. The 68000-based Plus, SE, or Classic refresh large grayscale or color monitors at a very slow pace. In such cases, be sure an accelerator is included in the display card to speed monitor mapping.

The Macintosh Portable has its own monitor options. Apple offers the Portable Video Adapter, which supports the Macintosh 12-inch Monochrome, Macintosh 12-inch RBG, AppleColor Hi-Res RBG, and similar monitors. And any Macintosh or IBM PC-type color monitor is connected to the Portable with Aura Systems Scuzzy-Graph.

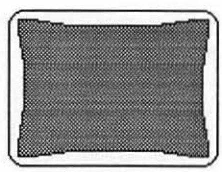
MAKING MONITOR DECISIONS

Don't let dots per inch, spot size, refresh rate, or pixels fool you. Specifications can lie, so you should select a monitor by sight. It's like buying a TV. First group together all the monitors with the size and shades of gray or colors desired. Then eliminate those which don't fit the size of your billfold. Finally, take a close look at the display of the remaining selections.

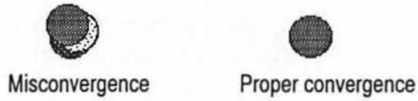
Pay particular attention to the focus—how clear and crisp text and graphics are on the display. Adjust the brightness control to see if the focus changes. There's a trade-off between brightness and focus on all monitors. It becomes more pronounced on large screens or color displays, where the focus at the corners get fuzzy as intensity increases. The following shows the difference between good and poor uniform brightness.



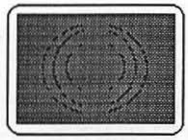
There's also a trade-off between brightness and contrast. It's like the difference between bright and dark display areas. Observe the display images at a number of different contrast and brightness control settings. A clear separation between solid blacks and whites denotes good contrast. Not very solid blacks and whites tending toward gray indicates poor contrast. Check for any bowing—the *pincushion effect*—at the screen edges. A good monitor has an almost perfect rectangular or square screen. The pincushion effect is shown here:



On color monitors, check for proper dot alignment (convergence). The red, blue, and green dots build all other colors. If they do not overlap perfectly (or misconverge), the resultant images are off-colored and fuzzy at the edges, as shown here:



Some large color monitors suffer from *moire interference*—patterns or rings of thin lines that ripple across the display surface. Watch for color changes as the amount of white in an overall image varies. A good color monitor maintains an almost constant balance with its reds, blues, and greens as white content shifts about. Here's an example of the moire interference effect:



PRESENTATION DEVICES

Desktop presentation software (discussed in Chapter 19) produces eye-popping, show-stopping graphics. These vivid images keep audiences alert and attentive (well, at least awake) and add credibility to the message presented. The best graphic presentations lose their value when the audience has to squint at a small, hand-held video display. A wide screen is more effective.

TRANSPARENCIES AND SLIDES

Overhead transparency and 35mm slide projectors are ways to get Macintosh graphics onto wider screens. Ink jet or thermal matrix color printers (described in Chapter 8, "Printers and Printing") will generate transparencies of Macintosh graphics for overhead projectors.

Film recorders produce 35mm slides of Macintosh presentation graphics. The recorder acts like a color printer, but prints on film. A tiny TV-like screen within the recorder flashes graphic images onto self-developing slide film.

PANEL PRESENTERS

A *liquid crystal display* (LCD) panel mounted on an overhead projector is another way to make a large screen presentation. Unlike projector transparencies or slides, the LCD panel-produced graphics are dynamic. The projection panel is fed image data directly from a Macintosh during the presentation. The graphic images can be changed or altered under the control of an application program running on the Macintosh.

LCD panels are available in monochrome, grayscale, simulated color (shades of yellow or magenta), and "true" color versions. The panels are about the size of a large picture book, weigh between 8 and 15 pounds, and are easy to carry around.

VIDEO PROJECTORS

LCD and CRT video projectors are other types of computer-driven large screen presentation devices. LCD video projectors, unlike LCD panels, contain an internal light source and optics. Overhead projector assistance is not required. LCD video projectors produce higher-quality color images and have faster reflexes than their panel relations. They project fast-moving computer animations and regular TV. These are the sort of dynamic images that the LCD panels cannot display.

CRT video projectors are an older, more familiar form of presentation device. They are the computer versions of the three-eyed TVs found projecting baseball games on overhead screens in bars all over the country. Unlike LCD panels or video projectors, CRT videos are heavy and difficult to move. Their eyes require fine-tuning if the projector is moved or jostled about. CRT video projectors don't make easy carry-alongs for traveling dog-and-pony shows. The only exception to this is the new Sharp one-eyed CRT video projector, which can be moved with no problems. It will fit in one giant suitcase, but it has combined the LCD technology and the CRT technology as a different hybrid. The display is acceptable, with better versions on the way.

HAND-INPUT DEVICES

Keyboards, mice, tablets, numeric keypads, trackballs, and so on would be called hand-input devices even if you manipulated them with your nose. These, in one form or another, are needed to make your computer functional. They allow you to interact with the computer.

KEYBOARDS

Some users love Macintosh keyboards, some hate them. When you go to buy a Macintosh, try to stay neutral. Test the touch and feel of different keyboards, including the third-party ones. (Apple doesn't include the keyboard with the price of the Macintosh, and you may find a lower cost and better touch layout.)

The Datadesk Switchboard is a neat keyboard to test type on. Each key grouping—the alphanumeric keys, the cursor cluster, the numeric keypad—on the Switchboard is a removable module. Left-handed users can switch the cursor and numeric key modules to the left side, and the alphanumeric keys can be reconfigured from a QWERTY to a Dvorak arrangement.

MICE AND MICE REPLACEMENTS

When you buy a Macintosh, a mouse comes with it. While mice are fine for most purposes, there are a number of alternatives and substitutes available. Alternatives include slippery, easier-to-move mice, cordless mice with infrared connections, and multi-fingered mice with two, three, or more click-command buttons.

One good substitute is the *trackball*. It doesn't move around and saves desktop space. (Apple's Portable Macintosh comes with a trackball built into its keyboard.) A trackball is no harder (or easier) to use than a mouse. The exposed ball on the top of the trackball is swiveled around with the thumb or fingers. The Kensington TurboMouse and MicroSpeed MacTrac are popular trackball choices among Macintosh users. Datadesk also offers a trackball option for its modular Switchboard keyboard.

Touch-screen devices are another mouse substitute. They're good at selecting icons, menu commands, or finger-size objects directly on-screen. In theory, you just point and touch the computer screen—but even a baby's finger is too big to touch an individual character. Touch-screens can't be used for detailed pointing, outlining, or drawing. If you use your Mac while you eat, the screen can get messy. Wash your hands before touching the screen or wash the screen itself—or both. If you really must use your

ABOUT THE ...
Dvorak Keyboard

The standard keypad is called "QWERTY" based on the first 6 letters on the left side of the keyboard. A Dvorak keyboard was invented by Anton Dvorak (no relation) in the early third of this century. The keyboard is designed to allow faster typing—indeed, some typists have been clocked at speeds in excess of 150 words per minute. There are a number of ardent fans of the Dvorak keyboard.

fingers—use a touchpad for a mouse substitute. A *touchpad* is a device that sits on the desk (it's about the size of a dinner plate, but square),and you touch it with your finger. The pad is a sensitive grid which represents the screen of the Mac—the place you put your finger is approximated on the coordinated location on the screen. Pinpointing pixels isn't possible, but the screen will stay clean. If you're interested in finger-pointing, try MicroTouch Systems UnMouse pad.

TABLETS

Digitizer (or digitizing) tablets are pen-and-pad type hand drawing devices rather than mouse replacements. The tablets are used by artists, illustrators, and designers in computer-aided drawing and drafting. Freehand images traced on the tablet with a pen or puck stylus are digitized, then bitmapped and displayed on the screen. You'd find a tablet handy when using draw and paint graphics programs. Would-be Picassos should contact Kurta, SumaGraphics, and Wacom for tablets. These companies offer digitizers in notepad to drafting board sizes with styli paint in colors and thin to broad strokes. Wacom makes a pressure- sensitive pen to paint wide to thin lines based on how much pressure you apply.

PROTECTION AND SECURITY DEVICES

An ounce of protection is... well, you know the rest. Invest in devices to protect your Macintosh and peripherals from physical damage and theft. They're good for peace of mind.

POWER PROTECTION

Never leave your Macintosh naked on a power line. Power surges and spikes disrupt data and destroy Macs. The first line of protection is a low-cost power outlet strip with noise-filtering and surge-suppression circuitry. A power control panel provides better protection at a higher price. The panel has faster surge suppression and better filtering capabilities.

An *uninterruptable power system* (UPS) provides the ultimate in power protection—at the ultimate in price. In addition to better surge and noise suppression, a UPS provides battery backup power when the lights go off.

This temporary backup lasts long enough for you to save files and turn off the power.

PHYSICAL PROTECTION

Basic physical protection comes with good housekeeping and operating procedures. Nothing will protect your Macintosh or data if you're prone to spilling soda on the keyboard or if you leave diskettes scattered around on the floor. Although not mandatory, dust covers help in keeping keyboards and Macs free of dirt. Diskettes should always be stored in closed file boxes away from field-producing electrical devices.

Keep your door locked to prevent some stranger from walking away with your Macintosh. Kensington helps out with its Apple Security System. This steel cable and snap-in plate kit locks the Macintosh, the monitor, and the keyboard to your desk or computer table. Kensington also offers PassProof hardware to lock up the diskette drive slot and SCSI and floppy disk ports. Similar security hardware from Anchor Pad and Qualtec bolts the Macintosh firmly to the desktop.

CONCLUSION

Once you've mastered your Mac, you'll probably want to enhance it. There are a number of peripherals to hook on to your Macintosh. Read the Mac magazines, attend users' group meetings, and talk to people to find out about these add-ons. They vary in price and features, but can add to the enjoyment you have while at the Macintosh. They can also add to the functionality of your machine and let you extend its usable life before a swap up to a newer, fancier Macintosh.

C H A P T E R 14

HYPERCARD

HyperCard is deep. You can use it right away, but it can take months to learn all of its features. Five years after its release, people are still discovering new ways to use it. Even its designers have been surprised by the myriad uses people have found for HyperCard. This chapter will give you a quick look at HyperCard and what it can do, but the best way to learn about HyperCard is to play with it on your own. It won't take long for you to understand why Apple includes HyperCard with every Macintosh it sells.

HYPERROOTS

HyperCard was created by Bill Atkinson. The original code was named Wildcard. Just before Apple released it in 1987, the name was changed to HyperCard. *Hyper* was used in homage to Apple Fellow (something like a guru) Alan Kay; *Card* indicates that the program looks like a card file.

One problem of the information age is the overwhelming quantity of information available to us. Computer scientists like Kay spend time thinking of ways to manage this flood of information. "Hypertext" was one of the tools they hypothesized about.

HOW PEOPLE LEARN

If you read an article and find a reference to something you want to know more about, you can put the magazine down and look up the reference in an encyclopedia. Then, if you need a definition for a word in the encyclopedia, you can look it up in a dictionary. This is the "natural" version of hypertext (and a good way to amass a pile of paper).

As Alan Kay envisioned it, hypertext would let you go through the same process electronically. In a hypertext encyclopedia, the reader can click a word to look up its meaning, click a word in the definition to learn more about it, switch between documents, and open and close others. Hypertext needn't be limited to text, either. Articles about composers might play musical passages. Hypertext history books could display video clips. Hypertext would use computer technology to organize information for easier browsing. Learning is simplified. It would be easy to move around in the stream of information, picking up just the information needed.

ABOUT THE ...

Put Yourself in Bill Atkinson's Shoes

Imagine you are a certified computer wizard. You've designed the innovative graphics routines behind the hottest new computer on the market, QuickDraw for the Macintosh. When your bosses at Apple needed a way to demonstrate the capabilities of their new computer, you whipped out a program called MacPaint without breaking into a sweat. All of Silicon Valley lies at your feet. Where do you go from here?

Bill Atkinson didn't rest on his laurels (or his stock options), he topped himself by writing HyperCard, a program he calls an erector set for building applications. With HyperCard, even novice users can create their own specialized programs. Apple is so enthusiastic about the program it bundles it free with all Macintosh computers. Now, four years after HyperCard's introduction, there are nearly as many HyperCard applications as there are HyperCard users. HyperCard is the most powerful software tool ever written for the Macintosh.

WHAT IS HYPERCARD?

HyperCard is more than a hypertext engine. HyperCard is a way of storing and accessing information—but it's more than a database program. It comes with an address book, appointment calendar, and a variety of other useful *stacks*, as shown in figures 14-1 and 14-2. It's more than just these, though; HyperCard is a programmable information organizer limited only by your imagination.

WHO USES HYPERCARD?

HyperCard is used by museums to provide visitors with background information on exhibits. It is used at conventions to help visitors find exhibits. Teachers use it to design their own educational software. Computer bulletin board systems and electronic mail applications have been written in it. Businesses have used it to make presentations, control machinery, ring up sales, and keep track of inventory. In the 1988 presidential election, one television network used HyperCard to provide information to its on-air anchors.

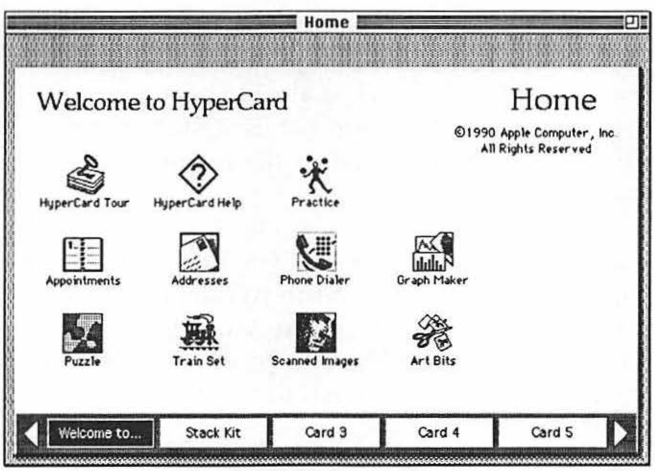


FIGURE 14-1
A Home card

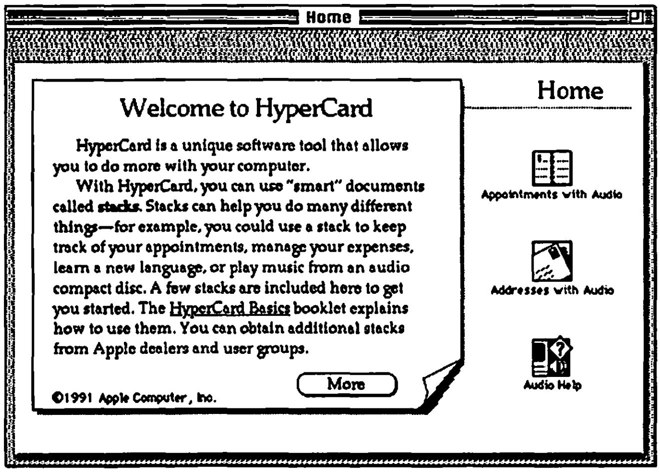


FIGURE 14-2
Another Home card

HYPERCARD—TURN IT ON

The first thing you should do is turn your limited version of HyperCard into a full-fledged version. (If you purchased a stand-alone version of HyperCard, you already have access to all its power, so you can skip to the next section.) It is assumed you have already installed HyperCard as instructed in the manual. You need a hard disk to use HyperCard effectively.

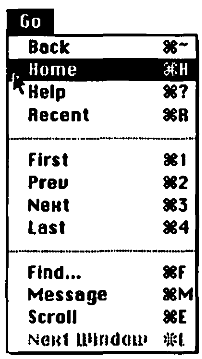
If you have the HyperCard version that came with your Macintosh (or a system upgrade), here's how to unlock it: Double-click the HyperCard icon on your hard drive. When you run HyperCard, it automatically opens a stack called Home (included with HyperCard). You must keep it in the same folder as the HyperCard application. The Home stack sets the parameters HyperCard requires to run, the most important of which for now is the user level.

USER LEVELS

Atkinson built five user levels into HyperCard: Browsing, Typing, Painting, Authoring, and Scripting. (This was to keep HyperCard simple enough for the neophyte without hampering the power user.) At the two simplest levels, Browsing and Typing, a user can only examine and modify information in a stack. The stack's structure cannot be changed, nor can any of the advanced authoring and programming tools be used. Apple's bundled version of HyperCard is configured to go no higher than the Browsing and Typing levels. It's fine for the average user, but you, the discerning reader, deserve more.

You deserve the right to modify stacks in any way you please. Of course, with such a right comes certain responsibilities. If you can modify a stack, you can also break it. If you choose to invoke the following magic word and free your HyperCard from the chains Apple forged around it, be prepared. You can continue to use HyperCard only at the Browsing and Typing levels, but once you have the ability to go farther, you will (and that's good). Unlike many other programming environments, HyperCard encourages experimentation. Just remember to modify *copies* of stacks so that you can go back to the original if something stops working.

The first card in HyperCard is the Home stack. To get there, press Command-H. You can also execute the command through the Go pull-down menu, as shown here:



The last card of the Home stack is the Preferences card, where the user level is set. Go to it by pressing Command-4. You will move to the Last Card command in HyperCard. As you can see, only two user levels are available to you, Browsing and Typing. To change that, type the magic word.

The magic word is ... *magic.* Type in **magic** and hit the RETURN key. You won't be able to see it as you type it. (If there were ever a doubt about these Macintosh creators being loony, this should dispel it.)

ABOUT THE ...
Command Key

The Command key is the key with the cloverleaf (or the Apple icon) on it. It's along the bottom row of the keyboard. You must hold down the Command key—as if it were the SHIFT key—and then depress a letter to activate the command. The commands in this book are written as Command-H or Command-4 to designate which key to hit while holding down the Command key.

After you hit RETURN, HyperCard will unlock to be fully usable (if you typed the word correctly). If you mistyped the word, try again.

The Preferences card will now show three new user levels: Painting, Authoring, and Scripting. These are the levels you need to access in order to create new stacks and modify old ones.

Click the Scripting button, and the HyperCard menu bar at the top of the screen will expand to show Tools, Objects, Font, and Style menus. These menus contain all the commands you need to design your own HyperCard applications.

Now all of HyperCard's power is available to you. Want to take it for a test drive?

LOOKING AROUND—BROWSING AND TYPING

First, learn how to use HyperCard at the simplest levels: Browsing and Typing. Set your user level to Typing by opening the Home stack and going to the last card, shown in Figure 14-3 (press Command-4 to go to the next card). Click the Typing button.

Click the line following the text "Your Name:" at the top of the card and type your first name. Notice that the hand cursor turns into an I-beam (also known as dog-bone or text) cursor when it's over an area where you can enter text. This won't happen if you selected the Browsing user level. The Browsing level is for users to examine information, not alter it. No text entry is allowed.

NAVIGATING IN HYPERCARD

HyperCard has a number of commands to get around in stacks. The Go menu shows some of them.

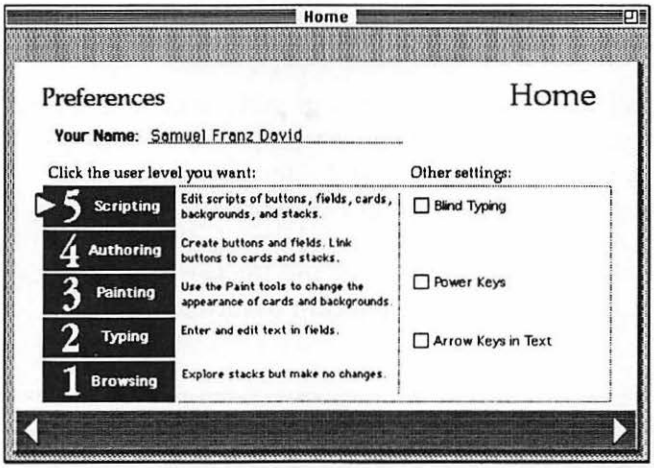


FIGURE 14-3
Preferences card

There are two ways to move through the cards in a stack: by the Go pull-down menu or by using Command-key combinations.

Card to Move	Select	Press
First card in a stack	From the Go menu	Command-1
Next card in a stack	Next	Command-3
Previous card	Prev	Command-2

When you're at the last card in a stack, the Next command brings you to the first card.

HyperTalk

HyperCard has an English-like scripting language called HyperTalk. It can also be used to navigate around in stacks. Open the message window with the Message command in the Go menu or by pressing Command-M. (Use this window to give HyperCard commands.) Type **go to the next card** into the window and hit RETURN. Now type **go to the previous card** and hit RETURN. If HyperCard can't make any sense out of your command, it will tell you. You can edit text in the message window in the usual ways. Whatever command is visible in the message window will be executed when you hit RETURN.

ABOUT THE ...

Using Arrow Keys to Move Around in a Stack

You can also use the arrow keys to move around in a stack. The left arrow goes to a previous card, the right arrow to the next card. If the arrow keys don't work, you may have to select them in the User Preferences card of the Home stack. The "Arrow Keys in Text" check box should not have an X in it (if it's a blank square, it's unselected, or off.) When this box is selected (with an X in the box), the left and right arrows move the cursor to edit text, and the key sequences of SHIFT-LEFT ARROW and SHIFT-RIGHT ARROW move you from card to card.

HELP STACK

Open another stack and learn about some other ways to navigate. Select Help from the Go menu or press Command-?. This opens the Help stack. The Help stack is a good example of an information-only stack; it will display unalterable information. If the Message window is still open, close it to see the whole screen. Press Command-M or select Message from the Go menu.

When you open the Help stack, a new menu named Help is created to the right of the Go menu. Stacks can create their own menus. Most stacks also contain buttons to do a variety of things such as moving you around in the stack.

The HyperCard Help stack has two buttons on the bottom of the first card: Find Topic and Overview of Help. Click the Overview button. This takes you to a new card in the Help stack called Overview of Help. Click the Go Back button to return to the previous card. (The standard icon is the bent arrow.) Many cards will also have left and right arrows on them. Click these to go to the previous or next card, respectively. (Traditionally, a picture of a house is used for the button that returns you to the Home stack. Don't worry if you don't see a Home button on your current screen; the Home command in the Go menu or Command-H will always return you to the Home stack.)

Take a look around the Help stack. It is a good example of how HyperCard uses hypertext concepts to help you browse around information. The Help stack contains a huge amount of data, but it is cleverly designed so you can easily find what you want. Its attractive and functional layout also makes it easy to just wander around, picking up facts here and there. When you are ready to come back home, press Command-H.

The Help stack is always available from any stack by pressing Command-?. If you move the Help stack into a different folder, HyperCard may ask you to help find it the next time you press Command-?. On cards two, three, and four of the Home stack, HyperCard stores search paths for stacks, applications, and documents, as shown in Figure 14-4. When you try to open a stack, HyperCard looks for it in the listed stack search paths. If it can't find the stack there, HyperCard will ask you where the stack is. When you tell it, HyperCard adds the location of the stack to the search path. HyperCard will be able to find the stack without help as long as you don't move the stack to another folder and don't modify the search paths.

HOW TO OPEN A STACK

To open a different stack, select Open Stack from the File menu, or press Command-O. Some stacks take up the entire screen. Others are designed to fit into a window. The Background Art stack that comes with HyperCard takes up the whole screen. Open it by pressing Command-O. Use the File Open dialog to find the Background Art stack. Open it up. This stack contains artwork you can use to create your own stacks.

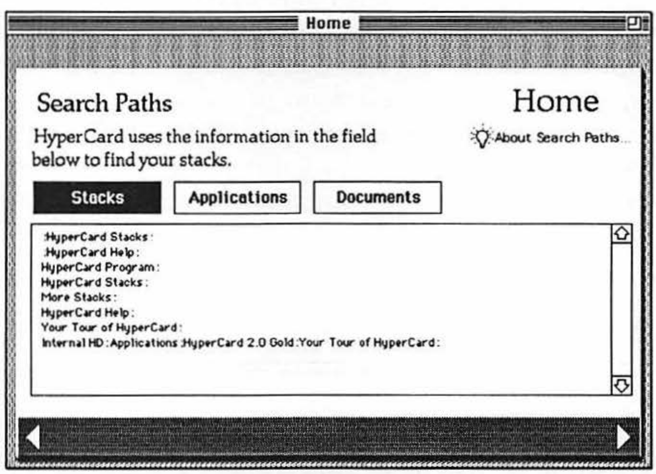


FIGURE 14-4
A Search Paths card

ABOUT THE ...
Using the Go Menu

The Go menu has several other navigation commands. Here they are, in order of appearance:

- *Back* moves you back to the last card you looked at.
- *Home* moves you to the first card of the Home stack.
- *Help* goes to the Help stack.
- *Recent* shows you miniatures of the last 42 cards you visited. (To go directly to any of these cards, click its miniature version.) *First* moves to the first card of the current stack. *Prev* moves to the previous card in the current stack. *Next* moves to the next card in the current stack. *Last* moves to the last card of the current stack.

Now open a stack designed to fit in a window. Press Command-O again and find the Phone Dialer stack. When this stack opens, it fits into a window. You can see other open stacks beneath it. Stacks in windows can be closed by clicking the close box or by choosing the Close Stack command from the File menu. Press Command-H to go back to the Home stack. See how easy it is to move around from card to card and stack to stack?

Most well-designed stacks contain navigation buttons to help you move around. Even if a stack doesn't have these buttons, you can always use the HyperCard Go commands to get around.

CREATE A NEW STACK

A stack can contain pictures, text, buttons, and more. Generally, stacks are made up of cards of similar information (like the Address stack which comes with HyperCard). There's no rule, though. A stack may contain any kind of information you want, related or not. Stacks can also perform calculations, play music, and reference other stacks.

Let's design a simple stack to give you an idea of what HyperCard can do. You don't need to be able to design stacks to use HyperCard. There are thousands of stacks available from user groups, software dealers, and online services to accomplish a wide variety of tasks. HyperCard is easy to use. Many people who would never consider themselves programmers have used it to create their own programs, and many of these stacks have been made available to the public. It is valuable to understand the process involved to create custom stacks, even if you never intend to do so.

TO BEGIN...

Go to the Preferences card of your Home stack (open HyperCard and press Command-H, and then press Command-4). Click user level 5, Scripting. You'll need to work at this level to create the new stack.

Select the New Stack command from the File menu. In this case, you want to start with a blank slate. Make sure that the check boxes next to Copy Current Background and Open Stack in New Window are unchecked. (The box should not have an X in it. When Copy Current Background is checked, the design of the current stack is copied to a new empty stack. This is a way to copy an existing stack for your own use.)

Enter the name **Work Stack** and click the New button. Now you have a new, blank stack. All well-designed stacks should have a Home button on them (to help you find your way back to the Home stack).

First, you need to make a decision. Every card in a stack has two layers: a background layer common to all cards and a foreground layer with information unique to a particular card. Since you want the Home button to be part of every card in your stack, you'll have to put it in the background. Select the Background command from the Edit menu or press Command-B. (Zebra stripes will appear in the menu bar to indicate that you are working in the background of the card.) Figure 14-5 is an example of a background in HyperCard.

You are going to do some serious work here, so put the Tools menu where you can use it. The Tool menu is really a tear-off palette. Click Tools to open the menu and then drag the menu to where you want it. They'll stay where they are until you close the menu.

Some of the tools shown in Figure 14-6 might look familiar. They are the standard graphics tools you'll find in any Paint program: the selection

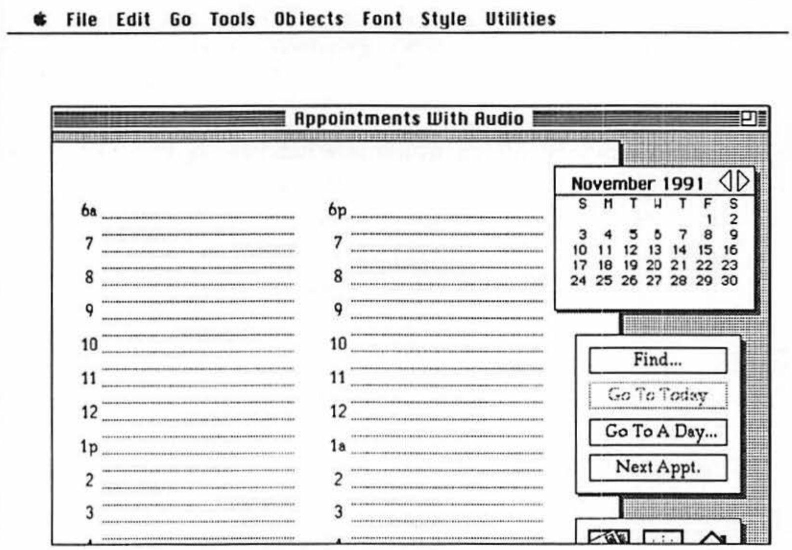


FIGURE 14-5

A background in a HyperCard card

tool, lasso, pencil, paintbrush, eraser, and so on. HyperCard has a full set of Paint commands to decorate your stacks as you wish.

Above the painting tools are three tools unique to HyperCard. The pointing hand is called the browse tool. You've been using it all along to navigate through HyperCard. To the right of the browse tool is an oval called the button tool. To its right is the field tool. The field tool is used to place text entry fields in a stack. Use the button tool to create your Home button.

Make a Button

Click the button tool. The cursor turns into an arrow. Press the Command key. The cursor turns into a plus sign. With the Command key pressed, you're ready to draw a button. Now point to a blank white area of the stack, hold down the Command key, and click. Keep holding down the mouse button as you move the mouse. You will draw a rectangle on the screen. Release the mouse button when you have a button about half an inch square. Don't worry if you change your mind about the button's

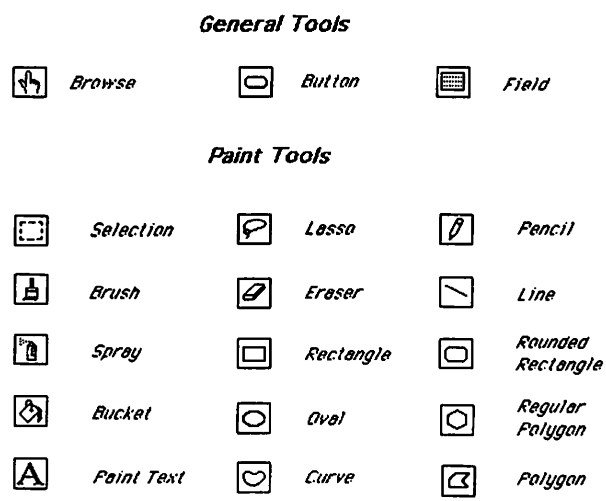


FIGURE 14-6

A picture of the tools

location or size; you can change both by clicking and dragging with the mouse. Click inside the button to move it; click the corners to resize it.

Double-click your new button. When you do, a dialog box will open for setting the button parameters. Start by typing in your new button's name, **Home**. Click the check box next to Auto Highlight. This will make the Home button darken when you click it.

For now, make your new button a shadowed rectangle. You can experiment with different styles, like those shown in Figure 14-7, later. Click the Shadow button.

Next, tell the button what to do when it is pressed. There are two ways to do this. Clicking the Script button opens an editing window. Objects in HyperCard can have small programs called *scripts* attached to them. Scripts are written in a language called HyperTalk. You've learned how to use HyperTalk commands to navigate. (**Go to the next card** is one example.) The required script for a Home button is **Go Home**. Scripts can be more complicated.

If you want to get an idea of what's possible with HyperTalk, set your user level to Scripting and browse around. You can open scripts attached to buttons by holding down the Command and OPTION keys and clicking the button. Scripts attached to backgrounds, cards, and stacks can be accessed by using the Info commands under the Object menu. Just make sure not to change any scripts unless you're willing to have things stop working.

LinkTo

You don't need to do any scripting in this example. HyperCard will do all the work for you with the LinkTo button.

Most buttons send the user to another part of the stack, or to another stack. Click the LinkTo button to link cards so a user can jump *through* the stack.

A dialog pops up with three buttons: This Card, This Stack, and Cancel. This window will stay open as long as needed. To go to the Home stack, press Command-H. This is where you want your Home button to take you, so click This Stack. HyperCard will return to the Work stack while linking the new button to the Home stack.

HyperCard has actually written a script. If you'd like to see the script, you can examine it by holding down the Command and OPTION keys and clicking the Home button.

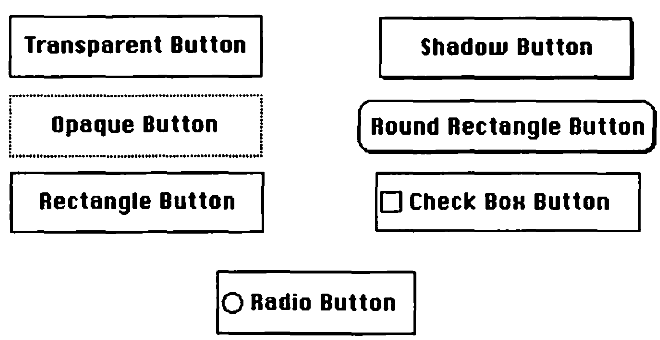


FIGURE 14-7
Standard buttons used by HyperCard

Add an Icon

Finally, add an icon to the button. Reopen the Button dialog by double-clicking the button, and then click the Icon button.

HyperCard comes with many standard icons. You can use its built-in icon editing tool to add your own, too. To use a standard icon, find the houses near the bottom of the scrolling list of icons. Pick one you like and then click OK. (If you can't see the whole icon, resize the button by dragging one of the corners out.)

Position the button where you want it and then select the browse tool from the tool palette. A shortcut for selecting the browse tool is pressing the TAB key.

Try Out the Button

Press your new button to try it out. It should bring you back to your Home stack.

Press Command-~ to return to the Work stack. (Command-~ is the Back command. It brings you back to the card you just left.) You can also look at cards recently visited with the Recent command—Command-R.

Let's add a few more features to your Work stack. (It won't turn it into anything particularly useful, but you'll learn the basic skills.)

Name the Stack

You are probably familiar with most of the paint tools. If you have ever used MacPaint or its descendants, you've seen them all before. Use the text tool to give your stack a title.

Go to the background to make the title appear on all of the cards. Press Command-B again to select the background layer. (The zebra stripes will again appear on the menu bar.) Click the letter *A* on the tool palette—it's the text tool. To select a font and style, double-click the *A*. Click near the top of the card and type a title, something like **My Incredibly Useful Work Stack**.

You can use the other paint tools to embellish it, too. Everything you type or paint on the background becomes part of every card with this background. You can also paint in the foreground. Items created in the foreground remain with the current card and no other. To add something to the foreground, press Command-B again. (When the zebra stripes disappear from the menu bar, you're in the foreground.)

INFORMATION, PLEASE

Most cards contain some kind of text information. This information is entered into text fields. Create a text field in your stack. Since you want this text field to appear on all cards in the stack, make sure you are working on the background. (Press Command-B if the zebra stripes aren't showing on the menu bar.) Click the field tool, the lined square to the right of the button tool on the tool palette. As with the button tool, press the Command key to create a new field.

When the cursor is a plus sign, click and drag to create a new field of any size. You can move and resize the field just as you can with the button. Double-click the highlighted field to set its attributes. Select a scrolling field style. You needn't name the field. Click the font button to set the field's font attributes. When you're satisfied, click OK. Press TAB to select the browse tool and Command-B to return to the foreground.

Let's see if the field works. Try to enter text into it. Type **This is the first card in my very first stack**. So far, so good—now for the real test. You have created the field and button in the background. Both should appear on every card you add to this stack. Try it. Select the New Card command from the Edit menu or press Command-N. An identical card is added. Try typing some different text into the text field, such as **This is card two**. Use the Next and Prev commands from the Go menu to move back and forth from card to card. If you did everything right, the button and text field should appear on both cards, but the contents of the text field should be unique to each. The text is in the foreground and the objects are in the background.

FIX A MISTAKE

If you inadvertently placed the text field or button in the foreground, it's easy to move it to the background, or vice versa, using cut and paste commands. Try it by putting another Home button in the foreground of card one. Go to the first card of your Work stack by pressing Command-1. Select the button tool from the tool palette. Click the Home button and select the Copy Button command from the Edit menu. Paste a copy in the foreground of this card. Select the Paste Button command. Another identical button will appear on top of the first. Drag it to a different location and press TAB. You have duplicated the Home button, but since you didn't place it in the background layer, the duplicated button should only appear on this card. What will happen when you go to the next card? Try it.

It seems silly to have two Home buttons on one card, so change the second button into something different. You can edit buttons to change their appearance and function. Go back to the first card of your Work stack and select the button tool from the palette. Double-click the second Home button. Rename this button Play Music for audio sound. Change the icon to something appropriate—maybe one of the speaker icons toward the bottom of the icon list.

Now it's going to get a little sophisticated; you're going to change the script attached to the button. (Remember, a script is a set of HyperTalk commands executed when the button is pressed.) Open the script by pressing the Command and OPTION buttons and clicking on the Play Music button.

The current script is left over from the Home button. It tells HyperCard to go to the Home stack when the mouse button is released (on mouseUp). Change the function of the button by changing the line in the middle, the one which begins "go to stack." Select it and replace it with the line "play harpsichord g2 e3 c3." This command instructs HyperCard to play the notes *g*, *e*, and *c* using the harpsichord sound. The numbers after the note indicate the octaves. Now press the RETURN key to save your changes and close the Scripting window. Press TAB to select the browse tool and press the Play Music button.

NOW YOU KNOW HOW IT WORKS

Congratulations, you've authored your first stack. You created buttons and text fields, and even wrote a HyperTalk script. With these basic skills, you can design HyperCard stacks to do a great many things. If you would like to learn more about HyperTalk, you may want to buy the HyperCard Script Language Guide offered by Claris. There are also a number of other good books on designing HyperCard stacks. You can get started right now by looking at the stacks others have created. You will get a lot of great ideas from them. You can also modify existing stacks to better fit your needs.

HYPERCARD APPLICATIONS

HyperCard stacks are referred to as HyperCard Applications. Today, there are well over one million stacks (or *stackware*) available on the market. They have all been created with the tools outlined above. Some of these applications are Macintosh-based front-ends to mainframes which return information in a user-friendly fashion. Reference stacks that use interactive video applications are available. Personal databases that serve a useful purpose to one individual are created daily.

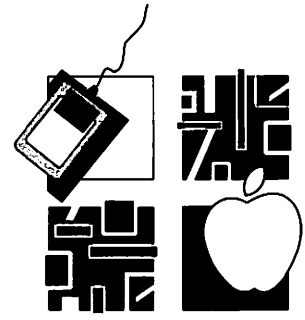
HYPERCARD COMPETITORS

Two major products in competition with HyperCard in the Macintosh environment are SuperCard and Spinnaker Plus for Macintosh. While SuperCard has many of the features of HyperCard, it also lets you develop stacks in color. It has a feature to automatically convert HyperCard stacks to and from its environment. Spinnaker Plus also supports color and conversion of stacks to and from HyperCard. It has a sister product that runs in the MS-DOS environment called Spinnaker Plus for Windows 3.0. This gives it the advantage of running the same application across both the Macintosh and MS-DOS environments.

CONCLUSION

By now, you probably have a good idea of what a sophisticated tool HyperCard is—and you've just scratched the surface. HyperCard is a powerful yet easy-to-use tool to manage information. It lets a novice explore and gain knowledge quite easily. It gives a curious author the ability to program an application (or stack) with a nonprogrammer's vehicles. Yet it is also a robust environment in which programmers can develop complex HyperTalk scripts (or programs) to do everything from tracking inventory to putting astronauts in space.

Thanks to Bill Atkinson, the HyperCard design team, and Apple, one of the most powerful pieces of software ever written comes free with the Macintosh. The rest is up to you.



C H A P T E R 15

PERSONAL AND HOME COMPUTING

The Macintosh is a wonderful tool to help you organize your personal finances. With it, you can simplify the dreaded annual income tax calculations or pay bills easily. (All you need is the money.) You can use the Mac to analyze where your money goes and help you figure out a sensible budget. You can also "let your fingers do the walking" with an online information service and a computerized, personalized telephone directory. The Mac won't clean the house and organize your closets, but it can make some of your chores easier.

PERSONAL AND HOUSEHOLD FINANCIAL MANAGERS

If you write checks without recording them, pay bills on the second notice, and balance your checkbook by opening a new account, financial management software won't do you a bit of good. A software program won't get you organized if you're not willing to do any of the work. Evaluate your personal financial habits honestly: you're either systematic about your finances or you're not.

If you are systematic—or want to be—personal financial software is a real timesaver. Many people justify owning a home computer because of financial management software. To get the most out of the software, you must be dedicated to using it. If you take the time to write all of your checks with it and make all of the necessary entries, you'll have accurate records, bills will be paid on time, your checkbook will be balanced, a budget will be maintained, and so on.

Personal and household financial management software can help you do the following tasks:

- Pay bills (it will write the checks, but you still need to earn the money)
- Keep track of where your money is and how much you have
- Analyze how you spend your money
- Create and maintain a household budget
- Calculate how much you need to reach your financial goals
- Plan a way to achieve your long-term financial goals

PROGRAMS

There are a variety of personal financial management software packages. Some are designed to focus on your checking account, others on paying bills, and yet another group is designed to recommend and monitor investments. The packages have different features. It's best to consider which features are most important to you before deciding which package to purchase.

Paying Bills with Electronic Debits

What is an *electronic payment?* It's a way to pay your bills without checks. You can use your Macintosh and a modem to draw funds electronically from your checking (or NOW) account to pay bills. All banks allow you to use these systems. (CheckFree, discussed later in this chapter, actually uses the same electronic transfer system that the Federal Reserve and commercial banks use.)

You can schedule payments to arrive by their due date without having to go to the post office. It's harder to lose a payment or "forget" to drop a bill off in the mail box. (You'll have to think of new excuses.)

Debits are automatically deducted from your bank account and credited to a merchant or service bureau's account, such as a utility company, gas company, credit card bank, or department store.

ABOUT THE ...

CheckFree

CheckFree is a program designed to let you make electronic payments. You'll need to use a modem and a phone line to make it work (see Chapter 12, "Telecommunications," for more details).

To start paying your bills with CheckFree, contact CheckFree Corporation to request an application form. (You must provide bank account and other personal information and a voided, printed bank check for verification purposes.) You choose your own personal identification number.

Checkfree Corporation confirms your CheckFree account and gives you a local modem access number to transmit your payments. Then you establish your payees (that is, the merchants and other accounts to which you pay money on a regular basis) as "CheckFree merchants." CheckFree will have checks printed and sent to those merchants that are not on the electronic transfer system.

CheckFree updates your bank account balance whenever it pays a bill. You can enter any other checks you write to keep the balance current. CheckFree can do some basic budgeting to see where you spend your money.

You can contact CheckFree at the following address:

CheckFree Corporation
720 Greenpress Drive
Westerville, Ohio 43081
614-698-6000

Check-Writing and Checkbook Control

Many financial management software packages offer a feature that writes checks and balances the checking account. (Many use a double-entry accounting system to track the checks and to generate reports, too.) You must update the software's information if you write any checks by hand, use an automated teller, make deposits, or get cash back from a deposit. The software can balance the checkbook correctly only if it has updated, accurate information.

Graphs, Charts, and Reports

Another feature of many financial management software packages is the ability to create graphs, charts, and projections of your future financial status.

You can generate graphs and put a trend line on them to show projected finances. Some of the available graphs include bar graphs and three-dimensional pie charts. A wide array of assorted reports are available to analyze your financial data. If these things are important to you, investigate the graphs and reports offered on different packages to find one that suits your needs. Some packages support the export of data into spreadsheets for further analysis and charting.

Goal Planning

Typical long-term goals include buying a home, saving for a child's college education, and planning for retirement. In figuring out the details of a home purchase, a financial management package will calculate how much you can afford to pay for a house, compare mortgages, figure insurance needs, and project your taxes. Investments can also be tracked and planned.

INCOME TAX PROGRAMS

Income tax programs let you produce your federal tax return on your Macintosh. Add-on programs are available for some state tax returns. When you use an income tax package, the process is simplified. Calculations are automatic—and correct. The tedious job of checking and rechecking is eliminated.

Income tax packages can help you with your tax planning throughout the year. They can be used to figure out "what if" scenarios for investments or major purchases, charitable contributions, or more kids. These programs can also help figure out a realistic quarterly return if your income increases or decreases substantially. (This feature is especially useful for the self-employed.)

ABOUT THE ...

Warning: Garbage In, Garbage Out

When you use any computer software, the information you get out is only as good as the data you put in. This is especially true for a financial management program. If you do not enter accurate figures into it, don't expect the output to be useful.

For example, imagine that you wanted to use your financial management software to build a household budget and then track your expenses against that budget. You spend time setting it up. Then, over the next month, you occasionally enter transactions for your expenses, when you think of it. But this information is far from complete. At the end of the month, it looks like you are way ahead of budget. You saved $250! Looking at it more closely, you realize that you spent an additional $275 that wasn't entered into the computer. You're not $250 ahead, but $25 behind!

Another thing to think about: software can only do what you tell it to do. Let's say that you want to use CheckFree to make your mortgage and car payments electronically. You set up the mortgage lender and car dealer as "CheckFree merchants." You tell CheckFree to send your payments to your mortgage lender, but you don't get around to putting your car dealer on the automatic payment schedule. When the first of the month rolls around, CheckFree automatically makes your mortgage payment—but not your car payment.

As for financial planning, if you give the wrong risk level, the advice given will be all wrong for you. It's not the program's fault if you indicate an "aggressive" risk level when you're in fact financially conservative.

Even if you don't do your taxes yourself, you can save time and money by using an income tax package. When you go through your tax package's exercises, you do a lot of the legwork. Your material is more organized when you hand it over to your tax preparer, saving the tax preparer time and you, money.

At the end of the year, it is easy and quick for you to estimate your taxes with a tax package. You can plug in how much you have paid in taxes so far and how much income you have received. You then estimate what you still need to pay and what you will receive. This determines whether you should file your tax return in January (if it's a refund) or in April (if it's a payment). Or, if you are married, you can try "what if" calculations to determine whether you should file jointly or separately.

Finally, you can get tax software for some states as well as for the federal government. If you live in one of the states for which software is available, you can roll your federal tax information into your state forms.

PERSONAL NETWORKS: ONLINE INFORMATION SERVICES

Arm your Macintosh with a modem, a telephone line, and an online information service starter kit, and you're hooked up to a world of information. From the latest airline schedules to the most recent stock market information, from magazine articles to world news, online information is just a telephone call away. All it costs is the telephone charge, the information service connection charge, and your time.

PROGRAMS

To use online information services, you must first sign up (some services will let you subscribe online) and then call up. Use the service for as long as you're willing to pay for it.

There are three major online information services: America Online, CompuServe, and PRODIGY.

America Online

Quantum Computer Services offers the nationwide online service America Online. When you access the service, a voice greets you with "Welcome." The Departments menu is shown in Figure 15-1; notice that America Online screens are true to the Macintosh interface, complete with icons and pull-down menus.

Here's a taste of what you get when you double-click one of these icons.

News & Finance Click the News & Finance icon for up-to-the-minute national and international news. You can read the latest political, business, and sports news or get 15-minute updates on stock quotes.

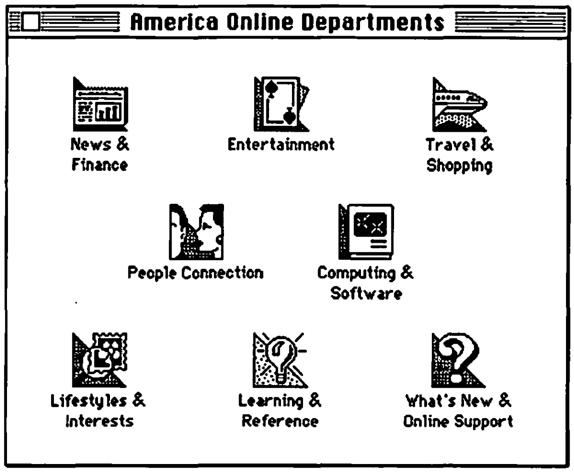


FIGURE 15-1
America Online's Departments menu

Entertainment In the Entertainment department, you can play games with other America Online members or read your horoscope. Want to see a movie tonight? Read the latest reviews of current and old movies, or do a search for movies by your favorite actor's name. You can leave messages for fellow members on the bulletin board, "You're the Critic." More interested in a book? Read the book reviews.

Travel & Shopping The Travel & Shopping department lets you use American Airlines' EAASY SABRE Travel Service to do research or make travel reservations. Use CompuStore Online's shopping service to buy products at guaranteed low prices.

People Connection You can have a conversation through the People Connection. Dozens of members currently online can use this interactive message board or chat group. (Note that America Online has many chat sessions. This is the central one; other special-purpose conference groups are described in the following sections.) In the People Connection department, you can exchange ideas and information with other Macintosh users, make new friends, or visit with old ones.

Computing & Software Click Computing & Software if you want to read MacWorld issues. You can search for a particular topic of interest, access software libraries, and download shareware, or attend software computing forums with titles such as Beginners and Business, Desktop Publishing, Education, and Hardware Support. Within the forums, you may leave messages on bulletin boards or visit conference halls and have a discussion with other members who have similar interests. In Industry Connections, click folders for dozens of companies that produce Macintosh products, leave messages on bulletin boards for vendors, or read company news. Click News and Reference to view high-tech periodicals like Newsbytes and USA Today Technology News. Read the latest about System 7 in the System 7 Resource Center.

Lifestyles & Interests In the Lifestyles & Interests department, you can visit any of America Online's numerous special-interest areas. They include everything from the Astronomy Club and Cooking Club to Stocks, Marketing, and the Wine Cellar. Click the Cooking Club folder, for instance, and do a search in the Celebrity Cookbook for your favorite actors' recipes. Visit The Kitchen, the Cooking Club's chat area. Within Stocks and Marketing, click the StockLink icon to get stock quotes.

Learning & Reference Click the Learning & Reference icon to use an online encyclopedia that has 32,000 entries and conducts searches in four seconds. Attend classes that professional teachers offer. Get help online to assist you with your kids' homework.

What's New & Online Support Use What's New & Online Support to learn how to use America Online's features. See a schedule of events, contests, and conferences or use the Customer Relations Hotline. If you post questions on the hotline, a customer relations representative should get back to you within two business days.

CompuServe Information Service

Since its introduction in 1979, CompuServe Information Service (CIS) has become the largest general online information service in the world. More than half a million members reach CompuServe by a local phone call. Members have access to more than 1,400 databases, including electronic mail, personal computer support, financial and stock market information, news services, educational and reference services, entertainment, computer games, and much more. CompuServe is popular in the PC-DOS environment.

CompuServe Information Manager (CIM) is a front-end package that adds a Macintosh interface to CompuServe. This means that you can use CompuServe through windows, pull-down menus, and dialog boxes.

CompuServe has three major modes that you can access in a given session on the information service:

- CompuServe Information Manager (CIM)
- Terminal Emulator
- CB Simulator

CIM is the Macintosh-like interface. The second mode is called the Terminal Emulator, which means that your Macintosh looks like a terminal to another system. In the Terminal Emulator mode, your Mac functions as an input/output device, and that's all—no attractive Macintosh screens with windows and pull-down menus will be shown. Your Mac emulates a terminal attached to another computer, which gives you access to many other systems.

The CB Simulator mode is an electronic conferencing service. You can use it to talk with other CompuServe members all over the world—sort of like an enormous conference call. You tune into Band A or Band B; each band has 36 channels. Some channels are general-purpose, and others are designated for special-interest groups.

You can bounce among these three modes when you use CompuServe, depending on which service you want to access.

Let's say you sign on with the CIM and then double-click the Information Manager icon. CompuServe presents you with the screen shown in Figure 15-2. The icons on this screen represent CompuServe's General Services. If you click any of these icons, a Navigating window like the one shown in Figure 15-3 appears. This gives you many topics from which to choose.

Let's look at just a few of the information services you can use when you click some of the icons in the General Services menu.

Computers In Computers, you can search periodicals for articles on computer hardware and software, reach technical experts for help, or download files and programs.

FIGURE 15-2
CompuServe Information Manager's General Services menu

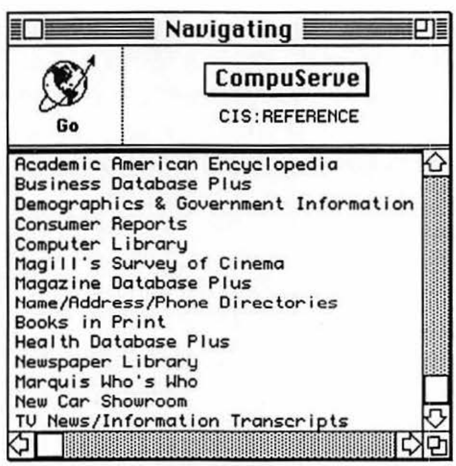


FIGURE 15-3
Navigating around CompuServe: Reference menu

Forums Click Forums to visit any of over 200 *forums*. These are special-interest groups in which you can meet other members either in person (in a live conversation in a conference room) or through messages on electronic bulletin boards. Forums also have libraries. You can browse through libraries or search for particular topics.

News In the News department, you can read national and international news flashes or tell CompuServe where you live or where you want to visit to get the local weather forecast. Look at a weather map like the one you see on TV or hook into major newswires. Have CompuServe clip and save articles of interest to you, or search for news by the ticker symbol of a company you want to follow.

Investment Use Investment to study investment data on stocks, bonds, options, mutual funds, money markets, and commodities. Access past performance data and forecasts of companies and markets, track market indicators and selected securities, or use CompuServe's online discount brokerage services.

Professional You can use the Professional department to keep up with the latest in your field, access information, and participate in special-interest group forums on topics ranging from aviation to technology to health professions. You can also use it to network with other professionals.

Games What kind of games do you like? Chances are that CompuServe has enough to keep you interested for hours. In Games, you can play a fantasy or adventure game like CastleQuest or a sports game like Advanced Digital Football, play parlor or trivia games like Baffle or Word Scramble. You could even engage in multi-player games with new friends from around the world.

Shopping Click Shopping to read the electronic version of Consumer Reports and decide what to buy; then buy it at The Electronic Mall, which lets you order from over 100 online stores. Use Shoppers Advantage, a discount shopping club, to purchase brand-name products at 10 to 50 percent discounts. Compare prices on car models in the New Car Showroom.

Travel The Travel department lets you use CompuServe's airline, hotel, and car rental reservation systems to plan your next national or international trip.

Reference With Reference, you can access specialized electronic reference databases to pull up abstracts or to read entire articles. Magazine Database Plus contains over 119,000 full-length articles from over 100 general-interest magazines. Have you lost track of some old friends? Look them up in Phone*File. This searchable database has the names, addresses, and phone numbers of about 80 million U.S. households.

ABOUT THE ...

CompuServe

For more information on CompuServe's services or to sign up for service, call 1-800-848-8199. You'll be sent a kit with everything you need to use CompuServe, including a User's Guide, a membership booklet containing your User I.D. number, a password, and detailed instructions for accessing CompuServe. In addition, CompuServe offers a $25 online usage credit to allow new members time to explore the service. The fee for using CompuServe varies depending on the modem speed and time of day.

PRODIGY

IBM and Sears, in their desire to be on the leading edge of the information age, formed the joint venture PRODIGY Services Company, which introduced the online information service called PRODIGY in 1988. PRODIGY is offered at a flat, low monthly fee to the consumer (in contrast to America Online and CompuServe, which have hourly connect fees). Constant advertising, which appears at the bottom of the screens, subsidizes the service.

PRODIGY offers access to over 700 features. When you type in a keyword for a service and hit ENTER, the service comes up. When you type **Index**, PRODIGY displays a list of its hundreds of services. When you double-click a name, you move to that service.

You can use PRODIGY to check the latest general, business, and financial news, check the sports and weather, or pull up a U.S. weather map. You can book airline reservations by using EAASY SABRE. In some areas, you can order groceries for home delivery. PRODIGY lets you get stock quotes from Dow Jones News/Retrieval, buy and sell stocks from a discount broker, or get advice from experts. You can buy merchandise from dozens of merchants, read movie reviews, play games, send electronic mail to your friends and associates, or read Consumer Reports articles. PRODIGY also features bulletin boards about Macintosh hardware and software. (Communication between parties is through electronic mail and bulletin boards and does not include conference areas in which you can interact in person with other members.)

ABOUT THE ...
PRODIGY

For more information on PRODIGY service, call 1-800-822-6922, extension 205. If you would like to get a PRODIGY startup kit, they are available through dozens of computer, software, and retail chains, including Egghead Discount Software, Radio Shack, Eletronics Boutique, Software Etc., Software City, and all Sears stores. Call PRODIGY's Membership Services Department at 1-800-759-8000.

OTHER PERSONAL ORGANIZATION AND TIME MANAGEMENT PRODUCTS

How can your Macintosh get your life organized? You can get software that does everything from keeping track of your friends, family members, and associates to keeping a calendar. In this section, two phonebook management and two time management packages will be discussed.

MACPHONEBOOK

Synex's MacPhonebook helps you manage address lists and phone numbers. It can run as an application or as a desk accessory. A MacPhonebook file can have up to 1,600 entries, and each file can be organized into up to eight categories. Figure 15-4 shows a sample entry. You can see the eight categories in the screen's top right section.

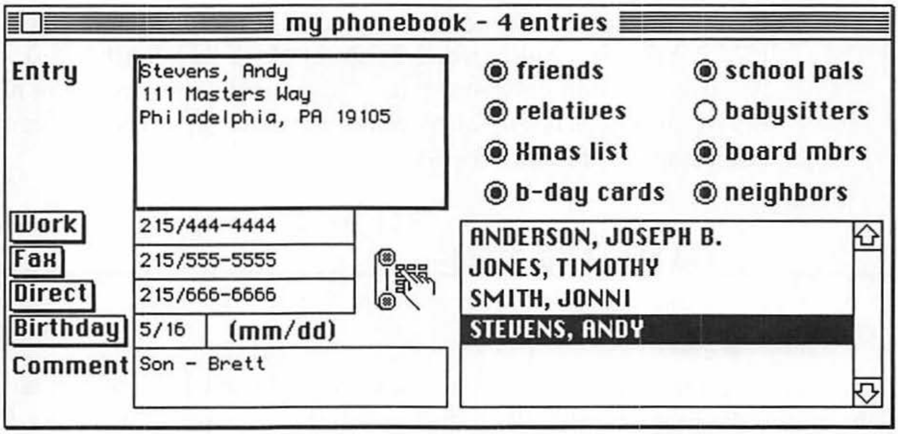


FIGURE 15-4

Sample MacPhonebook entry

MacPhonebook has room for personal information such as credit card numbers, bank account numbers, and driver's license, Social Security, health and auto insurance information. In addition, MacPhonebook includes a date field to help you remember important dates. Whenever you launch the application or desk accessory, MacPhonebook shows you the next five dates as reminders.

An Import and Export function allows you to use lists developed in other applications or to use your MacPhonebook address list in other applications. You might use the MacPhonebook desk accessory to update your database or use the desk accessory with your modem to call people listed in your MacPhonebook.

Finally, the program offers 6 different formats in which to print out your phonebook and over 40 formats for printing labels.

TOUCHBASE

TouchBASE is a desk accessory by After Hours Software. Use it to manage your addresses and phone numbers. TouchBASE automatically capitalizes words and formats phone numbers and zip codes, customizes fields to store special information, searches through your records for particular words or partial words or names, and prints out address books, envelopes, labels, fax cover sheets, and listing reports. TouchBASE will dial your telephone from a number in your database, and it will also work with a modem.

You can move data between other applications with the program's Import and Export functions, load into your database a list created elsewhere, or send information to other programs. TouchBASE comes with mail-merge templates for MacWrite, Word, and WriteNow word processors so that you can personalize letters.

MACINUSE

MacInUse tracks how you use your Macintosh. It runs invisibly—you don't see it run while you work. When you want to see how you've spent your time, pull up MacInUse. It tells you which applications you have used, when, and for how long. Export the data file that MacInUse generates into most spreadsheets, databases, and word processors to analyze and print your usage information. With MacInUse, you can customize screens to indicate personal or business use (including the client's name, account number, and so on).

ALARMING EVENTS

CE Software's Alarming Events is a desk accessory designed to help you manage your time. Use it to schedule appointments or to have it remind you about scheduled appointments. It can do so by flashing an icon in the corner of your screen or by interrupting your work with a pop-up menu.

You can keep a running "to do" list of your important tasks on Alarming Events. As you complete a task, mark it as done; if you don't complete all of your tasks, Alarming Events will carry them over into the next day, week, or month.

INTEGRATED PROGRAMS

An *integrated software program* is a single program with many functions. A typical integrated program includes word processing, spreadsheet, communications, and database modules. The program is said to be *integrated* because it allows information to be shared among the applications in the package. Integrated software programs were originally conceptualized and developed for the DOS world. The idea was to easily share data between different programs. In the DOS world, programs aren't uniform; to move data from a spreadsheet to a word processor can be very difficult. Creating the integrated package was a good answer.

The Macintosh is a different beast from DOS machines. The operating system is designed so all of the programs have similar commands and a familiar look; information can be shared through the clipboard function. On the Mac, integrated packages are excess baggage, duplicating the operating system's function while taking up a great deal of memory. Another disadvantage to an integrated package on a Macintosh is the program modules are nowhere near as complete or comprehensive as individual dedicated programs.

ABOUT THE ...

"Bundled" Software Packages

Sometimes vendors bundle multiple software packages in a single sales unit and sell them together to offer the buyer a volume discount. These bundles may have many of the same features of an integrated package.

There is a difference, however. An integrated package is a single package with multiple modules. A *bundle* is a bag of software sold together as a "grab bag"; the software wasn't designed to run together. Bundled software is just a good deal at a good price if you need some or all of the software packages. Do not confuse bundled software with integrated software.

SmartBundle is one example of bundled software. T/Maker Company bundled WriteNow (its word processor) with three other vendors' packages. You can buy these four separate applications together in a single box: WriteNow (word processing, by T/Maker Company), SuperPaint (graphics, by the Silicon Beach division of Aldus), RecordHolderPlus (database, by Software Discoveries), and Full Impact (spreadsheet and charting/graphics, by the Ashton-Tate division of Borland). You'll save about 45 percent if you buy these applications as a set. T/Maker positions SmartBundle as a low-cost, easy-to-use package aimed at first-time Macintosh buyers. (SmartBundle's applications are *not* integrated. You can, however, import and export data between the applications.)

Nonetheless, if you do not need all of the power and features of a single dedicated package, an integrated package offers the features of several applications at a lower cost than just one of the dedicated packages. Integrated programs have, in some instances, another advantage. Changes made in one function—for instance, the spreadsheet—are automatically made in the other functions, such as in word processing.

CONCLUSION

Many of the software systems designed to help you organize yourself won't help you unless you're already organized. If you are, the programs can help you save time and money. Tax programs, check-writing programs, and specialized programs such as alarms and calendars are all excellent for home use.

Online information services are both entertaining and informative. They give you access to databases, news, weather, and shopping sources. In addition, you can communicate with a world of people and participate in group dialogs. They're a great substitute for television, too.

C H A P T E R 16

NUMBER CRUNCHING

A spreadsheet (also called a worksheet) is a computerized version of an accountant's worksheet. It has columns and rows. The intersection of a column and row is called a *cell*. You enter numbers, text, and formulas in cells and calculate results based on formulas that are either built-in or typed in. A portion of a spreadsheet grid is shown in Figure 16-1.

Notice the lettered columns in the spreadsheet in Figure 16-1. The letters progress from A to Z and then from AA to AZ, BB to BZ, and so on. Most spreadsheet programs have 256 columns. (Imagine an accountant's worksheet with 256 one-inch-wide columns—it would be over 21 feet wide!)

A spreadsheet's rows are numbered from 1 upward. Some spreadsheets have over 30,000 rows. If you filled all of these rows and could print 50 lines on each page, your printout (or report) would be over 600 pages long.

Each cell in a spreadsheet has an address. The *address* is derived from the letter(s) of the cell's column and the number of the cell's row. For example, the very first cell in a spreadsheet is in column A, row 1. The address of this cell is A1.

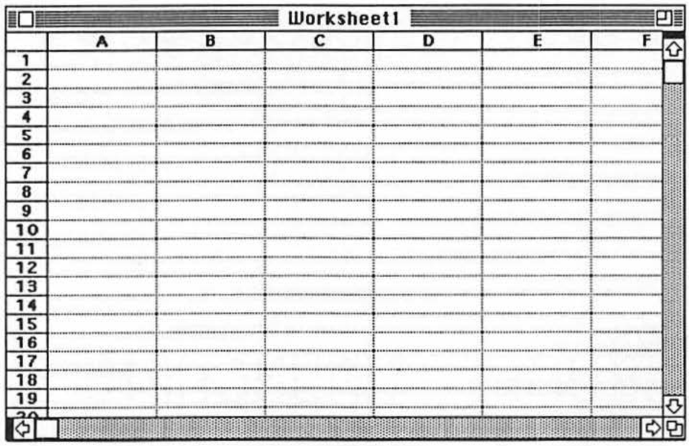
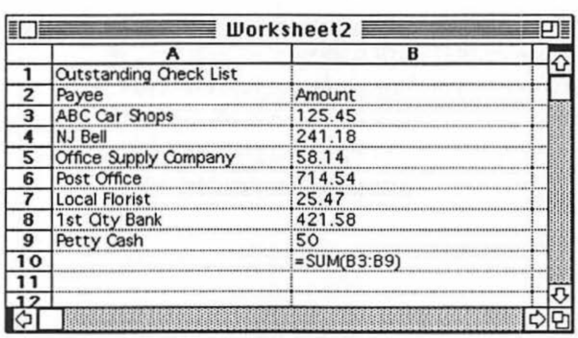


FIGURE 16-1
A typical spreadsheet window

HOW SPREADSHEETS WORK

Spreadsheets perform calculations based on the numbers, called *values*, and formulas you enter into cells. You can also enter text, referred to as *labels*, into cells to identify the spreadsheet's components.

For example, say you wanted to prepare a list of outstanding checks. You might use text in cells to put a title on the spreadsheet and label the columns. You also might use text in cells to list the payees of the outstanding checks. Then you'd list the amounts of the checks, with each amount in a separate cell. At the bottom of the list of numbers, you would write a formula to add them up. The input might look like this:


Worksheet2

	A	B
1	Outstanding Check List	
2	Payee	Amount
3	ABC Car Shops	125.45
4	NJ Bell	241.18
5	Office Supply Company	58.14
6	Post Office	714.54
7	Local Florist	25.47
8	1st City Bank	421.58
9	Petty Cash	50
10		=SUM(B3:B9)
11		

Let's look more closely at the formula in cell B10 of this example. Notice it starts with an equal sign (=). This tells the spreadsheet program (in this case, Excel), that the cell contains a formula rather than text or numbers.

This particular formula uses a function. A *function* is a built-in formula which performs certain calculations on the numbers. Functions have two parts, a keyword and one or more arguments. The *keyword* tells the spreadsheet program what kind of calculation it should do. The *arguments*, which are normally enclosed in parentheses, tell the spreadsheet program what numbers to perform the calculation on.

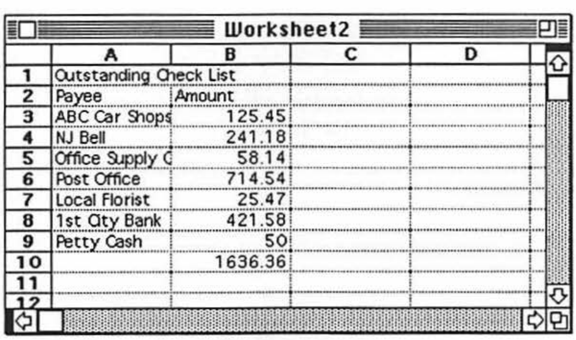
The SUM function tells the spreadsheet to add up the arguments. In this case, the arguments are listed as a range of cells, from B3 to B9. In Excel, a range is indicated with a colon (:). This formula tells the spreadsheet to add up the contents of all of the cells from B3 to B9.

It isn't necessary to use the SUM function to add numbers. You can use a regular plus sign (+). In our example, the formula could also have been written like this:

=B3+B4+B5+B6+B7+B8+B9

This tells the spreadsheet to take the contents of cell B3, add the contents of B4, add the contents of B5, and so on. This works no matter how many numbers are added—but imagine using this kind of formula to add a column of 75 numbers! The formula would take too long to write. Functions save time and effort.

No matter how you write formulas, when you enter information into the spreadsheet, it doesn't appear as shown above. Instead, it appears like this:

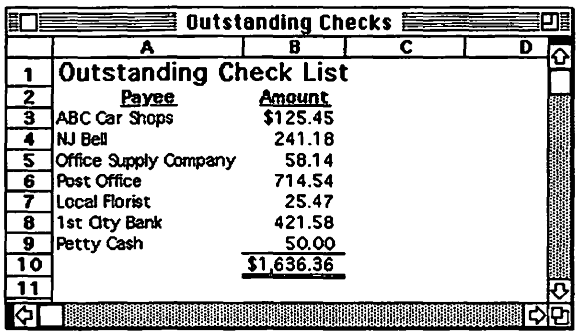


Worksheet2

	A	B	C	D
1	Outstanding Check List			
2	Payee	Amount		
3	ABC Car Shops	125.45		
4	NJ Bell	241.18		
5	Office Supply C	58.14		
6	Post Office	714.54		
7	Local Florist	25.47		
8	1st City Bank	421.58		
9	Petty Cash	50		
10		1636.36		
11				
12				

Notice how cell B10, the cell with the formula in it, displays the results of the formula rather than the formula itself. The formula remains in the background. All numbers, including the results of formulas, appear right-justified in the cells (lined up against the right side of the cell), while text is left-justified (lined up against the left side). (Of course, this can all be changed by the user.)

Notice how some of the text seems to be chopped off, especially in cell A5. The text can't fit in the cell. You can fix this by making the column wider. In fact, you can improve the formatting of the entire spreadsheet to make it picture-perfect. Compare the illustration above and this one:



WHAT IF...?

In the example in the previous section, the formula worked with cell addresses rather than with actual numbers. There is a reason for this. When a formula refers to cells, the result of the formula changes when the contents of any of the cells change; the formula itself does not need to be changed.

For instance, what if the outstanding check to 1st City Bank in the example was really $1,421.58? As shown in the following illustration, when you change the contents of cell B8, the result of the formula in B10 also changes. The formula itself does not change.

Outstanding Checks

	A	B	C	D
1	Outstanding Check List			
2	Payee	Amount		
3	ABC Car Shops	$125.45		
4	NJ Bell	241.18		
5	Office Supply Company	58.14		
6	Post Office	714.54		
7	Local Florist	25.47		
8	1st City Bank	1,421.58		
9	Petty Cash	50.00		
10		$2,636.36		
11				

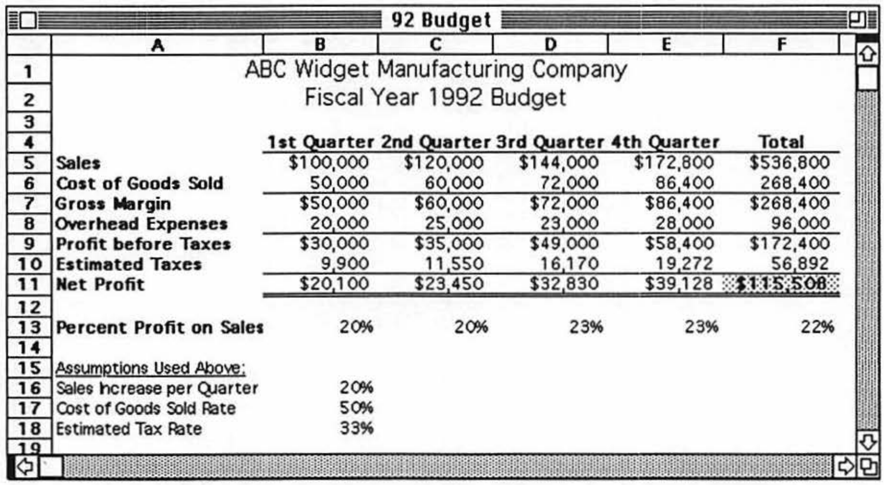
A formula makes it easy to do "what if" analyses. Imagine you have a spreadsheet that calculates the budget for your company for the upcoming fiscal year. You have built several assumptions into the spreadsheet to make it easy to change. It might look something like Figure 16-2.

92 Budget

	A	B	C	D	E	F
1	ABC Widget Manufacturing Company					
2	Fiscal Year 1992 Budget					
3						
4		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
5	Sales	$100,000	$110,000	$121,000	$133,100	$464,100
6	Cost of Goods Sold	60,000	66,000	72,600	79,860	278,460
7	Gross Margin	$40,000	$44,000	$48,400	$53,240	$185,640
8	Overhead Expenses	20,000	25,000	23,000	28,000	96,000
9	Profit before Taxes	$20,000	$19,000	$25,400	$25,240	$89,640
10	Estimated Taxes	6,600	6,270	8,382	8,329	29,581
11	Net Profit	$13,400	$12,730	$17,018	$16,911	$60,059
12						
13	Percent Profit on Sales	13%	12%	14%	13%	13%
14						
15	Assumptions Used Above:					
16	Sales Increase per Quarter	10%				
17	Cost of Goods Sold Rate	60%				
18	Estimated Tax Rate	33%				
19						

FIGURE 16-2

Sample company budget spreadsheet



92 Budget

	A	B	C	D	E	F
1	ABC Widget Manufacturing Company					
2	Fiscal Year 1992 Budget					
3						
4		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
5	Sales	$100,000	$120,000	$144,000	$172,800	$536,800
6	Cost of Goods Sold	50,000	60,000	72,000	86,400	268,400
7	Gross Margin	$50,000	$60,000	$72,000	$86,400	$268,400
8	Overhead Expenses	20,000	25,000	23,000	28,000	96,000
9	Profit before Taxes	$30,000	$35,000	$49,000	$58,400	$172,400
10	Estimated Taxes	9,900	11,550	16,170	19,272	56,892
11	Net Profit	$20,100	$23,450	$32,830	$39,128	$115,508
12						
13	Percent Profit on Sales	20%	20%	23%	23%	22%
14						
15	Assumptions Used Above:					
16	Sales Increase per Quarter	20%				
17	Cost of Goods Sold Rate	50%				
18	Estimated Tax Rate	33%				
19						

FIGURE 16-3

Sample company budget spreadsheet figured with new percentages

Suppose your boss wanted to know what the bottom line would be if sales increased by 20 percent each month rather than 10 percent and if the cost of goods sold was 50 percent rather than 60 percent. You could go back to your Macintosh, change two numbers, and have the answer for him immediately, as shown in Figure 16-3.

In the days before electronic spreadsheets, you would have had to recalculate all of the numbers manually. A well-designed spreadsheet can do all the work for you.

The Same but Different

Although the preceding examples used Excel to illustrate spreadsheet basics, all spreadsheets work in much the same way. The concepts remain the same from one program to another, but the menus and keystrokes may differ.

Let's return for a moment to the original example, the one with the outstanding checks. Compare the way the total formula is written in a number of spreadsheet programs:

Program	Formula
Excel	=SUM(B3:B9)
Wingz	=SUM(B3..B9)
Resolve	=SUM(B3..B9)
Works	=SUM(B3:B9)
Lotus 1-2-3 (Mac)	@SUM(B3..B9)

As you can see, although the notation may be different, the formulas themselves are very similar. If you learn one spreadsheet program, you are already well on your way to knowing the others.

COMMON SPREADSHEET FEATURES

Various spreadsheet packages have different features. Some of the common features available are dynamic links, outlining, goal seeking, charting, graphics, and macros.

Dynamic Links

Some spreadsheet packages let you link a cell or group of cells from one spreadsheet to another. For example, say Spreadsheet A calculates an overhead rate used in Spreadsheet B. The cell in Spreadsheet A which contains the rate can be linked to a cell in Spreadsheet B. When adjustments in Spreadsheet A cause the rate to change, the rate changes in Spreadsheet B as well.

With System 7's file sharing, linked spreadsheets can be used over a network. The person responsible for Spreadsheet A never needs to communicate personally with the person responsible for Spreadsheet B; the link handles all of the communication.

ABOUT THE ...
Design of Spreadsheets

Spreadsheet design is an important part of making spreadsheets work for you. A well-designed spreadsheet calculates information quickly and accurately and provides useful, well-formatted reports. It minimizes the risk of errors associated with adding, deleting, or changing data or formulas.

Here are a few tips to help you design better spreadsheets:

1. Plan the spreadsheet.

Sketch out your spreadsheet on paper before starting in at the keyboard. This helps you get a better idea of the information needed and the way it can best be presented. Although spreadsheet programs make it easy to add, delete, or modify spreadsheet layouts, the fewer modifications you need to make, the less likely you are to have errors associated with modifications.

2. Keep it simple, silly (KISS)!

The KISS rule applies to spreadsheets, too. The simpler the layout and formulas, the easier it is to spot errors and make changes.

3. Use a logical organization.

A well-designed spreadsheet often has these elements: assumptions, data entry cells, formula result cells, and notes. Whenever possible, group similar elements together. This makes it easier to find each element.

4. Use simple formulas.

Isn't it easier to write "=SUM(B3:B9)" than "=B3+B4+SUM(B5:B8)+B9"? Believe it or not, the results are the same for each formula. In addition, try not to write a lengthy formula in one cell. Instead, you might want to break the formula down into its components, put these calculations into separate cells, and then perform the final calculation based on these results. This can make spreadsheets easier to understand and easier to check for errors.

5. Create error-checking formulas.

Do debits equal credits? Is the input in cell G27 within the allowable range? You can write formulas to check for errors in your spreadsheet and alert you when one is found.

ABOUT THE ...

Design of Spreadsheets (continued)

6. Protect cells containing formulas.
   Spreadsheet software packages usually offer a cell-protection feature. When you use this feature to protect a cell containing a formula, the formula cannot be erased by accident.
7. Test the spreadsheet before depending on it.
   Just because it comes out of a computer doesn't mean that it is correct. It's easy to make a mistake in a formula. One well-placed error can make the entire spreadsheet incorrect.
8. Document the spreadsheet.
   Documentation is an important part of any computer application. Aren't the spreadsheets you create applications themselves? Include notes in your spreadsheet to explain what it does and how it is used. This is especially important if your spreadsheet will be used primarily by someone else.

Outlining

A spreadsheet-outlining feature lets you determine how much detail to show in a spreadsheet. You specify which columns or rows of a spreadsheet make up each outline level. You can then collapse or expand the outline to show desired levels. All of the data remains on the spreadsheet; it is simply hidden from view when the outline is collapsed.

Goal Seeking

Goal seeking lets you tell the spreadsheet the answer you want for a cell's formula. The spreadsheet then varies the contents of cells that feed into it to get an answer. It's not a feature of all spreadsheet programs.

For example, say you are preparing the monthly budget for your department. You create a spreadsheet to itemize expected revenues and costs to calculate net income. Then you realize the net income is less than the amount desired by management. Using goal seeking, you can tell the spreadsheet what the net income figure should be. Specify which cell can be changed to reach the number—perhaps a cost amount. The spreadsheet application changes the cost as necessary to arrive at the desired result.

Charting

Charts let you graphically represent some or all of the contents of a spreadsheet. Most spreadsheets provide a variety of chart types such as bar charts, pie charts, and line charts.

Graphics

Spreadsheet graphics capabilities vary from program to program. Most Macintosh spreadsheet applications let you change the font, font size, and font style for the contents of cells. Some also give you the ability to put borders around cells and shade them. Others add limited drawing capabilities to let you draw lines, boxes, and other shapes on the spreadsheet. Graphics help your spreadsheet look better.

Macros

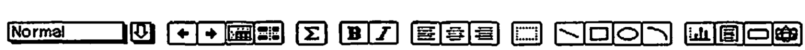
The term *macro* (or script) usually refers to a record of keystrokes and commands that can be played back in the spreadsheet. Macros help make life easier by automating repetitive tasks. Some spreadsheet applications offer more complex macro capabilities, which let you customize dialog boxes and menus. They enable you to create highly customized applications within the spreadsheet application.

SPREADSHEET SOFTWARE

A number of spreadsheet software packages are available to handle your number crunching needs. This section discusses some of them.

Excel

Excel, by Microsoft Corporation, is a full-featured spreadsheet application. Excel's tool bar, shown here,



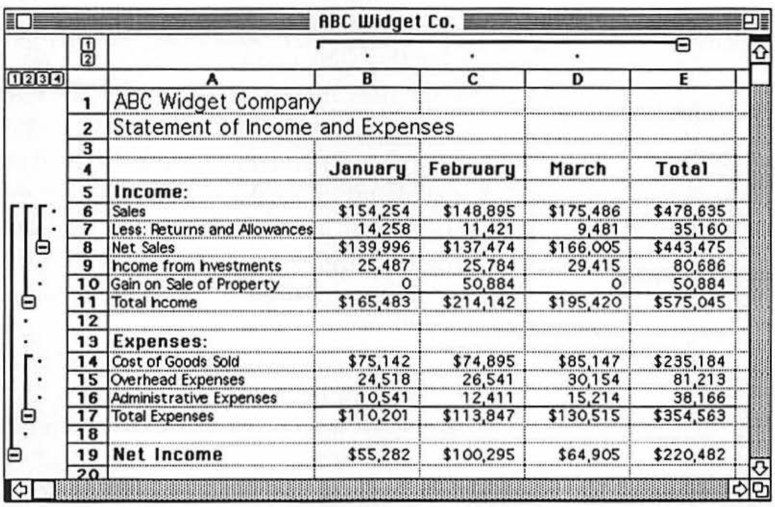
is positioned right beneath the menu bar. It puts many menu commands and features within reach of your mouse pointer.

The tool bar's Style Sheet menu lets you create cell-formatting templates and apply them to any cell. Style sheets can include font selection, size, and style as well as number formatting, borders, and shading. Select the cell you want to format and make the desired changes to it. Then click the current style name in the Style Sheet menu. When it turns black (becomes selected), type in a name for the new style. Press RETURN and the new style is created. To apply a style, select the cells you want to apply the style to and use the Style Sheet menu to pick a new style.

Outlining icons on the tool bar let you create, modify, and change the display of spreadsheet outlines. For example, look at figures 16-4 and 16-5. These figures illustrate the same spreadsheet. In Figure 16-4, all levels are displayed. In Figure 16-5, only the highest levels are shown. The result is a summary report that can be viewed on screen or printed.

Other tool bar buttons help make you more productive by speeding common tasks. The Sum button, labeled with the Greek letter sigma (Σ), writes formulas with the SUM function. There are also buttons for bold and italic formats as well as cell justification.

Graphics tools are also on the tool bar. With these you can draw straight lines, boxes, circles, ovals, and arcs right on your spreadsheet. A


ABC Widget Co.

	A	B	C	D	E
1	ABC Widget Company				
2	Statement of Income and Expenses				
3					
4		January	February	March	Total
5	Income:				
6	Sales	$154,254	$148,895	$175,486	$478,635
7	Less: Returns and Allowances	14,258	11,421	9,481	35,160
8	Net Sales	$139,996	$137,474	$166,005	$443,475
9	Income from Investments	25,487	25,784	29,415	80,686
10	Gain on Sale of Property	0	50,884	0	50,884
11	Total Income	$165,483	$214,142	$195,420	$575,045
12					
13	Expenses:				
14	Cost of Goods Sold	$75,142	$74,895	$85,147	$235,184
15	Overhead Expenses	24,518	26,541	30,154	81,213
16	Administrative Expenses	10,541	12,411	15,214	38,166
17	Total Expenses	$110,201	$113,847	$130,515	$354,563
18					
19	Net Income	$55,282	$100,295	$64,905	$220,482
20					

FIGURE 16-4
Excel's outlining feature; all cells displayed

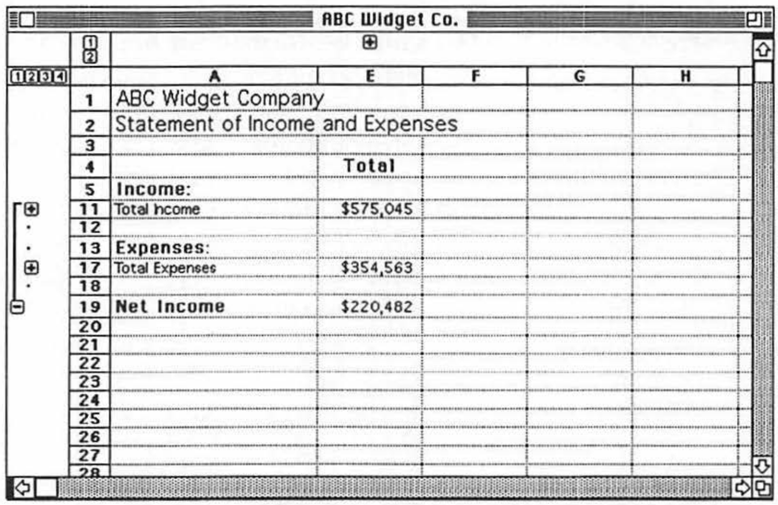


FIGURE 16-5
Excel's outlining feature; level 1 columns and rows level 1 and 2 displayed

Text button lets you create a box in which to type text. This box, shown in Figure 16-6, acts like a miniature word processor. A Charting button lets you create charts, like the one shown in Figure 16-6. Select the cells containing information you want to chart and click the Chart button. Then highlight the area in your spreadsheet where you want the chart to appear. Excel has many chart styles, including pseudo-three-dimensional charts that can be rotated and elevated for the best possible view.

Spreadsheets and charts are linked. If you make changes to the spreadsheet, the numbers in the chart are changed to reflect the new data. Excel also offers the ability to link cells or groups of cells from one spreadsheet to another.

An identical version of Excel is available for Microsoft's Windows platform on MS-DOS computers. The files created by the Macintosh and Windows versions can be exchanged between the two platforms without any special conversion. In addition, Excel can read most other spreadsheet files, including those created by Lotus 1-2-3 in MS-DOS.

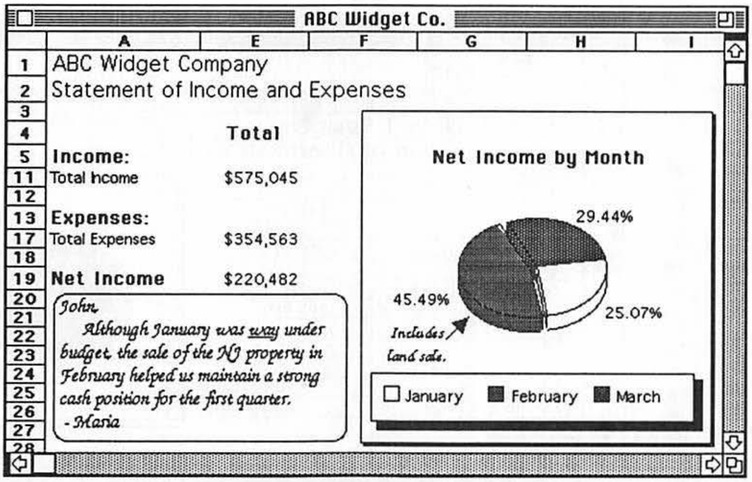


FIGURE 16-6

An Excel spreadsheet with a text box and chart

Wingz

Wingz is a spreadsheet package by Informix Software. In addition to standard spreadsheet features, Wingz has extensive graphics and charting capabilities. Its HyperScript language lets you write scripts to automate tasks and build custom applications. This is a very advanced form of macro.

A Wingz spreadsheet combining standard spreadsheet elements, graphics, and a chart is shown in Figure 16-7. The Current Cell Address box, Operator icons, Accept and Cancel icons, and Entry Bar stretch across the top of the window. The Tool Box stretches down the left side of the window. These features are used to enter data and formulas into the spreadsheet, make charts, and add graphics.

Select any drawing tool to add graphics to a spreadsheet. Use your mouse to draw shapes. You can use the Group command to group selected graphics objects together. This way, when you move one component of the group, they all move together. To add a chart to a spreadsheet, select the cells containing the information you want to chart. Click the Chart button

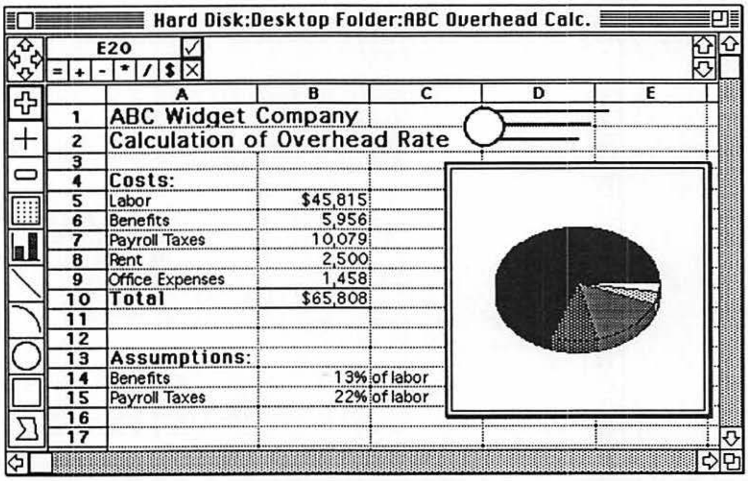


FIGURE 16-7
A Wingz spreadsheet combining spreadsheet information, graphics, and a chart

in the Tool Box. Then use the mouse to draw a box for the chart to appear in. You can add a legend to the chart if you like.

Resolve

Resolve is a new spreadsheet package from Claris Corporation. It combines standard spreadsheet features with presentation graphics and charting capabilities. A scripting language lets you automate tasks and create customized applications. It is similar in some ways to Wingz (because it uses the Wingz engine).

Resolve uses the same drawing tools found in other Claris applications. They appear in the upper left corner of the spreadsheet window, as shown in Figure 16-8. Click a tool to use it. Choose pen and fill patterns and colors. Resolve supports 32-bit color for camera-ready presentation graphics. Its charting feature lets you include charts on the page.

Resolve also has a spell checker to find text errors in your spreadsheet documents. The dictionaries provided with Resolve are the same ones used by other Claris applications. You can share the User Dictionary (a Claris customizable dictionary) between all applications. Resolve supports all of the features of System 7, including Balloon Help, Publish and Subscribe, and Interapplication Communication (IAC).

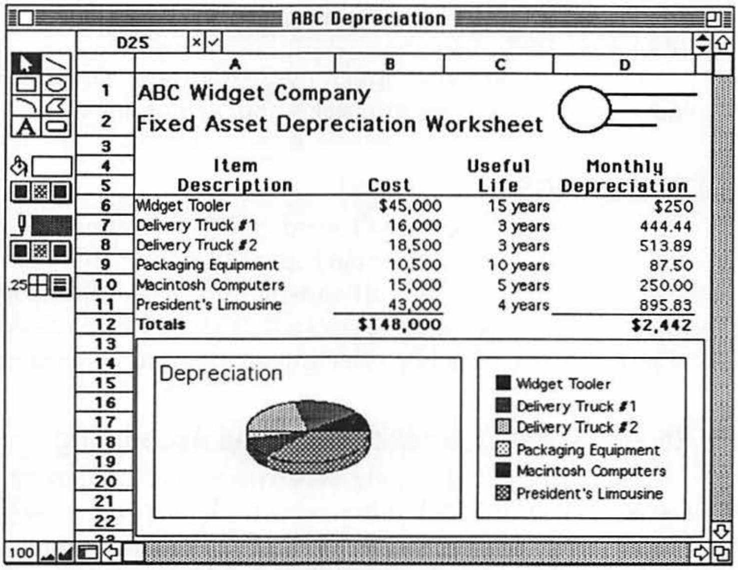


FIGURE 16-8
Resolve spreadsheet with graphics and a chart

Works

Works is an integrated software package by the Microsoft Corporation. Works has a spreadsheet module that is much like Excel, but with fewer features. Because Works is an integrated package and must devote resources to its other modules, the spreadsheet lacks many of the features found in full-featured spreadsheet packages. Its spreadsheet window is very simple. It looks very similar to the one shown in Figure 16-1. Still, it provides basic spreadsheet capabilities and some charting functions. (For more information on Works, see Chapter 15, "Personal and Home Computing.")

ACCOUNTING BASICS

Picture the stereotypical accountant—a slightly overweight, slightly balding man, with rolled-up sleeves and green eyeshade, hell-bent on adding up columns of numbers. You don't need to picture yourself like this to use Macintosh accounting software. (Only your software dealer will know for sure.)

However, don your green eyeshade for a moment, to take a look at some basic accounting principles and terminology.

ACCOUNTING BASICS

Even though you don't need to know accounting principles to use many accounting software packages, it's good to have some knowledge of the terminology used in software literature, packaging, and reviews when you shop for an accounting package. This section covers some of the terms to be familiar with when selecting an accounting software package.

Record-Keeping, Bookkeeping, and Accounting

The terms *record-keeping, bookkeeping,* and *accounting* describe varying levels of the same task. They refer to the process of keeping track of the possessions, income, and expenditures of an individual or company. Your method of record-keeping might consist of notes on napkins and receipts stuffed into envelopes, or it might consist of detailed, highly structured records kept on your Macintosh.

Accounts and Account Types

Most structured methods of accounting use accounts. An *account* is like a bucket where you store information about a specific thing. An *account balance* represents the value of an account at a specific point in time.

There are five main types of accounts: assets, liabilities, equity, revenue, and expense.

Assets An *asset* is something you own that has value, such as cash, a car, a building, or a computer. Accounts receivable is also an asset, representing the money owed to you by others. Many tangible assets (items you can touch, pick up, and hold) are normally depreciated. This means their value is *expensed* over their useful life.

For example, if you have a car that cost $15,000 and will be used for the next five years, you could expense the $15,000 over a five-year period. At the end of the time, the car will have no book value—its account balance will be zero. This is true even if it is in great shape and can last another five years. Your assets don't need to be fully paid for; that's where liabilities come in.

Liabilities A *liability* is something you owe to someone else. Accounts payable is the most common example of a liability. When you get a bill from the phone company for your monthly phone usage, it becomes part of your accounts payable until you pay it. A note payable may be a mortgage or a car loan. If you have a car recorded as an asset but you still owe $5,000 on it, $5,000 should be recorded as a liability.

Equity *Equity* is the net value of the individual or business. It is calculated by subtracting liabilities (what you owe) from assets (what you own). For corporations, the calculation of equity is more complex. It involves stock issue prices and values.

Revenue *Revenue* is income. It can be income from services you performed, items you sold. Your paycheck is an example of income.

Expense An *expense* is something you pay for with no real ongoing or future value. Your telephone bill is an expense because it covers the cost of services already rendered to you by the phone company. Some items appear to be assets, but they are usually treated as expenses. An example is office supplies, like paper clips and copy machine paper. Although these items do have ongoing value and can be treated as assets, many accountants prefer to expense them as purchased to save the bother of having to keep track of them.

Matching Revenue to Expenses—Cash Versus Accrual Basis Accounting

One of the most important rules of accounting—perhaps the accounting profession's "Golden Rule"—is the matching principle. It states you should record expenses in the same accounting period that revenues related to the expenses are recorded in.

This brings up two other accounting concepts: cash basis and accrual basis accounting. These two concepts determine when an expense should be recorded. *Cash basis* accounting requires you to record item expenses as you pay them. *Accrual basis* accounting requires you to record an expense when it becomes owed. Accrual basis accounting is actually the preferred method, despite the fact it requires more effort on the part of the accountant. It lets you match revenue to expenses—the expense is recorded in the same accounting period as the revenue related to it is.

For example, you use the phone all month long. At the end of the month, you owe the phone company money, but the phone bill won't arrive until a week or two later. If you were on a cash basis, you would record the phone expense when you paid the bill—perhaps three weeks after the phone costs were incurred. If you were on an accrual basis, you would estimate the amount of the phone bill based on previous phone bills and record it as an expense at the end of the month.

Debits and Credits

Accounts have *debit* (positive) or *credit* (negative) balances. Asset and expense accounts normally have debit balances. Liability, equity, and revenue accounts normally have credit balances. When you debit (add to) an account with a debit (positive) balance, the account balance increases. When you credit (subtract from) the account, the balance decreases. The same principle applies to credit balance accounts.

Journals and Ledgers

A *journal* is a document in which transactions are recorded. The most common journal is the general journal. All transactions can be recorded there. Subsidiary journals like a sales journal or accounts receivable journal are often used to record specific types of transactions. Transactions are usually organized by transaction date.

A *ledger* contains the same information as a journal, but the information is organized by account. For each account, you can see the debits and credits from transactions as well as the ending balance. The general ledger holds information about all accounts. Subsidiary ledgers such as an accounts receivable ledger or an accounts payable ledger further break down the accounts into amounts expected from or owed to others.

Transactions are recorded in journals. Periodically (usually at the end of the month), the transactions are posted (recorded) to ledgers.

Financial Statements

Financial statements are reports about an individual or business. The two most common financial statements are the balance sheet and income statement. A *balance sheet* shows the balances of asset, liability, and equity accounts. It reflects the worth of the individual or business. An *income statement* shows revenues and expenses and calculates net income (income minus expenses).

TYPES OF ACCOUNTING PROGRAMS

Accounting software packages generally fall into two categories: one-write systems and double-entry accounting systems.

One-Write Systems

A *one-write* system is a simplified accounting system meant to be used by people who have little or no accounting background. It works much like a checkbook. You record the amount of the expenditure and a category or account that the expenditure was made for. For example, suppose you wrote a check to pay the electricity bill. You would enter the check information and an account category or number to identify the expenditure as an electricity bill payment. That's it.

A one-write system can provide simple financial statements and reports based on the totals in each category or account. Some one-write systems can also print checks on your computer printer and help you balance your checking account.

Double-Entry Accounting

Double-entry accounting is "real" accounting. It requires a minimum of two entries per transaction. Entries are made in a journal. One entry records the account debited and the other records the account credited.

In our electricity bill example, when you write a check for the bill, you reduce the amount of cash you have in your checking account and increase the total amount of electricity expense paid for the year. You record this as a debit to an Electricity Expense account and a credit to a Cash or Checking account. Since both of these accounts have debit balances, Electricity Expense increases, while Cash decreases.

In more complex examples, you need to make more than one debit or credit entry per transaction. Suppose you purchased some office furniture, computer hardware, and supplies at a local office supply store. You would credit Cash or an Accounts Payable account to record the amount spent, but what would you debit? Furniture and computer hardware probably have separate asset accounts and need to be depreciated. Supplies may be expensed when purchased. As a result, you need to distribute the total expenditure among three accounts: Furniture, Computer Hardware, and Office Supplies Expense. Each account is debited for its share of the total amount spent. Then you need to calculate the amount of monthly depreciation for each of the new assets. You set up a *recurring entry* (a transaction entry that is made each month) to reduce the value of the asset and increase the expense account associated with the asset.

As you can see, double-entry accounting can become quite involved. But there are benefits to double-entry accounting. One benefit is the reports you can get from a double-entry accounting system. Balance sheets and income statements are commonly available. Other reports may be available; it depends on the record-keeping and reporting capabilities of your software.

ACCOUNTING SOFTWARE

Chapter 15 covered some home financial management and accounting packages. Most of those accounting packages are one-write systems. This section discusses some of the software packages designed primarily for business use.

Quicken

Quicken, by Intuit, is a one-write accounting system which can also be used as a double-entry accounting system. It can be used for business or home accounting. Because Quicken is designed for nonaccountants, it does not use standard accounting terminology. Instead, it lets you set up *accounts* for assets and liabilities and *categories* for income and expenses.

When you first set up Quicken, it asks if you want to use a set of predefined categories. You can select home or business categories, or both. Some home categories are Auto, Clothing, Household, Salary, and Utilities. Business categories include such things as Ads, Cost of Goods Sold, Entertainment, Office, and Services. These categories can be imported into your Quicken file, and you can add or delete categories as needed.

The next step is to create an account. You need at least one account to record transactions. Accounts can be Bank Accounts, Credit Cards, Cash, Assets, or Liabilities. If you want to write checks and use Quicken's check-printing feature, you need to create a Bank Account. You can have multiple accounts and transfer funds between them.

To write a check, Quicken opens a Write Checks window, shown in Figure 16-9. Fill in the blanks just as you would when manually writing a check. At the bottom of the window is a space for the category to be charged. Double-click this space, and a scrolling window containing all of the available categories appears. Select a category by double-clicking it, and then save the check. It can be printed later. If the check is post-dated, you can use Quicken's Billminder feature. When activated, this feature will remind you to print checks prepared in advance. You can set Billminder to remind you to print out checks when you start your Macintosh or when you start Quicken.

Quicken's check reconciliation feature takes all the manual calculations out of balancing a checkbook. Transactions are recorded in registers. Figure 16-10 illustrates the Register in Quicken's Sample Data file. This file comes with review files to help you get familiar with Quicken's features. You can see the check prepared in Figure 16-9 at the end of the register. You can also record transactions by entering them directly into a Register window.

Quicken has a variety of preformatted reports. The Home reports submenu lists reports for personal use, while the Business reports submenu lists reports formatted for business use. With the Cash Flow report,

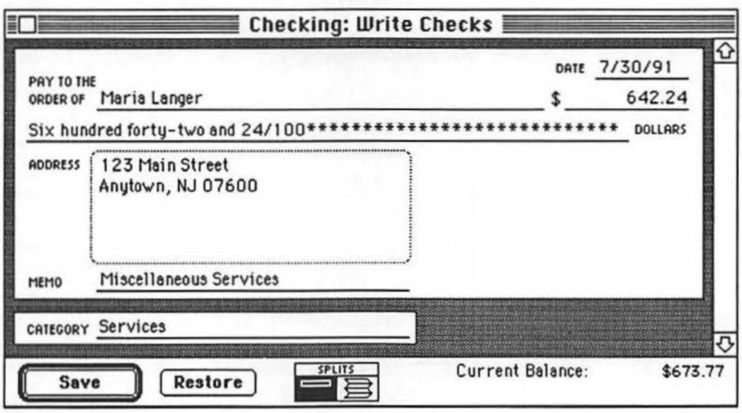


FIGURE 16-9
Quicken's Write Checks window

you can determine the period to cover, the breakdown of amounts (none, monthly, weekly, and so on), accounts to include, and other qualifying information.

Intuit sells blank checks to print Quicken-prepared checks on. Checks come in a number of formats for form-feed or laser printers. Envelopes are also available. (In addition, Quicken works with CheckFree, an online bill-paying service discussed in Chapter 15.)

MacMoney and InvoiceIt

MacMoney, by Survivor Software, was discussed in Chapter 15. InvoiceIt, also by Survivor Software, is invoicing software. It works with MacMoney.

Once installed, InvoiceIt acts as a separate module of MacMoney. You set up accounts receivable and revenue categories, provide client information, and define billing items. Select Invoices from the Transactions menu to create an invoice. InvoiceIt's Invoice Distribution window lets you itemize the goods or services on the invoice. This window is shown in Figure 16-11.

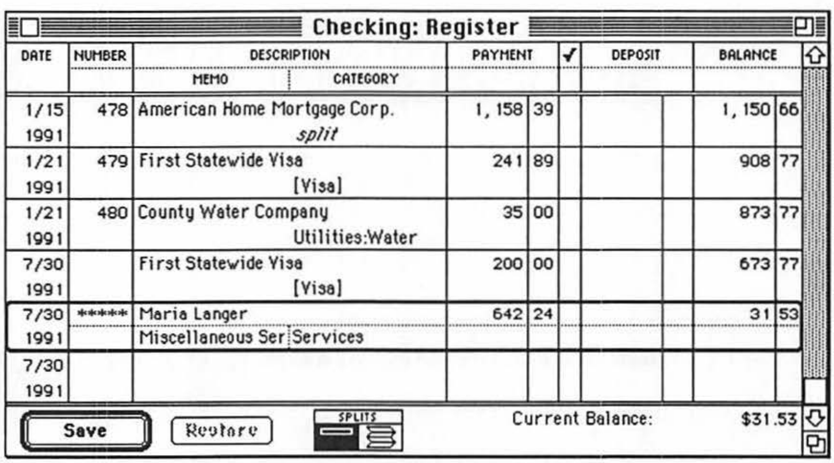


FIGURE 16-10

Quicken's checking account register

You can print invoices on forms available from Survivor Software or on blank paper, and there is some formatting flexibility. InvoiceIt also accounts for payments on invoices. It can create several reports, including client statements and accounts receivable aging reports.

Timeslips III and Timeslips III Accounting Link

Timeslips III, by Timeslips Corporation, is a time- and expense-tracking and billing system. It utilizes two modules—TSTimer and TSReport—to record report time and expenditures in a variety of ways. It is ideal for service businesses that bill by the hour.

To set up Timeslips III, use TSReport to create a data set. You'll need to identify users (a user is someone whose time will be tracked), activities, clients, matters, and controllers, and the related rates. Examples include consulting, training, writing, and programming.

Timeslips are generated with TSTimer. TSTimer comes in two formats: a desk accessory (for use under single Finder) and an application (for use with MultiFinder or System 7). Both work the same way.

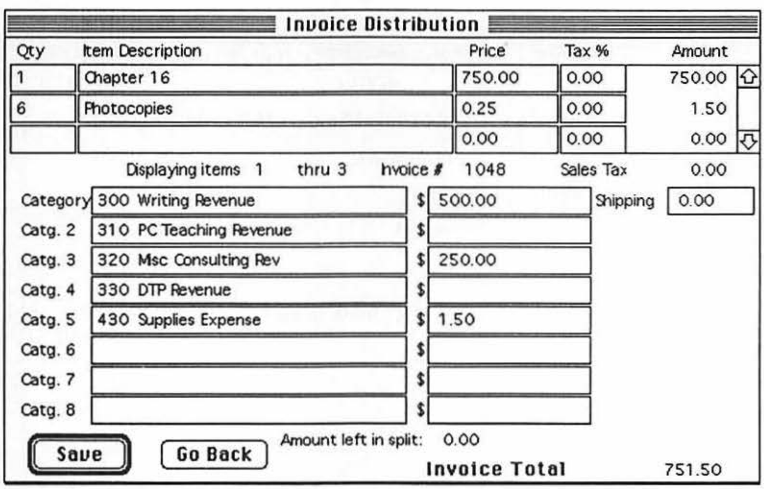
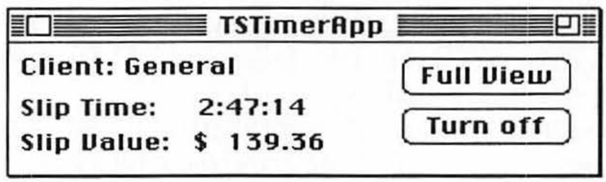


FIGURE 16-11

InvoiceIt's Invoice Distribution window

When you click the Turn on button, a timer at the bottom of the window starts. The active rate calculates charges at the top of the window, shown in Figure 16-12.

Once you've started the timer on a Timeslip, you can reduce the view of the window. Click the Mini View button. The window shrinks to show only the vital information, as shown here:



Position this small window anywhere on your Macintosh screen, or click to turn it off. The timer remains active until you click the Turn off button.

You can enter Timeslips manually in TSTimer. You can also use TS-Timer to create Timeslips for expense items like photocopies, postage charges, and mileage.

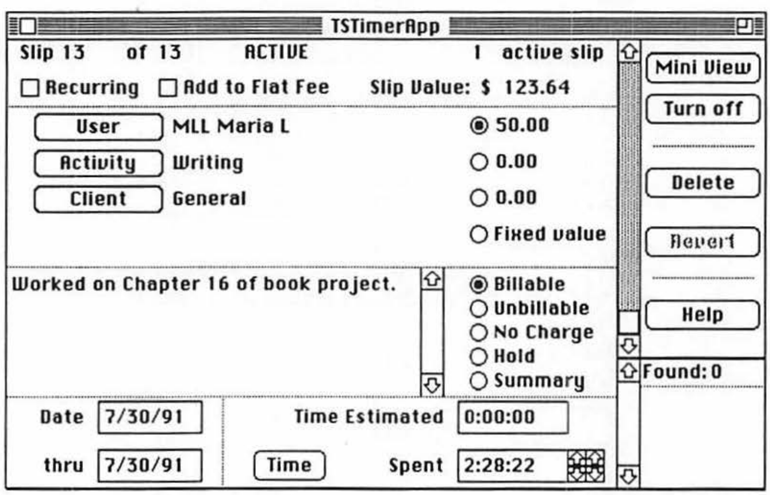


FIGURE 16-12

A Timeslips III active timeslip; full view

TSReport customizes Timeslips III's default report formats. Change and mix fonts and adjust the positioning of fields. Reports can be printed to a printer, the screen, or a disk file. Customized client bills can be printed to the screen. Charts are available for Timeslip information. TSReport also takes care of accounts receivable record-keeping. It lets you enter payments into a client's records and produce accounts receivable agings and account statements.

Timeslips III is available in single-user and network versions. Both have the ability to export Timeslips data to spreadsheet or database applications for further analysis or record-keeping.

Timeslips Accounting Link (TAL) works with Timeslips III. It exports Timeslips data to several popular general ledger programs. These programs include ACCPAC, atOnce!, Great Plains Accounting Series, and Accountant, Inc. Invoice amounts, payment amounts, and other transactions are sent to the general ledger software. TAL also adds features like open-item invoicing and customized income reports.

M.Y.O.B.

M.Y.O.B. (for Mind Your Own Business) is a double-entry accounting software package by Teleware. It uses modules connected by a control panel. This control panel, shown in Figure 16-13, is made up of labeled buttons. Click a module listed in the left column of the window. Then click an activity in the main part of the window to record checks, sales, and other transactions, and to view or print reports. All of the modules are linked internally so all transactions are recorded in whatever other modules they need to be.

The General Ledger module lets you create General Journal transactions, as shown in Figure 16-14. These transactions can be made into recurring entries if desired. They are posted to a general journal and to the account balances in your chart of accounts. You can use Analyze options to prepare a balance sheet, income statement, or a chart of any account category.

The Checkbook module lets you write checks, record deposits, and reconcile your checking account. It also prints checks and provides a number of reports like a cash disbursements journal and cash flow worksheets.

The Sales & Receivables module is used to record sales and prepare invoices. You can generate customer statements and perform various analyses. You can also keep track of accounts receivable from each cus-

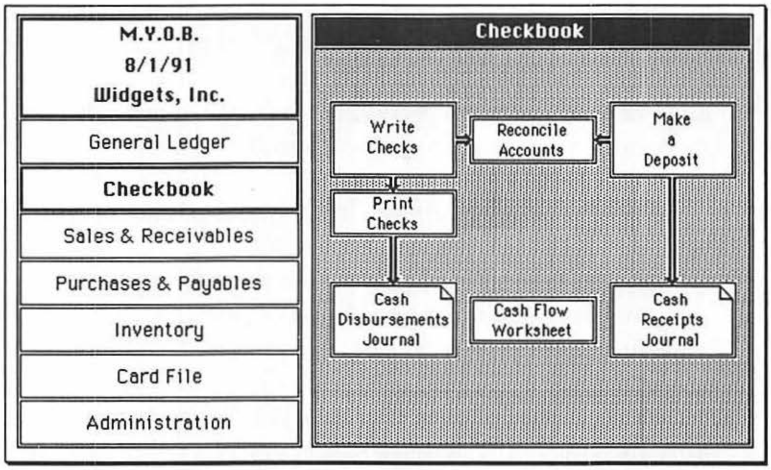


FIGURE 16-13
M.Y.O.B.'s control panel

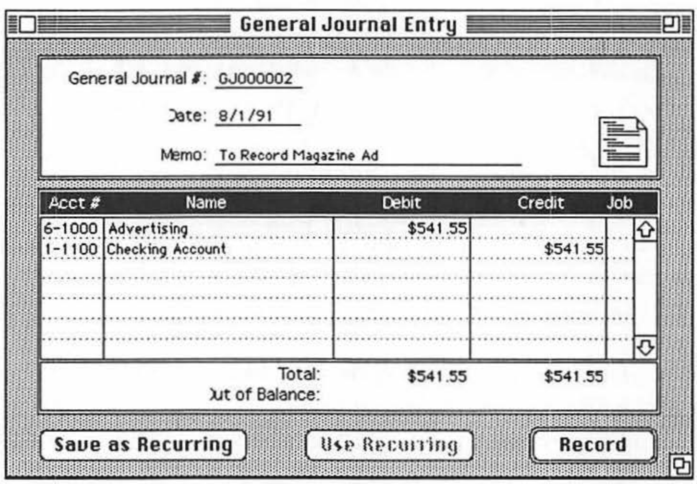


FIGURE 16-14
Writing a General Journal entry with M.Y.O.B.

tomer. M.Y.O.B.'s Purchases & Payables module handles the record-keeping for purchase orders and accounts payable. The Inventory module handles all inventory record-keeping. It can generate reorder information based on your criteria.

M.Y.O.B. has two general-purpose modules to help you keep track of nonaccounting information. The Card File lets you create a card (like an index card) for customers, prospects, vendors, contacts, and employees. The Administration module is a calendar and to-do list. These features work with the other M.Y.O.B. modules.

Great Plains Accounting Software and Utilities

Great Plains Software produces a series of accounting software modules that work together to form a complete accounting system. Each accounting function is performed by a separate module: General Ledger, Accounts Receivable, Accounts Payable, Payroll, Cash Management, Inventory, Order Entry, Purchase Order, Job Cost, and Executive Advisor. When you make an entry in one module, any other module affected by the entry is also updated. You purchase only the modules you need.

- *General Ledger* keeps track of all account balances, can handle up to 13 accounting periods in a year, and offers flexibility in account setup and financial statement formats.
- *Accounts Receivable* has invoicing and accounts receivable tracking and reporting capabilities.
- *Accounts Payable* handles purchases on account, manual and computer check payments, credit memos, and vendor history information.
- *Payroll* (available in U.S. and Canadian versions) calculates, records, and prepares payroll checks and reports.
- *Cash Management* tracks any number of cash accounts. It does things like checkbook reconciliations.
- *Inventory* tracks inventories and monitors on-hand quantities. It works with serialized inventory and prepares a number of reports. It supports five inventory valuation methods.
- *Order Entry* is a point-of-sale invoice feature.
- *Purchase Order* prepares, records, and prints purchase orders. It also prepares projected cash flow reports to aid in cash budgeting.

- *Job Cost* provides estimating, cost-tracking, billing, and analysis-reporting functions. It lets you explore "what if" scenarios.
- *Executive Advisor* provides graphical analysis and charting capabilities.

Great Plains Software also has utility software packages for the accounting series.

- *Import Manager* is a software package that transfers information from other applications to the Great Plains Accounting Series software modules. It supports most popular data formats.
- *Network Manager* adds multi-user capabilities to the Accounting Series modules.

For the simpler needs of smaller businesses or individuals, Great Plains also has a package called Plains & Simple, a one-write accounting system. It has a bunch of one-write forms—ledgers and checks—to complete on your Macintosh screen. The information you enter is transferred to the appropriate accounts in your general ledger, accounts receivable, and accounts payable. Plains & Simple offers 27 sample charts of accounts to use or customize. The program also generates accounting reports, including financial statements, analyses, customer statements, mailing labels, aging reports, and a special Cash-Flow Calendar to project cash flow needs.

Accountant, Inc.

Accountant, Inc., is a small business accounting system from Softsync/BLOC. It is made up of General Ledger, Accounts Receivable and Accounts Payable ledgers, Payroll, Inventory Control, and Project Management modules. These modules work together, but instead of the standard modular layout, functions are arranged by task. For example, instead of accessing an invoice module to prepare an invoice, you select Invoice from a Forms menu.

Accountant, Inc., can be used for service businesses, professionals, manufacturers, distribution companies, and retailers. Accountant, Inc., supports System 7 features such as Publish and Subscribe.

A4 Accounting

A4 is a business accounting software package by Softek Design. A4 was created with 4th Dimension, a database programming environment by ACIUS, but 4th Dimension is not required to use A4. A4 can be customized.

A4 has standard accounting functions plus additional management features. A variety of reports is available to help make management decisions, such as receivable reports, payable reports, transaction histories, financial statements, audit journals, and batch transaction reports. A4 has another useful feature: you can keep notes of conversations with potential and current customers and vendors. You can set dates and times for follow-up actions and have A4 notify you when it is time to take care of them (a built-in nudge). You can also send personalized letters to one, some, or all of the companies in your A4 database.

Single-user and several network versions of A4 are available. Source code is also available to take advantage of the modification capabilities offered by 4th Dimension.

Manapro Administrative Software

Manapro Administrative Software is a series of multilingual accounting software modules by Manapro. The series consists of the following modules: General Ledger, Sales & Billing, Accounts Receivable, Accounts Payable, Personnel & Payroll, Inventory Control, and Budget & Construction. You can export information from one module and import it into another to build a complete, customized accounting system.

The General Ledger module offers standard general ledger, journal, and reporting capabilities. A Journal entry window is shown in Figure 16-15. The Sales & Billing module prepares invoices. The Accounts Receivable module tracks accounts receivable information and provides related reports. Accounts Payable tracks accounts payable information and prepares payment checks. The Personnel & Payroll module lets you record personnel information and calculate payroll data. Inventory Control handles controls over, transactions for, and orders of inventory. Budget & Construction is an application to help you create a budget for contruction projects.

An unusual feature of the Manapro modules is their multilingual capabilities. A menu command lets you switch the interface or reporting

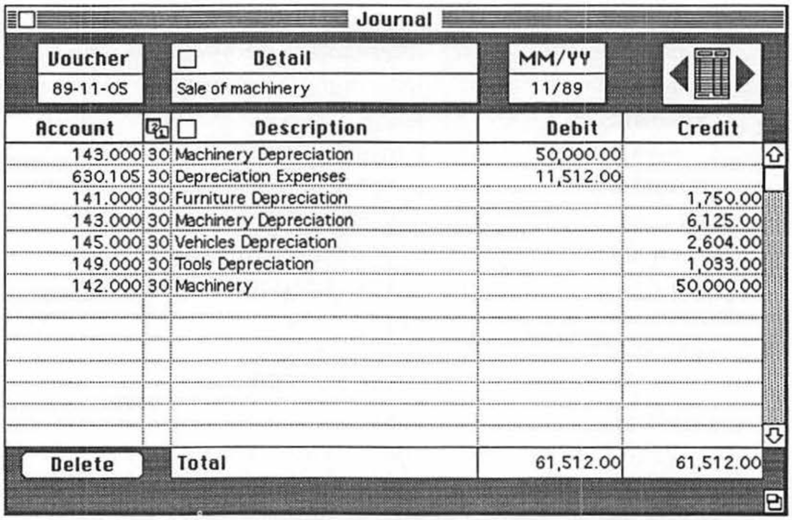


FIGURE 16-15
Manapro General Ledger's Journal entry window

language (or both) to any of the following languages: Spanish, English, Portugese, French, German, or Italian. An American company with branch offices in France could use the French interface of the product but produce English language reports for the home office. (Manapro also produces foreign-language versions of popular spreadsheet and word-processing software packages.)

Satori Accounting Products

Satori Software offers a line of modular accounting software packages called Satori Components. The Components accounting system is fully customizable, giving you, in effect, an accounting "construction set." You define the structure of your chart of accounts, entry journals, posting methods, and reports. Available modules include: General Ledger, Accounts Receivable, Accounts Payable, and Job Cost/Time Billing.

Satori also produces specialized billing software. Legal Billing II is a time-billing package designed specifically for attorneys. Project Billing and Project Billing+ are two time-billing packages created for graphic designers, architects, engineers, and other professionals. All of these products integrate with the General Ledger module of Satori Components.

Flexware Accounting System

The Flexware Accounting System is a modular accounting system from Microfinancial Flexware. Its modules include General Ledger, Accounts Receivable, Accounts Payable, Inventory, Payroll, Order Processing, Job Cost, Purchasing, and Point of Sale. The modules work together to provide a complete accounting system. A Report Writer feature lets you create customized reports from Flexware data.

Cost Management System

Cost Management System (CMS) is a cost estimating and control software package by Softouch Software. It is a combination application and database written in FoxBASE+/Mac.

When you use CMS to create a job, you specify job and client information, as well as sections, tasks, and prices. You can use the same sections, tasks, and prices in more than one job to speed up the use of CMS on similar jobs. Once information is entered, you can estimate costs. CMS will also track the progress of a job and its costs. It offers a variety of report and chart formats. CMS can interface with general ledger accounting systems and export files in popular formats.

SPREADSHEET TEMPLATES AND MACROS FOR ACCOUNTING

A *template* is a prepared file designed to work with a specific application or type of application. A simple spreadsheet template may calculate loan payments, amortization, and a break-even point, or balance your checkbook. A complex spreadsheet may use macros to create an entire accounting system, complete with its own custom menus and dialog boxes.

Spreadsheet templates and macros are available from many sources. Some can be obtained free or as shareware from computer bulletin board systems and online services such as America Online, CompuServe, and GEnie. Others are available from commercial software distributors. A few of them are discussed here.

Small Business Accounting System

Small Business Accounting System, distributed by Heizer Software, consists of three Excel spreadsheet files and an Excel macro. Together, they form a fully documented double-entry accounting system.

SBINSTR is an Excel spreadsheet file containing step-by-step instructions. SBMACROS is a macro file with the 16 macros listed in Figure 16-16. Follow the instructions to experiment with the macro file commands on SBJDEMO, a demonstration template file for example data and transactions. When you are finished with this tutorial, open SBJNL, a template file you customize to become your General Journal.

The instruction file guides you to set up your accounting system. It offers advice on naming and numbering the accounts in your chart of accounts. A macro command automates the setup of your initial chart of accounts. It prompts you to enter the number of each type of account you need: asset, liability, equity, income, and expense. It then inserts a column for each account in the proper location. You fill in the account number and name information at the top of each column. After a few other setup tasks, you're ready to begin entering transactions.

The macros in SBMACROS range from simple to complex. The Make Next Entry (m) macro positions the cell pointer in the proper position to enter a transaction and even enters the transaction number for you. The Post Transaction(s) (p) macro takes the amount entered under the active checking account and posts it to the account you specify in your entry. The

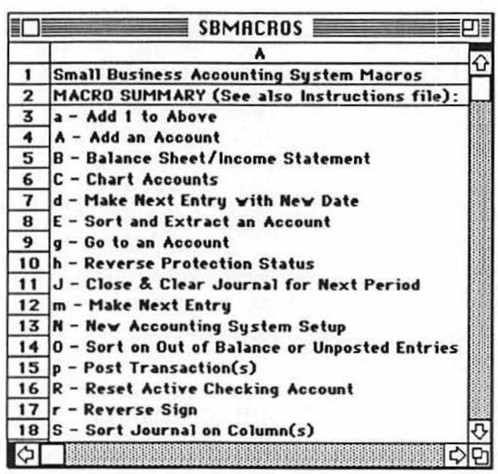


FIGURE 16-16

Macros included in Small Business Accounting System's SBMACROS file

Balance Sheet/Income Statement (B) macro takes the information in the journal, which is presented horizontally, and copies it to a new spreadsheet in which the information is presented vertically. It then formats the spreadsheet to prepare presentable financial statements. The Close & Clear Journal for Next Period (J) macro saves the current period's journal and then prepares a new one for the next period. All ending balances in the old journal become starting balances in the new one. Excel's charting capabilities are also used in a Chart Accounts (C) macro to prepare a column chart of any account category.

The Small Business Accounting System can support up to 10 checking accounts and a chart of accounts with up to 240 accounts. It requires Microsoft Excel to run.

Payroll Partner

Payroll Partner is an Excel template and macro application by E. B. Hilton, which is distributed by Heizer Software. It is designed to handle the needs of small-to-medium-sized companies. It calculates and summarizes information necessary to file state and federal government tax forms. In addition, it can print payroll checks (with stubs) on an ImageWriter printer.

Payroll Partner consists of four Excel spreadsheet files and an Excel macro file. PPINST91.XLS is a spreadsheet file containing detailed instructions. PPWKST91.XLS is the main worksheet file, in which you enter payroll information for each employee. PPSUMM91.XLS is linked to this main worksheet. It summarizes each pay period and quarter and has a place to record payments to government agencies for taxes withheld. PPCHCK91.XLS is a spreadsheet file to print payroll checks and stubs. It uses Excel's cell-linking feature to get information from the main worksheet (PPWKST91.XLS). A macro in PPMACR91.XLM cycles this check-writing template through each check.

Each of the template files comes with example information in it to illustrate how the application is used. Macros automate many of the setup functions. To customize the main worksheet for your use, use the Set Number of Pay Periods (P) macro. This clears out the sample data and prompts you to enter the number of pay periods in a year. It then inserts and labels rows as necessary to store each pay period's information. To similarly prepare the summary worksheet, use the Set Number of Pay Periods (S) macro. The Add New Employees (N) macro prompts you for the number of employees to add to the main worksheet. It then inserts a column for each and instructs you to enter employee information in the proper cells.

To enter pay period data, enter the employee's data into the appropriate main worksheet cells. This data-entry area is shown in Figure 16-17. Employee pay can be based on salary, sales and commissions, or an hourly rate. Tips and other taxable income may also be entered. The Record a Pay Period (R) macro calculates the pay period information, including all taxes, and records them on the appropriate line in the main and summary worksheets. You can then use macros to print checks or a number of reports. For the next pay period, use the Begin a New Pay Period (B) macro to clear out the previous period's information. The rate data for each employee remains; it does not need to be reentered each pay period.

Payroll Partner comes configured for calculating federal and California state taxes. You can adjust the state tax information to work for your state by changing information in the tax rate tables. Payroll Partner is updated every year to reflect the most current year's tax rates. It requires Excel to run.

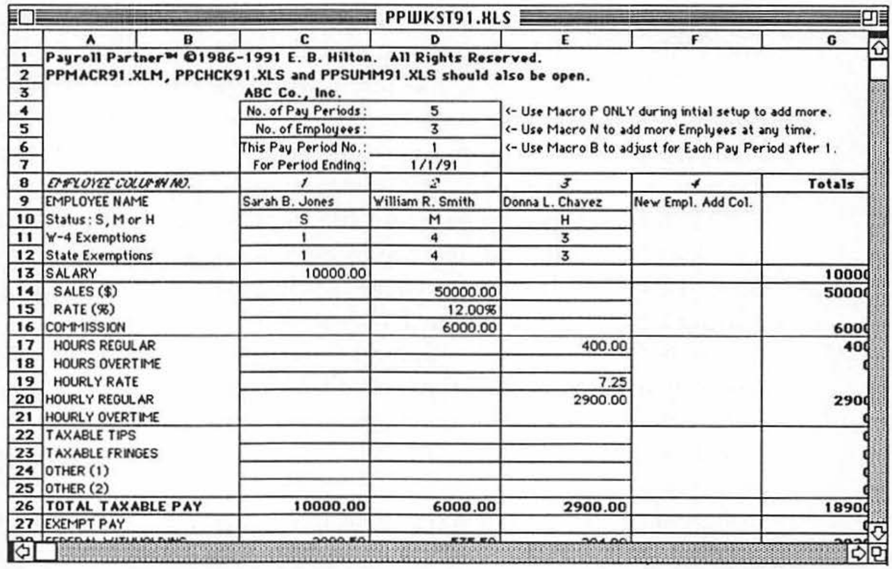


FIGURE 16-17
Payroll Partner's main worksheet data-entry area with sample data

MATHEMATICAL AND STATISTICAL SOFTWARE

Specialized software for mathematicians and statisticians is also available. A few of these products are discussed in this section.

CALCULATOR CONSTRUCTION SET

Are you tired of the limitations of Apple Computer's Calculator desk accessory? Calculator Construction Set, by Dubl-Click software, is an application that lets you create your own custom calculators. These calculators can be saved as desk accessories or applications.

Drag predefined part shapes onto a calculator case and select the functions. A large selection of mathematical, scientific, business, date/time, and conventional function keys are provided. If you prefer, you can define your own programmable keys. The Calculator Construction Set can emulate popular handheld calculators using Standard Algebraic or Reverse Polish notation.

MYSTAT, FASTAT, AND SYSTAT

Mystat, Fastat, and Systat are three statistics software packages from Systat. These programs vary in capabilities and features.

Mystat and Business Mystat are personal versions of Systat. Mystat provides a full-screen data editor, algebraic transformation, and the ability to sort and rank variables. Its procedures include basic descriptive statistics, correlations, multiway tables, chi-square, and nonparametric statistics. It performs a number of types of regression diagnostics. Graphics include histograms and various plots. Business Mystat is designed for use by graduate students in business schools. It produces time series, autocorrelation, and partial correlation plots. Both Mystat and Business Mystat can handle up to 32,000 cases and 50 variables. Both include online help.

Fastat is the next step in statistical software offered by Systat. Fastat takes full advantage of the Macintosh interface, making it easy to learn and use. It offers the basics in statistical procedures, including correlations, linear regressions, T-tests, and nonparametric tests. Color graphics include histograms, X-Y plots, scatterplots with regression lines, three-dimensional scatterplots, and probability plots. Graphs can be edited and customized with drawing tools. Like Mystat and Business Mystat, Fastat can handle 50 variables. Online help not only helps you use the program, but tells you what the numbers mean.

Systat is the final step in Systat's statistical software products. It includes the same features as Mystat and Business Mystat, but operates much faster when calculating statistics and drawing or mapping graphics. It also has many more advanced features. Systat has both online help and help messages that appear when errors are made. It features dynamic color graphics, 3-D rotation, dimensional maps, contour plots, nonlinear scatterplot smoothing, and other complex charting capabilities. Systat performs a wide variety of statistics procedures and can analyze up to 250 variables.

BEST ANSWER

Best Answer, by Market Engineering Corporation (distributed by Heizer Software) is an optimization program. It works on spreadsheets saved in SYLK format. (Most spreadsheets can save information in this format.) Best Answer uses a mathematical technique called linear programming. (The term *linear* refers to any algebraic formula.) When this formula is plotted on a chart, it forms a straight line. You don't need to know linear programming to use Best Answer, you just need to know how to express your problem in mathematical terms.

To use Best Answer, identify the spreadsheet cells containing adjustables, constraints, and an objective. *Adjustables* are what you want to solve for—the best mix. *Constraints* are rules Best Answer must obey; they usually consist of formulas with results that cannot fall below zero. The objective is a formula you want to maximize or minimize. When you select Maximize or Minimize from the Optimize menu, Best Answer calculates the right combination of adjustables to achieve the lowest or highest possible value for the objective.

An example is shown in Figure 16-18. In this model, a consultant wants to find out how to spend the work week. There are many assignments to work on (column A) and the consultant must pick and choose among them. Each has a different hourly rate (column B), but there are only so many hours of work for each job (column C). The object is to distribute the available work among the five days in the week (columns D through H) to earn the most money (cell C15).

The adjustables (what the consultant wants to solve for) are the cells representing the different jobs for different days of the week (cells D4 to H9). These cells are all zeros now, but they don't have to be. If the consultant had an appointment for three hours with a training client on one day, **3** is entered in the appropriate cell. There are two constraints.

Billable Hours

	A	B	C	D	E	F	G	H	I	J	K
1						(ADJUSTABLES)				(CONSTRAINT 1)	
2		Hourly	Available			Selected Hours				Remaining	
3	Job	Rate	Hours	M	T	W	T	F	Total	Hours	
4	Book Project	35	20	0	0	0	0	0	0	20	
5	Consulting	75	8	0	0	0	0	0	0	8	
6	Training	30	15	0	0	0	0	0	0	15	
7	Course Development	25	30	0	0	0	0	0	0	30	
8	Desktop Publishing	20	10	0	0	0	0	0	0	10	
9	Volunteer Work	0	20	0	0	0	0	0	0	20	
10											
11	Total Hours			0	0	0	0	0			
12	Maximum Number of Hours			10	10	10	10	8			
13	Free Time Hours (CONSTRAINT 2)			10	10	10	10	8			
14											
15	Total Billable (OBJECTIVE)		0								

FIGURE 16-18
A problem for Best Answer

First, the consultant cannot work more hours at a particular job than there are hours available to work. Thus, the values in column J can never drop below zero. Second, the scheduled work hours are ten hours a day Monday through Thursday and eight hours a day on Friday. Thus, the values in row 13 can never drop below zero. The objective is calculated by adding the total amount billed for each job based on the hours worked and the job rates. Selecting Maximize from the Optimize menu lets the consultant plan out the week, as shown in Figure 16-19.

Best Answer comes with a number of example files clearly explained in the documentation. It also has an online help feature. Once you have learned the "best answer," you can save the spreadsheet. It can then be formatted, charted, or otherwise used in your spreadsheet application.

MANDELZOT

MandelZot is an interesting freeware program by Dave Platt. It is designed to let you explore the *Mandelbrot set,* which is a connected set of points in the complex number plane discovered by Benoit B. Mandelbrot. The numbers resulting from the Mandelbrot calculations form an interesting graphic with *fractal* characteristics.

MandelZot lets you magnify the surrounding areas of the Mandelbrot graphic at magnifications up to one trillion. On color monitors, the images

Billable Hours

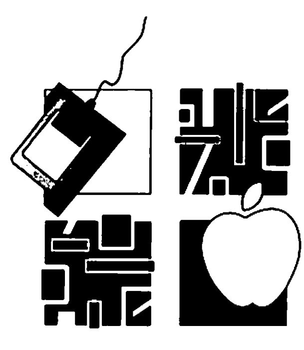
	A	B	C	D	E	F	G	H	I	J	K
1						(ADJUSTABLES)				(CONSTRAINT 1)	
2		Hourly	Available			Selected Hours				Remaining	
3	Job	Rate	Hours	M	T	W	T	F	Total	Hours	
4	Book Project	35	20	0	0	2	10	8	20	0	
5	Consulting	75	8	0	0	8	0	0	8	0	
6	Training	30	15	5	10	0	0	0	15	0	
7	Course Development	25	30	5	0	0	0	0	5	25	
8	Desktop Publishing	20	10	0	0	0	0	0	0	10	
9	Volunteer Work	0	20	0	0	0	0	0	0	20	
10											
11	Total Hours			10	10	10	10	8			
12	Maximum Number of Hours			10	10	10	10	8			
13	Free Time Hours (CONSTRAINT 2)			0	0	0	0	0			
14											
15	Total Billable (OBJECTIVE)		1875								

FIGURE 16-19
Best Answer's solution

are displayed in animated color. You can open one or more windows onto the Mandelbrot set. Each window can be independently sized, zoomed, and saved. You can also vary the display format in each window and specify the mathematical mode and limits of the Mandelbrot formula to change results. The contents of a window can be saved to the Clipboard or printed.

CONCLUSION

Macintosh has the mathematical capabilities you expect from a computer. It can do all of the tasks ranging from simple addition, to management of the finances of an entire company, to calculating complex statistics. With the right software, the Macintosh will help you come up with the correct results.



CHAPTER 17

INFORMATION MANAGEMENT PROGRAMS

File and database managers allow you to organize text and numerical data as searchable, scannable, and easily manipulated information. One example is a mailing list. With a mailing list on a set of alphabetized file cards, you are limited by the alphabet. Sure, you can scan the cards (one by one) to find everyone in Des Moines, Iowa, but it would take a long time. Enter all of the card information into a file manager, and you can easily scan the list by zip code, last name, city name, type of business (if you've included the information), birthday, or any other attributes you've chosen to enter. File and database managers let you rearrange, sort, and scan text and numerical data any way you can dream up.

Databases are the "electronic" version of an accountant's spreadsheet—except the program will do all the mathmatical calculations. It sure saves adding and re-adding columns of numbers to find the "missing" 53 cents.

FILE MANAGERS

File managers are the easiest information management programs to learn and apply. They employ a flat-file record structure to manage information. A *flat-file* record is analogous to a pancake or, in this instance, a piece of paper. The record is laid out with a number of fields. Each field holds a unit of information related to an object or subject. A collection of these records makes up a file. The types of fields available for entering information include:

- *Text fields,* to hold alphanumeric text and data. Text fields will hold everything from a single character to a multipage document.
- *Numeric fields,* used for number quantities (amounts, values, measurements, and money).
- *Date fields,* to enter days, months, and years.
- *Calculated fields,* to hold the results of calculations performed on values drawn from other fields contained within the same record (for instance, the odds on race horses).
- *Summary fields,* for "grand total" calculations on values drawn from the same field in a group of records (how much money you've lost at the racetrack all year—to date).

An invoice record is a good example of how calculated and summary fields can be helpful. Let's say the invoice contains numeric fields for entering the quantity of items sold and the unit price of each item. The calculated and summary fields to complete the invoice record would look like this:

Price field	= Quantity field * Unit Price field
Subtotal field	= Summary total of Price fields
Sales Tax field	= Constant (tax rate) * Subtotal field
Amount Due field	= Subtotal field + Sales Tax field

File managers such as ProVUE Development's Panorama or Claris FileMaker Pro have special picture fields to enter graphics, and lookup fields to build interfile data links.

A picture field holds digitized images of photos, illustrations, maps, or other graphics, as shown in Figure 17-1. The images are cut and pasted into the field from another Macintosh file or application. The picture field image is displayed and printed along with information from other fields in the record. (No one, so far, has introduced a commercial file manager with "mug shot" recognition to sort or search through digitized picture images.)

A lookup field imports information into the file record from another file. Here's how lookup works: Consider an invoice file linked by a customer name lookup field to a separate company address and by a product name lookup field to a product catalog file. Entering the company name would enter the address on the invoice with data imported from the company address file. Entering the product name would import the price or other product information from the product catalog file. These automatic data migrations save time and prevent errors.

Use the dialog panel to create the Catalog window (shown in Figure 17-2). Individual fields are defined by entering the item name and indicating the type of information that it will hold. Option panels opened from this window are used for building calculated field equations and other field formatting.

FIGURE 17-1
FileMaker Pro Browse Record window

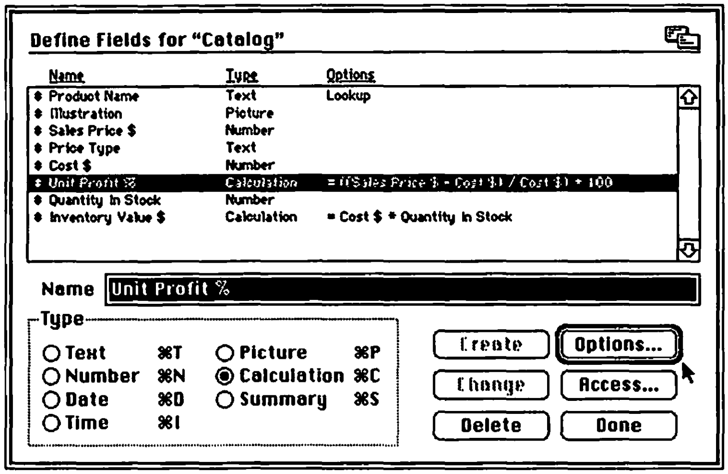


FIGURE 17-2
FileMaker Pro Define Fields dialog panel

A sort statement is built by moving fields from the field list to the sort order list. In the example shown in Figure 17-3, the sort statement arranges product catalog records first by inventory value in descending dollar amount order (highest to lowest values), then by unit profit in descending percentage order. Finally, the arrangement is sorted by product name in ascending alphabetical order. Figure 17-4 shows a Find statement which has searched all of the catalog records for a sales price of $50 or less, and an inventory value of $10,000 or greater.

Another style of file manager is Panorama. The record window and design sheet windows are shown in figures 17-5 and 17-6.

RELATIONAL DATABASE MANAGERS

File managers work on one file at a time; relational database managers work on many. Database managers are able to exchange and manipulate information between a number of linked files.

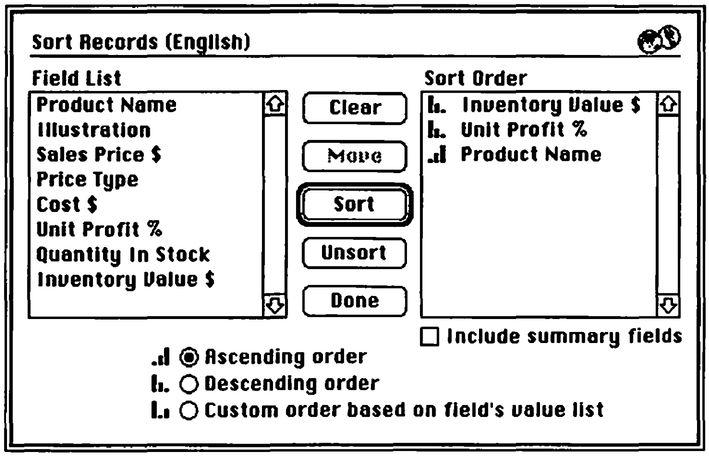


FIGURE 17-3
Filemaker Pro Sort Records dialog panel

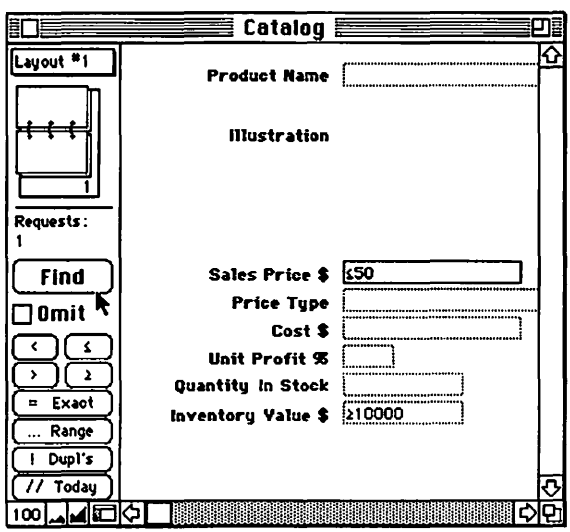


FIGURE 17-4
FileMaker Pro Find dialog panel

The lookup field of a file manager supports the import of data from other linked files. A relational database goes further, providing two-way information flow between its linked files. Information entered or changed in one record file is simultaneously updated in all of the related files. New files are built by joining the fields of existing files.

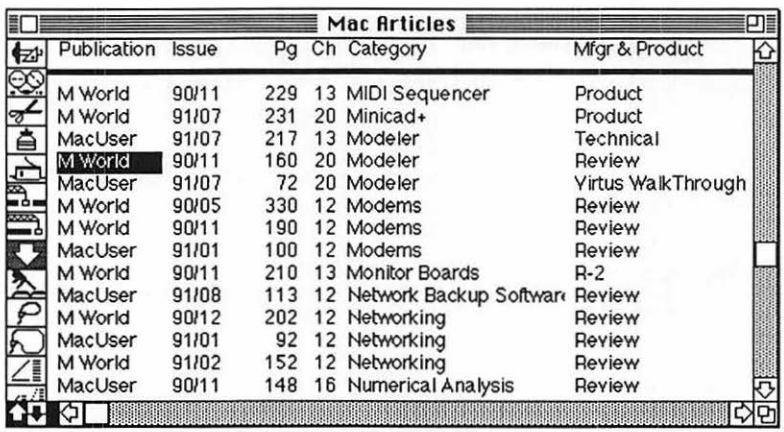


FIGURE 17-5

Panorama's Record window

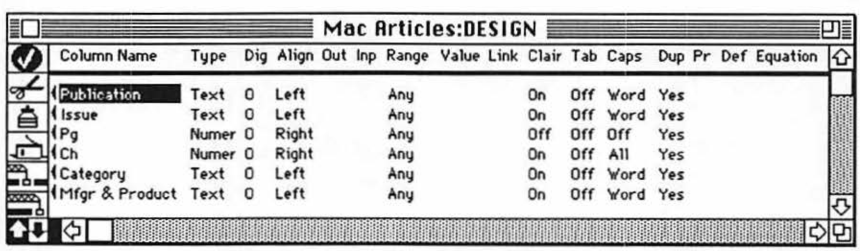


FIGURE 17-6

Panorama Design Sheet window

ABOUT THE ...
File Manager Basics—A Glossary

Field The smallest unit of information in a record. A field can contain text, numbers, dates, and times; the results of calculations on and summaries of other fields; and digitized picture images.

File A collection of records.

Find and Select The retrieval of records based on the information they contain. Record fields are searched for text or values that meet "equal to" or other user-specified criteria. Records with fields matching the criteria are found and grouped together.

Record A collection of one or more fields holding information related to the same subject or object.

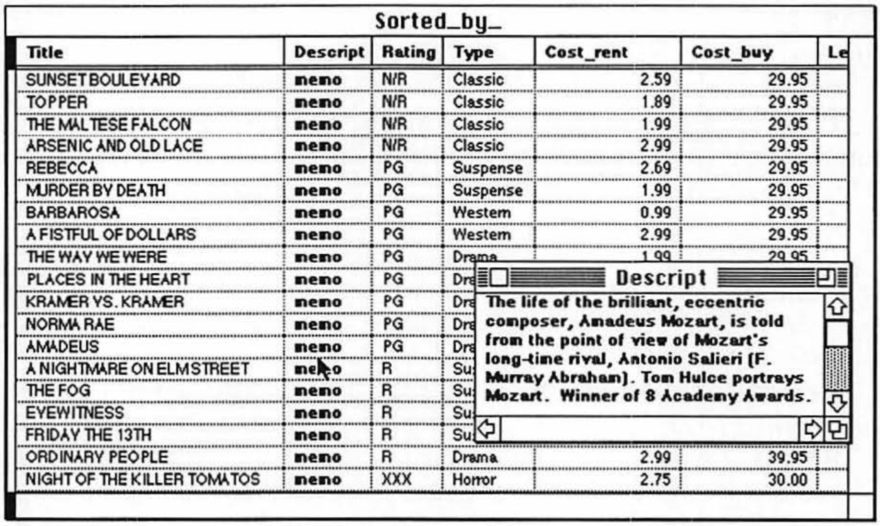
Report A record formatted to summarize information from groups of other records in the same file. A mailing label list, a telephone directory, a dunning letter, and a statement of overdue accounts are all examples of a report record.

Sort Arrangement of file records in field-by-field order. Records are sorted in ascending or descending order by information found in one field, then a second, then a third, and so forth.

Relational database managers have a richer set of commands, menus, and windows to format fields and manipulate information. Most provide programming capabilities for writing custom database applications, and some can forge data interchange with larger mini- or mainframe computer databases.

Power and flexibility cost money. Relational database managers are complex, harder to fathom, and expensive when compared to file managers. That said, Acius File Force, Fox Software's FoxBASE+/Macintosh, and Odesta's Double Helex are good relational managers to consider.

Figure 17-7 shows an example of the FoxBASE+/Mac Browse window. The example shows classic movies available on video: title, rating, type, cost to rent, and cost to purchase. The Descript file has a memo on the movie's plot. In the example, the description of Amadeus is displayed.


Sorted_by_

Title	Descript	Rating	Type	Cost_rent	Cost_buy	Le
SUNSET BOULEVARD	memo	N/R	Classic	2.59	29.95	
TOPPER	memo	N/R	Classic	1.89	29.95	
THE MALTESE FALCON	memo	N/R	Classic	1.99	29.95	
ARSENIC AND OLD LACE	memo	N/R	Classic	2.99	29.95	
REBECCA	memo	PG	Suspense	2.69	29.95	
MURDER BY DEATH	memo	PG	Suspense	1.99	29.95	
BARBAROSA	memo	PG	Western	0.99	29.95	
A FISTFUL OF DOLLARS	memo	PG	Western	2.99	29.95	
THE WAY WE WERE	memo	PG	Drama	1.99	29.95	
PLACES IN THE HEART	memo	PG	Dr			
KRAMER VS. KRAMER	memo	PG	Dr			
NORMA RAE	memo	PG	Dr			
AMADEUS	memo	PG	Dr			
A NIGHTMARE ON ELMSTREET	memo	R	Su			
THE FOG	memo	R	Su			
EYEWITNESS	memo	R	Su			
FRIDAY THE 13TH	memo	R	Su			
ORDINARY PEOPLE	memo	R	Drama	2.99	39.95	
NIGHT OF THE KILLER TOMATOS	memo	XXX	Horror	2.75	30.00	

FIGURE 17-7
FoxBASE+/Mac Browse window

PERSONAL INFORMATION MANAGERS (PIMS)

Do you have trouble remembering people, places, and things? Are too many facts and figures weighing you down? Are your plans and projects way off schedule? Maybe you need a personal information manager, or *PIM*—a HyperCard stack, desk accessory, or application program to get your address book, appointment calendar, and to-do lists in order. Other PIMs help organize your business contacts, time, activities—and even your thoughts.

PIMs are a good way to keep personal records and lists in order. The drawback is that you have to enter, structure, and view information *their* way (and you can't telepathically enter information).

PIMS FOR ADDRESSES

PIMs such as Casady & Greene's QuickDEX II, Power Up Software's Address Book Plus, or Portfolio Systems' Dynodex put your address book in order. They help maintain up-to-date name/address/phone lists on the

Macintosh. The programs provide note-taking, printout, and phone-dialing capabilities. Using Dynodex as an example, here's how an address book works and what it offers.

The Dynodex window shown in Figure 17-8 is used both to build and display an address record. The record is built by keying name, address, company, or other data into specific entry lines or spaces called *fields*. You can enter address information from other Macintosh files without rekeying. TAB-spaced (delimited) addresses in word-processing, spreadsheet, or other documents can be imported directly into Dynodex fields.

The Dynodex window has an icon palette (left border) to provide quick point-and-click access to the more frequently used functions of the main menu. For example, by clicking on the telephone icon, the boxed 800 number (as shown in Figure 17-8) is dialed. Clicking the magnifying glass will display the Find Record dialog panel.

The address record includes a free-form note field in which information can be noted about a person or company. Enter comments on the company and its products; remarks on your last sales call; or birthday, anniversary, or special dates. Address records can be retrieved and dis-

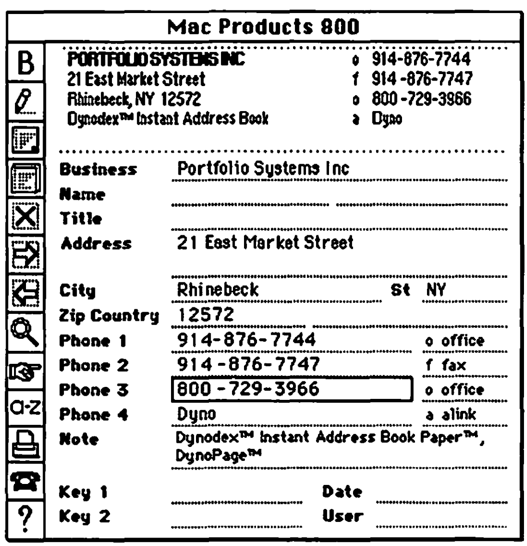
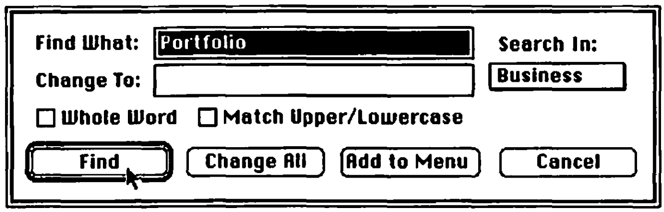


FIGURE 17-8
The Dynodex Instant Address Book window

played based on the text entered in any or all of the record fields. For example, here is a business field search for records containing the word "Portfolio."



(Use an "all fields" search to retrieve every record that contains the word "Portfolio.") Addresses or phone numbers can be found through pull-down menu list tables. Clicking a table listing of the company or a person's name will retrieve the complete address record.

Group together related addresses with a Select feature to make smaller address books or subdirectories. Use Select to obtain separate listings of all West Coast companies or of friends living in New York City. Dynodex has a three-field sort to rearrange address records.

You can print hard copies of complete or selected portions of the address book. Addresses can be printed on regular 8 1/2-by-11-inch paper, or on smaller, notebook-size pages. Addresses can be copied or exported to other Macintosh applications. Dynodex can even export addresses to electronic pocket organizers such as the Casio Boss or Sharp Wizard.

PIMS FOR APPOINTMENTS AND TIME

Appointment book and reminder PIMs list your meetings and dates, help manage your time, or issue on-screen reminders when things become due. Some of the Macintosh DayTimers available are Apple's HyperCard stacks (see the later section, "Apple PIMs"), JAM Software's Appointment Diary and Smart Alarms, CE Software's Alarming Events, and Psybron's CalenDAr.

The Appointment Diary's window is shown in Figure 17-9. Appointments are entered and viewed through a user-customized, diary note page. Page layouts can be changed—daily if you choose. Bold dates shown in the July and August monthly calendars flag days with appointments. Weekly and monthly overviews of appointment dates can also be displayed. Set Reminder is a feature to enter diary appointments into Smart Alarms, a companion time management PIM.

Smart Alarms' window is shown in Figure 17-10. With it, use the Sound control to set an audio alarm, which can range from a "beep beep beep" to a "quack." The Save button must be clicked to enter the new event on the reminder list table.

Each of these managers has its own unique, sometimes simple (sometimes mystifying) approaches to detailing calendars or issuing reminders. If you are a casual organizer, the stack managers Apple offers free with HyperCard or System 7 would be fine for you. If you are absentminded and need a warning when dates come due, CalenDAr would be a simple choice. It's a basic, inexpensive events reminder with both on-screen and audio facilities. Alarming Events is a more sophisticated reminder PIM with basic calendar features. JAM Software's Appointment Diary and Smart Alarms provide a balanced two-program approach to both appointment book and time reminder management.

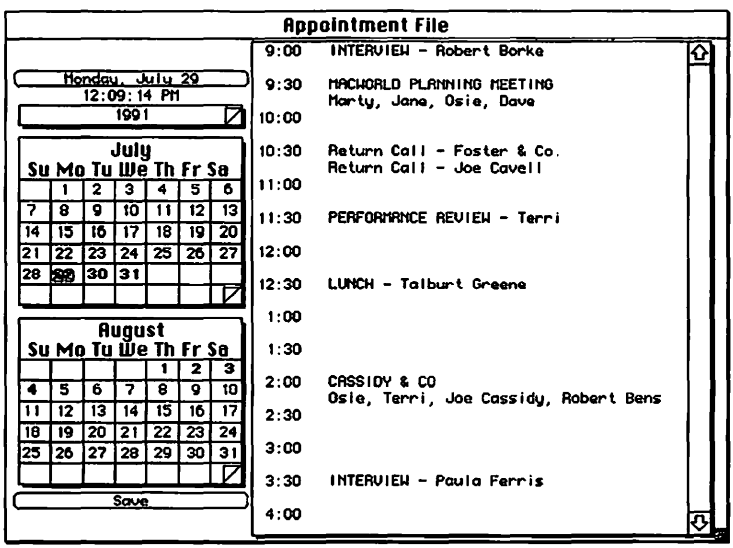


FIGURE 17-9

Appointment Diary Note Page window

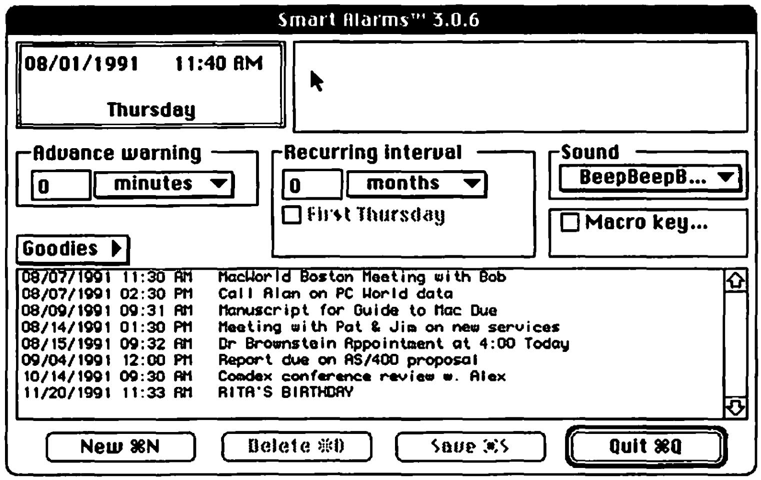


FIGURE 17-10
Smart Alarms window

APPLE PIMS

Before you run out to buy an address or appointment PIM, consider what Apple has already provided for you—*free*.

Older versions of HyperCard include Address (an address card stack with basic Find and Sort features) and Datebook (an appointment scheduler with linked Weekly, 6-Month Calendar, and To Do list stacks). With System 7, Apple throws in two new PIM stacks—Addresses with Audio and Appointments with Audio.

The System 7 PIMs are not rewrites of the older HyperCard stacks. They use new address card and appointment book formats. Most of the PIM functions and their associated menu and button commands are easy to learn and apply (which is fortunate, since Apple doesn't explain how to use the stacks anywhere in the System 7 manuals). The audio feature is nice if you want to hear talking PIM messages.

Figure 17-11 shows the address text. This can be entered directly from the keyboard or from other applications with the Copy/Paste and Import/Export main menu commands. The arrows scroll forward or backward through the card stack to locate another address. The Find function can locate a card with an all-field character string search. Clicking Show

Notes will display a notes area associated with this card (see Figure 17-12). The New Card button brings a blank card on screen to enter a new address. Delete Card erases the address card on display. An Appointments with Audio calendar page, shown in Figure 17-13, is brought on screen by clicking the Appointments button.

Figure 17-12 shows the Notes area displayed on screen in response to a Find string search for address cards with the word "Seybold." Apple only provides an all-field Find capability. If too many files are referenced in the stack, you'll have to scroll through a number of cards to select the one you want. (Other address book PIMs offer better facilities to find a specific address faster.)

Figure 17-13 is the Appointment stack with the current day's date. Appointments are logged for half-hour intervals on the lines provided. Each hour also has an off-screen note area for comments or reminders—or to log in shorter meetings. The notes area is brought on screen by clicking the hour figure (3 in the example). Other appointment book pages are accessed and displayed by clicking the day desired on the monthly calendar pad, or with the Go To A Day command button. Specific appointments and note text can be located with the Find character string searches.

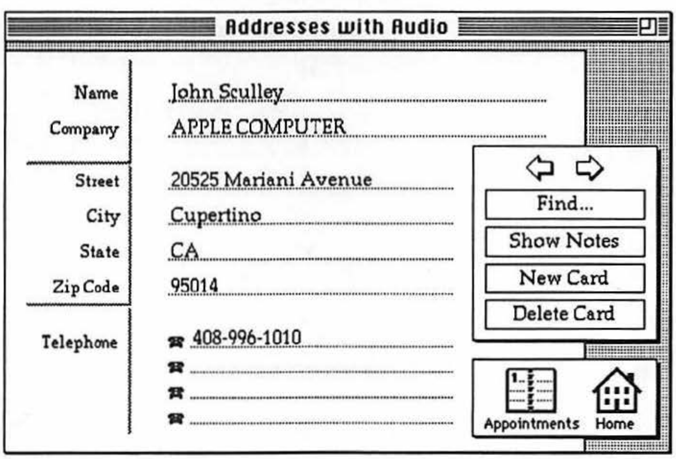


FIGURE 17-11

Addresses with Audio Address Card window

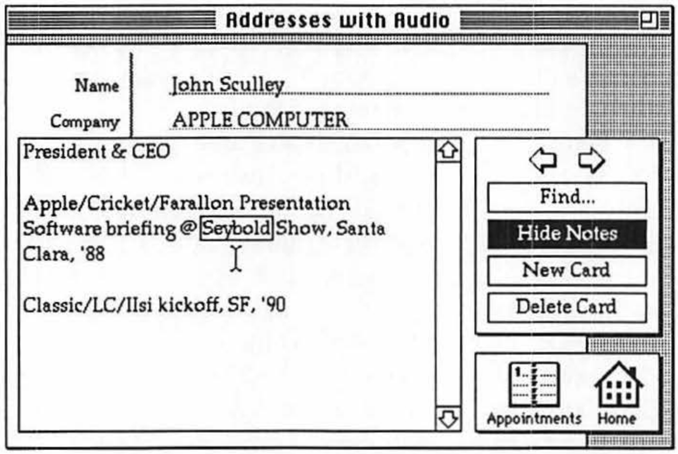


FIGURE 17-12

Addresses with Audio notes area

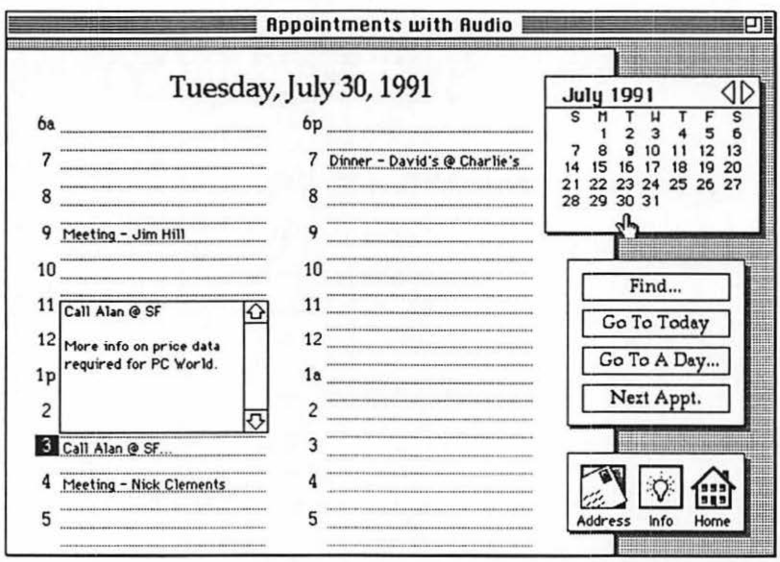


FIGURE 17-13

Appointments with Audio Daily Calendar window

The new Apple PIMs still lack a few of the refinements found with other managers. Appointments with Audio cannot display weekly or monthly overviews of pending events and offers no alarm or on-screen reminder function. Addresses with Audio lacks a Select function and has limited sort capabilities. Find searches can only be made on an all-field basis. Another Apple oversight is the absence of active data links between the two PIMs. A calendar name field linked to retrieve an address card would allow you to dial a phone number quickly when confirming or changing an appointment date.

Grousing aside, both old and new stacks provide more than adequate address and appointment management features, especially if you are unorganized, in a hurry, and short of money. These easy-to-use Apple PIMs should be tried and compared with any you might buy.

PIMS—CONTACT MANAGERS

Contact managers are the traffic cops of the corporate sales world. In the old days, they were the manual "tickler" files. Their purpose is to monitor and manage communications with the people you do business with. They generate lists based on customer interests and past purchases and track responses, orders, invoices, and expenses. Most contact managers include software modules to generate address labels, form letters, invoices, and activity reports.

Remote Control's TeleMagic and Software Complement's Client/Macintosh are telephone contact managers. They are able to build selective prospect lists based on criteria of a keyword or other data stored in address directories. TeleMagic offers a script facility to prompt telemarketers during a call.

Breakthrough Productions' Market Master Manager II is another such system. This contact manager maps out and implements a response strategy based on customer interest. A thank you letter is generated along with an invoice. A request for information triggers a follow-up call or adds the prospective customer to a mailing list to receive updated brochures. Those mildly interested would be retained on the prospect lists for future contact. Finally, those with no interest, no response, and no sales are placed in a deadbeat file or deleted from the contact files.

LIST MANAGERS

Other PIM-type managers include JAM's MacintoshList and Bananafish Software's ThoughtPattern. They replace card files and self-adhesive notes for organizing information. MacintoshList is a structured list manager. It uses a number of categories to index each record entry. For example, a list of your favorite restaurants could be laid out by the name of the eatery, its location, the type of food served, the relative surliness of the waitstaff, the ambience, and the average cost of a meal. You could then search or sort on any or all these categories to find an "ideal" place to eat.

ThoughtPattern takes a more extensive, free-form approach toward personal information management. Notes, messages, appointments, and other items are entered without a predefined record structure or file hierarchy. Information is searched and retrieved based on keywords or index phrases attached to each item. Bananafish's program includes a date-time alarm function with the program. You can flag items—appointment-book style—with an on-screen reminder.

ThoughtPattern is also a file locator. With it, you can retrieve word-processing, spreadsheet, or other Macintosh files. The disk files are linked to the PIM by short items outlining their contents. For example, a

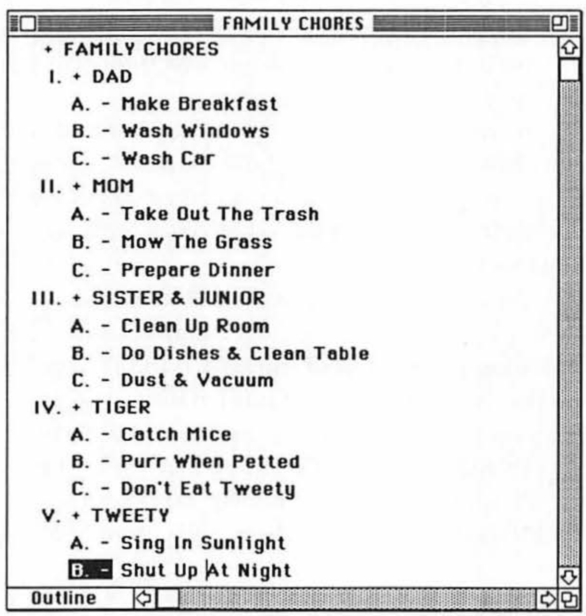


FIGURE 17-14
Inspiration Outline window

ThoughtPattern item to represent an Excel spreadsheet file would contain the Excel icon graphic and keywords to describe the file. Entering a keyword or search phrase on a topic recalls all of the related notes, appointment reminders, to-do slips, and file items.

OUTLINERS

PIMs bring order to records and files. Outliners are different—they don't work on data. They are personal organizers to get your thoughts in order. Use an outliner to figure out the chapters of a report or book or lay out the steps for starting a new business. You can put people and places into an organizational structure and build prioritized to-do lists or schedules, as shown in Figure 17-14.

Macintosh outliners include Symmetry's Acta Advantage, Symantec's More II, and Ceres Software's Inspiration. The latter two programs are graphic outliners that can build tree and bullet chart presentations based on the outline text. Figure 17-15 gives an example of this.

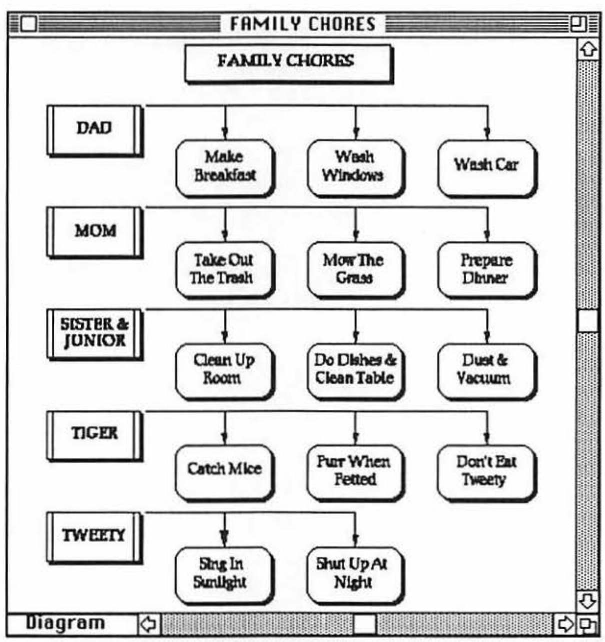
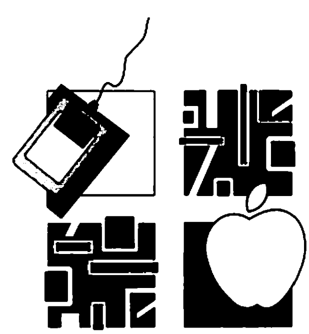


FIGURE 17-15
Inspiration Diagram window

The Inspiration outliner is touted as a way to get your thoughts in order graphically. (Ceres Software calls this "visual thinking.") Instead of a text outline, ideas are mapped out with diagrams. Text is entered randomly into pop-up symbols. Then the symbols are linked together with arrows and lines into a tree-like diagram. Once you have finished "connecting the dots," you can switch the concept over into an outline view.



CHAPTER 18

WORD PROCESSING

In the beginning, man discovered his ability to communicate. He then quickly discovered his ability to forget. This nature of only temporarily retaining information may have been the motivation for the development of writing. Writing preserved important information handed down from generation to generation.

WRITER'S CRAMP

In its early history, writing was a special art that required skills possessed only by the elite and well-educated (usually chaste and housed in a monastery). Later, as the three *r*'s (reading, 'riting, and 'rithmetic) became more widespread, there was a new problem. The only way to make a copy was to make a handwritten copy—a tedious task prone to errors and mis-copies. Letter writing was *the* means of communication.

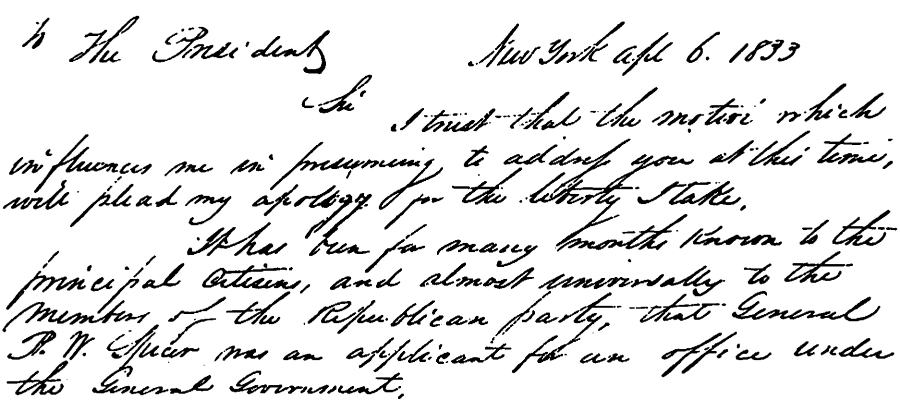
The wealthy hired two or three *copyists* to recopy letters sent and make duplicates and triplicates of letters received (which were to be sent on to other interested parties—an early system of FYI). A poorly copied letter—one with a line omitted, or so messy it was illegible—was a pitfall for business. (Good help has always been hard to find.)

There were different schools and theories of penmanship. Some were very flowery, with scrolls and flourishes on every letter. Others were plain, with angular letters, no dotted *i*'s or crossed *t*'s. These different styles were all very difficult to read, even with some practice. Figure 18-1 shows a sample of handwriting from 1833, written by a copyist.

THE TYPEWRITER

The invention of the typewriter was not only a cure for writer's cramp; it standardized the look of written material. Carbon copies could be made (once carbon paper was invented). Everything was great.

IBM made a mint on typewriters. The company improved the basic machine with the Selectric model, an ingenious machine with all the letters on one interchangeable ball. You could purchase different fonts on the ball, but the choices were limited to courier, elite, pica, and script fonts. Other typewriter makers appealed to typists' desire for a variety of fonts. These schemes involved variations on the *daisy wheel* (a central hub with spokes, each ending in a character).



To the President New York Apl 6. 1833

Sir

I trust that the motive which influences me in presuming to address you at this time, will plead my apology for the liberty I take.

It has been for many months known to the principal Citizens, and almost universally to the members of the Republican party, that General P. W. Spicer was an applicant for an office under the General Government.

FIGURE 18-1
Elaborate penmanship style dated 1833

GOOD 'OL GUTENBERG

Typesetting has been around since Gutenberg figured out a fast way to print a bible. He made so much money at this venture that he and his partner were accused of "being in league with the devil." How else could one man make so many bibles in one lifetime? (So it goes with new inventions. There are always the skeptics!) Gutenberg was run out of more than a few towns. He did, however, make a fortune.

Gutenberg movable type was a popular item. Besides the obvious ability to make multitudes of multiple-page copies, typesetting allows you to choose between many different fonts, each designed to convey a specific image, message, and feeling. The following illustration shows two different fonts. The word *News* on the left has a much different impact than *News* on the right:

News **News**

PERFECT COPIES

In the modern world, there are a variety of ways to make multiple individual copies. Forget writer's cramp and messy carbon paper. Why use that stuff when you can photocopy or fax it?

Now that it's so easy to make duplicates, typos are glaring. When copies were difficult to produce, a simple typo was overlooked, and a grammatical goof was politely ignored, but not anymore. It's embarrassing to find that you've just sent all six of the corporate vice presidents a memo about sales in sector two, and *sector* is misspelled as *sextor*.

It's not enough just to get the information out; it needs to be perfect too. IBM understood this concept early. In the 1960s IBM introduced the Magnetic Tape Selectric Typewriter (MTST). With this typewriter, letters could be typed into the magnetic tape memory, then printed out, scanned for obvious errors, corrected, and printed out again. In the late 1970s and early 1980s, word-processing applications that did the same thing and more were developed for computers.

Word processing on personal computers allows for more flexibility. On the Macintosh, you can cut a paragraph from the center of a document, move it to the end, and change the font, the size, and the style, among other things. Word processing on the Macintosh can be both a dream and a curse. It can cut down your work load tremendously, unless you succumb to taking hours to produce one perfect document that looks "almost" typeset. (Actually, everyone with a Macintosh does this at first. The temptation to try a different typeface, change a word here or there, or underline, italicize and boldface an occasional word is just too great to ignore.)

HOT LEAD TO COLD TYPE

When phototypesetting first became available, style and design became more important than ever before. Every major newspaper in the country has redesigned its pages (some after a century of the same format). Magazines and books tried different fonts and layouts. Typesetting has also come down in price, causing a boom in small publishing houses and small specialized newspapers.

Typesetting shares many similar features with personal computer word processing. In some cases, the personal computer data can be fed right to typesetting. Also, with desktop publishing programs, you can mimic a "real" typeset page. You can make columns and headlines, insert graphics, and add footnotes.

A FINE LINE

Desktop publishing is beginning to blur the distinction between computer word processing and typesetting. (This trend will continue.) There is also a fine, blurry line between desktop publishing and word processing. They are related, but they have different and unique features and uses. (It's like an upright vacuum and a canister vacuum. I'd hate to suck down cobwebs with an upright.)

However, desktop publishing doesn't interest everyone. For many computer users, the main focus is to replace the old Selectric typewriter with word processing on a personal computer. This chapter gives needed information on that. The next chapter covers desktop publishing and its unique features.

ABOUT THE ...
Basic Word Processing Features

Word processing software is an efficient tool for writing. It offers many features unique to computers. These are some of the basic word processing features:

- *Word wrap* When text reaches the right margin, it automatically flows to the next line.
- *Insert typing* Text can be inserted wherever the cursor is located. The text to the right of the cursor is pushed further to the right.
- *Block manipulation* Blocks of text can be selected, styled, and moved or deleted.
- *Search and replace* Specific text can be searched for and replaced. The search and replace can be manual or global. *Global* replace allows all instances of specific text in a document to be replaced with new text. *Manual* replace allows you to check each instance and decide yes or no.
- *Merge two* Word processing files can be merged to create multiple documents containing information from both files.
- *Spell checking* Files can be examined for spelling errors.

WORD-PROCESSING FEATURES

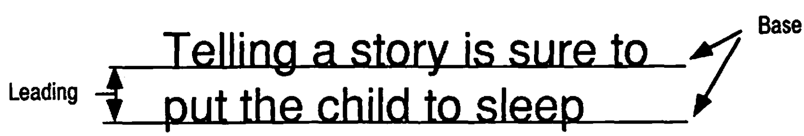
The hardest thing about computer word-processing programs is the lingo. It is a crazy world of *leading, kerning,* and *word wrap,* unless you have a background in printing or typesetting. Word-processing features are like a foreign language. It's just not common, everyday conversation. (Well, what in computer-speak is?)

TEXT-RELATED FEATURES

Many text-related features are related to how the character (letter, number, and so on) is presented on the page. The Macintosh is a very visual computer. The way the document looks on the screen is how the document will look printed. The Mac is different from other computers, where the screen may be similar, but not identical, to the printed version. The Macintosh allows you to alter the look of text—change the font, size of the print, spaces between the lines, among other things—instantly on the screen. If you italicize a word, underline it, or boldface it, that too will appear on the screen. This is a big advantage for design work and desktop publishing.

Leading

Leading (rhymes with *wedding*) is the distance between text base lines—the lines on which the type rests. The following illustration shows how leading is measured:



Some word processing programs allow leading to be adjusted. Others provide line spacing for single-spacing, line-and-a-half spacing, and double-spacing.

Leading is a basic adjustment in desktop publishing programs. Typically, leading can be fixed or automatic. Most applications let you adjust the amount of automatic leading.

Kerning

Kerning is the adjustment of space between specific letter pairs. Most fonts have a built-in table to designate important kerning pairs. Kerning adjustments range from points to fractions of an em space, depending on the application. (An *em space* is the width of the letter *m* in a given font.) Some applications use the width of two zeros (00) to define an em space. The width of letters is different for each font; therefore, an em space is a relative measurement.

A positive kerning value typically adds space. A negative value removes space. Kerned and unkerned letter pairs look like this:

We We

Unkerned letter pair Kerned letter pair

Kerning in some word-processing applications is used to mean adding or subtracting space between any letters, not just kerning pairs.

Tracking, Condensing, and Expanding

Tracking, condensing, and expanding are copy-fitting features. They come in handy when you are trying to do any of the following things:

- *condense* text to fit it into a narrow column
- *expand* text to give the font a different look
- *cram* one more sentence onto a single page
- *increase* letter space to reduce the word spacing in justified text

Tracking *Tracking* is the adjustment of space between all letters. Tracking is sometimes called letter spacing. Tracking adds or removes white space. It differs from kerning in that all letters are tightened up the same amount. It is an incremental text compression method; more adjustable than condensing. Tracking is often used to get the final few orphan or widow words onto a page. (A *widow* is a last line separated from its paragraph which appears at the top of the next page or column. An *orphan* is a first line separated from its paragraph at the bottom of a page or column.)

Some word processors have a built-in feature to guard against the widow/orphan problem.

Tracking is also used to adjust word spacing if a column of text is narrow and equally spaced between the right and left margins (justified). If not adjusted, the result is unsightly, as shown here:

No tracking	Tracking
Justified text in a narrow column can have spaces between words.	Justified text in a narrow column can have spaces between words.

Tracking can be found in both word-processing applications and desktop publishing applications. However, applications may call tracking by other names. For example, Microsoft Word has Condense or Expand options in the Character dialog box. These commands actually adjust the space between letters. They do not change the width of the font. Design Studio uses the terms *tracking* and *letter spacing* in a different way than described in this chapter. The tracking function in the Design Studio application reduces the space between letters, while the letter spacing function increases the space between letters.

Condensing and Expanding True condensing and expanding are an adjustment of the character width of a font. Condensing or expanding shortens or lengthens the space occupied by the text. They are not the same as tracking, which spreads the space evenly between the letters and the words. Use caution with condensing and expanding. Too much character and spacing alteration may make the line very difficult to read.

Text Alignment

In word processing, text can be centered, justified, or aligned along the right margin or left margin, as shown here:

This text is aligned left.	This text is aligned center	This text is aligned right

Justified text fills the space between the left and right margins by increasing the space between letters and words. However, the last line will not expand to fill the entire space between margins. This is to prevent just a few words from filling a space normally occupied by many words.

Forced justification causes a line to justify fully. If the line is short, the letter spacing will be very large.

Word Wrap

Word wrap permits the overflow of text to the next line as you type. (Word wrap is found in both word-processing and desktop publishing applications.)

Hyphenation and Hyphenation Zone

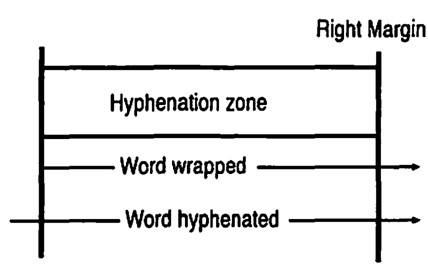
Hyphenation is the separation of words with a hyphen. Ragged lines (ones with uneven spaces at the ends) can be made less ragged by hyphenation. Even lines are attractive in some documents (like memos).

Many word-processing applications have a list that identifies the correct hyphenation points of words on the list. Generally, words may be added to this list of suggested hyphenation points.

The English language has rules regarding hyphenation. Some word-processing and desktop publishing applications refer to these rules to decide where a word should be hyphenated. Unfortunately, not all words follow these rules; the result is improper hyphenation. (Usually, an exceptions list can be added for words that break the rules.)

The determination of where a word should be hyphenated is part of the process. The next step is to figure out which words to hyphenate. The hyphenation zone is the vehicle to make this determination. Some applications allow the user to adjust the hyphenation zone.

A *hyphenation zone* designates how far from the right margin a word must be in order to be hyphenated. The following illustration shows a typical hyphenation zone.



The hyphenation zone is measured from the right margin toward the left margin. Words which are to be hyphenated fall within these guidelines:

- They begin before the beginning of the hyphenation zone.
- They extend past the end of the hyphenation zone.
- They have an acceptable hyphenation point within the zone.

Words that begin on or in the hyphenation zone, and extend past the end of the hyphenation zone, are wrapped to the next line.

Soft Hyphen A *soft* hyphen only appears when a word falls within the hyphenation zone. The soft hyphen won't show up if a word is inserted onto the line or the document is reformatted and it is no longer needed. The advantage of a soft hyphen becomes apparent when changes are made in the document. If these changes push the word out of the hyphenation zone, the hyphen disappears.

To insert a soft hyphen, place the cursor where you want the word to break. Then, press the Command and hyphen keys. The hyphen will be invisible until the word falls in a hyphenation zone.

Hard Hyphen *Hard* hyphens are always present. Once a hard hyphen is in a word, it appears even if the word is not broken and wrapped to the next line, leaving you with a little dash in a word in the middle of a sentence. A hard hyphen is always visible. You should put a hard hyphen in a word that should always be hyphenated, such as *quasi-intellectual*, so the word will not break in places other than the hard hyphen. Phone numbers are another example of a use for hard hyphens. Hard hyphens, instead of a soft hyphen, or keyed-in hyphen, prevent the phone number from breaking and wrapping if it falls within the hyphenation zone. Insert hard hyphens by pressing SHIFT-Command and the hyphen key.

Search and Replace

Word-processing programs usually include a function to do a global search and replace, or search and find.

You designate the word or words you want to find with a search string. The *search string* could be text, a word, a single keystroke, or a code. You also may search for a whole word or a part of a word. If you search for a whole word, only exact matches with a space before and after the word are located. A partial-word search will locate a search string even if there are letters before or after the string. Suppose you wanted to search for the word *read* in the following sentences:

> When I was ready, I read the memo. It warned me to tread lightly in my dealings with the outside contractors.

A partial-word search would find the words *ready*, *read*, and *tread*. A whole-word search would find only the word *read*.

Pagination

Pagination controls *line breaks*, which indicate where a page ends and begins. Automatic pagination usually occurs in the background, but many word-processing programs offer a "forced" page break. This is useful for pages such as a title page. You can insert a page break to get to page two instead of hitting RETURN over and over again until the page is filled and you get to the next page.

Text Blocks

Text blocks are chunks of text. Most word processors produce text that is anchored to the workspace. It can be moved by highlighting the chosen text and using the Cut and Paste commands in the Macintosh.

Text blocks are used in desktop publishing to wrap text around a graphic. Some word-processing programs allow you to create blocks similar to those used in desktop publishing applications. You can create blocks of text and position them anywhere in the workspace. WordPerfect is one word-processing application with this feature.

Greeking

Greeking is used to see what a word-processed document will look like in a preview mode. Most word-processing programs have a feature to preview a document. It's like looking at the pages from very far away. The letters are unreadable, grayish blurs, but the format and style of the page is shown clearly.

Preview Mode

Preview mode shows a word-processed document as a page. The preview mode normally shows elements, such as headers and footers, which are not normally visible. Some word-processing applications allow you to make changes to the document in the preview mode, others do not. Preview mode overrides the word processing program's continuous scrollable page format and displays one page at a time. The preview mode provides a truer representation of the printed page. The preview mode is called by different names in different word-processing applications. For example, Microsoft Word's name for this mode is Print Preview.

Headers and Footers

A *header* is repetitive information placed at the top of a page. A *footer* is repetitive information placed at the bottom of a page. Headers and footers are used to repeat a document or chapter name or to place the page number. Headers and footers are usually created in the same way. The only difference is their location. With right- and left-hand pages in a document, you can create two headers, one for left-hand pages and one for right-hand pages. Graphic elements may be placed in the header.

Headers do not usually show on the screen, but do appear when the document is printed. To see the header before printing, you may need to use the preview mode.

Columns

Columns features in word-processing applications allow you to create multiple columns on a page. There are two common column types, newspaper columns and parallel columns. In newspaper columns, the text flows from the top to the bottom of the first column. Then it flows to the top of the second column. Parallel columns are used to set up tables. As in a table, you read the text information from left to right, jumping between columns, before proceeding to the next line.

In some word-processing applications, the columns appear side-by-side as they will on the printed page. Other applications make you work with a single column at a time; the page does not appear on screen the way it will on the printed document.

Drop Caps

A *drop cap* means that the first letter of a paragraph is different than the body of the text. In olden (monk and handscript) times, the first letter of the page was dramatized. It was a big, flourished, arty letter. This effect can be achieved in word processing by changing the font or size of the first letter of a paragraph as shown here:

THIS IS WHAT a drop cap looks like. It replaces the first letter in a paragraph. Sometimes, several words on the first line in the paragraph can be all caps to help the transition from the initial cap to the smaller paragraph letters.

It is difficult to place drop caps throughout a multiple-page document. Drop caps are easier to produce in desktop publishing applications.

Reversed Text

Reversed text is light text placed on a dark background. Desktop publishing applications allow text to be reversed; word-processing programs do not. Reversed text, however, may be imported into word-processing programs as PICT or EPS files.

Outlining

Outlining is a method for organizing text into levels (like you learned in grammar school). Each level is identified by a unique number or letters and they repeat throughout the outline. Levels form a hierarchy so each level is a subset of the level directly above it. Levels contain unique information with common relationships. A typical outline might look like this:

I. Banks
    A. Locations
    B. Services
        1. Accounts
        2. Loans
II. Savings and Loans
    A. Locations
    B. Services
        .
        .
        .

ABOUT THE ...
Serious Outlining, Dude

For serious outlining, you may need a separate application. Two good ones are Acta and More. Each of these applications gives you more outlining levels than a word-processing application. You will also have better control over the display and manipulation of levels. Acta is less expensive than More, but has fewer features. More adds the ability to turn any outline into a sophisticated, full-color presentation in slides or overhead format. For more information, contact

Acta Advantage Symmetry
761 E. University Drive
Mesa, AZ 85203
800-624-2485

More
Symantec Corporation
10201 Torre Avenue
Cupertino, CA 95014
800-441-7234

"Banks" and "Savings and Loans" are first-level items. They are related in that they are financial institutions. The next level is "Locations." The first is locations for banks; the second, locations for savings and loans.

You could use any word-processing application to manually create an outline, but each time you delete or add an outline level, you have to renumber all other affected levels. The outlining function creates automatic numbering for specific outline levels. The number of levels varies among applications.

Style Sheets

Style sheets are templates for entire documents. They may have information concerning margins, subheads, font sizes, font faces, preset tabs, indents, leading, line spacing, and so on. Style sheets help give your documents a consistent look. They are excellent for reports, memos, or business letters with a rigid format. Another advantage style sheets have is the ability to make global changes. (A *global* change means that everything changes in the document.)

Styles are often paragraph-based, which means the style is applied to an entire paragraph. Styles also may be character-based. This means the style can be applied to characters (usually words) within a paragraph. Character-based styles are less common, but provide more flexibility. They allow you to select and style any range of text instead of just paragraphs.

To define a style, start by giving a paragraph the format you want. Then, select the paragraph and open the menu option for defining styles. Choose a new style and name it. It will acquire the format of the selected text. The new style can then be applied to any other paragraph. Later, you may want to change the style. Style sheets permit all text previously formatted as a certain style to be instantly reformatted with the new style specifications.

Most applications allow a change in the formatting of individual words in a styled paragraph. One reason to change the formatting is to emphasize a word. A style for a paragraph may specify Helvetica Plain as the font. You can select a word you want to emphasize and then select a new font, such as Helvetica Oblique. You cannot apply a new format that conflicts with the style sheet specifications. For example, the style sheet may call for text to be aligned to the left margin. If so, you could not select a word in the stylized paragraph and make it right-justified. (The Macintosh does not permit adjoining text to have different alignment.)

Individually styling words in a styled paragraph has disadvantages in applications using paragraph-based style sheets. You cannot globally change the individually styled words. This is not a problem with character-based style sheets. Since styles can be applied to individual words, they can be globally changed.

Paragraph-based style sheets retain the style added to individual words if you decide to change the style specifications. If you apply a new style to the paragraph, the style added to individual words will be removed and replaced with the new style.

Merging

Merging is a way to make multiple, customized documents from two separate documents, a primary file and a secondary file. The primary file contains the boilerplate. *Boilerplate* is text repeated in every final document. The primary document also contains markers that identify areas where customized text is to be placed into the boilerplate. The secondary file contains the customized text.

A good example of merging is junk mail. The boilerplate is the lousy text of the letter. The customized text of the secondary file is your name and address, as in "Dear Mr. J. Dvorak, As you know, Mr. J., you are one of our most valued customers...."

The merge function can be used effectively in the following types of documents:

- letters
- mailing labels
- forms
- contracts

A few word-processing programs allow conditional merges. A *conditional* merge implements the merge according to a set of conditions. For example, if you are creating a standard contract for employees, the information on payment may be different for exempt and nonexempt employees. The conditions are *exempt* and *nonexempt.* A conditional merge inserts the exempt payment information for exempt employees and the nonexempt information for nonexempt employees.

SPELL CHECKING

For some reason, spell checkers made for the Macintosh aren't nearly as good as the ones made for the DOS environment. This may be partly because most of the Macintosh word-processing programs come with a spell checker, and there is little demand for add-on products. Overall, people seem fairly satisfied with the spell checkers in use, but there is a great deal of room for improvement.

The existing spell-checking schemes are very similar among all applications. One major difference is in the size of the dictionary. In most cases, commonly used technical words, proper names, or slang may be added to the dictionary. (Sometimes you must add common, everyday words that are also not included.) The added words go into a separate file called the User Dictionary.

Some spell checkers automatically suggest a spelling for misspelled words. With others, you click a button or execute a set of keystrokes to request a suggested spelling. Not all spell checkers are equally proficient in suggesting words. The Spelling dialog box from Microsoft Word is shown in Figure 18-2.

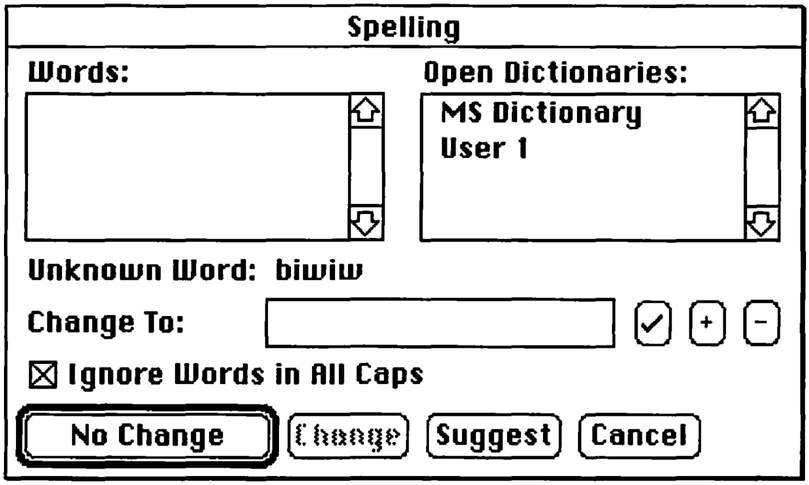


FIGURE 18-2
Spell-checking window from Microsoft Word

ABOUT THE ...
Simplifying Memos

The merge feature can make memo writing a snap when sending the same memo to many people. Here is how it works: First, create a file with the names of the people to receive the memo. Then create the template file. (The template file contains the text of the memo.) Each time you want to send a memo, open the template file and type the new memo, which will replace the old one. Then, use the merge feature to generate a memo for each person in the data file. If you don't want everyone in the data file to receive the menu, duplicate the master data file and remove some names. Then, merge this new data file with the template file.

THESAURUS

Spell checkers often are bundled with a thesaurus, although there are also add-on products available. These have many of the same limitations as the Macintosh spell checkers. They aren't as powerful or as convenient as their DOS counterparts.

A thesaurus generates a list of words with similar meanings. The list is generated when you enter a key word. One way to enter a key word is to highlight it in a document and then open the thesaurus. You can also enter a key word by typing it in the thesaurus window. Some thesauruses also provide the meaning of words.

WORD-PROCESSING SOFTWARE

The Macintosh has a handful of word-processing software compared to the DOS computer world. One of the key features of the Macintosh system is its uniform command structure. This makes it easy to move from one program to the next. Nowhere is this more apparent than in word processing. In DOS, every word-processing program is different; multiple-command keystrokes are required to alter text. The keystrokes become second nature after a while, but this forced habit causes problems if multiple word-processing programs must be learned and used. A DOS word-processing application demands devotion. Let's face it, once you use one program, you're hooked. Breaking the command keystroke regime is too difficult.

With the Macintosh, you're not a slave of a program. It is possible to have many word-processing applications on your Macintosh and live happily. The command structure is similar for each. It's easy to live with the minor nuances between programs, and it's actually optimal to have more than one program.

There are a few good reasons for this. For example, WriteNow has a compress and expand function that makes large, bold headlines more interesting, and it's easy to use. Microsoft Word is good for its compatibility with other word processors and MS-DOS files. Each word processor is similar to every other, but each has unique features. None of them is overpriced, so it's a good investment to have more than one.

If you are perplexed by the choices and the different features of the word-processing programs on the market, you are not alone. The trend is to load up word-processing applications with the most features and whiz-bang stuff like desktop publishing, draw and paint programs, and so on. The salespeople at the local computer store enjoy this (they have more stuff to rattle off in machine-gun succession), and customers feel like they are getting a good deal. However, it may not be in the best interests of the customer in the long run. The most feature-laden product may not be the best choice.

Simple, plain word-processing programs aren't cluttered with features which may never be used. A word-processing application devoted to simplicity and intuitive ease of use, and designed to address specific issues, has one important advantage over the other fancy products: less frustration.

ABOUT THE ...

Features of Word-Processing Applications

Word-processing applications typically perform the following tasks:

- automatically save files
- automatically save files at adjustable intervals
- change letters between upper- and lowercase
- count characters
- count lines
- count paragraphs
- count words
- document statistics
- open two or more files simultaneously
- provide readability statistics
- sort lines of text

General Features

- footers and headers
- foreign dictionary

ABOUT THE ...

Features of Word-Processing Applications (continued)

Text Features

- automatic creation of an index
- automatic creation of table of contents
- automatic hyphenation
- footnotes
- glossary
- paragraph-based style sheet
- styles defined by selecting text with desired style formats
- widow/orphan control

Spell Checking/Thesaurus

- automatically suggest replacement
- flag double words
- identify capitalization errors
- identify parts of speech (noun, verb, adverb)
- provide editable user dictionary
- replace a word but keep the same format
- replace words globally
- skip all instances of a string

Layout Features

- adjustable-width columns

ABOUT THE ...

Features of Word-Processing Applications (continued)

- columns on same page as text not in columns
- newspaper columns
- parallel columns
- right- and left-hand pages with gutter

Outlining Features

- at least five outline levels
- automatic generation of numbers/letters for levels
- automatic renumbering after level changes
- show/hide sublevels

Mail Merge

- conditional merge

Macro Features

- edit macro
- macros available to all application files
- record macro

Printing

- print only odd pages or only even pages (allows you to print double-sided)

WRITENOW!

With WriteNow, T/Maker has taken a different track than other Macintosh word processors. Other programs have added more and more features, including desktop publishing features. WriteNow has focused on simplicity. It is easy to learn and easy to use. WriteNow's features include

- mail merge
- footnotes (with auto-numbering)
- onscreen multiple columns (up to four)
- inline graphics
- format accelerators
- 135,000-word spelling checker
- 1.4 million-word thesaurus

WriteNow allows for a full range of font sizes (from 4 to 127 points), so you can use off-sized fonts. For example, you want 11-point Palatino. WriteNow will use one point size below and enlarge it with appropriate spacing. The point size is adjusted one point at a time, with Command-0 for larger and Command-9 for smaller. The ruler has adjustable point leading. There are two choices, Fixed and Flexible. This is helpful when a few words overflow to the next page. With a little adjusting, you can squeeze it on the line.

WriteNow is bundled with Grammatik Mac, version 2.0, a grammar checker. For more information contact

T/Maker Corporation
1390 Villa Street
Mountain View, CA 94041
415-962-0195

MACWRITE II

MacWrite, by Claris, was the original Macintosh word-processing program. It was the only one available on the early Macs. The program has been updated numerous times, and the present version is MacWrite II. (Claris will soon offer MacWrite Pro, a new package designed for System 7.)

MacWrite II has a full set of translators to import and export files. (Word-processed documents with graphics are translated intact.) Files can also be imported and exported to the DOS platform.

Bundled with MacWrite II is Microlytic's Word Finder. Word Finder is a thesaurus desk accessory that works within MacWrite. It does not give definitions of words, but does identify parts of speech.

MacWrite lets you select text with successive mouse clicks:

- Two clicks select a word.
- Three clicks select a sentence.
- Four clicks select a paragraph.
- Five clicks select the entire document.

Formatting is applied to paragraphs or pages through menu commands or with a ruler.

MacWrite II has automatic or manual hyphenation. Automatic hyphenation is determined by a hyphenation dictionary. You can specify hyphenation exceptions through the exceptions dictionary. Newspaper-style columns are easy to set up in MacWrite. The column format applies to the entire page.

The spell checker, in addition to the standard features, displays the number of words spell checked. With the interactive spell-checking feature, MacWrite will beep or flash the menu bar when a spelling error occurs.

MacWrite II supports PICT and MacPaint file import. Other formats can be brought in through the Clipboard (by cutting from one document and pasting onto the MacWrite document). Files from encapsulated PostScript programs (like Adobe Illustrator) are copied to the Clipboard by holding down the OPTION key while you select the Copy command. A graphic can be placed inline with the text, as shown in Figure 18-3.

For more information contact

Claris Corporation
5201 Patrick Henry Drive
P.O. Box 58168
Santa Clara, CA 95053
408-717-8227

WORDPERFECT

WordPerfect was created originally for DOS computers. In DOS, formatting codes were needed to implement word-processing features. The

Macintosh version of WordPerfect also uses codes. These codes may be shown or hidden.

WordPerfect has built-in translators for converting WordPerfect for the PC to WordPerfect for the Mac and Microsoft Word documents into WordPerfect documents. WordPerfect documents cannot be saved as Microsoft Word documents, however.

WordPerfect shares features of many of the desktop publishing programs. Text formatting is applied to characters, lines, and paragraphs. Pages can be given a gutter. Style sheets are supported. If the format of an individual word in a styled paragraph is changed, and the style sheet is redefined, the individual word retains its format. The program uses macros. (*Macros* are a method of storing commands and keystrokes for replay. Macros are based on a programming language.)

WordPerfect uses an adjustable hyphenation zone to determine automatic hyphenation. Select an auto-aided feature for hyphenation. The word is displayed in a window, and a suggested hyphenation is given for you to decide the proper hyphenation.

WordPerfect's spell checker has an added ability to check for phonetic spelling. If you accidently type **fone**, the spell checker will include *phone*

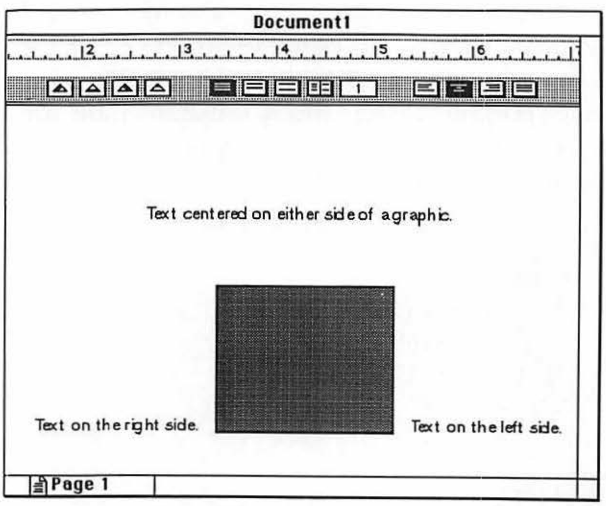


FIGURE 18-3
Graphic placed inline with text

in the Suggested Word window. The spell checker also offers an option to match multiple letters. For example, if you search for *...tire* (where ... stands for multiple letters), the Suggested Word window will display a list of words that end with *tire*. Examples are *entire, overtire, retire,* and *satire.*

A built-in drawing program to import encapsulated PostScript (EPS), TIFF, and PICT files is included. (See Chapter 20 for more information about these file types.) Graphics can be placed behind text, within text, or in front of text. The tool palette for drawing, shown in Figure 18-4, provides most common drawing tools, except Bezier curves—a tool for drawing complex curved shapes. WordPerfect's draw function also displays and allows you to edit color. Imported PICT files can be edited in the WordPerfect drawing layers.

The Librarian dialog box, shown in Figure 18-5, is unique to WordPerfect. A useful resource management tool, the Librarian allows you to store style sheets. This makes them available to any WordPerfect document. You also can store conversion utilities, keyboards, font maps, and macros.

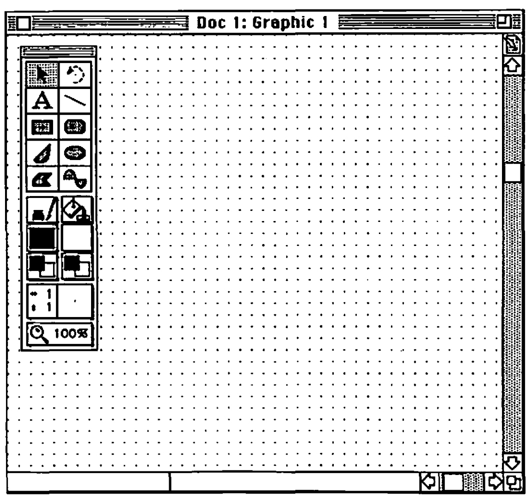


FIGURE 18-4
WordPerfect's drawing features

WordPerfect is compatible with System 7. For more information contact

WordPerfect Corporation
1555 North Technology Way
Orem, UT 84057
801-225-5000

MICROSOFT WORD

Microsoft Word, by Microsoft, has its counterpart in the DOS environment, too. This seems to be the biggest feature of the product. Word files are easily translated into a DOS-readable Word file.

File windows are a feature of Word. These can be split horizontally so one part of the document is displayed in the upper half and another part in the lower half. You can scroll through each half independently. You also can divide a Word file into sections. Each section can have its own layout, and you can renumber the pages so each section starts with page one.

Word has a column/table feature that allows you to create up to 31 even or variable-width columns. Columns can be newspaper or parallel.

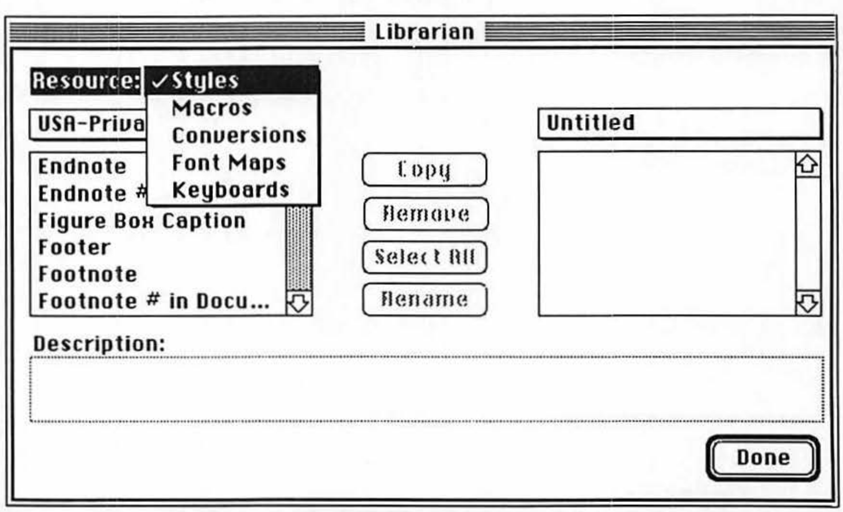


FIGURE 18-5
WordPerfect Librarian

In the table mode, simple math calculations can be performed in individual cells of the table. Cells also can have borders.

Outlining has nine levels. Spell checking does not automatically suggest a word; you must click a Suggest button. An option is available to ignore words that are all capital letters. The thesaurus gives the definitions of words.

A built-in drawing program is not included. However, graphics can be cropped and resized. (Cropping cuts off part of an image, but does not change the size of the image.)

Word has a Fast Save format that reduces the time it takes to save documents. These are some of the file-saving formats:

- MacWrite
- Text
- Microsoft Word (MS-DOS)
- RTF (for file exchange)

Word works on System 7. For more information contact

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052
206-882-8080

NISUS

Nisus, by Paragon Concepts, has a few rare features. For instance, you can assign keyboard equivalents for almost any operation by using the easy-to-use Menu Keys dialog box shown in Figure 18-6.

Nisus lets you undo as many cuts as memory will permit (up to 32,767 levels). You can paste or copy to ten clipboards. You can select text with successive mouse clicks:

- Two clicks select a word.
- Three clicks select a sentence.
- Four clicks select a paragraph.
- Five clicks select the entire document.

You can select multiple passages of text together even if the text passages are separated by unselected text. When text is selected and cut, only one space is left between words.

You can split file windows horizontally so one part of the document is displayed in the upper half and another part is displayed in the lower half. You can scroll through each half independently, or you can synchronize both window scroll bars so they scroll together. Nisus has a feature for comparing documents in which the cursor jumps to where the documents differ.

Style sheets in Nisus are character-based. Any range of text can be selected and styled. Defining or changing style sheet characteristics is simplified by a list of attributes displayed in the Style Definitions box shown in Figure 18-7. Clicking the attribute's selection box applies the attribute to the style definition.

Nisus has automatic or manual hyphenation. Automatic hyphenation is determined by a hyphenation dictionary.

A built-in drawing program is offered to import EPS, TIFF, and PICT files. PICT files can be created within the program. The tool palette for

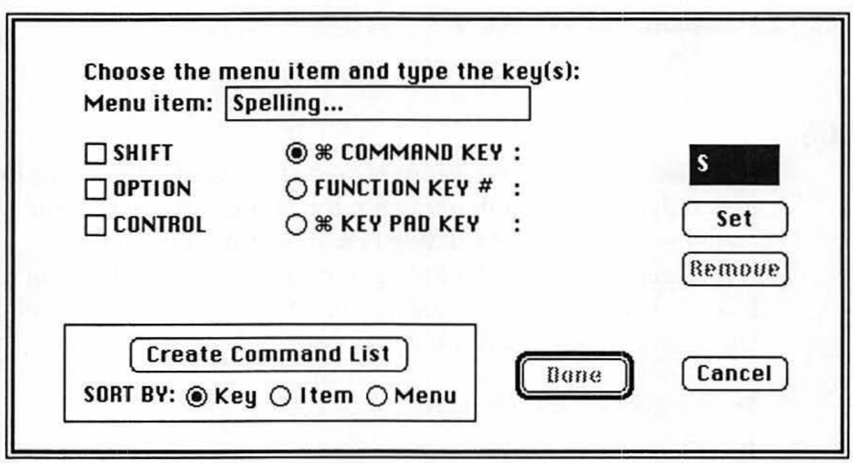


FIGURE 18-6
Menu Keys dialog box

drawing provides most common drawing tools, except Bezier curves. The search and replace features in Nisus include special characters and Power search+ for text patterns.

For more information contact

Paragon Concepts, Inc.
990 Highland Drive, Suite 312
Solana Beach, CA 92075
619-481-1477

OTHER WORD-PROCESSING PROGRAMS

Other word-processing programs available are FullWrite Professional, from Ashton-Tate, which uses many desktop publishing features. Delta Point offers two word-processing choices: MindWrite and Taste. MindWrite has excellent outlining features. A unique grabber selection tool lets you "pick up" text and move it in the document. Taste offers page layout and drawing features.

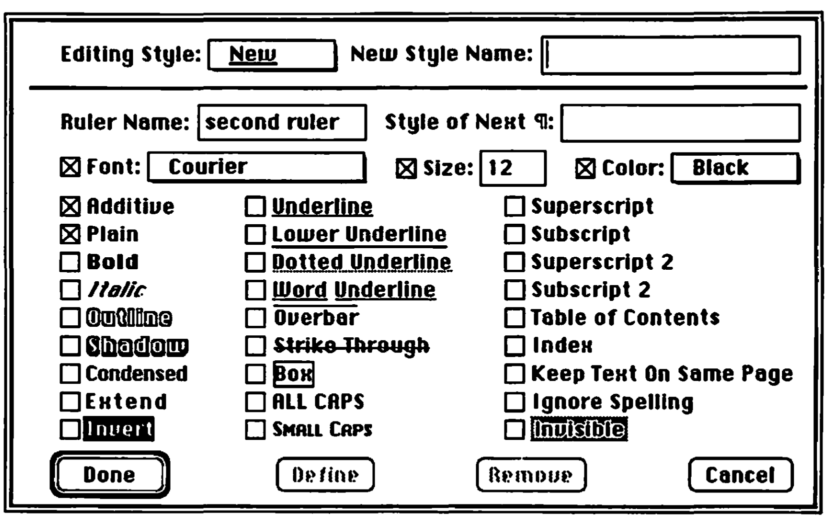


FIGURE 18-7
Nisus Style window

SUPPORTING APPLICATIONS

A number of applications to enhance word-processing functions include the often-bundled spell checkers and thesauruses, as well as the more exotic grammar checking and revision control programs.

GRAMMAR-CHECKING APPLICATIONS

Grammar checkers can help make your writing better structurally and grammatically. Grammar checkers have not reached the point where they can make a decision whether writing is good, mediocre, or just plain bad. (On the other hand, not all people agree on what is good and bad writing.) Grammar checkers cannot make these decisions because they use standard grammatical rules to identify problems. Great writing often breaks these rules. Still, rules are very important.

If you know very little about grammar, you may not find grammar checkers helpful. Grammar checkers can only flag a problem; you must decide if the error is really a problem and how you will correct it. Most grammar checkers will suggest how to fix the problem. This does not mean that grammar checkers flag many nonproblems—they don't. They do offer suggestions you may not want to take.

For example, after reviewing the following sentence,

> Writing was a painstaking endeavor not for the common man.

a grammar checker suggested replacing "a common man" with "ordinary people." In addition, it suggested:

> avoid(ing) man to generalize about people. You might describe exactly who the 'common man' is.

This is useful and thorough advice. Yet, the phrases "the common man" and "ordinary people" have a different impact. You need a sense of the difference to decide whether to accept the suggestion. In this case, "common man" was retained.

This is another sentence that was flagged:

> In the '50s, phototypesetting became popular.

Here is the advice that was given:

A noun or noun phrase should follow the 'the.'

The application was fooled by the apostrophe; the sentence is correct as it is written. Some grammar applications will let you change preferences and add or alter rules. In these applications, you could have the grammar checker ignore the apostrophe and the problem would not be flagged.

Some grammar checkers, such as Grammatik Mac, offer context-sensitive spell checking. This allows identification of misspelled words not recognized by most spell checkers. In addition to catching incorrectly spelled words, Grammatik's spell checker catches words that are spelled correctly but may be the wrong word.

Homonyms (words which sound the same but have different meanings) can be flagged, as in this example:

There house is a huge old country estate.

The grammar checker would note that "there" is spelled correctly, but is the wrong word. The correct word is "their."

Split words (two words that are improperly split) include phrases such as the one in this example:

Why complain about what you can not change?

The grammar checker would let you know that "can" and "not" are correctly spelled, but that they are the wrong words. The correct word is "cannot."

Grammar checkers also find transposed letters, as in this example:

The victim wanted money form him to help pay for the damages.

The grammer checker would give you the following message:

The word form is correctly spelled, but is the wrong word. The correct word is from.

Two popular grammar checking programs are

Correct Grammar
Lifetree Software
33 New Montgomery Street, Suite 1260
San Francisco, CA 94105
415-541-7864

Grammatik Mac
Reference Software
330 Townsend Street, Suite 123
San Francisco, CA 94107
415-542-0222

REVISION CONTROL APPLICATIONS

Applications in this category help you track and control revisions of documents.

ABOUT THE ...

Editorial Advisor

Checking grammar after you have written a document is helpful. But what if you have questions as you are writing? The answer is grammar advisor applications, such as Editorial Advisor. Like grammar checkers, Editorial Advisor offers guidance on grammar, punctuation, word usage, and style. Unlike grammar checkers, it does not offer suggestions. The application, which is HyperCard-based, provides examples. You must decide how to apply the advice. Use it the same way you would use standard reference books, such as *The Chicago Manual of Style.* The difference is convenience and the ability to use the computer to search for topics. This last feature can save you considerable time. Petroglyph, the publisher of Editorial Advisor, plans to release a non-HyperCard version of Editorial Advisor sometime in 1992. This should reduce the amount of disk space required and greatly increase speed.

Instant Update

Instant Update, by ON Technology, is designed for use when many people are editing the same document. If you are working with other people on a network to edit a document, you usually cannot see their changes. Instant Update keeps track of the edits, informs you of changes made, and lets you know who made the changes. It does this by keeping information in an object-oriented database. The database can store both text and pictures.

Instant Update is System 7-compatible. For more information, contact

ON Technology, Inc.
155 Second Street
Cambridge, MA
617-876-0900

VersionMaster

VersionMaster, by AStar Technologies, simplifies the task of keeping track of revisions. VersionMaster works within the application from a Check In, Check Out button added to the Open dialog box.

Changes are stored in a database to allow previous revisions to be retrieved. Each revision is given a sequential number. The following information also is stored with each revision:

- date of the revision
- name of the person who made the revision (obtained from the User Name in the Chooser)
- comments placed in the comments field

Revisions saved in VisionMaster's database require approximately half the storage space of the original document. A report that gives the history of the document's revisions can be generated.

VersionMaster is System 7-compatible. For more information, contact

AStar Technologies, Inc.
P.O. Box 1100
Littleton, MA

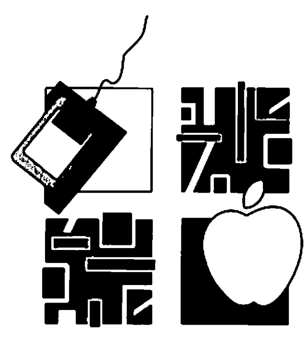
ABOUT THE ...

Read My Lips Sound Files

Word processing and desktop publishing are text- and graphic-oriented. What if you needed to use sounds to get your message across? There is a way. Read My Lips places sound files into many popular word-processing and desktop publishing applications, including MacWrite, Microsoft Word, WordPerfect, Nisus, and PageMaker. The sounds are placed as picture files, called Sound Notes. The Sound Notes can be played by pressing a user-definable set of hot keys. If you have the appropriate hardware, a sound recorder, or a Dove Fax+ modem, you can record sounds from within the applications. Read My Lips is the product of Praxitel.

For more information contact

Praxitel, Inc.
P.O. Box 452
Pleasanton, CA 94566



CHAPTER 19

DESKTOP PUBLISHING

Desktop publishing isn't really publishing, it's page layout on the Macintosh. What once required dedicated machinery, knives, and glue pots can now be done on a Mac. What you create on the Macintosh is a professional layout of a document or book that can then be sent to a print shop for manufacture. If you have a laser printer, you can have it crank out a few copies. It's amazing how powerful the Mac's desktop publishing tools are.

WHY BUY A DEDICATED DESKTOP PUBLISHING PROGRAM?

Many of the newer word-processing programs are adding desktop publishing features. This trend makes word processing more difficult for the novice to master, and falsely gives buyers the belief that they own a desktop publishing program.

If you need the scope and features of a desktop publishing program, you know it. These programs are designed for people and companies who would normally pay dearly for a typesetter, graphic artist, and layout person to do the same job. Desktop publishing packages allow for intricate page layout with multiple columns, graphs, and pictures complete with color separation. Newsletters, newspapers, ad agencies, marketing companies, and scores of others now have at their fingertips a fast, inexpensive way to produce quality documents. The demands for this kind of output cannot be met with a word-processing program. Desktop publishing systems handle type very technically and very precisely, far more so than any word processor.

On the other hand, if your needs are limited to occasionally producing a nice, attractive newsletter for your child's preschool, your club, or your business, a word-processing program should suffice. If you want to take the time (and spend the extra money) to learn a desktop publishing program, you still can—but it may not be necessary.

A COMPARISON: WORD PROCESSING VS. DESKTOP PUBLISHING

It is possible to generate publications in two ways on a computer: with word processing (discussed in Chapter 18) or desktop publishing.

Word processing is a tool that allows you to put text into a retrievable and alterable organized format. It is an efficient and simple way to produce printed documents. On screen, documents appear as a continuous, scrollable page. For example, when you open a new word-processing file, you will see a blank workspace and a cursor, as shown in Figure 19-1.

Type and letters appear in the workspace. When a full page is typed, an indicator—typically a dotted line—shows where the page "breaks." (It's even called a *page break.*) The continuous, scrollable page lends itself to plain, word-processed text.

The disadvantage is you can't get fancy. What you have is not an exact representation of the printed page. The text is not portable; it is attached to the workspace. You cannot move text around without changing the parameters (margins) of the workspace. Even then, text cannot be rotated or overlapped.

Desktop publishing applications were created to allow more flexibility within documents. The placement of elements (text, lines, and graphics) can be anywhere on a page. This is achieved through a page layout format.

When you begin a desktop publishing program, you'll see a blank page similar to the one shown in Figure 19-2. The page is defined by the edges of a rectangle. The space around the page is called the *pasteboard.* The rectangle is an accurate representation of the page's boundaries.

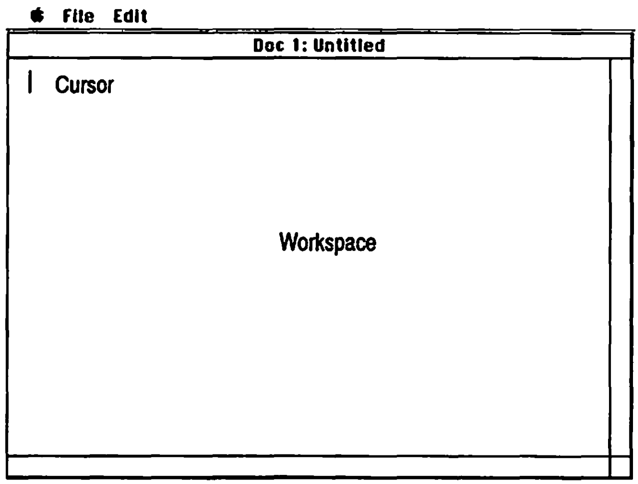


FIGURE 19-1
A new word-processing file

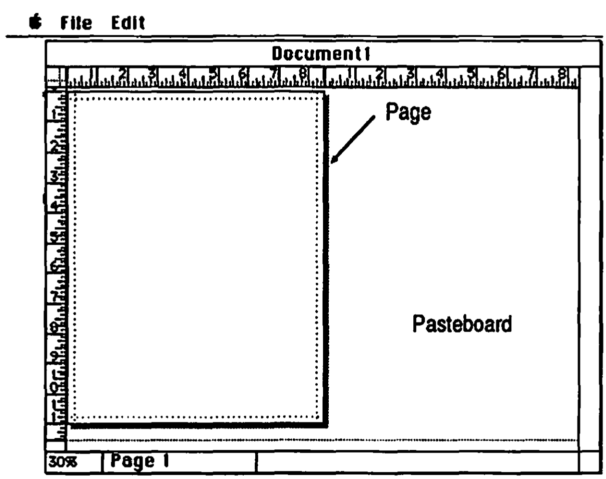


FIGURE 19-2
A new desktop publishing application

You do not scroll to the next page as you do in word processing. Instead, you can click the page number or the scroll bar icon to go to a specified page.

In a new file, the page rectangle is blank. There is no automatic insertion place for text. Text is not anchored to the workspace. You must first create text blocks, which are movable elements. The advantage of text blocks is they can be placed anywhere on the page rectangle.

Generally, all desktop publishing applications allow graphics to be pasted into the document. Many allow text blocks to be created and placed.

FEATURES

Word processing and desktop publishing share many common terms and features for text-only items. (Many of these terms are defined in Chapter 18.) Features specific to desktop publishing, which usually involve layout, graphics, and printing, are covered in this chapter.

LAYOUT FEATURES

Layout features in desktop publishing programs help you to set up and view the document. The layout features include master pages, templates, guides, thumbnails, and graphics boxes.

Master Pages

Many publications repeat information on many pages. (One example of this is page numbering.) *Master pages* are special pages to create a placeholder for these repetitive header and footer information elements.

Since publications often have different layouts on the right- and left-hand pages, most applications allow you to create a right- and left-hand master page. Normally, you can turn the master page on or off for each page in the document. Any element placed on a master page will appear in the corresponding right- or left-hand document page (unless the master page is turned off for that page).

The way master pages are handled varies from application to application. The master page may be static, which means that the elements cannot be changed anywhere except on the master page template. In other cases, the master page may be changed on the pages where the master page elements appear. Some applications, such as QuarkXpress, allow the creation of more than two master pages. Sample QuarkXpress master pages are shown in Figure 19-3.

Templates

Templates are reusable application files. A template can contain information that is normally a part of every document of that type. For example, a template for a newsletter may contain the title of the newsletter (the masthead), rules, formats, and style sheets. This template establishes the beginning point for each newsletter edition. Typically, the template is opened and saved under a new name. This prevents changes in the original template. Then the new stories and associated graphics can be placed in the newly created file and the final layout completed.

You can create templates. Some applications will create a special file in a stationery pad. (*Stationery pad* is another name for templates.) The stationery pad always opens as an untitled document, forcing you to save it as a new file.

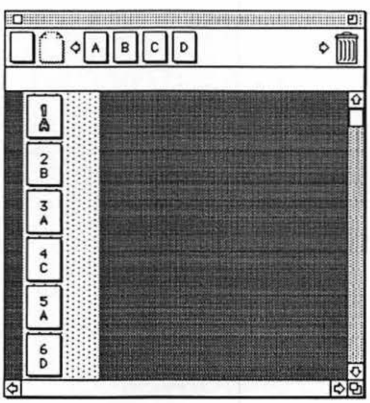


FIGURE 19-3
Master pages from QuarkXpress

ABOUT THE ...
Features of Desktop Publishing Programs

These are typical features of desktop publishing programs:

General Features

- adjust column guides
- adjust horizontal and vertical guides
- allow for page view of 50 percent, 100 percent, 200 percent, or fit in window
- control right- and left-side pages individually
- create documents larger than application's memory partition
- insert, delete, and move pages
- lock objects/guides
- number pages automatically
- open two or more files at the same time
- save files automatically, with adjustable intervals
- show and edit facing pages
- show/hide guides
- show/hide master page items
- snap-to guides
- support video display on full-page monitors
- thumbnail view of document
- two master pages

Text Features

- automatic and manual kerning

ABOUT THE ...

Features of Desktop Publishing Programs (continued)

- automatic tracking
- glossary
- exportable text
- force justification
- paragraph-based style sheet
- styles defined by selecting text with desired style formats
- user-adjustable kerning tables
- user-controllable hyphenation zone

Spell Checking

- ability to check single words
- editable user dictionary
- global replacement of words
- replacing word has same format of replaced word
- replacement automatically suggested

Layout Features

- adjustable-width columns
- automatic drop cap
- measurements in inches, picas, points, or centimeters
- objects can be grouped
- objects can be aligned
- reversed text

ABOUT THE ...

Features of Desktop Publishing Programs (continued)

- text in front of a graphic
- user-definable gutter

Drawing Tools

- drawing objects opaque or transparent
- line weights specified by user
- polygons
- rectangles, ovals, circles

Graphics Features

- import PICT, EPS, and TIFF files
- maintain image control (lighten/darken/color) over TIFF images
- resize and crop graphics
- rotate or flip graphics horizontally and vertically
- scale graphics by percentage

Printing

- ability to print only odd pages or only even pages (to print double-sided)
- automatic color separation of files
- automatic trapping
- automatically downloaded fonts
- tile printing

Gutters

The *gutter* is the white space created by two adjoining pages. This space allows for binding or for hole punches, as shown in Figure 19-4. In documents to be bound or placed in a binder, you would create a gutter on the left side of a right-hand page and on the right side of a left-hand page. The size of the gutter is determined by the width required for the binding.

Guides

Most desktop publishing programs provide nonprinting horizontal and vertical guides to help in the placement of objects on a page. (Click on the ruler and drag to create a guide.) The guides can be locked. Objects can be "snapped to" the guides. Snap-to is a feature that automatically aligns objects to the guide when objects are placed near the guide. This snap-to feature is optional and may be turned on or off.

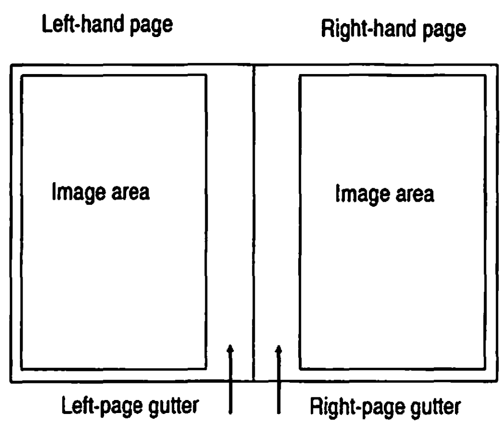


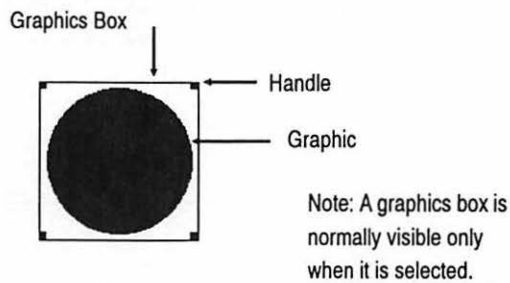
FIGURE 19-4
Gutters

Thumbnails

Thumbnails are small representations of pages. Some desktop publishing programs allow you to display thumbnails of all of the pages in the document.

Graphics Box

A *graphics box* is a placeholder for graphics. A graphics box is only visible when you select a graphic, unless the box is given a border. The graphics box has handles for resizing. Click the handles and drag to resize it. Resizing while holding down the SHIFT key produces proportional changes in the width and height of the graphic, which keeps the graphic from distorting. Here is an example of a graphics box:



Desktop publishing programs let you run text around the graphic inside the box and let you designate the *offset*, or space, between the text and the graphic.

Offset Graphics boxes are treated like objects. They can be placed in front of and behind other objects.

TEXT FEATURES

Text features include word wrap, text blocks, greeking, drop caps, reversed text, glossaries, and indents. These features are discussed in the following sections.

Word Wrap

Word wrap is a feature of both word processing and desktop publishing. In desktop publishing, it means the automatic repositioning of text around a graphic or text element. It also means breaking lines automatically.

The word wrap feature can vary in the way it functions. This variation depends on the characteristics of graphic elements. Graphic elements are placed in a rectangular or square graphic box within the application. When the graph is selected, the outline of the graphics box is displayed, and the text can be wrapped around the shape of the graphic. Figure 19-5 shows the difference between text wrapped around a graphic and text wrapped around the graphics box.

Text Blocks

Text blocks are chunks of text. Most word processors produce text that is anchored to the workspace. It can be moved by highlighting the chosen text and using the Cut and Paste commands in the Macintosh.

Text blocks are used in desktop publishing in a different way; they are used to wrap text around a graphic.

Greeking

Greeking, discussed briefly in Chapter 18, is the transformation of letters into a fast-displaying gray band that represents a letter or graphic's placement. The purpose of greeking is to allow faster display when work-

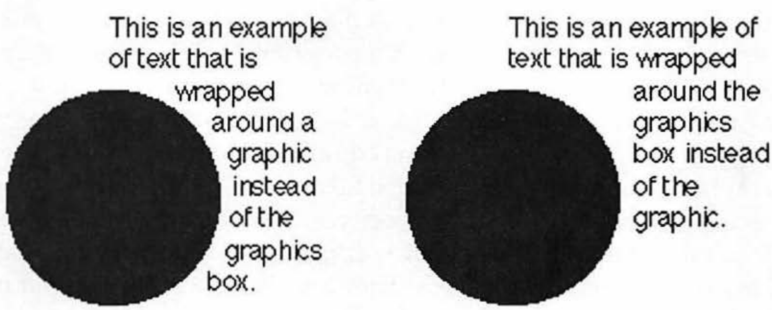


FIGURE 19-5
Graphics wraparounds

ing with nontext items, such as graphics, or when viewing text layout. (In printing, greeking is gibberish type used to show color.)

Drop Caps

A drop cap is the initial letter in a paragraph that has been stylized. For example, the initial letter can be made larger and inserted into the upper left corner of the paragraph. Drop caps are easy to produce in desktop publishing applications.

Reversed Text

Reversed text is light text placed on a dark background. Desktop publishing applications allow text to be reversed.

Glossaries

A *glossary* in desktop publishing programs is a built-in file to store blocks of text or graphics used more than once (for instance, a company

ABOUT THE ...
Macros

A *macro* is a method of storing commands and keystrokes that you use often. Instead of constantly typing the same long command names and combinations of keystrokes (for instance, your company name), you could create a macro to store the information and then run the macro as needed to save yourself some time in typing and formatting. Macros are based on a programming language. (For more information on macros, see Chapter 24.) They allow you to customize applications. However, macros must be created. If the macro has a simple task, such as typing in your company name, creating the macro is equally as simple and will take little time. The more complicated the task, the longer it takes to create the macro. Sometimes creating the macro may take more effort than you are willing to make. (To evaluate the usefulness of macros, consider your willingness to learn how to create them.)

Many programs utilize macros. They are also available as separate applications. Design Studio is an example of an application that provides macros via an add-on program.

name or address you find yourself typing often, or today's date). Each text block has an associated abbreviated text string or set of keystrokes. A glossary saves time because it lets you use only a few letters or keystrokes to retrieve a large text block. Some glossaries may contain graphics as well as text. Not all applications have glossaries. Programs which have macros may rely on the macros to create these glossaries.

The glossary function stores information you put into it. It should not be confused with a glossary which supplies the meaning of words.

Glossaries have many useful functions. For example, you can type your address into the glossary and associate the letters *adrs* with the block. Then, when you want to type your address, you can use the glossary to retrieve this information. The way the text is retrieved varies from application to application. In some programs, the short text string associated with the text block is displayed in the glossary menu. In the example of your address, you would go to the glossary menu. Then, you would select *adrs.* Your address would automatically appear where the cursor was located. In other programs, you may have to use the Command key and several other keystrokes to retrieve the address.

Hanging Indents

Desktop publishing applications create hanging indents. A *hanging indent* is a combination of a left indent with a negative first-line indent. This causes the first line of the paragraph to extend to the left of the left indent. Hanging indents are an ideal solution to the word wrap problem associated with bulleted text. The problem looks like this:

▶ Text that extends past the first line
wraps under the bullet instead of lining
up with text on the first line.

The solution, a hanging indent, looks like this:

▶ A hanging indent pushes the first line
to the right and then indents the remaining
lines so that they line up under the first line.

When creating a hanging indent, specify the left indent first and then specify the first-line indent. The first-line indent is equal to the distance from the bullet to the first letter of the text and is entered as a negative value.

PRINTING

In the 1940s, type was produced from molten metal. In the 1960s, phototypesetting became popular. (Phototypesetting created a film master of the type.) By the 1970s, digital phototypesetting was introduced. (Digital phototypesetting uses digital information to represent type. Digital information can be stored in computers.)

Digital phototypesetters set the stage for computer generation of typeset publications. For the most part, the final mechanicals (what the printer worked from) were created by pasting the elements of the publication to a "pasteboard." (The board is similar to the matte board used in framing pictures.) When the paste-up is complete, it's called camera-ready art. The printer photographs the pasteboard, then uses the photographic film to make plates for the printing press.

The Macintosh, coupled with Adobe's PostScript page description language, makes it possible to do away with the pasteboard. Instead, the entire publication, including both text and graphics, is created in the desktop publishing program. PostScript translates the desktop publishing file into the dots generated by a laser printer.

At first, the Macintosh computer was only able to create "near" typeset quality. This quality was based on the 300 dpi output of the first laser printers. In a space of one square inch, these produced a maximum of 300 dots along the horizontal axis and 300 dots along the vertical axis.

The total dots in the square inch are 300 (horizontal) times 300 (vertical), or 90,000 dots per square inch. This is "nearly" typeset, because 300 dpi is really no match for the 2400 dpi that is typical in phototypesetting. Phototypesetters produce over 5,760,000 dots in a space of one square inch

(2400 horizontal by 2400 vertical). This is 64 times greater resolution than the 300 dpi of the laser printer.

Imagesetters—digital phototypesetters able to produce both text and graphics—were introduced by Linotype. Imagesetters have made it possible to output typeset quality of 2400 dpi from the Macintosh.

The imagesetter's output can be generated on either paper or film. The film can be used to generate the plates for the printing press, or the file can be output on paper to create a mechanical. The printer then photographs the mechanical to produce the film. It may seem as though paper output is not necessary, but the printer may prefer to use paper when adding elements or making adjustments to the mechanical. (For example, photographs may need to be stripped onto the layout.)

Desktop publishing still suffers from its early days. The screen display images are based on QuickDraw routines in the computer's read-only memory. QuickDraw changes the digital information to dots displayed on the screen. If the printer uses QuickDraw to create the printed image, few problems occur. However, PostScript printers are more popular than QuickDraw printers.

The computer's output is in QuickDraw; the printer uses PostScript. These two programs don't normally understand each other. They need a translator to convert the computer's QuickDraw information into a format the PostScript printer can read. Unfortunately, the translations aren't always perfect.

PRINTING PROFESSIONALS

Over the years, printing professionals (print shops, typesetters, and offset houses) have developed methods to ensure that printed material comes out exactly as expected. Printers now have to adjust to the completely new technology of personal computer desktop publishing. Standard methods to solve problems between the print shop and a Macintosh-produced product have not yet been established. At the same time, print shop technology has been booming. The trick is to find a printing professional willing to work with you and willing to keep up with the times.

ABOUT THE ...

Trapping

Trapping is one of the problems that printers have had to solve. Trapping is the printing of different color elements that touch. Since the elements in question are different colors, the printing press must print each color separately. Accurate placement of the ink requires exact registration.

Most printing presses are very accurate, but slight misalignment is not uncommon. If the elements shift toward each other, the ink overlaps. This can cause a dark band where the overlap occurs. Worse yet, the elements may shift away from each other. This creates a gap where there is no ink, resulting in an unsightly white line.

The solution is trapping. Trapping is the "spreading" or "choking" of an element to increase (spread) or decrease (choke) its size. Trapping provides overlap between objects to minimize the chance of a white line. The skill is in trapping enough to prevent a white line while not overtrapping so much that the dark band from overlap is excessive.

Desktop publishing software allows traps to be set. If you are not an expert in the art of trapping, work closely with the printer to ensure that the trap settings are correct.

WORKING WITH A PRINTER

There are several steps you can take to make the publishing process work smoothly. First, choose a printer with experience in desktop publishing. This is important because the computer screen representation of a document and the laser printer output are not exact representations of the final product. You may need to rely on the printer to catch problems. For example, tints (also called screens) printed on a laser printer do not look the same as tints printed on an imagesetter. A 10 percent laser printer tint is much darker than the same imagesetter tint. A common mistake for beginners is to fill a box with a 10 percent tint. When the final copy is produced on an imagesetter, the 10 percent tint is almost invisible.

Second, you must fully understand the printer's capabilities. Be sure to provide the camera-ready copy consistent with the printer's production methods. For example, some printers prefer to have the camera-ready copy on paper instead of film.

PRINTING-RELATED FEATURES

Printing-related features aid in the printing of a document. These features include tints, color separation, crop marks, double-sided printing, and tiles.

Tints

Tints, also called screens, are areas where density of a dot pattern is purposely reduced. Tints are applied to colors to make them lighter. Tints usually are expressed in percentages, with 100 percent signifying the original color. Smaller percentages indicate a lighter color. For example, a box filled with 100 percent black, no tint, is black. A box filled with 50 percent black tint is gray. Figure 19-6 shows an example of black tints.

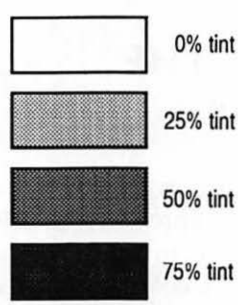


FIGURE 19-6
Tints of black

Color Separation

Documents produced in color must be separated in the colors that the printer uses before being printed. The separation identifies the elements to be printed in a specific color.

There are two types of color printing: spot or process. In *spot* color, the printing ink matches the color designated in the document file. The most common system for matching colors is the Pantone Matching System (PMS). If you specify a PMS color, the printer uses the same PMS color of ink.

Process color combines four colors—cyan, magenta, yellow, and black—to "build" all other colors. A shorthand notation of the four basic colors is *CMYK*. Other colors are built by specifying the percentage of each of the four process colors. (More advanced desktop publishing programs specify the CMYK percentages in the separation process.) Separation breaks a page into four plates, with one plate for each of the four process colors. Each plate contains all the elements of a page that contain the same color as the plate.

Most desktop publishing applications allow spot color separation. Some can separate process color. Others require an additional application to produce process color separations. You can normally separate all of the elements produced in the application, but you may not be able to separate imported objects, such as graphics. You will have the fewest problems separating PICT and EPS graphics.

ABOUT THE ...
Process Color

Color is created in printing by dots. The percentage of a color depends on the density of the dot pattern that represents the color. This dot pattern is printer-dependent. If the final printout is on an imagesetter with a resolution of 1200 dpi, then 1200 dpi represents 100 percent of a color. A tint of 600 dpi represents 50 percent of the color. For example, the combination of 50 percent cyan and 50 percent magenta results in a shade of purple. Four plates are produced. The yellow and black plates are empty, the cyan plate contains the image in a 50 percent tint of cyan, and the magenta plate contains the image in a 50 percent tint of magenta. When all of the plates are printed, the cyan and magenta dots build the purple color.

The art of color separation is quite complex, and it is beyond the scope of this chapter to fully explain it. This complexity affects your ability to produce high-quality color separations. While desktop publishing continues to make advances in color separation, it is still an area in which close communication with your printer is essential.

Crop Marks

Crop marks are reference markers to allow precise alignment of objects on a page. They come into play when documents are printed in more than one color. For example, if a document has elements with two different colors on a page, the page must be printed twice. The first printing is for one color. The second printing is for the second color. The first color prints on top of the second color. When the second page is printed, the printed elements are carefully aligned so they are placed in their actual position on the page. Crop marks, shown in Figure 19-7, allow the printer to obtain this careful alignment.

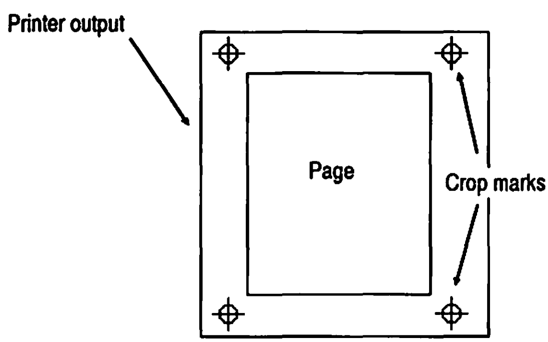


FIGURE 19-7
Crop marks

Tiles

Tiles are sections of a document pieced together to create the whole document. Printing tiles breaks files too large to fit on a page into printable sections. Each section overlaps. You can usually specify how much you want the tiles to overlap. You can normally add crop marks to make it easier to align the tiles as you assemble them.

DESKTOP PUBLISHING PROGRAMS

Two of the most popular desktop publishing programs are QuarkXpress (commonly referred to as Quark) and PageMaker.

QUARKXPRESS

QuarkXpress, by Quark, is a desktop publishing program which can be enhanced with Quark Extensions. Extensions are add-on programs created by Quark or third-party developers. (The latest extension is a program to import PageMaker files into Quark.)

Quark places text and graphics into frames. The frame concept allows precise placement. Double-clicking the frame brings up a dialog box that contains specifications for the frame and graphics or text. One advantage of the frame concept is it allows you to specify exact values. For example, you can designate the amount you want to rotate a frame and its contents in thousandths of a degree. Also, text can be justified vertically in a text frame, as shown in Figure 19-8. This allows text to be distributed equally from the top to the bottom of a frame.

Quark lets you convert a page to an Encapsulated PostScript (EPS) file. This converted page becomes a picture that can be pasted into a graphics box. This feature is handy if you want a picture of a page to appear on the cover of the document.

As many as seven documents can be opened simultaneously. Pages can be cut and pasted between documents.

Most desktop publishing programs permit two master pages: a right- and a left-hand page. Quark can have as many as 254. Each page is assigned a master page by you. Master page items are active on each page and can be changed. Master page items can be changed and then reapplied to each page.

Like most desktop publishing programs, Quark establishes links to graphics instead of storing a copy in a file. This makes graphics handling efficient. Links, though, can complicate management of the file, especially when graphics are altered. Quark simplifies this management with a picture usage utility that gives the status of pictures. It also has a library feature to store graphics. This is a convenient way to store and retrieve graphics when needed.

Quark is the only desktop publishing program with automatic trapping controls. Trapping prevents problems that occur with slight misalignment of the press. These trapping controls can be automatic, or they can be set manually.

Quark 3.0 is System 7-compatible, but it does not incorporate System 7 features. Quark 3.1 incorporates most System 7 features. For more information, contact:

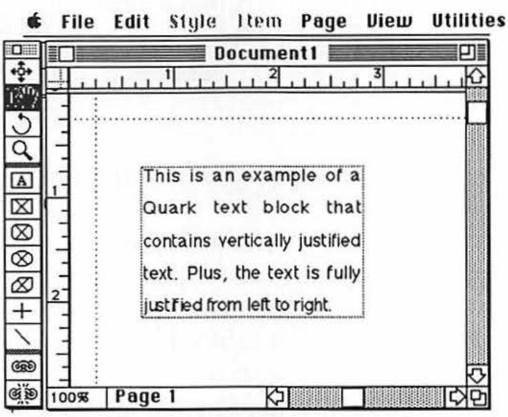


FIGURE 19-8
Quark text block with vertically justified text

Quark, Inc.
300 S. Jackson Street, Suite 100
Denver, CO 80209
303-934-2211

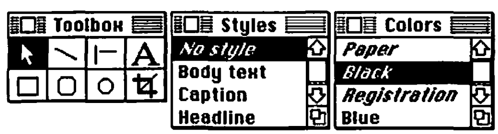
PAGEMAKER

PageMaker, by Aldus, is based on a pasteboard concept, as shown in Figure 19-9. This desktop publishing program mimics the actual conditions of traditional layout methods.

Nonprinting lines mark the outline of the page. Dotted interior lines are nonprinting guides. The white space around the page is the pasteboard. Any item in the pasteboard area is visible from any page.

Placement of objects can be done by hand or by aligning to nonprinting, adjustable guides. Items cut from one page will paste into another page, but they will appear slightly offset from their original position.

Only one document can be opened at a time in PageMaker, and glossaries are not used. Styles, color, and tools are selected from movable, resizable window palettes, some of which are shown here:



This window palette approach lets you replace a series of keystrokes with a mouse click.

Text is handled in a separate text editor window called the *story editor*. Spell checking and search-and-replace options are available while you are in the text editing window, shown in Figure 19-10.

PageMaker has full graphics-handling capabilities. It is unique in its ability to place a graphic in a text file and then treat the graphic as a character. For more information on PageMaker, contact:

Aldus Corporation
411 First Avenue, Suite 200
Seattle, WA 98104
206-622-5500

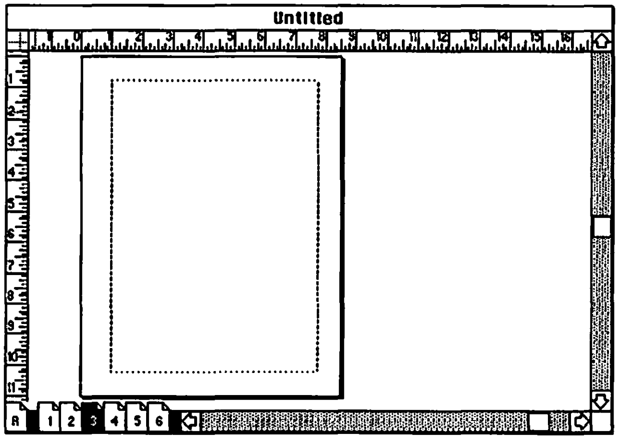


FIGURE 19-9
The PageMaker pasteboard and page area

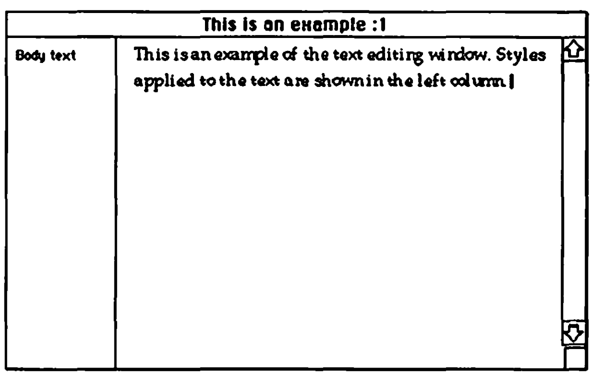


FIGURE 19-10
Text editor window

OTHER DESKTOP PUBLISHING PROGRAMS

Desktop publishing programs other than the ones mentioned here are also available, each with its own strengths. Design Studio, available from Letraset, offers strong layout support and color separation. Design Studio also has a macro utility, purchased separately, that can automate repetitive tasks.

Several applications are designed especially for producing long documents. These include Ventura Publisher, FrameMaker, and Interleaf Publisher.

Ragtime is unique in its combination of word-processing power, spreadsheets, desktop publishing, charts, and graphics.

CLIP ART

Clip art is a collection of drawings that can make the creation of graphics faster and simpler.

Clip art comes in the four most common graphics file formats. These formats fall into two categories: bitmapped and object-oriented (sometimes called vector). The two categories and their associated formats are listed here:

Bitmapped	Object-oriented
MacPaint	PICT
TIFF	EPS

Bitmapped graphics are created by dots. Scanned images are bitmapped. Paint applications also produce bitmapped images. The dots in a bitmapped image usually cause the edges of images to appear jagged. The eye can easily see that the dots do not join in an absolutely smooth line. This is especially true of MacPaint images, which have a resolution of only 72 dpi. Greater resolutions make the image appear less jagged. For instance, TIFF files have a resolution of up to 300 dpi. This is about the same resolution as most laser printers provide. Bitmapped images usually become distorted if resized. Some graphics applications will allow you to trace a bitmapped image automatically and turn it into an object-oriented image.

ABOUT THE...
Clip Art Packages

A few clip art vendors are listed here.

Bureau of Electronic Publishing, Inc.
141 New Road
Parsippany, NJ 07054

Image Club Graphics
1902 11th Street, S.E. #5
Calgary, Alberta, Canada T2G 3G2

Multi-Ad Services, Inc.
1720 W. Detweiller Drive
Peoria, IL 61615

Silicon Designs
P.O. Box 2234
Orinda, CA 94563

T/Maker Company
1390 Villa St.
Mountain View, CA 94041

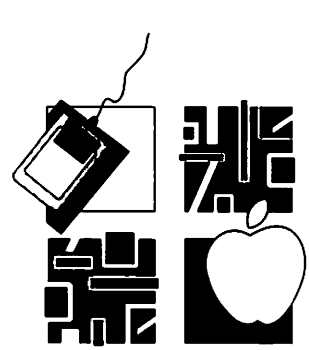
Wayzata Technology, Inc.
P.O. Box 87
16221 Main Avenue, S.E.
Prior Lake, MN 55372

Object-oriented images are created by storing a mathematical formula for the objects in the image. This allows the image to be printed in the maximum resolution of the printing device. Object-oriented images will have a resolution of 300 dpi on a laser printer. On an imagesetter, object-oriented images will have a resolution of 2400 dpi or greater. In almost all cases, object-oriented images appear less jagged than bitmapped images when printed. In the case of imagesetters, object-oriented graphics rival professional illustrations. Object-oriented images may be resized without problems.

CONCLUSION

If the Macintosh is known for any one thing, it's desktop publishing. Desktop publishing was invented for the Mac.

While desktop publishing shares many features with word processing, desktop publishing programs give you the ability to produce more complex documents. You can combine text and graphics, rotate graphics, wrap text around graphics, and more. With the right desktop publishing software, you can learn to do the same kind of work that you are now paying a typesetter and graphic artist to do.



CHAPTER 20

GRAPHICS, PRESENTATION, AND MULTIMEDIA PROGRAMS

One of the great strengths of the Macintosh is its graphics capability. To take full advantage of these abilities, you must know their limitations and strengths. A lot depends on your equipment (memory, monitor, and output device) and on the software you use.

This chapter explains how hardware affects graphics and describes the software available to generate basic graphics, presentation graphics, and multimedia presentations.

WYSIWYG—WHAT YOU SEE IS WHAT YOU GET

WYSIWYG (pronounced *wizzy-wig*) is an acronym for "what you see is what you get." This concept is more important than it sounds. In the world before Macintosh, the video image of a document was often much different from the printed version. In DOS, the image on the screen is not alterable. You cannot easily change the fonts or the proportional spacing. If there is a special font, it's in the printer; you don't quite know what the page will look like until it's printed out. You must often make a number of test prints before the final, correct copy. This is a tedious process—and a waste of paper.

The Macintosh is WYSIWYG to a point. There is a slight incompatibility between QuickDraw and PostScript. Sometimes the spacing is just a bit off, but overall, WYSIWYG does work. The fonts, characters, boldfacing, underlining, and proportional spacing displayed on the screen are printed exactly as you see them. This is wonderful. You can try out a dozen different fonts, or different font sizes, or different effects, like a Zapf Dingbat here and there, or italics and underlining. With the Macintosh, you can customize a printed page to give it a special feel and know what the printed result will look like. WYSIWYG is a dream-come-true for plain document printing.

In graphics applications, WYSIWYG is often more an ideal rather than a reality. The resolution of video monitors is low compared with the capability of laser printers (a quarter of the resolution or less). The problem is with those little things called *pixels.* (No, not a puckish sprite—that's a *pixie.*)

PIXELS

A pixel is a dot—one dot. It doesn't sound too important, does it? If you looked at a picture in a magazine with a magnifying glass, you would see the picture is made up of a mass of little dots placed very close together. If these dots were on a computer video screen, they'd be called pixels.

Your color television set also uses pixels. The picture is made up of trios of red, green, and blue dots. The system is called RGB for the *red, green,* and *blue* colored dots. The sharpness of a picture is determined by how many of these dots can be jammed into a square inch (dots per inch or dpi). The less "air space" between the dots, the sharper the image will appear. This sharpness is called resolution. *Resolution* is the number of dots per inch.

RESOLUTION

The pixel count on a video monitor is somewhere around 67 to 75 dpi; 72 is considered standard. That's what the first Macs had. This is normal for many Apple Macintosh monitors. It isn't a very high resolution, but adequate for most applications.

Printers have a greater resolution. For instance, basic dot-matrix printers run at 144 dpi and laser printers at 300 dpi. Some of the high-end specialty printers may be as great as 2,460 dpi. This difference means what you see on screen is not exactly what you get. It may mean extra dots and a sharper image on the printed page. However, some applications aren't programmed to utilize the full potential of the printer. These applications only send the exact information from the screen to the printer. The resulting printed image is rough, which isn't too impressive if you've spent the bucks for a laser printer.

HOW YOUR VIDEO MONITOR DISPLAYS GRAPHICS

The Macintosh video monitor uses pixels to display letters, characters, and pictures. Each pixel uses one or more bits to identify the location, color, and intensity on the screen. As discussed in Chapter 9, a collection of pixels with their associated bits is called a bitmap. If the bitmap could be seen, it would look like a grid of the screen. The pixels can be represented by 1-, 4-, 8-, 16-, or 24-bit information. The higher the bit count, the more versatile the pixel can be in the number of colors it utilizes, its intensity, and other attributes.

One-Bit and Four-Bit Monochrome Displays

In the typical Macintosh monochrome display, there is 1 bit of information for each pixel, which is called *1-bit addressing*. This lets the Macintosh store 1 bit of information about each pixel. One bit of information tells the Macintosh the pixel's specific location in memory and if the pixel should be on or off. If the bit is on, the pixel display is *neutral*; the color of the background screen. When the bit is off, the pixel display is black. (Gray may be simulated by alternating on and off pixels.)

In full-page and dual-page Macintosh monochrome displays, there are 4 bits of information per pixel, or *4-bit addressing*. This allows more information to be sent to the screen (4 bits to each pixel at its specific location in memory). The pixel can display up to 16 intensities of gray (the number of possible on/off combinations for each bit). Pixels of varying intensities of gray are called *grayscales*.

When printing graphics displays with 1-bit and 4-bit addressing, the LaserWriter or ImageWriter printer will only print a black dot for a gray pixel.

Four-Bit, Eight-Bit, and Twenty-Four-Bit Color Displays

In Macintosh color displays with a compatible video adapter card installed, there are 4, 8, or 24 bits of information per pixel. With an 8-bit address, the pixel can display up to 256 colors (the total number of possible on/off combinations), although the possible number of color combinations is actually much greater. For each pixel, you can select up to 256 shades of each color. If you include these shades, the total possible number of colors is actually 16.8 million. (Don't try to count them.)

The 4-, 8-, or 24-bit color video display can create black-and-white pictures of photographic quality with an impressive selection of shades of black.

GRAPHICS

In Mac lingo, *graphics* are images that are not text. A graphic can be your company logo, an artist's rendering of your face, a cartoon, some clip art, or a scanned or captured image.

File formats are of two types, bitmapped and object. *Bitmapped* file formats store images as a collection of pixels. *Object* file formats store images as mathematical descriptions. In cases where you want to use graphics created in one application in another application, you need to be aware of file formats. The file format indicates how your graphic image is stored when you save it. Common graphics file formats are listed and described in Table 20-1.

GRAPHICS APPLICATIONS

There are four basic types of graphics applications: paint, draw, draw/paint, and illustration.

Paint

Paint applications are usually designed to create images or edit scanned images. The programs which use paint are designed to let you "paint" on your computer screen as if you were painting a picture on paper. An example of this is seen in Figure 20-1.

Paint applications create and store images as bitmapped images. Bitmapped pictures can be edited pixel by pixel, which is an advantage

File Format	Description
PAINT	PAINT file format is bitmapped. PAINT files are a widely used graphic file format and are accepted by almost every graphics application.
PICT	PICT file format stores bitmapped and mathematically described information. Most graphics programs can accept PICT files.
PICT2	PICT2 file format is an upgrade of the PICT file, designed to better handle color. These files may also embed PostScript information for better text output.
TIFF	TIFF (Tag Image File Format) file format stores bitmapped graphics created when images are scanned into a computer.
EPS	EPS (Encapsulated PostScript) file format stores images as PostScript algorithms. These files may include a PICT file version of the image for screen display.

TABLE 20-1
Common Graphics File Formats

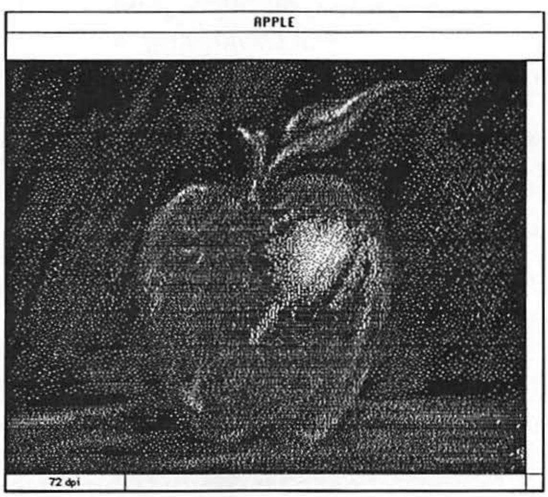


FIGURE 20-1
Paint example

when working with detailed images. All scanned images are bitmapped and can be edited at the pixel level in paint applications.

The size and detail quality of paint images are limited by the resolution of your video monitor. It may be difficult to resize your images perfectly. Often there is a problem in obtaining an accurate print of the image.

Many paint applications offer special features such as the ability to rotate, flip, or put images in perspective. Table 20-2 highlights common paint features.

Draw

Draw applications are used to create object-oriented images such as geometric shapes. Examples are schematic drawings, technical drawings, and blueprints. With draw applications, you can create images with precise shapes which can be resized and rearranged quickly. They require less memory than a bitmapped image.

Draw applications create and store images as object vectors or as geometric equations. These applications are not dependent on the resolution of your video monitor. They don't have the detail of paint applications. They appear smooth and crisp at any size or level of resolution.

Draw applications generally have more versatility for text handling than paint applications. You can mix fonts, font sizes, and colors within a single text block. You may edit text at any time. Some applications feature spell checkers. Draw applications print PostScript fonts to any PostScript printer—even those that do not support PostScript file formats.

Features common to most programs include

- tools to create lines, shapes, or free-form drawing
- tools to magnify and reduce images for easier editing
- ability to edit an entire shape
- ability to change color, fill pattern, line width, or size of an entire shape
- ability to build a picture in layers

The layering feature allows you to create a part of the picture in one layer, as shown in Figure 20-2, and then add details in subsequent layers, which sit on top of the first picture like tissue overlays.

Many applications offer special features such as the ability to rotate or flip, or Bezier and spline tools to create smooth curved lines. For those of you who create scaled drawings, other special features include metric rulers, grids, and lines which display their dimensions as they are drawn.

Common Paint Functions	Common Paint Tools
Brush on patterns or solids	Paintbrushes of various sizes
Spray on patterns or solids	Spray-can tool
Paint mirror images	Brush mirrors tool
Draw lines and shapes	Rectangle, rounded rectangle, oval, rounded oval, freehand shapes, and polygons
Use patterns to fill an area	Pattern selection with paint bucket
Draw a patterned line or border	Pattern selection with line or shape tool
Draw lines	Pencil tool
Zoom	Varies in applications
Change an area	Select with special rectangle tool
Change an irregular area	Select with lasso tool
Resize an area	Select with special rectangle with scale or mouse
Invert a selection	Select tools with Invert menu
Trace edges of a selection	Select tools with Trace Edges menu
Flip a selection	Select tools with flip horizontal or vertical tool
Rotate a selection	Select tools with Rotate menu
Fill with pattern	Select tools with Pattern menu
Space pixels for perfect spacing	Autogrid selection
Erase selections	Eraser tool
Add text	Text tool
Change text font/size	Select font from menu before typing
Take a snapshot	File menu

TABLE 20-2
Common Paint Features

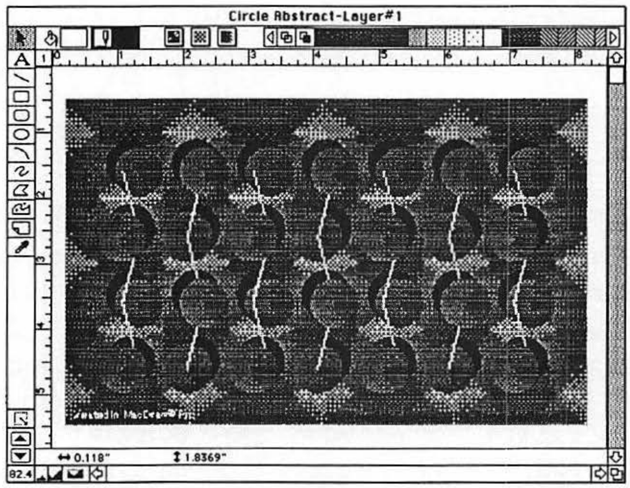


FIGURE 20-2
Example of draw image

OTHER GRAPHICS OPTIONS

There are many other graphics available to you. You can even change nongraphic images into a graphic format. Here are your options:

- *Create your own images* You can create graphics images with your Macintosh with one of the software packages discussed in the next section or, if file formats are compatible, you can import and use images you created in other applications.
- *Clip art* You may also buy and use clip art. Clip art is a collection or library of pictures released for public use.
- *Scanned images* If you have the appropriate peripheral, you may scan images from any printed source—color or black-and-white. Your Macintosh translates all scanned images into bitmapped files, which you can edit with most graphics applications.
- *Images captured from video and television* If you have the appropriate peripheral, such as a frame grabber, you may capture images from any video source. A frame grabber is a device for capturing a single frame of a full-motion video. Your Macintosh translates video images into bitmapped files, which you can edit with most graphics applications.

PAINT APPLICATION SOFTWARE

Several paint application products are discussed here. MacPaint 2.0 from Claris is a direct descendant of the original paint application. Others include PixelPaint from SuperMac and Studio 1/8/32 from Electronic Arts.

MacPaint

MacPaint 2.0 is the grandfather of Macintosh paint programs and is still effective for certain black-and-white graphics displays and printouts.

Artists and designers can use MacPaint 2.0 to enhance newsletters, brochures, and technical documentation. Business professionals can use MacPaint 2.0 to enhance presentations and reports.

PixelPaint

PixelPaint 2.0, by SuperMac, is a popular graphics program among professional graphic designers. PixelPaint supports PostScript graphics and 256 or more colors. PixelPaint 2.0 supports RGB, HSV, CMYK, Color Theory Selectors, spot color, and four-color separations. A library with a 256-color palette is included with PixelPaint.

Studio 1

Studio 1 is a full-featured paint program with presentation, slide show, and animation capabilities. Studio 1 supports most common file formats: PICT, EPS, S1AN (Electronic Arts animation compression format), and TIFF. It can only do 1-bit or black-and-white work.

Studio 8

Studio 8 (for 8-bit color) is also a full-featured paint program with presentation, slide show, and animation capabilities. Studio 8 supports RGB, HSV, CMYK, Color Mixer Selectors, four-color separations, and variable dithering for graduated fill. A library with a 256-color palette, background fonts, and textures is included with Studio 8. Studio 8 creates PICT and TIFF files and accepts PICT, TIFF, LZW-compressed TIFF, ILBM, and MacPaint files.

Studio 32

Studio 32 is used by graphics designers, media specialists, and video professionals. Studio 32 supports 8-, 24-, and 32-bit color, HSV, RGB, CMYK, and the Pantone Matching System. Other features include an airbrush tool—which you use to retouch images displayed on your video monitor—and true color, 32-bit color.

DRAW, DRAW/PAINT, AND ILLUSTRATION APPLICATION SOFTWARE

There are a number of other applications with which you can draw, illustrate, and design on the Macintosh. The following sections describe the features of various software packages.

MacDraw

MacDraw, by Claris, is the first and most widely known of the Draw applications. One of MacDraw II 2.0's key features is the ability to create designs in any number of layers. With layers, you can lay out a rudimentary shape—a map of a continent, for example—in one layer. You may then add details such as rivers, mountains, and other geographic features in a second layer. You may add cities and points of interest in a third layer. In a fourth layer, you may handle other material such as text and labels. Layering makes MacDraw suitable for engineering applications formerly achieved with high-end CAD/CAM applications.

Cricket Draw/CA Cricket

Cricket Draw, by Computer Associates, is aimed at the novice Macintosh user. Cricket Draw allows considerable flexibility for handling text. You can mix fonts, sizes, and styles, add subscripts and superscripts, and justify margins. Cricket Draw provides for linear, logarithmic, and radial graduated fills. You can also rotate and tilt objects for special effects. Cricket Draw imports PICT, EPS, and MacPaint files and exports EPS and PICT files. (Cricket Draw does not run on the Macintosh IIci or fx.)

Illustrator

Illustrator, from Adobe, is used by professional graphic artists to create detailed illustrations or line art. Illustrator uses PostScript and offers flexibility in text handling and editing. Illustrator supports CMYK and the Pantone Matching System. Illustrator requires over 4MB of RAM to operate properly. Illustrator has complex features which require much practice to learn and use effectively. Documentation is often equally complex. Illustrator imports MacPaint, PICT, and EPS files and exports EPS files.

FreeHand 3.0

FreeHand, from Aldus, is used by graphic designers, cartographers, technical illustrators, publishers, and others with a need for precision. FreeHand is fully compatible with Adobe Type Manager. Its editing capability allows you to cut lines with a knife tool to split drawing paths. You may also see changes in an element's position and angle, in precise numerical increments, using an on-screen information bar. You may apply styles such as line, fill, and halftones to multiple elements. FreeHand imports PICT, PICT2, EPS, and MacPaint files and exports EPS and PICT files.

SuperPaint

SuperPaint, from Silicon Beach (a division of Aldus), offers a combination of paint and draw features. Painting occurs in one layer and drawing occurs in another. There is a facility to transfer images from one layer to the other. SuperPaint imports and exports PICT, TIFF, and MacPaint files. It does not work with System 7.

Canvas

Canvas, from Deneba, is a paint and draw combination application. When you create objects, their exact measurements are displayed. You may make hairlines as small as 1/1000th of an inch with internal precision of 64,000 dpi. You may zoom, expand, or reduce your image from 3 percent to 3,200 percent. You may create layers with Canvas and manipulate them using dialog boxes. You may blend objects from one shape to another. Paint tools are limited to four, and only one color may be applied to a Paint area. You may not blend colors or patterns or create transparent shading. Canvas imports PICT and MacPaint files and exports EPS and PICT files.

UltraPaint

UltraPaint, also by Deneba, is a combination of paint and draw capabilities. UltraPaint uses separate modes to paint and draw. Up to eight drawing layers can be worked on and edited with 600 dpi precision. UltraPaint imports and exports TIFF and PICT files.

ABOUT THE...

TypeStyler Font Manipulation Programs

TypeStyler, by Broderbund Software, is a font manipulation program. It allows you to bend, squeeze, stretch, twist, and rotate text. Users can style text to add perspective, shadows, shades, inlines and outlines, patterns and colors. Your work can be as small as 1 inch by 1 inch or as large as 17 inches by 17 inches.

The program was developed for graphic designers, desktop publishers, and general business Macintosh users. Applications include logo and signage design, advertising graphics, newsletters, logos, package art, presentations, and manuals. PICT and EPS files may be imported to and exported from TypeStyler. TypeStyler ensures compatibility with page layout, illustration, and drawing applications—including Adobe Illustrator, Drawing Table, PageMaker, and Quark XPress.

Effects Specialist

One of the most interesting and spectacular font utilities is called Effects Specialist, from Postcraft International in Valencia, California. This program will take any PostScript font and add weight, depth, and special effects. It can break up the font, stretch it, and add all sorts of 3-D action. Effects Specialist also contains a powerful background generator. It is highly recommended for all PostScript users.

PRESENTATION APPLICATIONS

Graphics applications give you the tools to create pictures. Presentation applications give you two additional tools: the facility to better communicate numerical relationships through visual representations and the facility to organize elements such as graphics, text, and graphs to create your presentations.

VISUAL PORTRAYALS OF NUMERIC RELATIONSHIPS

There are two basic classes of applications made to aid you in visual interpretations of numbers. The first class of applications provides the tools for turning numbers into simple graphic portrayals such as bar, pie, and line graphs. These applications take you beyond the rudimentary chart capabilities of spreadsheet applications and are widely used in business. They provide you with multiple options for onscreen editing and good interfaces to printers and film recorders. You may use many of them to create 35mm and overhead slides to support various presentation needs.

The second class of visual data representation applications provides the tools for performing mathematical operations on data in addition to creating complex visual data displays, such as regressions, statistical analyses, schematic diagrams, or contoured displays (see the sine wave in Figure 20-3). These applications are useful in all disciplines.

INTEGRATING ELEMENTS AND CREATING PRESENTATIONS

The second facility of presentations applications is to organize elements such as graphics, text, and graphs to create well-integrated and easy-to-understand presentations. You may also use many of these applications to create 35mm slides or overheads in addition to desktop presentations.

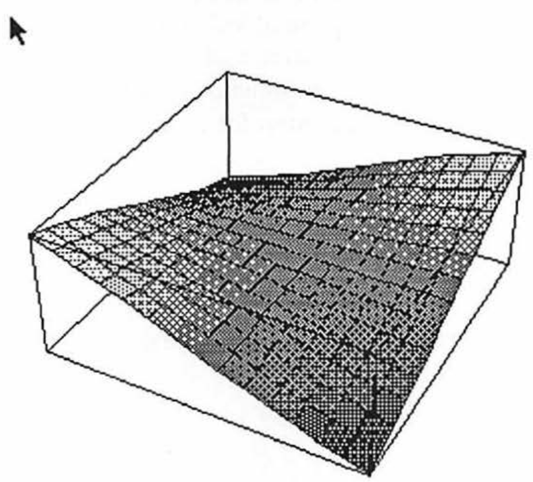


FIGURE 20-3
Sine wave

COMMON FEATURES

Features available among presentation applications include 24-bit color, object-oriented draw capability, and tools to create both simple and complex charts. Some examples of charts include bar, line, logarithmic, contours regression, symbol, flow, schematic diagram, and statistical estimations. PostScript, text editing, on-screen editing, and interfaces to film recorders, scanners, and imagesetters are also available in presentation applications.

Most presentation applications provide templates or master slides to ensure consistency from one slide to the next. Many include libraries of symbols, preselected color schemes, and other clip art.

For data-dependent visuals, look for the ability to import data from your spreadsheets. Also be sure you can import graphics and text from your other applications. If you need to print your presentations, look for good printer interfaces. For commercially printed presentations, look for CMYK and Pantone Matching System support.

PRESENTATION APPLICATION PROGRAMS

Several application programs are discussed here. Cricket Graph from Computer Associates and KaleidaGraph from Synergy Software are used to create charts. Cricket Graph is a vehicle for visually portraying your data. KaleidaGraph is a tool for performing mathematical operations on your data for the purpose of visual display.

Persuasion, from Aldus, and PowerPoint, from Microsoft, are used to create presentations. Persuasion is a full-featured, well-integrated program. PowerPoint is known for its dazzling color displays. Both are very popular.

Cricket Graph

Cricket Graph is an application for portraying the relationships of numerical data visually. It creates simple charts and may be used with other Computer Associates applications, such as Cricket Presents, to create presentations.

KaleidaGraph

KaleidaGraph is a presentation application that uses complex mathematical operations to visually portray data. In addition to elementary operations, KaleidaGraph performs statistical estimations, regressions, curve fitting, cubic spine, and other functions. You may change chart type, switch x,y coordinates, and use logarithmic axes and scaling techniques. Some of the chart types are listed here:

- bar, column (stacked), pie
- scatter (a collection of dots)
- histogram (frequency distributions using rectangles)
- line
- polar (defines in terms of coordinates on a plane)
- percentile and probability
- box and horizontal bar
- templates for charts
- text

KaleidaGraph also offers draw capability and supports spot color and on-screen editing. Spreadsheet data can be imported from many other applications. KaleidaGraph imports ASCII, Cricket Graph, Text, and PICT files, and exports ASCII, binary, KaleidaGraph, PICT, MacDraw and EPS files.

Persuasion

Persuasion is an integrated, full-featured presentation application. Persuasion supports the development of presentations. The program has libraries to store multiple templates (for data-dependent charts, graphs, and clip art). It has several charts, including

- bar and column charts in stacked, clustered, or 3-D versions
- pie charts with a 3-D version
- 3-D area charts
- scatter diagrams
- line charts
- high/low displays

Persuasion imports PICT, PICT2, MacDraw, and EPS files and exports PICT, PICT2, and Macintosh scrapbook files.

PowerPoint

PowerPoint is a widely used presentation program. The program has 5,000 preselected color displays, and it is easy to use. PowerPoint is not an integrated application. You may not import spreadsheets, enter data, or create graphs and charts. You may not use scanned images. Resolution is limited to that of your video monitor. Graduated fill can be used only on the slide's background. PowerPoint imports and exports PICT, PICT2, and EPS files.

MULTIMEDIA

Multimedia applications integrate information from multiple media sources, including audio, video, and print. They create comprehensive presentations with these sources. Other multimedia sources include animation applications, three-dimensional animation, image capture, and database applications.

ANIMATION APPLICATIONS

Animation applications allow you to simulate real life on your computer video monitor. With animation, you can demonstrate the operation of a new machine before it is built; create visual interpretations of things you cannot see (such as electrons spinning in orbit around the nucleus of an atom); or diagram the actions in a war zone. With animation applications, you may also transform the size and shape of images and impose animation over still pictures or video sequences.

Animation works because of limitations of the human eye. Your eyes perceive still pictures as if they are in motion if you view them at a rapid rate in a sequence. In animation, each still picture is called a *frame.* When you record a series of still pictures (each with a slight alteration in the position of its components) on a media such as film, and then project that film at a rate not less than 12 frames per second, you perceive motion in the still objects.

In the early days of Walt Disney cartoons, frames were comprised of thousands of artists' drawings. Each drawing was recorded on film in a frame. The films ran at 24 frames per second. For every minute of cartoon enjoyment, artists rendered 1,440 frames—truly a labor of love!

Today, you can create the same type of animation in minutes with your Macintosh. Copy a picture, draw a path, designate a time, and then sit back to watch. There are two methods to create animation on your Macintosh: page flipping and keyframing.

Page Flipping

Page flipping works just as cartoon animations do. You create several pictures, each with a slight variation from the previous one, and store them in frames, as shown in Figure 20-4. The Macintosh displays them on your video monitor in rapid sequence. HyperCard may be used to create page-flipped animation. Page-flipped images are bitmapped.

Keyframing

Keyframing is another method used to create animation. It is suitable for simple animation like changing the shape of an object. With keyfram-

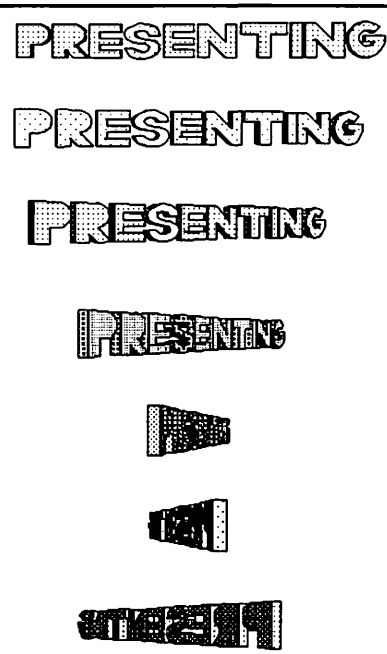


FIGURE 20-4
Page-flipping sequence

ing, you create an object in one frame. In the next frame, you create the object as you want it to appear in the last frame by stretching or distorting it. Your Macintosh draws all of the logical intervening frames, called *tweens* (short for between). You are fully animated in seconds! This animation is also called *tweening*. Keyframing uses object-oriented files, which it manipulates as vectors. Keyframing requires less memory than page flipping.

ANIMATION APPLICATIONS

There are a number of different animation programs on the market. The following sections describe a few of them.

Macromind Director

Macromind Director is an example of animation that provides both page-flip and keyframe animation. Macromind Director allows you to animate up to 24 independent elements and make interactive presentations. You may also use Macromind Director to control CD-ROM devices and laser disc players.

Macromind Director operates with two modules, an Overview and a Studio module. In the Overview module, you can string together a series of pictures, text, or animation imported from your other Macintosh applications. In the Studio module, you may create full-color paint pictures and handle text.

The Overview module displays your presentation sequence in the Overview window. In the Overview window, the icon for each source file in the presentation is displayed, as shown in Figure 20-5. You may view, combine, and set the speed and length of the presentation with the Overview menu.

The Studio module allows you to create, copy, or import images and sounds. You may import MacPaint, PICT, PICS animation, scrapbook, color palettes, and sound from other applications.

To animate an image, select it and drag it to another position. This action records a path for your animation sequence. (The Score window, shown in Figure 20-6, displays action codes, ink codes, and motion indicators.) The program will copy a selected image. If you have an image of one bird flying, for example, you can copy it to create a flock of birds. With the Studio module, you can also create paint pictures using 8-bit color and some draw images.

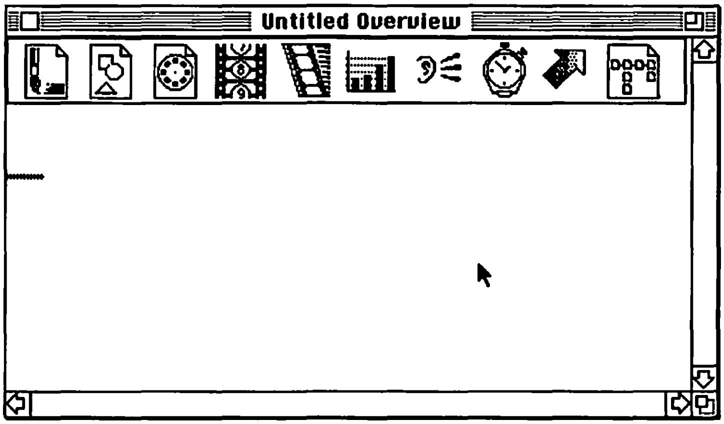


FIGURE 20-5
MacroMind Director Overview window

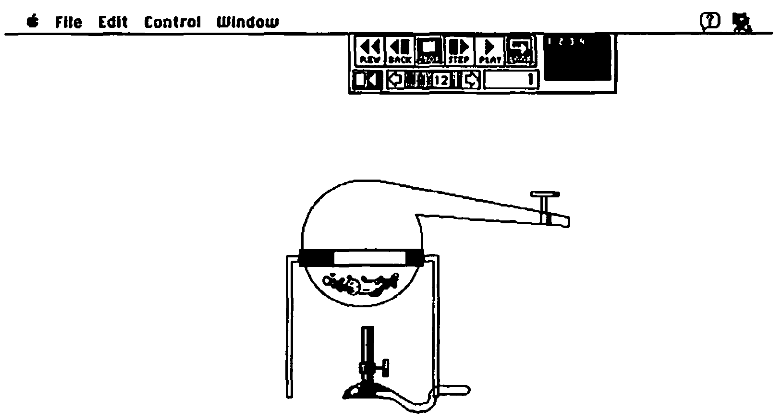


FIGURE 20-6
MacroMind Director Score window

THREE-DIMENSIONAL APPLICATIONS

Animation can be either two-dimensional (2-D) or three-dimensional (3-D). Macromind Director is a two-dimensional application. In two-dimensional applications, you create animation in the two dimensions defined by the flat surface of your video monitor. For most purposes, two dimensions are sufficient for impressive animation.

Where you wish to create animation with breathtaking realism, you may want to use a third dimension. Three-dimensional animation is a two-step process. The first step is to design and edit your still objects in three dimensions. The second step is to move them in space.

There are many ways to create 3-D effects in still objects. One way is to apply certain treatments to the surface of the object. You may shade or color the surface of the object. You may elect to make the object transparent to create special effects such as light penetrating a window. Another choice is to change the luster of the surface of the objects as if they reflect light. You may create a texture on the surface with a pattern, using a special tool. Another approach to creating 3-D effects is to add a background, such as mountains and sky.

After you create all of your objects in 3-D, you must render them (make the finishing touches) to create the finished picture. Here are three common rendering techniques:

Wireframe	Encase in a hollow wire box like a dog cage to aid in rendering 3-D effects
Surface model	Apply rudimentary shading to suggest rather than really portray 3-D
Ray trace	Trace the path of a ray of light from the camera's point of view to every element in the display

Despite all of the wonderful effects you can create with 3-D, one shortfall is that you cannot readily export your animation to other applications.

Swivel 3D

Swivel 3D, from Paracomp, is a three-dimensional drawing and modeling application with animation capability. Swivel 3D uses keyframing to create animation. You first create objects, known as *polygons*, and then use a tool to create vertexes (corners or edges) on the polygon. Finally, you drag the vertexes to create new shapes.

You may create the third dimension with a duplicate of an object you create in one plane, such as the side of a box. You might also use lathing. With *lathing*, you draw an outline of the object and then rotate it around an axis (just as the world rotates on an axis). You might also *extrude* the object. Extruding works just like squishing soft clay with a garlic press.

You can use the World View window to view your Swivel 3D creations from any side, as shown in Figure 20-7.

IMAGE CAPTURE APPLICATIONS

One of the most useful of all multimedia applications is the ability to capture and modify an image from any source. Two image-capture applications are discussed next: PictureLink and PictureAccess from Media Lab

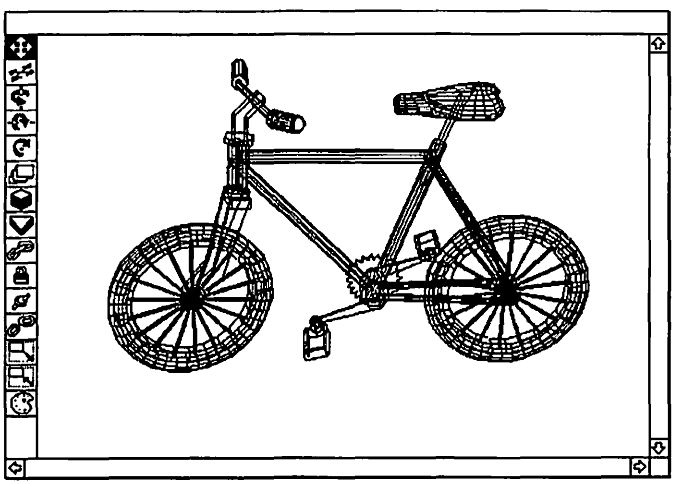


FIGURE 20-7
World View in Swivel 3D

Technologies. PictureLink is an image database tool. PictureAccess is a computer photograph laboratory.

PictureLink

PictureLink, by Media Lab Technologies, is an application designed to enhance the capability of ACIUS' 4th Dimension, a database application. PictureLink is an image database. Capture images from any photograph or printed source with a scanner. PictureLink digitizes the image with built-in scanner drivers and stores them in 4th Dimension and File Force database fields. PictureLink supports Apple, Sharp, Abaton, and Howtek scanners.

With PictureLink, you may capture images from cable television, a video camera, or a VCR by use of a frame grabber. PictureLink digitizes them as you import them. PictureLink supports RasterOps, True Television, Radius TV, Data Translation, and Orange Micro frame grabbers.

PictureLink offers paint capability, 29-bit color, and grayscale support. You may retouch, repair, or edit any captured image and store it in your PictureLink database. PictureLink provides a toolbox for 4th Dimension and File Force programmers.

PictureAccess

PictureAccess provides you with an online photolab. It captures images from any photograph or printed source with an optical scanner. PictureAccess digitizes them with built-in scanner drivers. PictureAccess supports Apple, Sharp, Abaton, and Howtek scanners.

With PictureAccess, you may capture images from cable television, a video camera, or a VCR using frame grabbers. PictureAccess digitizes them as you capture them. PictureAccess supports RasterOps, True Television, Radius TV, Data Translation, and Orange Micro frame grabbers.

PictureAccess offers paint capability and 32-bit color support. You may retouch, repair, or edit any captured image to create the effect you wish. PictureAccess supports four-color separation of images for use in commercial printing.

CONCLUSION

With a variety of graphics programs available you can really "punch-up" a presentation. You can create a new logo, make a cartoon, or design a dynamic brochure cover. Even if you don't consider yourself the artistic type, you can still find the creative side of yourself—and express it.

CHAPTER 21

EDUCATIONAL SOFTWARE

If you have kids around the house, educational software is the greatest thing since cartoons. For kids, it's got all of the appeal of computer games; you won't have that nagging parental guilt that your children are wasting their time with frivolous nonsense, though. Six-year-olds can spend hours on the Macintosh, pleased because they're on a "real" computer. Meanwhile, educational programs can strengthen their reading-readiness skills or early math concepts. There's an added bonus for parents: kids stay quiet and busy while they learn.

In the classroom, educational programs are another resource. The kids look forward to getting onto the computers—it's a break in the same old routine, and they learn something that can be applied in the "real world." Today's kids know the value of computer skills.

HISTORY OF COMPUTERS IN SCHOOLS

As society becomes more technologically sophisticated, schools are under increasing pressure to prepare students for a high-tech future. The use of a computer is a basic skill now, right along with language skills and mathematics. Personal computers are a versatile and patient teacher.

INTRODUCTION OF THE APPLE II

The Apple II product line was introduced in 1977. For the next seven years, Apple encouraged the development of educational solutions. Developers received generous contributions from the Apple Education Foundation. Schools were encouraged to use Apple computers through a program (announced in December of 1980) called Apple Seed. This program provides schools with computer literacy materials.

These early efforts paid off. Many schools have Apple computers today, and it's no wonder. There are over 10,000 different educational applications for the Apple II.

MACINTOSH ARRIVES ON THE SCENE

The Macintosh was introduced in 1984. Apple continued to encourage the use of its computers in classrooms everywhere, and educators eagerly jumped on the Macintosh bandwagon. In May, the University of Texas at Austin placed an order for 13,000 Macintoshes, with a dollar value of $24,708,287. This enormous order showed the potential for the system in academic circles.

HYPERCARD

A big boost for the Macintosh in the classroom came with the introduction of HyperCard in 1987. (See Chapter 14 for more information on HyperCard.) HyperCard has the ability to easily create flexible course materials, tutorials, and even online quizzes and tests. This makes it a popular choice as *authorware* (software used to create interactive course material). Many Mac educational applications were created with HyperCard.

MULTIMEDIA

Another plus for the classroom Macintosh is its ability to control other devices, such as CD-ROM drives and laser disc players—it is a multimedia computer. *Multimedia* is the communication of information using more than one form. This includes the use of text, audio, graphics, animation, and video. For more information on this topic, see Chapter 20, "Graphics, Presentation, and Multimedia Programs." An entire encyclopedia can fit on one compact disk. This saves space in a library or classroom, and the information can be easily updated.

You can use the Macintosh to look up information in the encyclopedia and print or copy it into other documents. Laser discs contain video clips and still photographs which are accessed from the Macintosh by a keyword or by the individual frame number where the item is stored on the disk. These videos and photos make instruction come alive. For example, a teacher might highlight part of a speech by Martin Luther King, Jr., by having a video monitor play a digitized recording of Dr. King saying the highlighted text.

MACINTOSH LC: THE BEST OF BOTH WORLDS

The Macintosh's increased popularity creates a dilemma for schools considering new computer purchases. How can they take advantage of new educational software on the Macintosh and still protect their investment in Apple II software?

The solution to this dilemma is in the Macintosh LC. The LC can use an Apple IIe card (a fully functional Apple IIe computer on a circuit board installed inside the Macintosh LC). With the card, the LC can run a wide selection of Macintosh and Apple II software. One drawback is that the Macintosh LC becomes an Apple II while the card is in place. With the card installed, the machine can run all Apple II software. With the card removed, it again becomes a Macintosh LC, able to run Mac software.

This is a boon to schools that have a glut of Apple II software but want to move to a Macintosh. It's a bridge to use the old software while funds are accumulated to buy new software.

TYPES OF SOFTWARE

Educational software can be divided, roughly, into four different categories (although many applications fall into two or more categories): drill and practice, information, simulation, and tools.

DRILL AND PRACTICE

Drill-and-practice programs drill students on subject matter. This includes such things as multiplication tables or vocabulary flashcards. The student receives positive reinforcement for correct answers (for example, the computer might cheer or play a tune). The wrong answer might play a negative noise (like the television game show buzz); then the program gives the correct answer.

These programs were the most common type of application in the early days of educational software. However, many students found these programs repetitive (read *boring*). As new techniques became available, teachers looked to applications that would hold their students' interest longer. The better drill-and-practice programs disguise rote drills in the form of a video arcade-style game.

INFORMATION

Information programs present a body of information in a form that allows flexible exploration. Students can take different paths, determined by their interests, through the material. For example, an informational application on American history could be used in many ways. One student might gather facts on a particular period in history, while another student studies the events in a specific geographical area over a long period of time. Often, these informational applications include the use of CD-ROMs or laser discs.

SIMULATION

Simulation programs let students experience a real-life situation on the computer. For example, a student could perform a physics experiment to investigate the results of dropping a two-ton weight from the top of a twelve-story building. Unlike a "real" experiment, the simulation can be repeated many times. It can be performed safely—without injury or damage to the shrubbery. Students can creatively explore different solutions to problems.

TOOLS

Tools are things such as word processors or graphics programs. The application becomes the means to solve a problem or create a project. For example, a student might write a term paper with a word processor. The research could be drawn from a CD-ROM-based encyclopedia, and illustrations might be drawn in a graphics program.

TYPICAL PACKAGES FOR PRESCHOOL

Programs for preschoolers have graphics, color, and sound. The activities are geared for short attention spans. Preschool students are not yet ready to use a keyboard. The keystrokes, if used at all, are limited to single letters. With a little practice, most preschoolers become adept enough with a mouse to point and click.

THE PLAYROOM

The Playroom has six activities to provide reinforcement of basic skills. The main screen, shown in Figure 21-1, looks like a playroom. A mouse click on anything in the room will get some kind of reaction. For example,

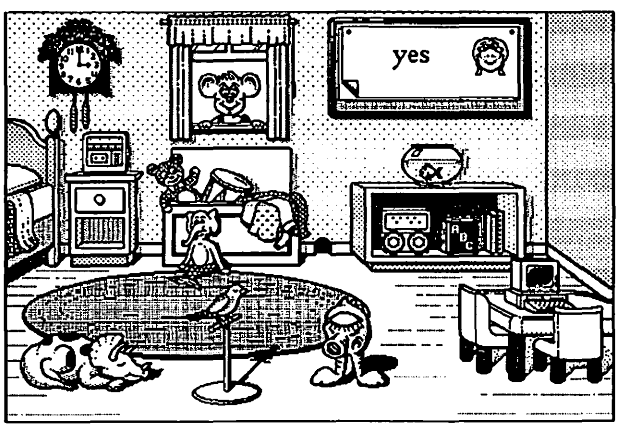


Figure 21-1
The Playroom

a click on the bedside table opens the drawer and releases a balloon, which floats toward the top of the screen. You can pop the balloon by clicking it.

Six key spots on the screen take the child to one of the activities. These programs teach kids how to tell time, and they test reading-readiness skills, early spelling and keyboard skills, creativity, numeration, and recognition of letters, numbers and words. The program guide includes activities to enhance the program and gives suggestions to customize the program. You can substitute the program's sounds with your own (Chapter 11, "The Noisy Mac," covers sound in detail). The Playroom is black and white, but there are enough surprises to keep preschoolers occupied for quite a while.

MCGEE

In McGee, by Lawrence Productions, children explore a typical day in the life of a little boy, "McGee." The interaction consists of pointing and clicking pictures. Because there are no words, this program is suitable for students with limited language skills. The game encourages exploration and creativity as the child moves through various rooms in McGee's house. Along the bottom of the screen are pictures of objects such as a ball or music box, which the user can explore further with a mouse click. For example, when a child clicks the ball, McGee picks up the ball and bounces it off the wall. A teacher or parent could encourage discussion about the objects on the screen to stimulate language development and storytelling.

TYPICAL PACKAGES FOR ELEMENTARY GRADES

Children in kindergarten through sixth grade are busy learning to read, write, and grasp number concepts. Contemporary children are fascinated by computers and video games. Good educational software takes advantage of these interests.

Sound and graphics are still important factors in attracting students and keeping them engaged. Many programs fall into the drill-and-practice category. The best drill-and-practice applications disguise the drill in the form of a game. Elementary school teachers can use computers to help students develop critical thinking skills such as problem-solving and memory development.

KIDSTIME

KidsTime, by Great Wave Software, contains five activities for elementary school students. Students might start with ABKey, which prompts students to find a match for the letter shown on the screen. The child can make the match with a mouse click on a panel of letters along the bottom of the screen. The keyboard may also be used. If the correct match is made, the computer pronounces the letter.

DISCIS BOOKS

Discis Books is a series of children's books on CD-ROM. The titles range from the Beatrix Potter classic *The Tale of Peter Rabbit* to spooky poetry in *Scary Poems for Rotten Kids*, by Sean O'Huigin. There are two options: the computer can read the book aloud or the student can read it. If the student stumbles on an unfamiliar word, highlighting the word with a click of the mouse will cause the computer to pronounce the word and give its definition. The highlighted words are stored in a list that can be recalled and studied later. The illustrations can be clicked to find out the names of objects. Many of the titles in the series are available in Spanish and French.

KIDPIX

Most young children love to draw and paint. KidPix is a paint program with all of the features of a standard paint program like MacPaint, but with special features just for kids. For example, every tool performs a job (like a real paint program) and makes an appropriate sound when in use. (The pencil tool sounds like lead scratched against paper.) If the user wants to start all over, a "bomb" tool will blow up everything on the page with a loud boom. If you can't draw trees or dogs, a set of "stamps" will insert trees, dogs, or other objects. This art can be printed out in color if your printer can support it. A sample KidPix screen is shown in Figure 21-2.

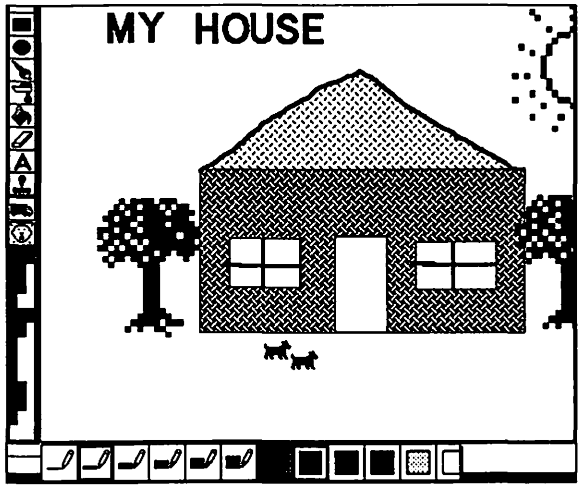


Figure 21-2
A picture drawn with KidPix

PROGRAMS FOR JUNIOR AND SENIOR HIGH SCHOOL

High school students use the computer as a tool and begin to prepare computer skills for the work world.

INTERACTIVE PHYSICS

Interactive Physics, by Knowledge Revolution, is a simulator to create experiments that can be repeated easily and safely. You would not want your high school physics class to drop that two-ton weight off a twelve-story building. With Interactive Physics, an experiment can be simulated, as shown in Figure 21-3. Adjustments to the simulated universe can be made. For example, what would happen to a two-ton weight if gravity were adjusted to the gravity on the moon? Teachers can adapt experiments from their own textbooks or use experiments from a 337-page curriculum guide called Physics Interactions, which was developed to go along with the program.

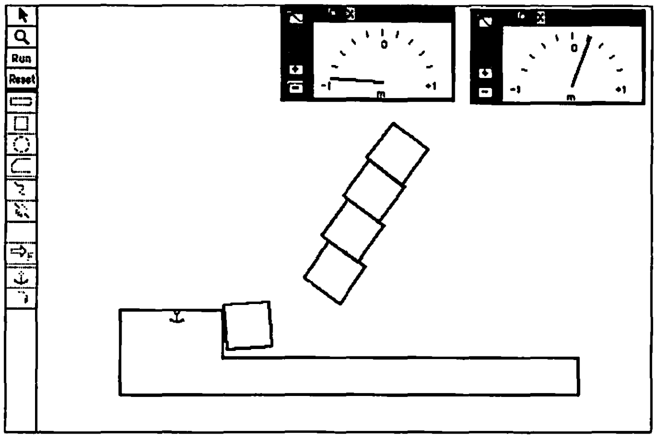


Figure 21-3

An experiment with falling blocks in Interactive Physics

ABOUT THE ...

Apple Global Education Network

Could children in New Jersey and Sweden compare notes about air pollution in their neighborhoods? Is it possible for students thousands of miles apart to collaborate on projects? With the Apple Global Education (AGE) network, it's not only possible, it's a reality. Students from all over the world are brought together.

This program was created by Dr. Martin Engel and the Education Research Team in Apple's Advanced Technology Group. The purpose behind the AGE Network is to create Macintosh-based global communication for teachers and students so that they may exchange ideas and learn from each other.

Potential schools are targeted for membership in the network by local Apple sales offices. If accepted, the school receives an address on AppleLink, Apple's global communications network.

With AppleLink, students and their teachers can send electronic mail to other schools all around the world. They can use AppleLink to read and post messages on the AGE bulletin board. As an example, students involved in a project on killer bees might post a message about their project and ask for information from other schools around the world.

POINT OF VIEW

Point of View, by Scholastic, is a graphic timeline of American history. Students compare events with other events that occurred around the same time. For example, right around the time William McKinley was elected president (November 1900), the first hamburger was introduced, and a gigantic hurricane slammed into Galveston, Texas. Students can move through history from 1756 to the present day, browsing through events in the arts, daily life, politics, Native American history, and twenty other areas.

MACWRITE II (SPANISH VERSION)

MacWrite II is available in a Spanish edition from Claris. (See Chapter 18, "Word Processing," for more information on MacWrite II.) The menu choices, dialog boxes, and Help facility are all in Spanish. This edition supports the Spanish character set and has a Spanish dictionary for its spell-checking function. A foreign-language word processor can help a student develop the ability to think and write in another language.

PROGRAMS FOR HIGHER EDUCATION

Universities were among the first to adopt Macintosh technology. Educators saw the Macintosh as an excellent instructional platform. It's easy to use and to network into other campus computer services. In fact, at some schools, such as Drexel University in Philadelphia, students are required to purchase a Macintosh. There, professors make assignments on the assumption that students have access to Macintoshes and know how to use them.

Today's higher education users break down into three groups: faculty, students, and administrators.

- *Faculty members* want access to academic information. They need to use powerful course-authoring software and to have sophisticated multimedia capabilities.

- *Students* want a system that is affordable and easy to learn, and they want to be able to connect to campus networks.
- *Administrators* have the same needs as business users. They need a system to handle budgets and schedules and access central databases.

With such a wide range of needs, just about every software application on the market has a place somewhere on campus.

ABOUT THE ...
Apple Student Representative Program

College students are encouraged (or even required) by their schools to use the Macintosh. However, much of the pressure to use the Mac comes from the student body.

To assist Apple's account executives and computer dealers, Apple created the Apple Student Representative Program. In this program, a student is hired by Apple to be its on-campus representative for the year. Apple keeps them busy.

Apple student representatives provide on-campus support by:

- setting up booths at events on campus
- publishing Macintosh newsletters
- forming and sponsoring user groups
- helping faculty members choose software solutions for their classrooms or labs
- demonstrating software
- providing information on Apple products

The Apple Student Representative Program is one of the best support programs in the computer industry.

TEACHER PRODUCTIVITY

Today's teachers have many demands on their time. The hours they spend in the classroom are only part of their job. They have to keep records on their students and develop tests and teaching materials. They must also attend meetings with other teachers, administrators, and parents. The computer is more than just an instructional aid—it helps teachers make better use of their limited time.

EDUCATOR HOMECARD

Educator HomeCard, by Intellimation, is a collection of HyperCard stacks developed by Apple Computer for teachers. The stacks help teachers keep track of students, plan and create lessons, and keep records of instructional materials. With HyperCard's ability to link items, a teacher can access information about a student's grades from the seating chart, then access information about a particular lesson from the gradebook.

Educator HomeCard comes with a stack of clip art for classroom use and a Help stack that can be printed out and used as a manual. Add-on applications that work with Educator HomeCard are available from the Intellimation Library for the Macintosh.

ADULT EDUCATION

Education does not stop with graduation from high school or college. In order to develop and improve skills (either for business or personal reasons), many people decide to continue their studies. For busy people, the computer can be a good teacher. Studies in this area break down into two categories: basic education (adult literacy and GED programs) and enrichment (such as learning a foreign language).

BASIC EDUCATION (LITERACY)

Concepts in adult literacy are the same as those used in literacy education for children. Elementary school applications can teach adults to read and write. The best ones to use are the simplest, such as ABKey and StoryWriter from KidsTime (mentioned earlier). These programs can be supplemented with programs developed especially for adult literacy. One such program is *Keystrokes to Literacy: Using the Computer as a Literacy Tool for Adult Beginning Readers*, by Antonia Stone (NTC Publishing Group, Lincolnwood, Illinois). This manual outlines methods to introduce computer skills and reinforce literacy in adults. The activities outlined in the book use an existing curriculum and "off-the-shelf" productivity programs.

Another resource text, *The Reading/Writing Teacher's Word Processing Companion* by Patricia Pollack (Institute for the Study of Adult Literacy, Penn State University), provides over 85 exercises on disk to teach basic word processing and literacy skills to adults.

ENRICHMENT

Adults like to learn and develop skills on their own. However, with the demands of a full-time job and a family, it is often difficult to find time to attend classes, too. A computer can teach you a foreign language, the secrets behind Beethoven's Ninth Symphony, or some new culinary techniques. CD-ROMs are a good way to browse through stacks of books. You can satisfy your curiosity or research a topic you've always wanted to know more about.

The Electronic Computer Glossary

If you read books and magazines about computers, you may from time to time come across words unfamiliar to you. In the dynamic world of computers, it happens often. Fortunately, you will probably find these words defined in the Electronic Computer Glossary by Computer Language. This HyperCard stack contains over 5,000 definitions of computer terms. These terms cover all computing environments, from mainframes to microcomputers and from networks to desktop publishing. A sample screen is shown in Figure 21-4. If you find a term *within* a definition you do not understand, you can select the term and go directly to its definition. The Electronic Computer Glossary includes charts and diagrams to illustrate many computer concepts. The glossary is updated twice a year.

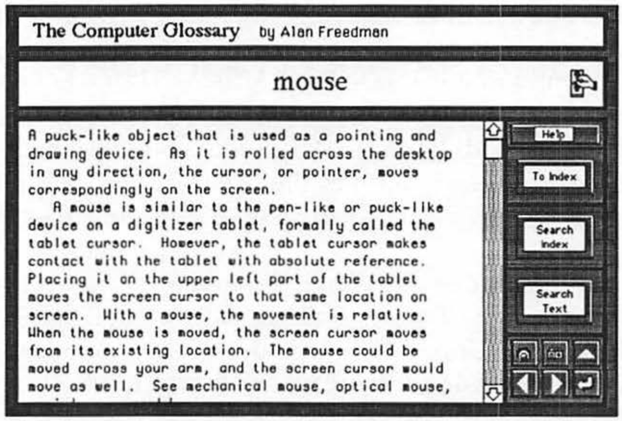


Figure 21-4
The Electronic Computer Glossary

THE FUTURE OF COMPUTERS IN SCHOOLS

Computers have become a basic part of education. Unfortunately, the idea of having a computer for every student in every school has not materialized. The barriers are the price of equipment, the cost of maintenance, and teacher reluctance.

FINANCIAL CONCERNS

School districts find it hard to finance all of the equipment and services they'd like to provide for their students. Often, when budgets are cut, computers are regarded as a large, expendable expense. Schools try to stretch their computer money by seeking grants and donations, and by keeping the equipment they have for as long as possible.

TRAINING TEACHERS

Another factor that limits computer use is teacher ignorance. When computers were first installed in the classroom, they weren't used. The teachers had no idea how to incorporate them into their curriculum.

It's a good idea to give a teacher six months to a year to learn about the computer before making computers available to the students. This gives the teacher time to get familiar with the computer and to choose the best software for the planned curriculum. Some school districts and teachers' organizations provide computer training to get their teachers off to a good start.

CHAPTER 22

COMPUTER-AIDED DESIGN

Computer-aided design, CAD, has totally changed the fields of engineering, drafting, architecture, and construction.

CAD, in effect, replaces common drafting equipment such as the T-square, triangle, and compass with the mouse, monitor, and plotter. Using CAD software can't make you another Frank Lloyd Wright overnight, but CAD can make the Mac an electronic drawing board for both the would-be and certified architect. With CAD you are able to draw floor plans of your house, add the fixtures and furniture, top the house off with a roof, and then lay out the landscape. It has revolutionized mechanical drawing, from a high-tech spaceship to a low-tech paper clip.

Specialized CAD programs help design electronic circuit and microchip schematics, highways and suspension bridges, America's Cup sailboats, high-fashion clothing, and DNA chains. CAD-like modeling programs will even sculpt stereoscopic images of surfaces and solid objects on the Mac's flat screen.

DIMENSIONS

Most architectural and mechanical drawing is performed with two-dimensional (2-D) CAD software. You draw X-Y coordinate objects that have height and width but no depth. Real-world objects in three dimensions are represented by drawing separate 2-D views. You draw onscreen individual plots of the object's top, sides, or bottom.

Three-dimensional (3-D) CAD software adds the extra Z coordinate—the depth dimension—to 2-D images. Three-dimensional objects are drawn on X-Y-Z coordinate axes which, for the purposes of perspective, are set at an angle to one another on the frame on your screen. In reality, each axis is at a 90 degree angle with each other axis. The objects to be drawn may also appear onscreen in skeleton-like wireframe, fleshed-out surface or full-bodied solid objects.

Knowing the exact 3-D coordinates, the Mac is able to redraw and display design objects in an unlimited number of ways. The object can be rotated and viewed onscreen at different angles and distances. The position of the imaginary sun illuminating the screen can also be changed to vary the object's shading and the shadows it casts. More important, a change made to one drawing view will be reflected automatically in all other views. Heighten a wall in the front view of a building and its height changes in the side and back views, or in the solid model views of the object. With 2-D CAD, any view effected by a change would have to be redrawn.

CAD BASICS

Drawing with CAD is similar to drawing with graphics and presentation software. CAD programs provide toolbox and menu command sets to produce basic, building-block graphic objects or "primitives" directly on screen. For example, you don't have to create and connect parallel pairs of horizontal and vertical lines to draw a square or a rectangle. Using the CAD toolbox you're able to draw rectangles, arcs, squares, circles, ellipses or other graphic object primitives on screen automatically.

ABOUT THE ...
Double Lines and Walls

Tools such as double-line drawing might seem to be frosting on the CAD cake, with little practical value. But consider the labor required to trace and join the double lines that go into room or floor plan design. CAD eliminates much of this line doubling drudgery. Programs such as Claris CAD enable you to draw double-line walls easily and quickly. Dialog box controls specify if the walls are to be drawn open or capped at end locations; snapped to the center, inside or outside of the pointer position; how the wall angles and joints are drawn; and the spacing between the double lines that make up the walls.

You can move about onscreen objects and position them freehand with a mouse or a digitizer tablet. Or you can specify the precise place and dimensions by keying in the object's exact coordinates and size. A snap-to CAD feature helps when positioning, moving, or grouping objects onscreen. Like a magnet attracting a needle, objects are pulled towards and locked onto snap-to points. The points can be a grid coordinate or an axis common to a group of objects; the middle of a circle or an ellipse; the midpoint, corner, or tangential surface point of an adjacent object.

CAD editing commands such as Undo, Cut, Copy, and Paste work with graphic objects similar to the way their word-processing counterparts work with text. Other CAD editing is performed with special tools which can move and rotate, reshape and resize, duplicate and mirror, fill in and paint over, link and group objects. Figure 22-1 shows an example of the Mirror editing tool available on Claris CAD.

Dimensioning, the ability to label lengths, angles, areas, or even volumes automatically, is another important feature provided by CAD software. Click the beginning and end points of a line, and the program will label its length automatically. Move the side of an angular object, and the new values for degrees, minutes and seconds will appear. Change the overall shape of an object, and all of its dimensions will be relabeled.

These are just some of the features and functions available with CAD programs. Industrial strength packages have hundreds of different tool,

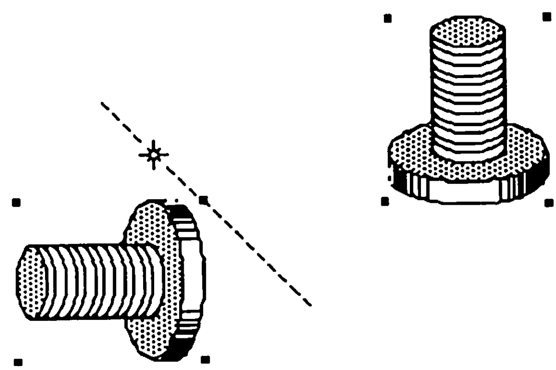


FIGURE 22-1
Clicking the Mirror editing tool on Claris CAD produces a mirror image which you can then rotate by dragging the dotted line

method, and command combinations for drawing, editing, and labeling graphic objects. It takes more than a "one-night stand" for anyone to get the hang of most programs. But take heart. You don't have to become a CAD master and learn the ins and outs of everything. A working knowledge of 20 to 30 functions should make you a productive CAD designer.

BUILDING BLOCK LIBRARIES

Graphic primitives such as lines, arcs, circles, or squares are the basic building blocks used to draw more complex graphic objects. These objects, in turn, are combined or grouped with additional primitives to draw the final plans or models. Figure 22-2 shows a simple example of how primitives can be used to draw more complex objects. A large rectangle, two small rectangles, a triangle, and lines are used as building blocks to draw the graphic object or symbol representing a twin bed.

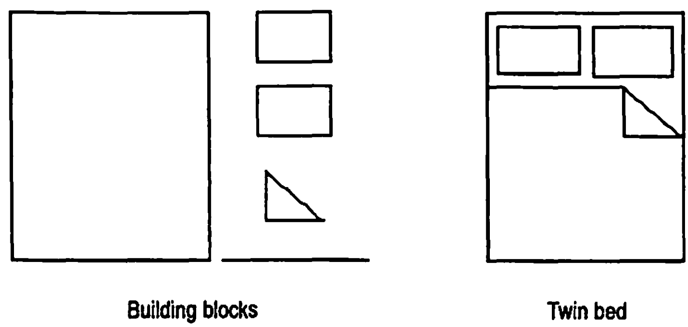


FIGURE 22-2
Drawing a graphic object using primitive building blocks

More complex and sophisticated objects are created in a similar fashion using primitives combined with other primitive-built building blocks. Figure 22-3 shows an arch drawn with Generic Software's CADD program (the extra *D* stands for drafting). This arch was formed by using combinations of straight-line primitives and objects drawn from a symbol library. (Generic terms its library a "list.") Most CAD programs provide similar library facilities for storing graphic objects or blocks of text that are used frequently. These building-block libraries can hold newly drawn objects and objects copied from other documents. Libraries speed the drawing process. Instead of drawing an object from scratch each time it is needed, it's drawn once and stored in a library. The object then can be copied from the library and pasted onto the screen. As an example of how drawing from libraries works, let's use the Symbol List of Figure 22-3 to draw a new arch.

Prefabricated symbol objects are pasted onscreen automatically by clicking the appropriate word in the list (library) dialog box. Clicking "Column" draws a new column object onscreen. The column can then be positioned and grouped together with other columns, arches, pedestals, sconces, and so forth to form a totally new object. The triple arch gateway shown under construction in Figure 22-4 is being drawn in this way using the Symbol List used to draw the single arch of Figure 22-3.

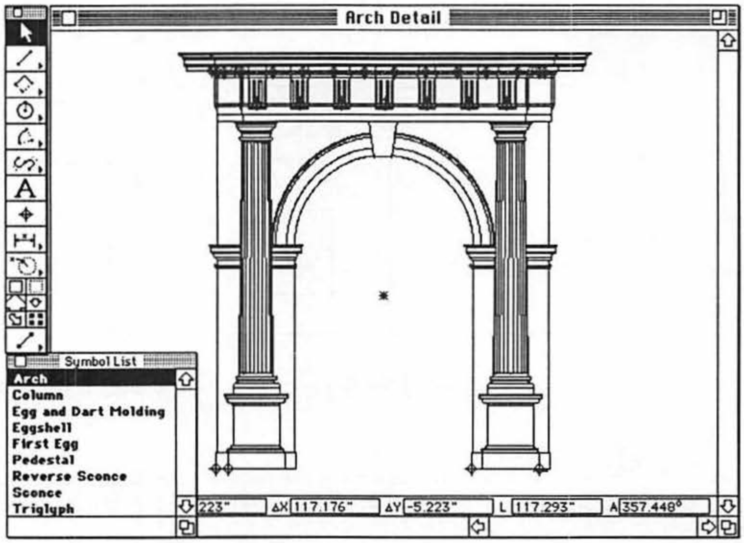


FIGURE 22-3

Arch designed with Generic CADD using line primitives and objects pasted from the Symbol List (library)

In addition to growing your own objects, you can also purchase ready-made, clip art object libraries. Most CAD software vendors offer extensive, industry-specific object libraries in support of their design programs. Libraries hold symbol collections of furniture, appliances, and room fixtures; cams, pulleys, and gears; trees and shrubbery; diodes, transistors, and logic modules; windows and doors; ducts, pipes, and wiring; nuts and bolts; and other component parts of a building, machine, or circuit.

Libraries can also be used in other ways. Several CAD programs can count the number of times each library object is used in a drawing or design. With such capability, you could obtain the total number of partitions, desks, chairs, and tables used to furnish an office building. Some CAD programs can store information about the object in the library. This could include the object's price, building code specifications, the supplier's name and address, and other related data.

Want to know the cost of the materials needed to build your house? A few CAD programs can use this stored object information to generate a

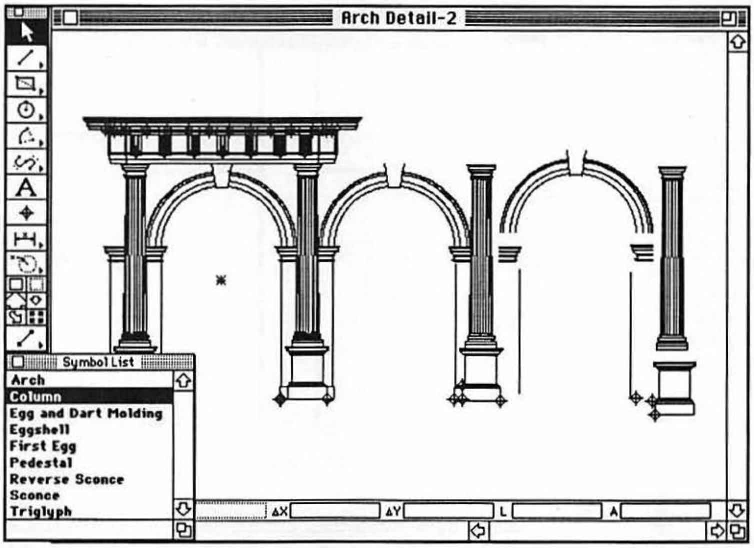


FIGURE 22-4

Designing a three-arch gateway with Generic CADD using the symbol objects of Figure 22-3

bill of materials (BOM) report, an invoice, and an order form based on the total numbers and costs of the objects used in a design.

DESIGN LAYERS

Most CAD programs allow you to work with separate overlay or layer drawings to portion out the design work or decrease object clutter when drawing. You could, for example, start by laying out the bare walls of a room or building shown in Figure 22-5. Next, you might flesh the walls out with a number of other separate drawing layers showing the furniture (Figure 22-6), fixtures, windows, and doors (Figure 22-7). Then you could combine the layers together to resolve any design conflicts, and obtain a completed view of the final floor plan (Figure 22-8).

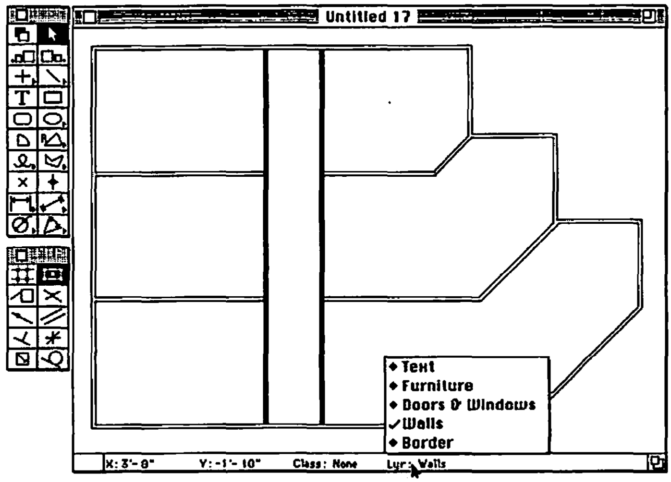


FIGURE 22-5
Walls layer of an office floor plan designed with Graphsoft MiniCad+

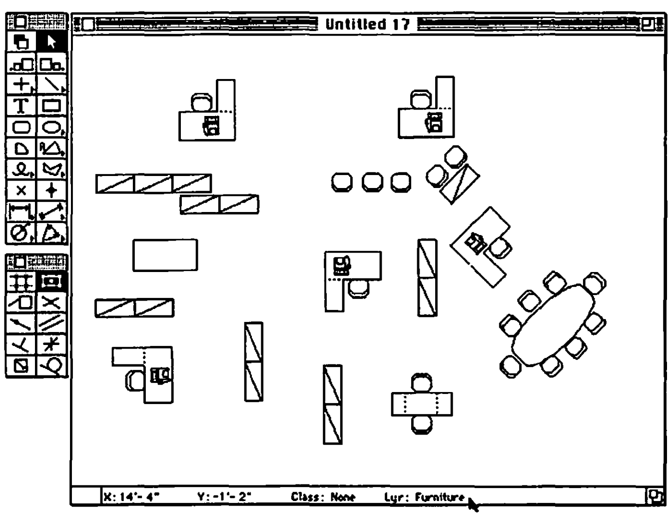


FIGURE 22-6
Furniture layer of MiniCad+ office floor plan

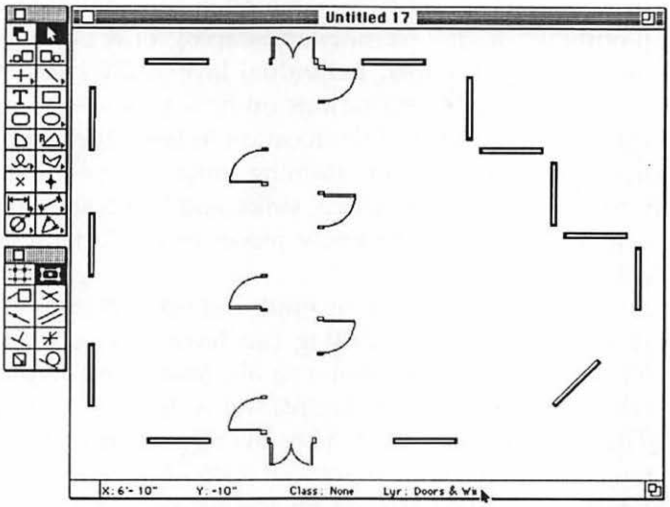


FIGURE 22-7
Doors and windows layer of MiniCad+ office floor plan

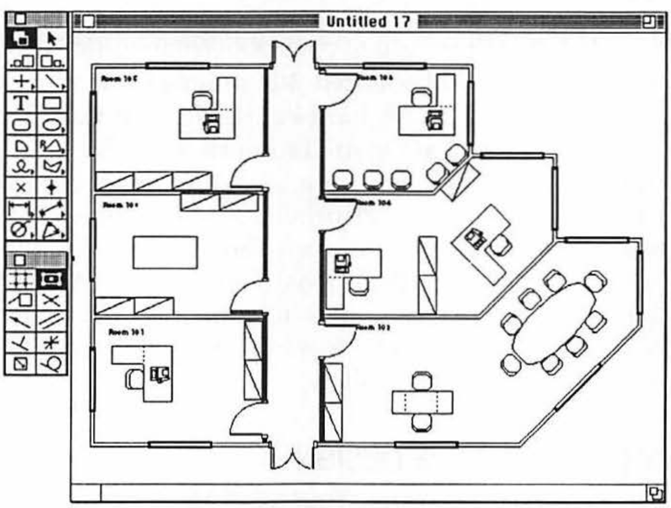


FIGURE 22-8
All layers of the MiniCad+ office floor plan

Architects use separate layers to draw electrical wiring and lighting plans; the HVAC (heating, ventilation, air conditioning) layout; pipes and plumbing; or the exterior landscaping of a building. When printed or plotted out on paper, individual layer drawings provide the electrical contractor with specifications on how to wire the building. The heating contractor would find the location to hang the duct work, and to install the furnace and air conditioning units. The plumbing contractor would find where the pipes, drains, sinks, and toilets should go. The landscaping contractor would also know places to plant the greenery and pave the sidewalks.

Layers are also used as guides or masters to produce other drawings. A multistory office building can have a floor plan showing the fixed location of objects common to all floors such as the exterior walls and windows; the interior columns, stairwells, elevator shafts, and rest rooms. This plan becomes the master overlay for drawing the different interior wall and room arrangements of each floor. Similarly, an electrical wiring master could be overlaid on top of each floor plan, and then quickly modified to accommodate the different room arrangements.

WHAT TO CAD AROUND WITH

Modeling the world to your dimensions with 3-D CAD can be fun, but it's also costly. Full-featured 3-D programs retail for $500 or more, and you'll need some heavy hardware to do them justice.

Basic equipment required to work in 3-D includes a memory-rich, 4M or more, Mac IIci or IIfx (or a IIsi with a math coprocessor), lots of hard disk storage, and a laser printer. Strongly suggested options include a two-page display, a graphics accelerator board and a B-size (11 by 17-inch) plotter. You'd better be serious about working in X-Y-Z coordinates on a daily basis. Otherwise, stick to drawing objects in 2-D. Casual home planners should consider low-cost programs. Brief descriptions of some of the better programs follow.

LOW-COST CAD FOR HOME DESIGN

Abracadata's Design Your Own Home series is a three-program set with an Architecture package for drawing floor plans, top and side building views, and structural details. Furnishings and color schemes can be added using a separate Interiors program. A Landscape module performs the yard work.

Drawing, editing, and dimensioning functions provided with Design Your Own Home programs are not as extensive as those offered on the larger and more expensive packages. You're also limited to architectural design and won't be able to draw camshafts or circuits. Abracadata includes surprisingly good symbol libraries and sample plans with these bread-and-butter building programs, and they're cheap. Each member of the series retails for under $70, and can run on Classic or Portable as well as the bigger Macs.

DRAFTING PROGRAMS

A step up in 2-D functionality (and price) includes drafting programs such as Graphsoft's Blueprint and Innovative Data Designs' MacDraft. These $200 to $300 CAD packages can draw creditable mechanical assemblies as well as architectural floor plans.

FULL-FEATURED TWO-DIMENSIONAL CAD

For doing journeyman 2-D work at $500 to $700 prices, try programs such as Generic CADD or Claris CAD. Both provide almost everything you could want or might dream up in the way of 2-D drawing tools for designing buildings to engines. Both come with other niceties, such as software drivers for blueprinting final plans with plotters; graphic file exchange utilities for exchanging drawings with other CAD systems; and complete, easy-to-understand documentation. Claris even includes an online HyperCard Help stack to quickly demystify most of the mysteries of CAD's toolbox.

THREE-DIMENSIONAL PRODUCTS

If you want to test more solid 3-D waters, try CAD programs such as Graphsoft's MiniCad+ or DesignCAD's 2D/3D. They also retail for $500 to $700, and provide a good set of 3-D capabilities at 2-D prices. Both are very adept 2-D drafters and are worth considering even if 3-D isn't a part of your plans just yet. MiniCad+'s Worksheet—an integrated database/spreadsheet feature—can be used to calculate design cost estimates and BOMs. This feature alone makes MiniCad+ attractive to users who may not have an urge to draw in 3-D.

POWERFUL (AND EXPENSIVE) CAD PACKAGES

Powerful and expensive 3-D programs such as Gimeor's Mac Architron II or Autodesk's AutoCAD are best utilized by professionals. But if you're an amateur with $3,000 or more to draw upon, here's what these programs can do.

Mac Architron II, as its name implies, is tailored specifically for architects and others in the construction or building trades. The program has three modules covering every aspect of building design and construction from producing the plans, to estimating the costs, to obtaining the permits. Architron's Versatile/2D module draws, layers, and decorates the floors, sides, and roofs of the building in X-Y fashion. A companion Volumetric 3D module generates solid model perspectives of room cut-aways, floor cross-sections, and complete building designs. It also includes shadowing functions that produce almost lifelike walk-through views of rooms and floors and their furnishings. The third Quantifier module does all of the accounting, and provides a room-by-room, floor-by-floor breakdown of building areas, volumes, materials, fixtures, costs, and so forth.

Autodesk's AutoCAD is the granddad of all CAD programs and has the largest following of users. The majority, however, do their CAD work on the PC rather than the Mac. This PC orientation is both a plus and a minus. PC and Mac versions of the program are written in AutoLisp, Autodesk's CAD programming language. This guarantees Mac AutoCAD users will receive strong third-party vendor support in the way of customized applications, symbol libraries, and other program enhancements. Close to 500 developers write vertical market software for AutoCAD for applications ranging from road building to drilling oil wells. But the Mac tail never wags the PC dog. Autodesk always enhances the PC edition long before the Mac's. Release 10, the present AutoCAD version for the Mac, does most every 3-D thing extremely well. But the program does lack the AME (Automatic Modeling Extension) solid modeling features available with Release 11—the current PC version of AutoCAD. As such, AutoCAD for the Mac can't compete at a 3-D visualization level with CAD programs such as Mac Architron II.

OTHER CAD WARES

Electrical and electronic engineers use CAD to design circuits or schematics, which are drawings showing how diodes, resistors, transistors, and more complex circuit components are wired together. Regular CAD programs fitted with electronic libraries can be used for most circuit layout work. Heavy wiring is usually drawn by specialized CAD programs such as Capilano Computing's DesignWorks or Douglas Electronics' CAD/CAM Professional. These programs are able to simulate how signals will flow through the final circuit design. CAD/CAM Professional will even rearrange the schematic into a printed circuit board, and then instruct a board-making machine on where to drill the holes and insert the components.

Engineers, designers, and commercial artists also model objects in 3-D. Programs such as Paracomp's Swivel 3D Professional or Ray Dream's Ray Dream Designer are dedicated to such 3-D visualization tasks. With them you first draw a 2-D image of the object and then mold it into a solid 3-D model. Like modeling blocks of clay, objects are shaped and smoothed as 2-D drawings and then converted into a finished solid (see Figure 22-9).

Numbers of separate 3-D objects can also be linked together to create bigger, more complex solid models. Ray Dream Designer, for example, can furnish an onscreen room with hierarchies of solid model objects such as a fireplace mantle with lighted candles; a table with coffee mugs, bowls,

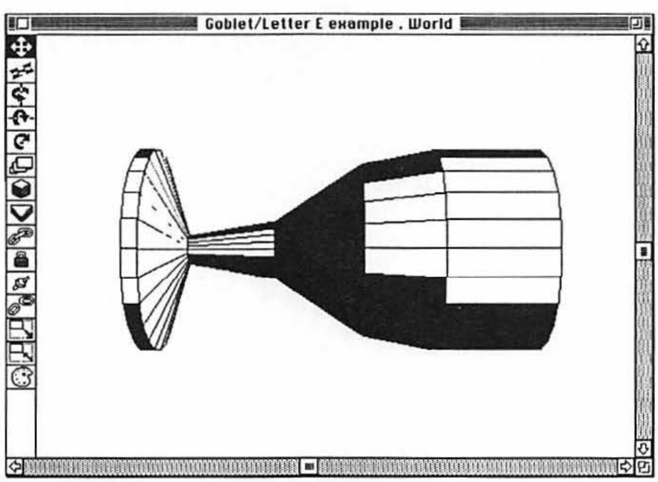
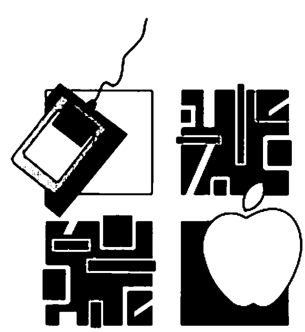


FIGURE 22-9
Three-dimensional goblet model drawn with Paracomp Swivel 3D Professional

and dishes; chairs; windows; and a picture on the wall. Each 3-D object in this domestic scene is itself built from other objects and then pasted and positioned into place. In paintbrush fashion, imported graphics may be mapped onto model surfaces. The picture on the wall can be mapped with an image of a Van Gogh or Picasso, the window with a vista of blue sky, the table with an oak veneer.

Swivel 3D, living up to its name, will even construct solid models that twirl about. The 3-D objects comprising the model can be linked together by flexible as well as inflexible joints. Combined with a Swivel 3D "tween" or animation feature, the solid models can bend, twist, and rotate as well as move laterally up and down onscreen. A furniture designer, for example, could present an animated solid model of an office chair design that tilts back and forth, rotates, and rolls around. Or a mechanical engineer could build a live-action 3-D engine model onscreen where the pistons, cams, and camshaft move about.

All this sounds like, and is, great fun, but 3-D modeling, like 3-D CAD, isn't a quick learn and doesn't come cheap. Program costs are in the $400 to $700 range, and you'll need a big, colorful, memory and disk-packed Mac.



CHAPTER 23

NETWORKING

Networking is a loosely applied term. It usually means a system of computers, terminals, and nodes, and all the connections. These connections can include cables or lines (copper wire or fiber optic), a trunk circuit (an interconnecting telephone cable between two large switching machines), orbiting satellites, microwaves, and medium- and long-wave radio.

Networking is also a term applied to a small-scale connection in one room, office, building, or plant. A network can be a *local area network* (LAN) or a *wide area network* (WAN).

LANs offer high-speed data communications to directly connect different computers. They offer a low error rate and a means to share information and software among many users. *Gateways* are used to connect LANs, or to connect longer-distance networks.

A WAN is different from a LAN in that it may contain more than one local area network and can encompass a greater distance. The WAN may be used to interconnect hub sales offices, different plants, offices on different floors in a large building, or offices in different cities.

Networking has also come to mean simply hooking a personal computer onto a bigger computer like a mini- or mainframe computer by means of a direct connection (not through a modem). Or, it can mean to hook the personal computer to another computer.

WHY NETWORK?

Networks are a convenience. They make it easy to move files from machine to machine. They allow several people to work on the same file, for instance, a database. (It is similar to multi-user computing, but less expensive.) Networks allow a number of users to share a single, expensive printer or other peripherals. They also allow you to monitor workers on the network.

E-mail is the main reason networks get hooked up in the first place. E-mail is a fast, inexpensive way to send and receive memos. Memos may be sent from station-to-station, through a gateway to other E-mail systems, or to employees in the field. E-mail can be forwarded, edited, broadcast (to everyone on the network), and archived. All this is done quickly. It is efficient and saves copy paper, postage fees, interoffice mail, file cabinet space, and garbage (the circular file cabinet method of filing). For more information on the larger E-mail systems, refer to Chapter 12.

Arguments against networking include:

- lack of privacy
- problems with the network which prevent everyone from working
- the need for a network administrator on more involved networks
- the complicated nature of networking

Of course, compared to other networks, Apple's basic network system, AppleTalk, is easier than most. In fact, it's the single most used network in the world. This is because most users are "networked" when they don't even realize they are. (If your Mac is hooked up to a laser printer, you're already networking because a laser printer will only "talk" to the network port.)

NETWORK ARCHITECTURE BASICS

The way a network is strung together is called its *architecture.* There are set rules about this. A network design must take into account how the information is to be encoded, error control, flow control, and how to address the users on the network. Two of the more common network architectures are OSI (Open System Interconnection), which is favored by the International Standards Organization (ISO) and SNA (Systems Network Architecture), used in the IBM mainframe environments.

Encoding

Encoding is changing a message from one symbolic form to another without the loss of information. The process of changing the data is called encoding and changing it back is called decoding. On a network the information must be changed from the form it's used in the computer (electrical impulse) to a form that can be transferred across a connection (sound or light impulses). Then at the other end, the data must change back into a form which can be used by the computer.

Error Control

Error detection and correction is an important part of transferring data. Errors must be corrected for the information to be identical.

CRC, Cyclic Redundancy Check or Code, is a widely used error control scheme. Extra digits are placed at the start and end of a block of data. If an error happens, the location of the bad data is identified, and that block will be sent again.

Flow Control

The rate at which the data is shipped and received is based on flow control. There are two kinds, end-to-end and hop-by-hop. End-to-end control limits the flow of data based on the capacity of the final destination (how fast the computer can suck up the data). Hop-by-hop controls the flow based on how fast the data can move down the line to each individual user and each connection. This method is usually based on the slowest link in the network.

Addresses

Addressing identifies the location of a user in the network. Usually the address is for the physical location of the user in the network, not the actual user. There may be different "layers" of addressing. The data link level may address a specific user station, the network level will identify the source and destination of the data, while other addressing levels will be associated with different connections or processes.

Network addressing is very similar to your home address: the building number, apartment number, street name, city, state, and zip code. Each item addresses a different level, but together they give your exact location. It is a hierarchical addressing system: addresses are grouped to reflect relationships among related addresses. (For instance, a zip code which begins with a 9 is associated with the West Coast.)

NETWORK DESIGN

There are many different ways and theories on how to wire a network. The interconnections can form a star, a ring (or loop), a bus, or a hybrid of these.

A star has a single central point, like the center of a bicycle wheel, with the users connected at the end of each spoke. Sometimes the end of each spoke will also be a hub, with more spokes radiating out like a tree branch.

A ring, or loop, is a circle of computers. The information usually flows in one direction, and if the connection is broken at any location all the terminals cease to communicate. (Like a set of cheap Christmas tree lights.)

A bus network (such as Ethernet) has information flowing in both directions. Data flows in and out as needed or sent. It's not cyclic.

NETWORKING THE MACINTOSH

AppleTalk is Apple's local area network protocol (the network communication scheme built into every Macintosh). It provides a standard, consistent method for users to attach to network services. These services include file servers, printers, and communications (such as network modems that dial out over telephone lines to computers in other networks). The access method, connection, and security are accessed and used in a consistent way (from the user's perspective) across any type of network device that is AppleTalk-compatible (set up with devices which follow the design rules set up for AppleTalk).

The Macintosh was designed to network to many other computers. The AppleTalk network system has an open, layered protocol on which a wide range of network services is built. (The layers are like building blocks placed on top of one another.)

ABOUT THE ...

OSI and ISO

AppleTalk is consistent with the Open Systems Interconnection reference model as defined by the International Standards Organization. The OSI has layers of communications standards. These include: the physical, data link, network, transport, session, presentation, and application layers.

- *Physical layer* This layer is the cabling and the electrical interface.
- *Data link layer and network layer* These are the functional connections between your Macintosh and another computer.
- *Transport layer* This provides the control to get the data from one place to another.
- *Session layer* It allows for the delivery of sequenced packets (chunks of data), as well as coordination of activities across network zones (a zone is a grouping of devices in a network that makes it easier to locate and access network services).
- *Presentation layer* At the presentation layer, file services (conversion of file formats) and control representation of information takes place.
- *Application layer* The applications layer handles network-based applications and utilities. The layer makes sure the information gets delivered from point A to point B.

PORTS

The Macintosh has three ports in the back used to communicate and network. These ports make the installation to a LAN or a WAN an easy task.

Serial Port

The first of the two serial ports is also known as the phone or modem port. It is identified by a telephone handset icon on the back of your

Macintosh. This port is an RS-422C communications port. It connects your Macintosh to local, non-networked printers or to modems for dial-out services. This port is often used for modems or fax modems.

AppleTalk Port

The second RS-422 serial port, the AppleTalk port, is more commonly referred to as the printer or network port. It is identified with a printer icon on the back of your Macintosh. It connects Macintoshes to printers on the network, file servers, modems that can be accessed from the network, routers, and gateways for host connectivity. This serial port has AppleTalk network software built into it for plug-and-play networking.

SCSI Port

The SCSI port is the port usually used to connect hard disks and CD-ROM drives. It is a high-speed communications port where high-speed network devices can connect to the Macintosh.

FILE SERVERS AND FILE SHARING

A file server is the traffic cop of the network. It provides service to the terminals by managing a shared resource, usually a centralized hard disk. There are also printer servers (to share a single high-speed printer) and communications servers (to provide connections to gateways, other local area networks, or public networks like MCI, or CompuServe).

File servers allow two or more machines to share each other's information, or to allow multiple machines to share files and applications from a centralized hard disk. The ability to share files, and to connect to file servers for easier file access, can be accomplished in a number of ways.

AppleShare

AppleShare is Apple's file server software. Within an AppleTalk network system, an AppleShare file server provides a location where a user on the network can store and access commmon files without disrupting other users' activities.

With AppleShare file server software installed, a Macintosh computer with one or more hard disk drives (or CD-ROM drives) can become a dedicated file server. (A *dedicated* file server is a computer used exclusively to store and share information.) An AppleShare file server can also be configured as an AppleShare print server to enable many users to access up to five different printers on their network, or an E-mail server for the distribution of mail around the network.

Each hard disk attached to an AppleShare file server is called a *volume.* When a user selects a volume, its icon appears on the user's desktop. The volume then functions the same way as any attached disk drive. Apple II and PC users who have been connected to the network with an add-on board can also select volumes from the file server (but they don't use icons). Within a volume, files are stored in folders. Folders on an AppleShare server volume are used to organize and store files, just as manila folders are used in a file cabinet. Each folder has an owner. (The owner of the folder may determine which users have access to the folder.)

FileShare in System 7 FileShare is an extension in System 7. It allows ten folders per Macintosh to be shared by up to ten users simultaneously. This feature to share files gives you file access without a dedicated server. PC users on an AppleTalk network can access these folders as well.

DataClub

DataClub from International Business Software uses a new concept in file sharing. It allows each Macintosh user to harness the collective power of a network by combining computing and storage resources. Then they are made available to everyone in the network. It is based on the concept of parallel sharing.

Parallel sharing collectively saves and retrieves from any hard disk on any computer in a network. The combined disk space on all the machines makes up the total size of the file server disk.

The drawback of parallel sharing is that users connect and disconnect at will. If Joe turns off his machine and your files are on Joe's Mac—too bad for you. You won't be able to access the files until he reconnects to the network.

MacintoshTops

MacintoshTops from SITKA is a network system for either dedicated servers or peer-to-peer. *Peer-to-peer* networks allow direct access to another user's computer to view, copy, or share files. This program allows for networking between System 7 and 6 Macintoshes as well as DOS PCs and Sun workstations.

ABOUT THE ...
Fiber Optic

A fiber optic cable is a special glass or plastic "wire." It is able to transmit data by modulating light. The fiber can carry light—shine a light at one end and it will come out at the other end. It is less expensive than copper wire, lightweight, and allows a cleaner transmission. The optical fibers are nonconductive.

Early uses for fiber optic cables included military applications where copper cable presented a safety hazard. Since no electromagnetic radiation is emitted from the cable, it is hard to "bug," or tap into the cable (it's more secure from a James Bond point of view). There are a variety of different fiber optic cables in use. The differences are mainly in the optical density of the fiber from core to edge. These differences affect the way light moves down the cable, the wave lengths, and the number of signals which can move at the same time.

For a long time there has been talk of the Bell telephone company moving to fiber optic cables; however, the cost and effort to rewire the country seems overwhelming (especially with the break-up of big Bell into a zillion baby Bells). However, fiber optic is a perfect choice for LANs. Sprint is entirely optic now, and optic is common in long distance lines, in all uses and companies.

Files can be translated between a PC and Macintosh with built-in MacLink/Plus translators. (*Translators* are programs that take the formats and information from one computer and move them into the formats on another, for example, from Macintosh to PC, or visa versa.)

Novell NetWare File Server

NetWare for the Macintosh allows AppleTalk interaction with Novell networks (a LAN controlled by one of Novell's operating systems, such as NetWare). This gives the Macintosh the ability to connect with services shared by DOS, OS/2, or Windows PCs. To the Macintosh user information stored on the NetWare server is seen as icons. To the PC user Macintosh files and folders are seen as directories, subdirectories, and files in their familiar format. Macintoshes can connect to a Novell network using LocalTalk, Ethernet, or TokenRing.

ABOUT THE ...

Farallon Computing

Farallon has become a leader in the development of networking hardware, software, and management tools. Founded by Reese Jones, Farallon Computing got its start by putting a simple idea in use.

The typical telephone jack has four wires—red, green, black, and yellow. The red and yellow wires were needed for the old "ringer" telephones of the past. The ringer mechanism needed a ground, and the ringer needed a wire to give it the juice for it to ring. The handset uses the green and black wires.

When the telephone system moved to the modular system, the new telephones no longer needed the extra juice and ground to ring. The red and yellow wires fell into disuse.

Reese Jones figured these wires were good for something. After all, there were two unused wires which already existed within the phone cabling installed in the building. What a great way to run a cheap, small local area network. He called the brainstorm PhoneNet. (The result: he drives a Ferrari.)

Farallon's product line has expanded to include a wide variety of products. To name a few: PhoneNet connectors; the associated products like the Passive and Active Star Controllers; PhoneNet Ethernet cards; connectors; Timbuktu and Timbuktu remote software; NetAtlas (for network diagramming); and Traffic Watch (for network control and statistics).

CABLES AND CONFIGURATIONS

There are many ways to string together a network. Most of the products on the market for networks are a combination of cables and connectors, "do-hickeys and thingy-stuff." There are limitations on the number of devices (Macintoshes, printer, and the like) which can be connected to a network, the space between each device, and the total distance of the entire network.

LocalTalk

LocalTalk is Apple's popular implementation of the AppleTalk protocol. It is an AppleTalk network system connected by LocalTalk cabling.

Originally, LocalTalk was implemented over a shielded, twisted-pair cable manufactured by Apple. Other companies (such as Farallon) offer LocalTalk connection in a different scheme (unshielded twisted-pair wire).

The connection (cables, connectors, and cable extenders) is the only missing ingredient to attach any Macintosh to a LocalTalk network. Hardware and software to make LocalTalk work are built into every Macintosh. The port used in a LocalTalk network is the printer port on the back of the Macintosh.

LocalTalk twisted-pair cable supports a maximum of 32 devices (printers, file servers, and modems) and allows transmission speeds of up to 230.4 kilobits per second (Kbps). A LocalTalk network can span up to a total of 1,000 linear feet.

PhoneNet

PhoneNet from Farallon Computing allows devices on an AppleTalk network to communicate over ordinary telephone wire. PhoneNet Connectors come in three models: Mini DIN-8 plug, DB-9, and DB-25.

- A Mini DIN-8 is on the back of every Macintosh (except the original Macintosh 128 and 512K/Ke machines) and on LaserWriter II NT, NTX, and the Personal LaserWriter IINT.
- The DB-9 plug is on the original Macintosh 128 and 512K/Ke machines, LocalTalk PC Card and LaserWriter and LaserWriter/Plus.
- The DB-25 plug is on the old Apple Lisa and (the repackaged Lisa) the Macintosh XL.

PhoneNet can run AppleTalk a total distance of 3,000 feet at 230.4 Kbps. The network can be configured as:

- *A simple daisy chain network* In this arrangement the devices are connected in a line, one after the other. If the chain is broken, all the devices connected after the break don't work, but the ones prior to the break aren't affected. (It's like that children's game "crack the whip." A bunch of kids join hands, and as the ones at the end of the "whip" get thrown off, the others continue to play the game.)
- *A passive star* As shown in Figure 23-1, the devices radiate out in a hub from the center point without any additional processing. The devices sit silently and work independently.

- ▶ *An active star* This is a network design similar to the passive star, except signals are regenerated from the central hub, as shown in Figure 23-2.

Ethernet

Ethernet is a local area network developed jointly by Xerox, DEC, and Intel. It permits AppleTalk network protocols to run on high-speed Ethernet coaxial cable or twisted-pair. This is a high bandwidth medium. (*Bandwidth* is the transmission capacity—the total number of data channels moved along the network at a time. It's like a freeway, the more lanes—the more cars.) A big, wide, high bandwidth is preferable for heavy traffic networks. It's also good for long distances. (LocalTalk can only travel so far.) Ethernet allows data transmission speeds of up to 10 megabits per second (Mbps).

Ethernet supports up to 254 active AppleTalk users on a network. The limit is 1,023 total devices (printers, file servers, and so on).

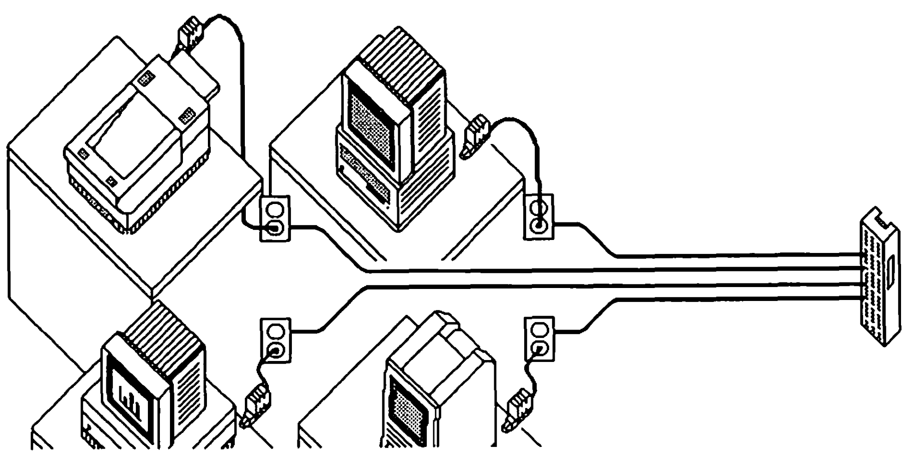


FIGURE 23-1
Passive star PhoneNet configuration

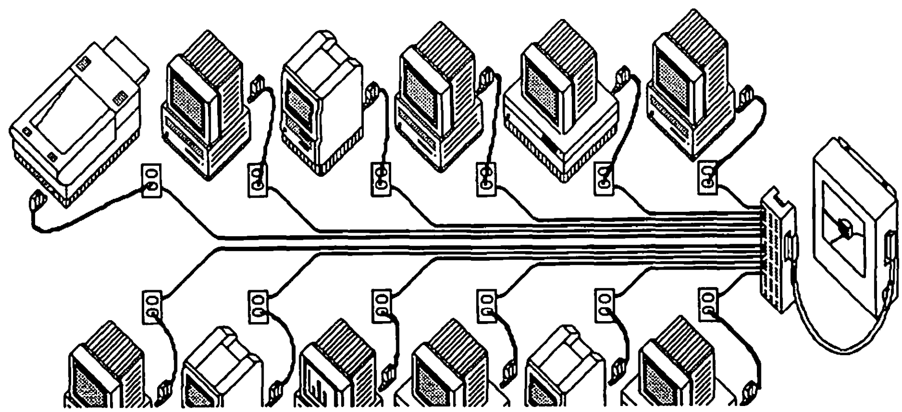


FIGURE 23-2
Active star PhoneNet configuration

There is a choice of either thick or thin Ethernet cables to connect the network. The differences are described here:

- Thick (standard) Ethernet cable allows a maximum of 200 nodes per 1,640-foot segment, with 8,202 feet the maximum network length.
- Thin Ethernet cable allows 30 nodes per 656-foot segment over a maximum of 3,281 feet.

An Ethernet network is often part of an internet. (An *internet* is two or more networks connected by routers—devices to route traffic between the networks.) Ethernet can have different information on its cable without interference between pieces of information. Figure 23-3 shows an Ethernet configuration.

TokenRing

TokenTalk permits AppleTalk network protocols to run on a high-speed TokenRing. A TokenRing is an IBM LAN design. Access to the network is controlled by a unique signaling sequence—called a Token. When a device is not signalled by the Token it is unable to access the network.

TokenRing allows data transmission speeds of 4 or 16 Mbps. Current Mac implementations only run at 4 Mbps. Sixteen Mbps service will be possible sometime in 1992. This high bandwidth medium is for heavy traffic networks. A variety of network environments are supported, including AppleTalk, IBM 3270 (for computers connected to IBM mainframes), APPC (Advanced Program to Program Communication), and SMB (Server Message Block, a file sharing protocol for IBM's PC Network and LAN Manager).

Apple's TokenRing software supports AppleTalk Phase 2. (This is an extension of AppleTalk with flexibility to address devices connected together.) Other protocols run over IEEE 802.5 TokenRing networks (IEEE are standards developed by the Institute of Electrical and Electronic Engineers). Figure 23-4 shows a TokenRing configuration.

File Transfer and Conversion

When you need to get a file from your Macintosh to a PC, or from a PC to a Macintosh, file transfer is the vehicle to use. File transfer allows you to move files between Macintoshes and other systems, while translating one application format to another.

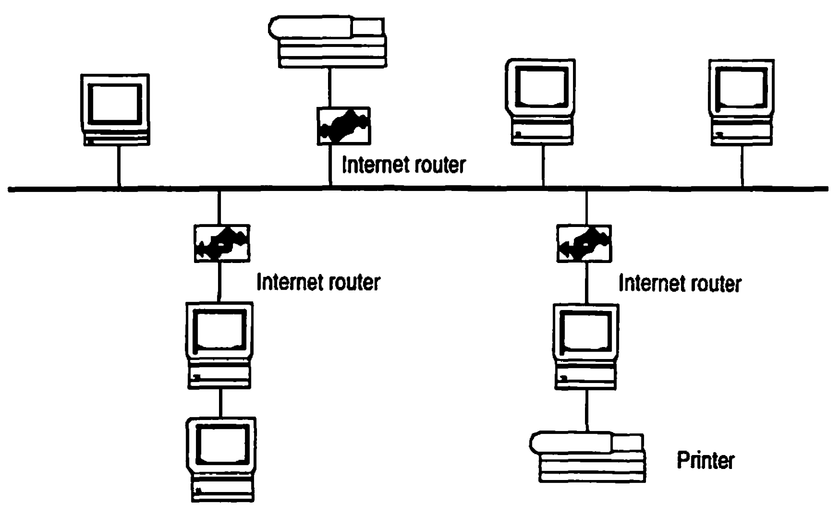


FIGURE 23-3
Ethernet configuration

Apple File Exchange

Apple File Exchange allows you to exchange information from different computer formats. The formats it covers are MS-DOS, ProDOS (The disk operating system of the Apple II computer family) and another Macintosh.

Apple File Exchange, or AFE, ships with every Macintosh operating system. It opens up a window that shows you the contents of the folder, floppy disk, or hard drive you want to transfer a file from or to, as shown in Figure 23-5. AFE shows you two listings of files, one on the right side of the screen and one on the left so you can decide which file to move from what listing.

AFE moves files without any translations (it leaves the file in its original format but just moves it from one system to another). However, it can use a plug-in translator.

Another feature of the AFE application is its ability to format floppy diskettes. It can format 400K, 800K, or 1.4MB floppies for Macintosh formats. It will handle ProDOS formats or the Apple II, and it will format MS-DOS diskettes in 720K, 1.4MB, or PC 5.25 drive, 360K diskettes.

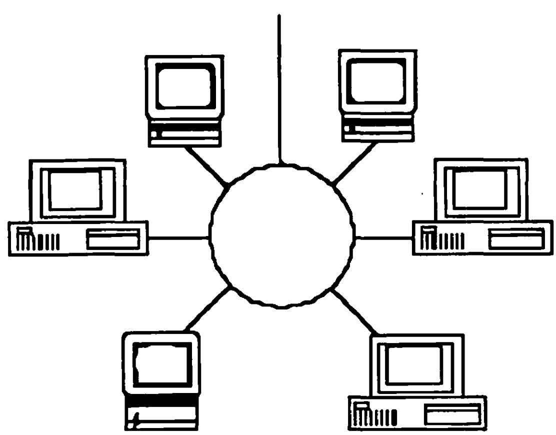


FIGURE 23-4
TokenRing configuration

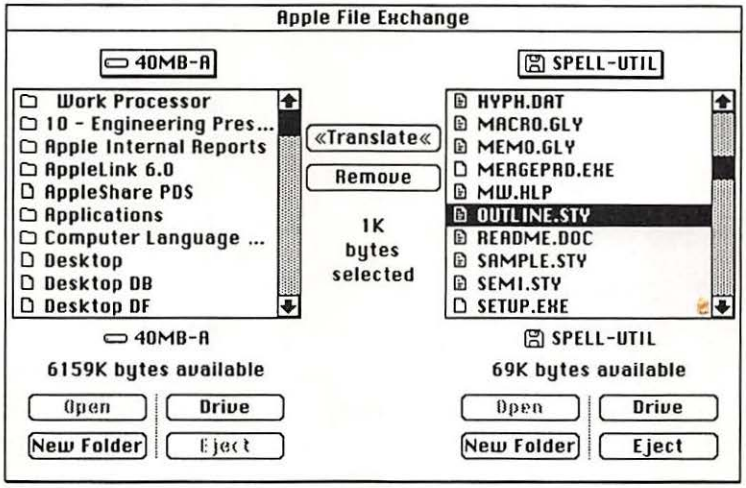


FIGURE 23-5
Apple File Exchange window

MacLink Plus PC

MacLink Plus PC from DataViz is a popular Macintosh-to-PC file exchange program. The program allows you to transfer information in a fashion similar to AFE.

The MacLink Plus PC program has libraries of translators which allow you to move information between the following packages:

Word-processing Programs

Macintosh	*PC*
Framemaker (MIF)	DCA-RFT
MacintoshWrite	Framemaker (MIF)
Word	IIMultimate
WordPerfect	Word
Works WP	WordPerfect
WriteNow	Works WP
	Text
	Word for Windows
	OfficeWriter
	WordStar
	XYWrite

Spreadsheets and Databases

Macintosh	*PC*
Comma Values	dBase
DIF	Excel
Lotus 1-2-3	Lotus Symphony
Multiplan SYLK	Tab Text
Tab Values	Works SS

Graphics Programs

Macintosh	*PC*
PICT	AutoCAD (DXF)
Harvard Graphics (CGM)	Lotus Freelance (CGM)
Lotus (PIC)	PC Paintbrush (PCX)
Ventura Publisher (IMG)	Ventura Publisher (GEM)
Windows Bitmap (BMP)	WordPerfect (WPG)

File Transfer Programs

Macintosh	*PC*
EPS	PageMaker
TIFF	Binary

LapLink

LapLink from Traveling Software is a file transfer and conversion program. It has many of the features described in Apple File Exchange and MacLink Plus PC. Plus, it includes transfer software, cables, and translators to allow files to move between two Macintoshes, or between Macintoshes and PCs by way of direct cabling, modems, an AppleTalk network, or a SCSI cable (if you have a Macintosh PowerBook).

Two features set LapLink apart from similar programs. One is a special accelerator which boosts transfer rates between Macintoshes connected by cable to 750,000 baud—nearly 3MB per minute. Its other unique feature is the ability to do transfers over an AppleTalk network between two Macintoshes, or more if you add additional LapLink Network Pacs. (A LapLink Network Pac is a connection that allows the usage of LapLink file transfer on an AppleTalk network.)

ABOUT THE ...

Mini and Mainframe Networking

Mini- and mainframe computers are everywhere. Banks, insurance companies, state and local governments, and major corporations run their businesses on these machines. Access to this information by a Macintosh has become common.

The Macintosh can hook up to a minicomputer by acting like a typical terminal of the minicomputer. This is done with a combination of a terminal emulation card and software. All the Mac has to do is simulate the type of terminal the mini will talk to.

Connecting your Macintosh to the mainframe environment is typically handled through a *cluster controller* (a control unit that manages several peripherals, such as terminals or disk drives). The data flows to and from the terminal to the controller and into the host. Again, the Mac must simulate a terminal.

Terminal Emulation

The Macintosh must pretend to be a dumb terminal. This is done through an emulation program and hardware. (An emulation program is a way to "fool" another computer. With some computer mumbo-jumbo a Macintosh can simulate another computer, or a dumb terminal.) Most of the terminal emulation programs allow for TTY (teletype) emulation, VT100, and VT220, which are standard types of terminals.

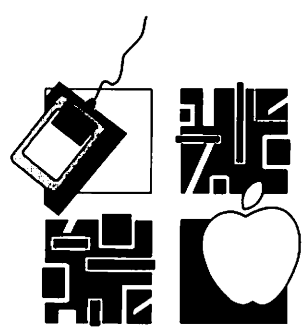
Other DOS Access Programs

Access PC from Insignia Software allows you to place your MS-DOS disk directory on the Macintosh desktop, just like a Macintosh disk. This is helpful if you work with both environments and must transfer files between these worlds. The program also lets you format diskettes on a Macintosh to be read by an MS-DOS machine.

DOS Mounter from Dayna Corporation is a program which allows the Macintosh to display MS-DOS disk directory disks on the Macintosh desktop. This program also lets you format diskettes on a Macintosh to be read by an MS-DOS machine.

CONCLUSION

If you only have one Macintosh you can connect to the outside world through a modem. If you have more than one Macintosh, or a Macintosh and another computer, you should look into networking. Besides the obvious benefits of E-mail, it is a way to share resources—printers, scanners, disk space, and so on—for a minimal cost. Because the Macintosh was designed to network, it doesn't have the problems which seem to be inherent in networking in the DOS enviroment.



C H A P T E R 24

PROGRAMMING THE MACINTOSH

The Macintosh is a computer designed for users, not for programmers. The only thing you'll probably ever program on the Macintosh is a spreadsheet macro, and most of those aren't even "programmed." For example, in Microphone (a communications package), to program the telecommunications system to do various chores the user simply gives a Watch Me command, and the program writes the program in its own macro language.

Programming the Macintosh is mostly done by programming professionals who create programs for others to use. DOS-based PCs have many more tools, including a batch programming language, and programming is encouraged. Only a small number of Macintosh users will ever program in the traditional sense.

Some people insist you know something about programming because it has always been a part of the computer scene. It may help to know the differences between Pascal and FORTRAN, in case it comes up in conversation. Or, if your boss asks about object-oriented programming (OOP), which is "all the rage" right now, you can have a little background information.

Programming is a very broad subject, with many specifics. There are also many generalizations. It's like trying to describe literature. What is literature? Is anyone who has put words to paper a writer? Is anything written on paper literature? Is poetry literature? Are limericks literature?

WHAT IS A PROGRAM?

A computer can't do anything at all until it's given instructions. These instructions are called (as a group) the operating system. This operating system tells the computer how to handle all other instructions given to it, like your applications programs. It also instructs the computer how to handle all those pull-down menus and dialog windows, and the rulers (all that stuff that makes the Macintosh look like a unique computer).

Macintosh applications programs act in very predictable ways. They offer a menu of commands. Each command is actually a set of instructions, or a "recipe" for the computer to follow. For instance, when you select a Save command, the program supplies instructions for the computer to save the document's data to a disk file.

Some programs, like utilities or extensions, are given orders to stay active for indefinite periods of time. These programs are still programs even though you don't direct their actions. They work on their own, in the background.

A mechanical example would be a washing machine. The menus are the wash temperature, the rinse temperature, the load size, and delicate or normal. You push a few buttons to select the correct washing "parameters," and the machine executes the commands. The buttons and switches direct the variable actions of the machine. Other things, such as spin dry, or how to slosh the clothes around, are already part of the washing machine's program. They work in the background without your involvement.

The computer is certainly no more magical or difficult than any appliance; there are just a wider variety of commands.

WHAT IS A PROGRAMMER?

Usually, the programmer is a slightly overweight guy with glasses, a pocket protector, a case of Jolt Cola, and a serious craving for Thai food.

Besides that, computer programmers are people with a special knowledge (just like the washing machine repairman has a special knowledge of belts and pulleys, switches, knobs, and lint traps). They're versed in a foreign language, a programming language.

There are a number of different programming languages. Some are for big mainframe computers (JCL, RPG, COBOL), some are for IBM PCs (BASIC, C, C++, Pascal), some are for Macintosh (HyperCard, Pascal, C). Some programmers are able to program for many different computers, some are specialists.

There are different levels of programming languages. Machine-level programmers work to program the most basic part of the machine—the minute details of the computer's operation, from memory allocation to each mathematical calculation. Then there are the Assembly-level programmers and high-level language (HLL) programmers. These guys could create the operating system of the computer, or more likely, write an accounting program or CAD/CAM program. There are spreadsheet programmers who work in a highly specialized language specifically designed to manipulate numbers. Then, there are applications programmers. They could also write an accounting program or CAD/CAM program, or write easier stuff, like a checkbook balancing program, a word-processing program, or a mailing list program.

On and Off

Let's go back to that washing machine for a second. The washing machine is directed to perform functions with a series of switches. Let's say the washing machine has two sets of three buttons to choose wash temperature and rinse temperature: hot, warm, cold. You choose a hot wash and a cold rinse. The switches would be: hot-on, warm-off, cold-off, hot-off, warm-off, cold-on. The switch settings (on-off-off, off-off-on) would direct the machine to carry out the correct selections. These switches are mechanical. They are either on (with electrical current) or off (without current).

The computer is directed by a series of on or off electrical impulses. If you could hear the impulses they would sound like a very fast Morse code. The impulses are represented visually as 1s or 0s (1 means on; 0 means off). All computer languages are based on this code of 1s and 0s. The sequences of the 1s and 0s make up the commands (as words are made up of set sequences of letters). This is called a *machine language.*

LANGUAGES

There are many different programming languages. Each has its own unique history and quirks. For the average Macintosh user, a passing acquaintance of the notable languages is in order. It is a way to be a well-rounded computer user. It's no different than knowing in France they speak French, in Australia they speak English, and in Iran they speak Farsi.

ASSEMBLER

Every microprocessor is accompanied by an Assembly language and its compiler, a low-level language. Motorola has its own assembler versions for the 68000 family (MC 68000, 68020, 68030, and 68040) of microprocessors. Likewise, for example, Intel has its own assembler for its microprocessors.

Low-level languages, as mentioned earlier, contain commands the Macintosh's processor, the Motorola 680x0, can completely understand. This is because the commands in the assembler correspond to the most basic commands built into the processors, like add, subtract, compare values, and take a chunk of RAM space. Since this is the only language the computer understands, all other languages have to be translated into assembler by a compiler.

When a single command to add two numbers together is given in assembler, the identical command is executed by the Macintosh. The processors can only execute one of these commands at a time. This may sound slow, but the Macintosh can execute up to several million instructions every second.

The processor in the Macintosh only understands the short, cryptic commands which correspond to assembler commands and condition statements. This helps keep the programs small and fast. Commands are instructions to do something, and condition statements are instructions which yield results such as "true," "false," "equal to," and "greater than." Usage of commands like BNE (go to a specified part of the program if the previous condition statement is not equal), CLR (clear information from a register) and CMP (compare two values) make assembler a cumbersome method of application development.

FORTRAN

The acronym FORTRAN comes from formula translation. FORTRAN is used in the scientific community as a means to create sophisticated mathematical models and formulas. Some FORTRAN applications are so complex, such as those used to calculate weather forecasts, they can take up to an hour or more to run.

FORTRAN has been in use since the 1960s and has yet to make a major migration from mainframe and supercomputers into microcomputers. This is because many microcomputers are not powerful enough to efficiently run some of the complex FORTRAN programs in existence. Also, some FORTRAN programs are so complicated it may have taken a team of programmers ten or more years to develop and perfect. The process to translate the code from a mainframe computer to a microcomputer may take several more years. Worse yet, the translation process may cause errors in the code and decrease the reliability of the application.

Language Systems FORTRAN (by Language Systems), MacFortran II (by Absoft), and Mactran Plus (by DCM Data Products) are available for the Macintosh. Language Systems FORTRAN is used to compile VAX/VMS (DEC mainframe) FORTRAN programs onto the Macintosh without many compatibility problems. MacFortran II is limited to Macintoshes with 68020 and higher processors, but claims to have the ability to run FORTRAN programs from several different mini-, mainframe, and supercomputer environments including VAX/VMS, IBM/VS, Cray, and Hewlett-Packard, with little or no program modification.

COBOL

The acronym COBOL stands for common business oriented language. COBOL has been in use on mainframe computers since the early 1960s. COBOL is a fairly simple language to grasp, as its syntax and commands are very straightforward. It's still used primarily for mainframes and large minicomputers; it is very rare in the microcomputer world.

There is a COBOL tool used on a Macintosh, COHORT-COBOL (CASE Corporation), which allows developers to design code and port the code to a mainframe.

BASIC

The acronym BASIC stands for beginner's all-purpose symbolic instruction code. BASIC was created in 1964 at Dartmouth College as an easier alternative to FORTRAN. John Kemeny and Thomas Kurtz are credited with the development of this popular language.

Many people use BASIC because its syntax (grammatical requirements) is lenient. It is often taught in high schools and colleges as an introduction to computer programming. However, BASIC is rarely used commercially because it lacks features native to other high-level languages. Some of the shortcomings include the lack of quality libraries, object-oriented programming capabilities, and efficient compilation into machine language. BASIC's inability to compile programs into machine language as efficiently as other high-level languages gives applications created with BASIC the reputation of slow performers.

BASIC has its place on the Macintosh. QuickBASIC (Microsoft), True BASIC (True BASIC), PCMacBASIC Compiler (Pterodactyl Software), and ZBasic (Zedcor) are less expensive than other high-level languages. Prices are usually anywhere from one-half to one-fifth of those for C, Ada, and Pascal compilers.

PASCAL

Personal computers became increasingly popular in the late 1970s and early 1980s. At the time, BASIC was virtually the only high-level language available to programmers who wanted to write programs for this new market. Mainframe computers were essentially the only platforms with "serious" high-level languages like COBOL and FORTRAN. BASIC was considered too anemic to create powerful programs. Niklaus Wirth developed Pascal. The language was named after French mathematician Blaise Pascal.

The language's ability to manage databases, efficiently compile programs into machine language, and effectively manage memory made Pascal a viable development tool for personal computers. For instance, in 1984, Apple used Pascal to write the operating system for the Macintosh.

The wave of popularity for Pascal in business and education gave rise to several spin-off languages. These languages took the best of Pascal and added new functionality for their own special purposes.

Ada

Ada was a development language to create applications for the U.S. Department of Defense. The department wanted a language versatile enough to create business applications as well as weapons and defense systems. Ada programs can have the ability to control robotic functions like wing movement on guided missiles. Ada also has the ability to create basic business programs like word processing. Ada compilers for the Macintosh include Alsys Ada Compilation System (Alsys), Adagen (Mark V Systems), and AdaVantage Compiler (Meridian Software Systems). Alsys has a separate Ada version for A/UX (Apple's UNIX).

Object Pascal

Object Pascal was created by Apple in the mid-1980s as a substantial Pascal extension to support OOP. Object Pascal offers programmers a full-featured Pascal compiler in addition to its ability to create object-oriented applications.

Modula-2

Niklaus Wirth created a spin-off of Pascal called Modula-2. It gets part of its name from the modular way to create programs. This language has the ability to compile single programs into several modules. These different modules can be executed at the same time. For instance, an integrated business program can have a module to pull sales totals from a database and, at the same time, have another module performing a mail merge. Metrowerks Modula-2 (Metrowerks) and Modula-2/68 for A/UX (anasystems) are available for Macintosh Modula-2 programming. Metrowerks Modula-2 has a standalone as well as MPW version.

C and C++

C was created by Dennis Ritchie at AT&T, as an alternative to Pascal. The C language has more syntax demands than Pascal. For example, all commands are case sensitive. This means punctuation isn't the only important syntactical rule, as is the case in Pascal.

There are enough similarities between Pascal and C to make it easy to learn if you are proficient with Pascal, but it's not required.

Although a demanding language, C is very flexible and fast. It is also portable (important if you move your programs over to other operating systems, such as UNIX). It's a favorite of many commercial software developers. C compilers for the Macintosh include C (Apple Computer), Aztec C (Manx Software), Think C (Symantec), Consulair Development System for 68020/030 (Consulair), and D-CC/68K C Tools (Diab Data). MPW C, Aztec C, and D-CC all work under MPW. MPW C is the only one of the three which requires MPW in order to be used.

C, like Pascal and Object Pascal, has been updated to support object-oriented programming. The name of this updated language is C++. Apple's MPW C++, Green Hills C++, and Glockenspiel C++ (both from Oasys) are available for the Macintosh. Glockenspiel C++ can only run under A/UX, and MPW C++ requires MPW. Think C, listed in the previous paragraph is not a C++ compiler, but it does include object-oriented programming capabilities.

Apple's direction has been toward C++. For instance, MacAPP 3.0, Apple's comprehensive object library for object-oriented programmers, is not compatible with Pascal anymore. This move to C++ may signal a downturn in Pascal's popularity.

LISP

LISP stands for list processing. It is used to manipulate information in lists, primarily in industrial and academic research labs, to log test and survey information into huge lists. This language has been in use since the early 1960s.

In LISP applications, qualitative questions like, "if Mount McKinley erupted tomorrow, what economic and environmental damage would result?" may be posed. The application would sift through lists of study results from volcanic eruptions around the world. It would compare and contrast geographical locations; demographic residential, industrial and commercial elements of the area; and plot likely ash plume trajectories with weather patterns and prevailing winds. This information is needed to arrive at a likely scenario to answer the question with an acceptable degree of accuracy.

These stores of lists can range in size from several megabytes (300 pages per megabyte) to gigabytes (300,000 pages per gigabyte). This staggering amount of information can be efficiently processed with LISP in order to arrive at qualitative answers. A qualitative question and answer process performed by a machine like a Macintosh is generally referred to as Artificial Intelligence (AI). LISP can also arrive at responses to quantitative questions ("how much is 1 and 1?"), but there are less complicated languages to use to answer these types of questions.

Prolog

LISP's French cousin is a language called Prolog, short for programming in logic. Prolog, created in France in 1973, is very similar in form and function to LISP and is designed to work with information contained in objects. The objects Prolog uses can be, for example, cities on a map. Each city can contain information which a program would use to find the best delivery route or determine the best location for a new store branch.

OTHER LANGUAGES

There are more languages available for use on the Macintosh. Of interest are the object-oriented languages such as Prograph from TGSSystems, which uses graphic icons to create OOP applications.

Smalltalk and Forth are examples of less popular languages. Smalltalk was developed at Xerox's Palo Alto Research Center (PARC), and has the distinction of being the first object-oriented programming language. However, OOP languages such as C++ have cast a shadow over Smalltalk and its already strained popularity. A Smalltalk compiler for the Macintosh is Objectworks for Smalltalk-80 (ParcPlace Systems).

Forth was developed in the late 1960s. Forth is difficult and has never become a popular language. Features such as reverse Polish notation (a math notation formula where you first enter all the numbers for an equation and then enter all the operands such as "*" and "+" after the numbers) don't motivate many people to buy Forth compilers. Forth, however, does permit chip-level control of Macintosh hardware. This makes it very useful in the creation of data acquisition instruments. Data acquisition tools can be used to gather readings from instruments in engineering labs and measurements of products at industrial plants.

Compilers

Machine language and assembler are difficult to learn. Because of this, translation programs have been created. The translators, called *compilers*, allow programmers to write instructions for the computer in a high-level language. High-level languages such as C, COBOL, BASIC, and Pascal are examples of languages that use more descriptive English words or word combinations (called code) to form commands for the computer. Compilers for these languages translate words and instructions into machine language to form a file.

PROGRAMMING PHILOSOPHIES: STRUCTURAL VS. OBJECT-ORIENTED

The components of a program have to be constructed in a logical way. The way in which the program is written affects its performance, stability, and upgradability. There are two popular methods of program development: structural and object-oriented.

STRUCTURAL PROGRAMMING

A structural program is comprised of a main program or *event loop* with very general references to tasks to be accomplished. These tasks are handled outside of the main loop in procedures. Procedures are designed to perform portions of complex operations. This flow of information through a program's procedures can become very hectic and difficult to track in large applications.

The benefits to structural program design are its quickness, performance, and compactness. Performance is high because the program is under central control. The programs are very compact because each procedure has a specific and well-defined task to complete which sidesteps duplication of efforts in the program.

These benefits disappear whenever a structural program has to be updated, becomes lengthy, or is ported to an object-oriented design. Program updates and changes to an object-oriented design are tedious because adjustments must be made to many, if not all, procedures.

OBJECT-ORIENTED PROGRAMMING

Object-oriented programming designs work in an entirely different way than structural. Programs based on OOP's tenets are modeled after the way people operate. Great care is taken to perform the application design process from the user's perspective. OOP programmers often map what interface tools and objects they intend to let the users operate and create.

With this in mind, the first step to OOP is to identify the objects a program's user will manipulate on the Macintosh screen. An *object* is anything in Macintosh programs; they can be squares, circles, bodies of text, pictures or lines. Objects can have attributes such as color, sound, and motion.

An OOP program contains the methods for each of its objects. The *methods* control all operations that affect an object's attribute(s), such as how to change the color of a square. Definitions combine methods and attributes for a particular object in an encapsulated, virtually self-sufficient form. The definitions are like small programs inside the bigger program.

Objects with identical methods are in the same *class*. The objects in a class can inherit methods and/or attributes from its ancestral object. So when the ancestor of a class is changed, the objects within it are also changed. Objects, however, have the ability to refuse to take on these modifications if you program the objects to resist the changes.

The object definitions usually work independently of each other and communicate to each other and to the main program with messages. Messages are the means by which objects and the main program notify other objects about user-specified changes to objects, object attributes, object relations, and anything else that might relate to another object's job.

You may be able to see OOP's implications for programmers. The problems encountered by structural programming techniques such as upgradability and code readability almost vanish. Upgradability is easy because you can add objects to a class. These objects will inherit methods and attributes that you have already created in an ancestor. You can then add methods and attributes to the new object. You can also add new classes of objects when you like, without the need to adjust any of the existing objects in your program.

The problem of code readability is greatly reduced because each object definition has a specific purpose and remains independent of the other objects. This makes it simple for programmers to follow the flow of information in the code.

Another added benefit of object-oriented programming is that object definitions used in one program can be implemented easily in another program. This is because the object definitions are essentially small, independent programs and need only slight, if any, adjustments to function in other applications. This reduces development time of new applications significantly.

PROGRAMMABLE PROGRAMS

In the gray area of Macintosh programming lie programmable programs. These programs include applications such as database managers and spreadsheets. Programmable programs are not as powerful as most high-level languages because they are limited in the scope of programs they can create. For instance, a database manager can't create a graphics design program.

Database managers let you create databases and define how you want information to be stored and accessed. You can design the menus the database will offer and the general layout of the interface. Some database generators will also be able to access information on mainframes, if you are inclined to give the programs that ability. Customized database applications are popular among small businesses who want to, for instance, save and use customer information in a way that is more convenient to the owner. FoxBASE+/Mac (Fox Software), 4th Dimension (ACIUS), Omnis 7 (Blyth Software), and Oracle for Macintosh (Oracle) are database generators for the Macintosh.

Applications such as Full Impact (Ashton-Tate), Wingz (Informix Software), and Resolve (Claris) are examples of programmable spreadsheets. You are able to write scripts that the spreadsheet will do for you. For example, you can write a script that takes information from a spreadsheet file, adds the information to that from another file, creates a bar graph with the totals from the files, and prints out the results. Another term used in place of "script" is macro.

PROGRAMMER'S RESOURCES FROM APPLE

Apple provides a wide variety of tools and support programs for programmers. These facilities include Apple Programmers and Developers Association (APDA) and development tools.

APPLE PARTNERS AND ASSOCIATES

The Associates program is Apple's mainstream program for developers of Macintosh-compatible products. Associates receive technical and marketing information and self-help technical support tools. This program is geared toward developers of commercially available products and services. Associates pay a modest annual fee in order to remain in the program.

The Partners program is Apple's technical development support program for select Apple developers in highly technical product development. Partners receive the highest level of support Apple offers. Partners must pay a larger annual fee than Associates.

Developer University

Developer University (DU) provides hands-on instruction to those with any degree of Macintosh program development experience. Most of the courses, however, require some proficiency in a programming language such as C, Pascal, or assembler. Some of the courses are self-paced and very affordable, such as Macintosh User-Centered Design and Macintosh Programming Fundamentals. Others are more costly and require travel to locations such as Cupertino, California or Boston, Massachusetts, where DU training is routinely held. Among the courses you will most likely need to travel long distances to attend are C++ for the Macintosh, MacApp, Object-Oriented Programming, and MacWorkStation. There are other DU training sites throughout the United States and Europe.

Developer Conferences

Apple invites all certified developers to gather once a year at what is called the Apple's World Wide Developer Conference (WWDC). This conference presents new development tools, system software extensions, and specifications for new Macintosh products to its developer community. Other items, such as future APDA and Apple marketing plans that directly effect the developers, are also discussed.

Developer CD-ROMs

Quarterly deliveries of CD-ROM discs are sent to Macintosh certified developers. These discs are packed to near capacity with technical Q&A libraries, programming tools and utilities, an electronic version of Inside Macintosh, an electronic version of Apple Technical Journals, and sample code. A collection of tools called Developer Essentials includes Apple publication guides, human interface updates, Macintosh technical notes, several versions of U.S. System Software, and International System Software. Some of the foreign languages covered in the International System

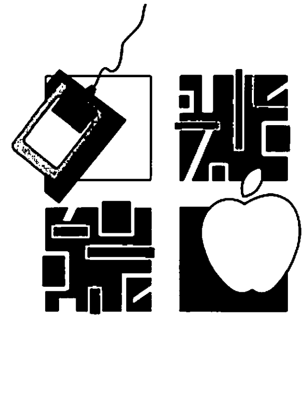
Software folder include Arabic, French, French-Canadian, German, German-Swiss, Greek, Hebrew, Icelandic, Italian, and Kanji. This provides developers with a means to test their applications.

In short, the Developer CDs bring a wealth of valuable tools and information to the programmer's desk. But if a programmer gets nothing else out of the discs, the tongue-in-cheek names may be amusing. Titles such as "Night of the Living Disc," "A Disc Called Wanda," and "Lord of the Files" are some of the silly names given to the CDs.

Quarterly Publications

Apple has two major publications for programmers, "APDAlog" and "develop," published quarterly. "APDAlog" is, as the name hints, a catalog of all products and services APDA supplies to developers. It provides full development product descriptions, programmer training courses, product locator guides, product highlights, and new product previews. All the products and services listed in the catalog can be purchased from APDA.

The other Apple developer journal, "develop," includes a wide variety of features such as programming tips, future trends, and editorials, and it is included in electronic form on the developer CDs.



A P P E N D I X

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MACINTOSH MODELS

OLD-TIMER MACINTOSHES

The Classic and Modular Macs are the old-timers of the Mac family. They range from the very first Macintosh, the 128K, introduced in 1984, to the Macintosh IIcx.

MACINTOSH 128K: CLASSIC LINE

The Macintosh 128K is no longer available from Apple Computer. You can find these systems in the used computer market.

The Macintosh 128K's main microprocessor is a Motorola MC68000 chip. It operates at a clock speed of 7.8336 megahertz. It has 32-bit internal registers and a 24-bit address bus. The Macintosh 128K cannot accept a coprocessor (a chip to speed up mathematical processing). The system has a 64K ROM chip. It comes standard with 128K of RAM—in fact, that's where it gets its name.

The Macintosh 128K has no hardware memory management capabilities. Hardware memory management controls the way some hardware features are handled by the system. It does not have an expansion slot used for additional computer boards to "expand" the system. It can play sound. It has a RAM-based monophonic sound buffer which produces monaural.

Unlike later models of the Macintosh, the Macintosh 128K can only read and write 400K disks in its internal 3 1/2-inch drive. If the system has an external drive, this drive, too, can only read and write 400K disks. There is no SCSI adapter on this Macintosh, yet there are two serial ports with DB-9 connectors.

As is the case with the entire Classic line of Macintoshes to follow it, the Macintosh 128K has a built-in 9-inch video display with a resolution of 512 by 342 pixels.

The keyboard which comes with the Macintosh 128K is a 94-key keyboard. It is connected to the CPU with an RJ-11 jack (the same jack a regular telephone uses).

A mouse port and mouse are a part of the Macintosh 128K standard configuration. The mouse is attached to the CPU with a DB-9 connector.

The Macintosh 128K can be upgraded to a Macintosh Plus. To upgrade it, add a Macintosh Plus disk drive (800K drive and 128K ROMs), a Macintosh Plus logic board, and a Macintosh Plus keyboard.

MACINTOSH 512K: CLASSIC LINE

The Macintosh 512K is similar to the Macintosh 128K:

- The Macintosh 512K is no longer sold through Apple Computer's distribution channel.
- The system uses a Motorola microprocessor MC68000. This microprocessor operates at a clock speed of 7.8336 megahertz.
- This Macintosh, like the 128K, has 32-bit internal registers and a 24-bit address bus.
- It doesn't have a coprocessor, hardware memory management capabilities, or an expansion slot.
- The Macintosh 512K has a 64K ROM chip. It has sound capabilities through a RAM-based monophonic sound buffer. It contains a 400K internal 3 1/2-inch floppy disk drive; an external 3 1/2-inch 400K floppy disk drive.
- This Macintosh has 512K of RAM, unlike the 128K. The Macintosh 512K accepts an optional external 20MB hard disk.
- The Macintosh 512K has:

no SCSI port
two DB-9 serial ports
a built-in 9-inch 512 by 342 pixel video display
a Macintosh keyboard which attaches to the CPU with an RJ-11 connector
a Macintosh mouse which connects to the system with a DB-9 connector

The Macintosh 512K can be upgraded to a Macintosh Plus with a Macintosh Plus disk drive (800K drive and 128K ROMs), a Macintosh Plus logic board, and a Macintosh Plus keyboard.

MACINTOSH 512KE OR 512K ENHANCED: CLASSIC LINE

The Macintosh 512Ke is identical to the Macintosh 512K except for two differences:

- The Macintosh 512Ke has a 128K ROM chip in it.
- The 512Ke accepts a 400K or 800K external 3 1/2-inch floppy disk drive.

MACINTOSH PLUS: CLASSIC LINE

The Macintosh Plus uses a Motorola MC68000 microprocessor. It operates at a clock speed of 7.8336 megahertz. It has 32-bit internal registers and a 24-bit address bus. There is no coprocessor with the Macintosh Plus.

System 6.0.2 (or above, up to System 7) is required for Macintosh Plus operation.

The system comes with a 128K ROM chip and 1MB of RAM, expandable to 2, 2.5, or 4MB. There is no hardware memory management feature and no expansion slot.

Sound is achieved through a monophonic RAM-based sound buffer.

The Macintosh Plus has an 800K 3 1/2-inch internal floppy disk drive and either a 400K or 800K external floppy disk drive. There is an optional 20MB external hard disk for the system as well as other external SCSI hard disks. The Macintosh Plus has a DB-25 external SCSI port and two mini-8 serial ports.

A built-in 9-inch 512 by 342 pixel resolution video display is on the system. The Macintosh Plus keyboard with an RJ-11 connector is the appropriate keyboard for the system. A DB-9 Macintosh mouse is the compatible mouse.

The Apple 2MB Memory Expansion Kit (two 1MB SIMMs) expands the Macintosh Plus' memory. If one is used, it upgrades the Macintosh to 2MB, 2.5MB, or RAM. If two are used, they upgrade the system to 4MB of RAM.

MACINTOSH SE: CLASSIC LINE

The Macintosh SE, like all other Macintoshes in this section, is no longer sold by official Apple Computer distribution channels.

The system itself contains a Motorola MC68000 microprocessor with a clock speed of 7.8336 megahertz.

The Macintosh SE runs on any level of the Macintosh operating system from 6.0.2 through System 7.

It has 32-bit internal registers and a 24-bit address bus. There is no coprocessor with the Macintosh SE.

The system comes with a 256K ROM chip and 1MB of RAM, expandable to 2, 2.5, or 4MB. There is no hardware memory management feature on the Macintosh SE. There is one expansion slot with an SE bus.

Sound is achieved through a monophonic RAM-based sound buffer.

The Macintosh SE has an 800K 3 1/2-inch internal floppy disk drive and either a 400K or 800K external floppy disk drive. An external DB-25 SCSI port and internal in-line 50-pin SCSI port are both on the system. There are two mini-8 serial ports.

The SE contains a built-in 9-inch 512 by 342 pixel resolution video display. The Macintosh SE accepts an external video display through a video card which fits in the SE bus. The Apple Keyboard (mini-4) and Apple Extended Keyboard (mini-4) both function with the system. The mini-4 Apple Desktop Bus (ADB, or any other compatible mouse) works with the Macintosh SE.

Memory may be upgraded with the Apple 2MB Memory Expansion Kit (two 1MB SIMMs). One kit is required to upgrade to either 2MB or 2.5MB. Two kits are required for an upgrade to 4MB. The entire system may be upgraded to function like an SE/30 with the Macintosh SE/30 Logic Board Upgrade Kit. The 400 or 800K drive may be upgraded to an Apple SuperDrive with the Apple SuperDrive Drive Upgrade Kit.

MACINTOSH SE SUPERDRIVE: CLASSIC LINE

The Macintosh SE SuperDrive is identical to the Macintosh SE except for a Macintosh SuperDrive. It accepts a second SuperDrive when no hard drive is installed in the Macintosh SE SuperDrive.

The Macintosh SE SuperDrive operates with any level of the operating system from System 6.0.2 through System 7.

MACINTOSH II: MODULAR LINE

The Macintosh II can also be found in the used computer market today.

The system contains a Motorola MC68020 microprocessor. The chip runs at a clock speed of 15.6672 megahertz. It supports 32-bit internal registers and a 32-bit address bus.

The Macintosh II operates with any level of the operating system from System 6.0.2 through System 7.

The Macintosh II supports the Motorola MC68881 FPU Coprocessor. The system comes standard with a 256K ROM chip and either 1 or 4MB of RAM. The RAM is expandable to 2, 5, or 8MB.

Hardware memory management is performed on the Macintosh II through a built-in 24/32-bit address mapping unit (AMU) for address translation. An optional Motorola MC68851 paged memory management unit (PMMU) is installable to assist in efficient memory management.

The Macintosh II has six NuBus expansion slots. It can accommodate stereophonic sound output. It uses external speakers in conjunction with the Apple sound chip. The Macintosh II also has a monaural internal speaker.

An internal 800K, 3 1/2-inch floppy disk drive is standard on the Macintosh II. A second 800K is optional. The Macintosh II does not support a 3 1/2-inch external drive.

An internal and external SCSI hard disk are optional and are supported with an external SCSI port (DB-25) and an internal SCSI port (in-line 50-pin). The system has two mini-8 serial ports.

The NuBus expansion slots on the Macintosh II support multiple external color and monochrome monitors. Both the Apple Keyboard and the Apple Extended Keyboard can be used with the Macintosh II. The Apple Desktop Bus mouse port enables use of either the standard Macintosh mouse or any other third-party mouse that runs with the Apple Desktop Bus.

There are six upgrades available for the Macintosh II:

1. Apple 1MB Memory Expansion Kit (four 256K SIMMs)
2. Apple 2MB Memory Expansion Kit (two 1MB SIMMs)
3. Macintosh II 4MB Memory Expansion Kit (four 1MB SIMMs)

4. Macintosh IIx Logic Board Upgrade
5. Macintosh IIfx Logic Board Upgrade
6. Apple SuperDrive Internal Drive Kit

MACINTOSH IIX: MODULAR LINE

The Macintosh IIx uses a Motorola MC68030 microprocessor with a clock speed of 15.6672 megahertz. It has 32-bit internal registers and a 32-bit address bus. This Macintosh comes with a Motorola MC68882 FPU coprocessor.

A 256 ROM SIMM chip and 4MB of RAM are standard with the Macintosh IIx. RAM is expandable to 8MB.

The Macintosh IIx operates with any level of the operating system from System 6.0.3 through System 7.

Hardware memory management is performed with a 24/32-bit address translation, and paged memory management is supported by the Motorola MC68030.

The Macintosh IIx has six NuBus expansion slots. It supports stereophonic sound output and a monaural internal speaker as input.

The internal 3 1/2-inch floppy disk drive on the system is a 1.4MB Apple SuperDrive. A second Apple Superdrive is optional. External 3 1/2-inch floppy disk drives are not supported by the Macintosh IIx. It does support an optional internal or external SCSI hard disk. This support is through an external DB-25 SCSI port and an internal in-line 50-pin SCSI port. Two mini-8 serial ports are a part of the system.

The video display on the Macintosh IIx supports multiple external color and monochrome monitors through the NuBus expansion slots. Both the Apple Keyboard (Apple Desktop Bus) and Apple Extended Keyboard work with the system. An Apple Desktop Bus (or third-party compatible) mouse functions with the Macintosh IIx.

The Macintosh IIx may be upgraded in four ways:

- More memory can be added with the Apple 2MB Memory Expansion Kit (two 1MB SIMMs). If you are upgrading to 8MB, two 2MB Memory Expansion Kits are required.
- The Macintosh II 4MB Memory Expansion Kit (four 1MB SIMMs) upgrades memory by 4MB.
- An Apple SuperDrive Internal Drive may be added to the IIx.

- Most significant, a Macintosh IIfx Logic Board Upgrade is available which gives the IIx the power of a Macintosh IIfx.

MACINTOSH IICX: MODULAR LINE

The Macintosh IIcx provides the power of the Macintosh IIx with three fewer NuBus expansion slots and a much smaller footprint. It is targeted to users who don't need six NuBus expansion slots. As a result, it was offered to the market at a lower price than the six-slot IIx.

The computational power of the Macintosh SE is one-third to one-fourth that of the Macintosh IIcx.

The Macintosh IIcx functions with System 6.0.3 or later of the Macintosh operating system.

Like the Macintosh II and IIx, the IIcx uses a Motorola MC68030 microprocessor. The chip runs at a clock speed of 15.6672 megahertz. It has 32-bit internal registers and a 32-bit address bus. This Macintosh comes with a Motorola MC68882 FPU coprocessor.

A 256K ROM chip and either 1 or 4MB of RAM are standard with the system. RAM is expandable to 8MB.

Twenty-four/thirty-two-bit address translation and paged memory management is supported by the MC68030.

Unlike the II and IIx, this Macintosh has only three NuBus expansion slots. It supports stereophonic sound output and monaural input.

The internal 3 1/2-inch floppy disk drive on the system is a 1.4MB Apple SuperDrive. A second Apple SuperDrive is optional. It does support an optional internal or external SCSI hard disk. This support is through an external DB-25 external SCSI port and an internal in-line 50-pin SCSI port. Two mini-8 serial ports are a part of the system.

Like the Macintosh IIx, the IIcx video display supports multiple external color and monochrome monitors through the NuBus expansion slots. Both the Apple Keyboard (Apple Desktop Bus) and Apple Extended Keyboard work with the system. An Apple Desktop Bus (or third-party compatible) mouse functions with the Macintosh IIx.

The Macintosh IIcx may be upgraded in two ways:

- With the Apple 2MB Memory Expansion Kit (two 1MB SIMMs), memory may be added to the system's base memory. SIMMs must be in sets of four to work correctly.
- The Macintosh II 4MB Memory Expansion Kit (four 1MB SIMMs) can add memory in increments of 4MB.

MACINTOSH PORTABLE

The Portable is no longer available through regular dealer channels. It has been replaced by the Notebook line of computers. The Macintosh Portable is powered by a Motorola MC68000 microprocessor which operates at a clock speed of 15.6672 megahertz. It has 32-bit internal registers and a 24-bit address bus. The Portable's coprocessor is a Power Manager Processor Mitsubishi M50753 microcomputer chip.

The standard Macintosh Portable has a 256K ROM chip and 1MB of RAM. The RAM is expandable to 2MB, with up to 9MB possible. There is no hardware memory management on the system.

Possible slot expansion on the Macintosh Portable is accomplished through the Macintosh Portable PDS, RAM Expansion, ROM Expansion, and an Internal Modem slot.

As with all of the other Macintoshes available today, sound supported by this system is stereo sound output through a miniature stereo phone plug. The internal speaker is monophonic.

The Macintosh Portable supports a 1.4MB internal 3 1/2-inch floppy disk drive as well as an external 800K, SuperDrive, or Hard Disk 20. An external (DB-25) and internal (in-line 50-pin) SCSI port are supported. Two mini-8 serial ports are also within the system.

The video display of the Macintosh Portable is unique. It uses an active matrix liquid crystal and produces a full page width. The resolution of the display is 640 by 400 pixels.

Keyboard

A 63-key keyboard is built into the Macintosh Portable. An optional 18-key numeric keypad is available as an alternative to the trackball which comes with the system. The trackball is a 1.3-inch diameter low-power ADB trackball used as a pointing device. It may be placed on either the left or right side of the keyboard (for left- or right-handed people). Even with the use of the trackball, a low-power ADB mouse may be used in a mini-4 port.

There are five available upgrades for the Macintosh Portable:

- Macintosh Portable 1MB Memory Expansion Card
- internal 40MB hard drive
- internal 2400 baud modem
- Macintosh Portable Video Adapter

- second internal SuperDrive

The following technical specifications were provided by Apple Computer.

CPU	Microprocessor: 16 MHz CMOS 68000 Address bus: 24-bit Registers (32-bit): 17 Addressing modes: 14
Coprocessor	Power Manager Processor Mitsubishi M50753 microcomputer chip
Memory	1MB of low-power RAM, expandable to 2MB through the installation of a memory card in the RAM slot, and up to 9MB when higher-density chips become available 256K bytes of ROM 128 bytes of settable parameter memory with built-in battery backup 32K bytes of RAM for the video display
Display	Active Matrix Liquid Crystal Full-page width 640 by 400 pixels
Keyboard	Built-in 63-key keyboard Optional 18-key numeric keypad as trackball alternative
Trackball	Low-power ADB trackball 1 1/3-inch diameter trackball as pointing device Left- or right-hand placement Replaceable by numeric keypad
Mouse	Low-power ADB mechanical tracking, optical shaft encoding at 3.54 pulses per mm (90 pulses per inch) of travel
Disk Drive	One 1.4MB high-density (Apple FDHD) internal drive; two internal floppy drives are supported when hard drive is not installed External connector for 800K or 1.4MB external floppy
Hard Disk Drive	A low-power internal 3 1/2-inch 40-megabyte drive
Interfaces	One ADB connector for keyboard, mouse, and low-speed input devices

Two RS-232/RS-422 serial ports, 230.4K baud maximum (up to 0.920 Mbit per second if clocked externally)
SCSI interface
Stereo sound port for external audio amplifier
External drive port
External video port

Sound Generation Apple Sound Chip (ASC) including four-voice wave-table synthesis and stereo sampling generator capable of driving stereo mini-phono jack headphones or stereo equipment
Mixed stereo monophonic sound output through internal speaker

Electrical Line voltage: 70 to 270 VAC
Line frequency: 48 to 62 Hz
Maximum power consumption: 15 watts

Environment Operating temperature: 50° to 104°F (10° to 40°C)
Storage temperature: -40° to 140°F (-25° to 60°C), for a period not to exceed three days; storage for longer period must be within operating temperature range
Relative humidity: 5% to 95%
Altitude: 0 to 10,000 feet

Size and Weight Main unit
Height rear panel: 4.05 inches (102.87mm)
Height front panel: 2.1 inches (53.34mm)
Height base to highest point with display open: 11.0 inches (279.4mm)
Width: 15.25 inches (387.35mm)
Depth: 14.83 inches (365.25mm)
Weight (including battery): 13.75 lbs. (6.25 kg)
Weight (including battery and hard drive): 15.75 lbs. (7.16 kg)

Technical Note

1. Shut down the Macintosh Portable to attach devices to the external ports. Failure to do so might damage your system.
2. The SWIM chip (the floppy disk drive management chip developed by Steve Wozniak) doesn't support the 400K floppy disk drive and therefore can't be used by the Macintosh Portable.

3. An external device connected to the system must be powered on and ready or the Macintosh Portable will not boot.
4. When the internal modem port is in use, either the printer or modem port is disabled. The modem automatically uses the modem port unless you enable the modem's use of the printer port through the Control Panel.
5. Only the Apple Macintosh mouse can be used with the Macintosh Portable. Any other mouse draws too much power from the system.
6. You can't install both an internal hard disk and a second internal floppy.
7. The Sleep feature of the Macintosh Portable eliminates the need for a screen saver. Do not use a screen saver with the Portable. It will show a black pixel for the "on" and make the display unreadable.
8. A low contrast level on the screen reduces the response time. If you notice a reduced response time from the mouse, turn the contrast up with the Control Panel.
9. To clean the Portable's screen use either ethyl alcohol, methyl alcohol, or water-based photographic lens cleaner. Apply this solution to a lint-free cloth. Do not spray directly on the display. There is a danger that a liquid can run down into the computer and damage the system.
10. If you leave your Macintosh Portable on for more than 24 hours, you see what is called a *ghost* image on the screen. This ghost can reverse itself, unlike CRT burned-in images. The reversal process takes twice as long as it took to create the ghost. It reverses itself, naturally, over time.
11. You need the main battery to operate the Macintosh Portable unlike modular Macintoshes, which require the electric power source.
12. If your software shuts down ("hangs") on your Portable, plug in the power adapter or replace the battery to revive the system.
13. If the hardware shuts down, you can retrieve your information as long as you recharge the battery within five days of the shutdown. If not, you will lose your data.
14. System software and HyperCard are installed on your Macintosh Portable when you purchase it.

ACTIVE MACINTOSHES

There are 12 active Macintoshes: 2 Classics, 1 Portable, 4 Modular, and 5 PowerBook Macintoshes. Detailed descriptions, technical specifications, and upgrade options for these active Macs are discussed here.

MACINTOSH CLASSIC: CLASSIC LINE

The Macintosh Classic is the least expensive Macintosh on the market, today. Applications run on the Macintosh Classic up to 25 percent faster than on the Macintosh Plus.

The system comes in one of two configurations:

- 1MB of RAM (expandable to 2MB); an internal 1.4MB Apple SuperDrive floppy disk drive; and an ADB keyboard and mouse
- the Macintosh Classic 2/40 is equipped with 2MB of RAM (expandable to 4MB); an internal 40MB hard drive; an internal 1.4MB Apple SuperDrive floppy disk drive; and an ADB keyboard or mouse

The Macintosh Classic requires at least System 6.0.7 to operate. It comes standard with a 7.8336 megahertz Motorola MC68000 microprocessor. It has 32-bit internal registers and a 32-bit address bus. There is no coprocessor for the Macintosh Classic.

The system comes standard with a 512K ROM chip and 1 or 2MB of RAM. This memory may be expanded to 4MB. There is no hardware memory management and no expansion slot.

The sound chip in the Macintosh Classic can drive stereo headphones or other stereo equipment through its sound jack.

The Macintosh Classic has an Apple SuperDrive which can read and write 1.4MB floppy disks. The system can handle an optional 40MB hard drive.

There are six built-in ports on the Macintosh Classic:

- one SCSI port
- one Apple Desktop Bus port
- one external 3 1/2-inch disk interface
- two serial ports
- one sound port

There is a built-in 9-inch 512 by 342 pixel resolution video display. The Macintosh Classic has an ADB keyboard with a numeric keypad as a standard component. It also uses an Apple or any third-party compatible ADB mouse. The Macintosh 2MB Memory Expansion Kit (two 1MB SIMMs) may be used to expand memory up to 4MB.

The following technical specifications were provided by Apple Computer:

CPU	Microprocessor: 7.8336 MHz MC68000 CPU
Memory	1 or 2MB RAM, expandable to 4MB 512K of ROM 256 bytes of parameter memory
Display	Built-in 9-inch diagonal, 512 by 342 pixel, monochrome monitor
Keyboard (not included)	ADB keyboard with numeric keypad Two-level tilt adjustment
Mouse	Apple Desktop Bus mouse standard mechanical mouse
Disk Drive	One 1.4MB Apple SuperDrive internal drive (optional external connector 800K or 1.4MB external floppy)
Hard Disk Drive	Optional internal 40MB hard drive Optional external Apple SCSI hard disk (many capacities available)
Interfaces	One Apple Desktop Bus connector for keyboard, mouse, and other low-speed input devices Two RS-232/RS-422 serial ports, 230.4K baud maximum (up to 0.920 Mbit per second if clocked externally) SCSI interface, using a 50-pin internal connector and a DB-25 connector for the first external device 3.5-inch external floppy disk drive (800K or 1.4MB) interface Stereo sound port for external audio amplifier
Sound Generation	Four-voice sound with 8-bit digital-to-analog conversion using 22 KHz sample rate—can drive stereo mini-phono jack headphones or stereo equipment Mixed stereo monophonic sound output through internal speaker
Electrical	Line voltage: 120 volts AC Line frequency: 47 to 63 hertz Maximum power consumption: 100 watts maximum

Environment	Operating temperature: 50° to 104°F (10° to 40°C) Storage temperature: -40° to 116.6°F Relative humidity: 5% to 95% (noncondensing) Altitude: 0 to 15,000 feet	
Size and Weight	Main unit	Height: 13.2 inches (33.6cm) Width: 9.7 inches (24.6cm) Depth: 11.2 inches (28.5cm) Weight: 16 to 17.1 lb. (7.3 to 7.8 kg)
	Apple keyboard	Height: 1.3 inches (3.3cm) Width: 16.0 inches (40.5cm) Depth: 5.9 inches (15.1cm) Weight: 6 oz. (.17 kg)
	Apple mouse (ADB)	Height: 1.1 inches (27.9mm) Width: 2.1 inches (53.3mm) Depth: 3.8 inches (96.5mm) Weight: 6 oz. (.175 kg)

MACINTOSH SE/30: CLASSIC LINE

The Macintosh SE/30 is available in one of three configurations:

- 1MB of RAM, a 1.4MB FDHD floppy disk, and a mouse
- 1MB of RAM, an internal 40MB hard disk, a 1.4MB FDHD floppy disk, and a mouse
- 4MB of RAM, an internal 80MB hard disk, a 1.4MB FDHD floppy disk, and a mouse

The Macintosh SE/30 operates with a 15.6672 megahertz Motorola MC68030 microprocessor. It supports 32-bit internal registers and a 32-bit address bus.

The coprocessor is a built-in Motorola MC68882 chip, which also operates at 15.6672 megahertz. Other coprocessors may be added into the SE/30 through the 030 Direct Slot (its expansion slot) on the system.

The Macintosh SE/30 has a 256K ROM SIMM chip and comes with either 1 or 4MB of RAM, which is expandable to either 5 or 8MB.

The hardware memory management is a 24/32-bit address translation. Paged memory management is fully supported by the Motorola MC68030.

The expansion slot found on the SE/30 is unique to it: the slot is an 030 direct slot with a EuroDin-120-pin connector.

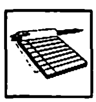
This system supports stereo sound output to an external stereo system. The internal speaker is a mono speaker.

An internal 3 1/2-inch FDHD floppy disk drive can read or write 400K, 800K, or 1.4MB floppy disks. An external 3 1/2-inch floppy drive is available which can read either 800K or 1.4MB floppy disks. The Macintosh SE/30 may be configured with either a 40 or 80MB internal SCSI drive. The system can also accept any external SCSI drives. It doesn't support the Hard Disk 20.

An external (DB-25) and internal (in-line 50-pin) SCSI port are both available on the Macintosh SE/30. The system has two mini-8 serial ports.

The Macintosh SE/30 has a built-in 9-inch 512 by 342 pixel resolution video display. Through the 030 Direct Slot, the system accepts external video cards. Either the standard Apple Keyboard or Apple Extended Keyboard (both mini-4) are usable with the Macintosh SE/30. Any ADB-compatible mouse works with the system. An Apple ADB mouse comes standard with the system.

Either the Apple 1MB Memory Expansion Kit (four 256K SIMMs) or the Apple 2MB Memory Expansion Kit (two 1MB SIMMs) may be used to expand RAM. RAM may be expanded to 2, 4, 5, or 8MB.



Cards designed to work in the Macintosh SE do not work in the Macintosh SE/30. There is a 96-pin connector in the Macintosh SE while there is a 120-pin connector in the Macintosh SE/30 030 Direct Slot.

The following technical specifications were provided by Apple Computer.

CPU Microprocessor: 15.6672 MHz MC68030 CPU
Address bus: 32-bit
Registers (32-bit): 16 general purpose data and address, two 32-bit Supervisor stack pointers, 10 special-purpose control registers
Addressing modes: 18
256-byte instruction cache and 256-byte data cache
Built-in paged memory management unit (PMMU)

Coprocessor MC68882 floating point unit (follows IEEE standards)

Memory 1, 2, 4, 5, 8MB RAM
256K of ROM
256 bytes of settable parameter memory with built-in battery backup

Display	Built-in 9-inch diagonal, 512 by 342 pixel, black and white monochrome monitor (no grayscale)
Keyboard (not included)	Apple Keyboard or Apple Extended Keyboard can be connected through the Apple Desktop Bus port
Mouse	Apple Desktop Bus mouse standard mechanical mouse
Disk Drive	One 1.4MB high-density (Apple FDHD) internal drive; only one internal floppy drive is supported; the unit ships with the Apple FDHD, but the logic board also supports an 800K drive External connector for 800K or 1.4MB external floppy
Hard Disk Drive	A 3 1/2-inch 40MB or 80MB hard drive is standard
Interfaces	Two ADB connectors for keyboard, mouse, and low-speed input devices 030 Direct Slot supporting full 32-bit address and data lines through a 120-pin Euro-DIN connector Two RS-232/RS-422 serial ports, 230.4K baud maximum (up to 0.920 Mbit per second if clocked externally) SCSI interface Stereo sound port for external audio amplifier
Sound Generation	Apple Sound Chip (ASC) including four-voice wave-table synthesis and stereo sampling generator capable of driving stereo mini-phono jack headphones or stereo equipment Mixed stereo monophonic sound output through internal speaker
Electrical	Line voltage: 85 to 270 volts AC Line frequency: 48 to 62 hertz Maximum power consumption: 75 watts continuous, 99 watts maximum for 15 seconds 10% duty cycle
Environment	Operating temperature: 50° to 95°F (10° to 35°C) Storage temperature: -40° to 116.6°F Relative humidity: 5% to 95% (noncondensing) Altitude: 0 to 10,000 ft Fan: 10 CFM radial
Safety	FCC Class B, part 15 Computing Devices DHHS Rules 21CFR, Subchapter J, applicable at date of manufacture UL 126Z Office Equipment

Size and Weight	Main unit	Height: 13.6 inches (345.4mm) Width: 9.6 inches (243.8mm) Depth: 10.9 inches (276.2mm) Weight: 21.5 lb. (9.75 kg)
	Apple keyboard	Height: 1.8 inches (44.5mm) Width: 16.5 inches (418.3mm) Depth: 5.6 inches (142.0mm) Weight: 2 lb. 2oz. (1 kg)
	Apple Extended Keyboard	Height: 2.3 inches (56.4mm) Width: 19.1 inches (486mm) Depth: 7.4 inches (188mm) Weight: 3lb. 10 oz. (1.6 kg)
	Apple mouse	Height: 1.1 inches (27.9mm) Width: 2.1 inches (53.3mm) Depth: 3.8 inches (96.5mm) Weight: 6 oz. (.175 kg)

MACINTOSH LC: MODULAR LINE

The Macintoch LC is named for its most important attribute: low-cost color. The system is more than 100 percent faster and more responsive than the Macintosh SE and Classic computers.

The Macintosh LC comes in one of two standard configurations:

- 2MB of RAM, an Apple SuperDrive and a keyboard
- 2MB of RAM, an Apple SuperDrive, a 40MB hard drive and a keyboard

At the core of the Macintosh LC is a Motorola MC68020 microprocessor which runs at a clock speed of 156 megahertz. It supports 32-bit internal registers and a 32-bit address bus.

A built-in video card supports three Apple monitors on the system:

Macintosh 12-inch RGB display
Macintosh 12-inch monochrome display
AppleColor high-resolution RGB monitor

Sound input is built into the Macintosh LC. It enables you to capture input from a variety of sources. Through applications which support sound, it can be added to word-processing, spreadsheet, electronic mail and presentation documents.

The system has 2MB of RAM expandable to 4 or 10MB. The 512K ROM chip and 256 bytes of parameter memory are standard.

The Macintosh LC has an 020 Direct Slot which can accept 020 direct cards for expansion. One of the purposes of this 020 Direct Slot is to house an Apple IIe emulation card. With the card, the Macintosh LC can run applications developed for the Apple IIe. The Apple IIe card supports 5 1/4-inch and 3 1/2-inch floppy disk drives and enables applications created in Apple IIe mode to be printed on LaserWriter printers. Additionally, the 020 Direct Slot supports an Ethernet card which enables a Macintosh LC to run on an Ethernet network.

The system has a built-in 1.4MB Apple SuperDrive floppy disk drive and an internal 40MB Apple SCSI hard disk. Optional external SCSI hard disks are available for the Macintosh LC.

The following ports are built into the Macintosh LC:

- an ADB port to support a keyboard, mice, or other devices
- two serial ports
- one video port supports Apple and third-party color and monochrome monitors
- a 50-pin internal and a DB-25 connector used for SCSI devices
- a monophonic sound output port
- a sound input port for monaural sound input

With the optional Macintosh LC 512K VRAM SIMM, color depth is increased to 256 colors or shades of gray on the 12-inch AppleColor high-resolution RGB or monochrome displays. With the Macintosh 12-inch RGB display, 32,000 colors are available with this 512K VRAM SIMM.

The Control Panel contains a device which drives the basic sound input.

With the Macintosh 2MB Memory Expansion Kit the Macintosh LC is expandable to 4MB of RAM. Memory is expandable to 10MB, with third-party 4MB SIMMS.

The following technical specifications were provided by Apple Computer.

CPU Microprocessor: 16 MHz MC68020 CPU
Address bus: 32-bit
Registers (32-bit): 16 general purpose data and address, two 32-bit Supervisor stack pointers, ten special purpose control registers

Memory	2MB of MB RAM expandable to 4 or 10MB 512K of ROM 256 bytes of parameter memory
Display	Supports several color and monochrome monitors including the Macintosh 12-inch RGB and monochrome displays and AppleColor high-resolution RGB monitor Supports other Apple and non-Apple monitors with a video expansion card
Keyboard	ADB keyboard with numeric keypad Two-level tilt adjustment
Mouse	Apple Desktop Bus mouse standard mechanical mouse
Disk Drive	One 1.4MB Apple SuperDrive internal drive (optional external connector 800K or 1.4MB external floppy)
Hard Disk Drive	Internal 40MB hard drive Optional external Apple SCSI hard disk (many capacities available)
Interfaces	One ADB connector for keyboard, mouse, and other low-speed input devices Two RS-232/RS-422 serial ports, 230.4K baud maximum (up to 0.920 Mbit per second if clocked externally) Video port, supporting color and monochrome monitors of various sizes and resolutions SCSI interface, using a 50-pin internal connector and a DB-25 connector for the first external device Internal expansion slot, supports an 020 Direct Slot expansion card Monophonic sound output port for external audio devices Sound input port for monaural sound input
Sound Input	Monaural 8-bit sound Sound samples can be made at 22 or 11 kilohertz Macintosh Audio Compression Expansion (MACE) sound utility, supporting 3:1 or 6:1 compression, which allows approximately one-half hour of sound stored on a single 440MB hard disk
Sound Generator	Four-voice sound with 8-bit digital-analog conversion using 22 kilohertz sample rate—capable of driving stereo mini-phono jack headphones or stereo equipment Mixed stereo monophonic sound output through internal speaker

Microphone	Hands free omnidirectional electret microphone	
Electrical	Line voltage: 90 to 240 volts AC, RMS Line frequency: 47 to 63 hertz, single phase Maximum power consumption: 50 watts maximum	
Environment	Operating temperature: 50° to 104°F (10° to 40°C) Storage temperature: -40° to 116.6°F Relative humidity: 20% to 80% (noncondensing) Altitude: 0 to 10,000 ft	
Size and Weight	Main unit	Height: 3.0 inches (7.7cm) Width: 12.2 inches (31.0cm) Depth: 15.0 inches (38.2cm) Weight: 8.8 lb. (4.0 kg)
	Apple keyboard	Height: 1.8 inches (4.4cm) Width: 16.5 inches (41.8cm) Depth: 5.6 inches (14.2cm) Weight: 2 lb. (1 kg)
	Apple mouse	Height: 1.1 inches (27.9mm) Width: 2.1 inches (53.3mm) Depth: 3.8 inches (96.5mm) Weight: 6 oz. (.175 kg)

MACINTOSH IISI: MODULAR LINE

A 20 megahertz Motorola 68030 is at the heart of the Macintosh IIsi. This microprocessor enables the IIsi to run applications up to five times as fast as the Macintosh SE. The system has a built-in memory management unit (MMU), which enables it to support the virtual memory feature found under System 7. An optional Motorola 68882 floating point math coprocessor enables the IIsi to perform mathematical calculations rapidly.

There are two configuration of the Macintosh IIsi:

- Macintosh IIsi with 2MB of RAM, a SuperDrive, and a 40MB hard disk drive
- Macintosh IIsi with 5MB of RAM, a SuperDrive, and an 80MB hard disk drive

RAM is expandable on the IIsi up to 17MB. A 512K ROM chip along with 256 bytes of parameter memory are also a part of the system.

Four Apple color and monochrome monitors are supported by this Macintosh:

Macintosh 12-inch RGB display
AppleColor high-resolution RGB monitor
Macintosh 12-inch monochrome display
Apple Macintosh Portrait display

The IIsi's onboard video supports a host of other third-party monochrome and color monitors.

The Macintosh IIsi can accept either a NuBus or an 030 Direct Slot card in its one expansion slot. This feature enables you to use either cards developed specifically for the Macintosh SE/30 or any of the Macintosh II modular Macintoshes.

Like the Macintosh LC, the Macintosh IIsi allows the addition of a user's voice to many Macintosh-based applications. A microphone and a phono jack adapter come with the system.

The ports on the Macintosh IIsi are as follows:

- one Apple Desktop Bus port
- two mini-8 serial (RS-232/RS-422) ports
- one SCSI interface
- a video port
- a sound input port
- a sound output port
- an external floppy disk drive port

You can buy either a Macintosh IIsi NuBus adapter card (for NuBus cards) or a Macintosh IIsi 030 Direct Slot adapter card (for 030 Direct Slot cards).

The following technical specifications were provided by Apple Computer.

CPU	Microprocessor: 20 MHz MC68030 CPU Address bus: 32-bit Two 256 byte, built-in instruction and data caches
Coprocessor (Optional)	MC68882 floating point math coprocessor 20 megahertz clock speed

Memory	1MB of MB RAM expandable to 17MB 512K of ROM 256 bytes of parameter memory
Display	Supports several color and monochrome monitors including the Macintosh 12-inch RGB and monochrome displays, AppleColor high-resolution RGB monitor and Apple Macintosh Portrait display With a video expansion card, supports other Apple and non-Apple monitors
Mouse	Apple Desktop Bus mouse standard mechanical mouse
Disk Drive	One 1.4MB Apple SuperDrive internal drive (optional external connector 800K or 1.4MB external floppy)
Hard Disk Drive	Internal 40 or 80MB SCSI hard drive Optional external Apple SCSI hard disk (many capacities available)
Interfaces	One Apple Desktop Bus connector for keyboard, mouse, and other low-speed input devices Two RS-232/RS-422 serial ports, 230.4K baud maximum (up to 0.920 Mbit per second if clocked externally) Video port, supports color and monochrome monitors of various sizes and resolutions SCSI interface, using a 50-pin internal connector and a DB-25 connector for the first external device Internal expansion slot, supports a NuBus or 030 Direct Slot expansion card Stereo sound output port for external audio devices Sound input port for monaural sound input
Sound Input	Monaural 8-bit sound samples can be made at 22 or 11 kilohertz Macintosh Audio Compression Expansion (MACE) sound utility, supporting 3:1 or 6:1 compression, which allows approximately one half an hour of sound to be stored on a single 440MB hard disk
Sound Generation	Eight-bit stereo sampling at 44.1 kilohertz including four-voice wave-table capable of driving stereo mini-phono jack headphones or stereo equipment Mixed stereo monophonic sound output through internal speaker
Microphone	Hands free omnidirectional electret microphone

Electrical	Line voltage: 120 volts AC, RMS Line frequency: 47 to 63 hertz, single phase Maximum power consumption: 100 watts maximum	
Environment	Operating temperature: 50° to 104°F (10° to 40°C) Storage temperature: -40° to 116.6°F Relative humidity: 5% to 95% (noncondensing) Altitude: 0 to 10,000 ft	
Size and Weight	Main unit	Height: 4 inches (10cm) Width: 12.4 inches (31.0cm) Depth: 14.9 inches (37.2cm) Weight: 10 lb. (4.5 kg)
	Apple mouse (ADB)	Height: 1.1 inches (27.9mm) Width: 2.1 inches (53.3mm) Depth: 3.8 inches (96.5mm) Weight: 6 oz. (.175 kg)

MACINTOSH IICI: MODULAR LINE

The Macintosh IIci was designed for Macintosh users who don't need six NuBus expansion slots. It was also designed to take up less workspace than other Macintoshes.

The Macintosh IIci is based on a Motorola MC68030 processor, which runs at a clock speed of 25 megahertz. It supports 32-bit internal registers and a 32-bit address bus. Its burst mode (non-parity) RAM enables it to process instructions and data more efficiently, increasing system performance.

A Motorola MC68882 floating point math coprocessor provides quick mathematical calculations. The paged memory management unit (PMMU) enables the Macintosh IIci to support multitasking operating systems.

A cache memory card is available for the IIci which can improve system performance by 20 to 30 percent. The cache card is connected to the system with a cache connector that is part of the system.

A 512K ROM chip is standard on the system. One or 4MB of RAM is available on the system. Memory is expandable up to 8MB.

The Macintosh IIci operates with System software 6.0.4 or later.

The Apple Sound chip provides stereophonic sound output to a stereo system or mono output from its internal speaker.

The IIci has a 1.4MB Apple SuperDrive internal 3 1/2-inch floppy disk drive. An additional external Apple SuperDrive is available for the system. A host of internal SCSI-based hard disks are supported by the IIci.

These are the built-in ports on the Macintosh IIci:

- two serial ports
- two Apple Desktop Bus ports
- one SCSI port
- one DB-19 serial port, for an external disk drive
- one DB-15 video port
- one sound port

The video card is built into the system and supports one external high-resolution RGB, monochrome, or portrait display. Use of the NuBus slots allow for multiple external Apple or third-party monitors.

Any keyboard or mouse compatible with the Apple Desktop Bus works with the system.

There are three memory upgrades available for the Macintosh IIci:

- Apple 1MB Memory Expansion Kit
- Apple 4MB Memory Expansion Kit
- Apple 4MB Parity Memory Expansion Kit (used to improve overall system performance)

The following technical specifications were provided by Apple Computer.

CPU Microprocessor: 25 MHz MC68030 CPU
Address bus: 32-bit
Registers (32-bit): 16 general purpose data and address, two 32-bit Supervisor stack pointers, ten special purpose control registers
Addressing modes: 18
256-byte instruction cache and 256-byte data cache, with burst mode enabled
Built-in paged memory management unit (PMMU)

Coprocessor MC68882 floating point unit (follows IEEE standards)

Memory	1, 2, 4, 5, 8MB RAM / 4, 8MB parity RAM 256K of ROM 256 bytes of settable parameter memory with built-in battery backup
Keyboard (not included)	Apple Keyboard or Apple Extended Keyboard can be connected through the Apple Desktop Bus port
Mouse	Apple Desktop Bus mouse standard mechanical mouse
Disk Drive	One 1.4 MB high-density (Apple FDHD) internal drive; only one internal floppy drive is supported; the unit ships with the Apple FDHD, but the logic board also supports an 800K drive External connector for 800K or 1.4MB external floppy
Hard Disk Drive	A 3 1/2-inch 40MB or 80MB hard drive is standard
Interfaces	Two Apple Desktop Bus connectors for keyboard, mouse, and low-speed input devices Three NuBus Slots supporting full 32-bit address and data lines through a 96-pin EuroDIN connector One cache connector for an optional high-speed memory cache card, supports full 32-bit address and data lines through a 120-pin EuroDIN connector Built-in video port that supports the Apple high-resolution monochrome monitor, the Apple high-resolution RGB monitor and the Macintosh Portrait display Two RS-232/RS-422 serial ports, 230.4K baud maximum (up to 0.920 Mbit per second if clocked externally) SCSI interface stereo sound port for external audio amplifier
Sound Generator	Apple Sound Chip (ASC) including four-voice wave-table synthesis and stereo sampling generator capable of driving stereo mini-phono jack headphones or stereo equipment Mixed stereo monophonic sound output through internal speaker
Electrical	Line voltage: 100 to 240 volts AC, RMS automatically configured Line frequency: 50 to 60 hertz single phase Maximum power consumption: 130 watts maximum, 90 watts maximum continuous (not including monitor power)
Environment	Operating temperature: 50° to 104°F (10° to 40°C)

Storage temperature: -40° to 116.6°F
Relative humidity: 5% to 95% (noncondensing)
Altitude: 0 to 10,000 ft
Fan: 17 CFM radial

Safety	FCC part 15 Class B Computing Devices UL 478 Electronic Data Processing Equipment CSA (Canadian Standards Assn.) 220 Information Processing and Business Equipment	
Size and Weight	Main unit	Height: 5.5 inches (140mm) Width: 11.9 inches (302mm) Depth: 14.4 inches (365mm) Weight: 13 lbs. 10 oz. (6.2 kg)
	Apple keyboard (not included)	Height: 1.8 inches (44.5mm) Width: 16.5 inches (418.3mm) Depth: 5.6 inches (142.0mm) Weight: 2 lbs. 2 oz. (1 kg)
	Apple Extended Keyboard (not included)	Height: 2.3 inches (56.4mm) Width: 19.1 inches (486mm) Depth: 7.4 inches (188mm) Weight: 3 lbs. 10 oz. (1.6 kg)
	Apple mouse (ADB)	Height: 1.1 inches (27.9mm) Width: 2.1 inches (53.3mm) Depth: 3.8 inches (96.5mm) Weight: 6 oz. (.175 kg)

Technical Note

1. Version 3.0 of the AppleCD SC setup must be used with the Macintosh IIci. Anything less will make the system crash.
2. Built-in video on the IIci causes the logical location of the video to remap. The 68030 memory management unit remaps memory to appear as if it is mapped in a standard fashion. The result, though, is that physical and logical memory mapping are not identical.

NuBus master cards can have a problem with this remapping. NuBus master cards include accelerators and coprocessor boards. Routines are present in the memory manager to convert addresses from logical to physical ones. These problematic cards may require a firmware update to fix the situation.

These same cards have problems when virtual memory is used. If virtual memory is turned off, the problem may still remain. If you have a problem, contact the board manufacturer.

3. Some third-party video cables and extenders only support the Apple displays. Due to the pin configurations, other monitors fail with the built-in video card. Contact the specific cable manufacturer to insure that they can configure the cable to your monitor's needs.
4. The Macintosh IIci will crash if there is RAM used which doesn't satisfy the timing specifications of the 25 megahertz Motorola 68030. A RAM speed of 80 ns or greater is required. The RAM must also work with fast page modes.
5. There are two conditions that must be met when you install RAM SIMM modules:

- Each bank must contain SIMM boards with the same density.
- Any bank that contains RAM must be completely filled with RAM to function.

MACINTOSH IIFX: MODULAR LINE

The Macintosh IIfx is powered by a 40 megahertz Motorola MC68030 processor. It has 32-bit internal registers and a 32-bit address bus. The system employs a 40 megahertz Motorola MC68882 floating point unit to facilitate rapid mathematical calculations. System efficiency is increased through the use of custom-designed Application Specific Integrated Circuits (ASICs). They handle low-level input/output tasks which had been handled by the main microprocessor on other Macintoshes.

512K ROM SIMM is standard on the Macintosh IIfx. The system has 4MB of RAM and is expandable to 8MB. With third-party RAM, it may be expanded to 128MB.

A minimum of System 6.0.5 is required to run the Macintosh IIfx. The computer also runs A/UX 2.0 (Apple UNIX).

Twenty-four/thirty-two-bit address translation and paged memory management is supported by the Motorola MC68030.

The Macintosh IIfx has six NuBus expansion slots. A high-speed interface is provided to third-party hardware through the Processor Direct Slot (PDS).

The sound is achieved with the Apple Sound Chip. The sound output is stereophonic to a stereo speaker and mono through the internal speaker.

An internal 1.4MB SuperDrive is standard. A second drive is optional. An external 3 1/2-inch floppy disk drive is not supported. An 80 or 160MB SCSI hard disk are options on the Macintosh IIfx. An external SCSI hard disk is also optional.

The system has an external (DB-25) and internal (in-line 50-pin) SCSI port. SCSI performance is enhanced with the SCSI DMA controller. The Macintosh IIfx has two mini-8 serial ports.

Through the NuBus expansion slots, multiple external monitors may be used. The Macintosh IIfx can be used with either the standard Apple keyboard or the Apple Extended Keyboard II. Any mice that support the Apple Desktop Bus may be used with the IIfx.

There are two upgrade possibilities with this Macintosh:

- Memory may be upgraded to 8MB with the Macintosh IIfx 4MB Memory Upgrade Kit (four 1MB SIMMs).
- A second internal SuperDrive can be supported by the system.

The following technical specifications were provided by Apple Computer.

CPU	Microprocessor: 40 MHz MC68030 CPU Address bus: 32-bit Registers (32-bit): 16 general purpose data and address, two 32-bit Supervisor stack pointers, ten special purpose control registers Addressing modes: 18 256-byte instruction cache and 256-byte data cache Built-in paged memory management unit (PMMU)
Coprocessor	MC68882 40 MHz floating point unit (follows IEEE standards) Macintosh System software 6.0.5 or later A/UX 2.0 (Apple UNIX) or later
Memory	4 or 8MB RAM, up to 128MB using third-party RAM 80 ns, 64-pin SIMM 4 or 8MB Parity RAM 60 ns, 64-pin SIMM Built-in 32K Static RAM Cache, zero wait state operation 512K of ROM 256 bytes of parameter memory with built-in battery backup

	Optional parity support Supports overlapping reads and writes to DRAM
I/O Processors	Two dedicated I/O processors manage low-level I/O tasks for the serial ports, floppy disk drive(s), and Apple Desktop Bus, providing higher levels of overall system performance
Mouse	Apple Desktop Bus mouse standard mechanical mouse
Disk Drive	One 1.4MB high-density (Apple SuperDrive) internal drive; two internal floppy drives are supported; the unit ships with the Super-Drive, but the logic board also supports an 800K drive
Hard Disk Drive	A 3 1/2-inch 80MB or 5 1/4-inch 160MB hard drive is available
Interfaces	Two Apple Desktop Bus connectors for keyboard, mouse, and low-speed input devices Six NuBus slots supporting full 32-bit address and data lines through a 96-pin EuroDIN connector Two RS-232/RS-422 serial ports, 230.4K baud maximum (up to 0.920 Mbit per second if clocked externally) SCSI interface Stereo sound port for external audio amplifier
Sound Generator	Apple's custom digital sound chip provides 8-bit stereo sampling at 44.1 kilohertz, and includes four-voice wave-table synthesis capable of driving stereo headphones or other stereo equipment through the sound jack
Electrical	Line voltage: 100 to 240 volts AC, RMS automatically configured Line frequency: 48 to 62 hertz single phase Maximum power consumption: 230 watts maximum (not including monitor power)
Environment	Operating temperature: 50° to 104°F (10° to 40°C) Storage temperature: -40° to 116.6°F Relative humidity: 5% to 95% (non-condensing) Altitude: 0 to 10,000 ft
Safety	FCC part 15 Class B Computing Devices UL 478 Electronic Data Processing Equipment CSA (Canadian Standards Assn.) 220 Information Processing and Business Equipment

Size and Weight	Main unit	Height: 5.5 inches (140mm) Width: 18.7 inches (474mm) Depth: 14.4 inches (365mm) Weight: 24 lbs. (10.9 kg) not including hard drive
	Apple mouse (ADB)	Height: 1.1 inches (27.9mm) Width: 2.1 inches (53.3mm) Depth: 3.8 inches (96.5mm) Weight: 6 oz. (.175 kg)

MACINTOSH POWERBOOK 100: NOTEBOOK LINE

The PowerBook 100 is a laptop computer, with all the "feel" of a "real" Macintosh. It is the lowest priced of the three new laptop computers.

It comes with a 9-inch diagonal backlit Supertwist liquid crystal display, 640 by 400 pixels. The battery is sealed lead-acid, 2.3 ampere-hours. It provides 2 to 4 hours of usage before recharging is needed. (Recharge time is 3 hours.) There is one internal 20MB hard disk. An additional external 1.4MB floppy disk drive reads, writes, and formats Macintosh MS-DOS, OS/2, and ProDOS diskettes. The keyboard is built in with the standard Macintosh layout. There is an added feature of a two-level tilt adjustment and a 25mm-diameter, dual-button trackball. It has one Apple Desktop Bus port for keyboard, mouse, and devices using a low-speed, synchronous serial bus. There is one RS-422 serial port for LocalTalk networking, printers, modems, and other devices. There is an HDI-30 SCSI port for hard disks, scanners, CD-ROM drives, and other devices. There is one HDI-20 floppy disk drive port for the external 1.4MB floppy disk drive. The Apple Sound Chip provides 8-bit sound capable of driving headphones or other stereo equipment through the sound port. The system software is System 7.0.1.

Features	Processor: 16 MHz 68HC000 microprocessor 2MB pseudo-static RAM on the logic board and one memory expansion slot Expand up to 8MB of RAM with expansion card One internal 20MB hard disk An external 1.4MB floppy disk drive is available
Expansion	Five built-in ports for peripherals Internal slots for modem and RAM Optional SCSI disk adapter allows the computer to be used as an external hard disk

Size and weight Height: 1.8 inches (4.06cm)
Width: 11 inches (28.0cm)
Depth: 8.5 inches (22.0cm)
Weight: 5.1 pounds (2.3 kg)

MACINTOSH POWERBOOK 140

The PowerBook 140 is the midrange-priced Macintosh laptop computer. It has all the "look and feel" of a desktop Mac.

The PowerBook 140 comes with a 10-inch diagonal backlit Supertwist liquid crystal display, 640 by 400 pixels. The battery is a NiCad, 2.5 ampere-hours which provides 2 to 3 hours of usage before recharging is needed. (Recharge time is 3 hours.) There is one built-in 1.4MB drive that uses high-density floppy disks and reads, writes, and formats Macintosh, MS-DOS, OS/2, and ProDOS formats. There is one internal 20 or 40MB hard disk. The keyboard is built-in with a standard Macintosh layout. It has a two-level tilt adjustment. A 30mm-diameter, dual-button trackball comes with it. It has one Apple Desktop Bus port for keyboard, mouse, and other devices using a low-speed, synchronous serial bus. It has two RS-422 serial ports for LocalTalk networking, printers, modems, and other devices. There is one HDI-30 SCSI port for hard disks, scanners, CD-ROM drives, and other devices. One sound output port for an external audio amplifier is provided. There is also one sound-in port. There is an optional internal 2400 baud modem with fax send at 9600. Apple Sound Chip provides 8-bit sound, capable of driving stereo headphones or other stereo equipment through the sound port, and sampled at 11 or 22 KHz. The system software is System 7.0.1.

Features Processor: 16 MHz 68030 microprocessor
2 or 4MB of RAM expandable to 8
One built-in 1.4MB drive
One internal 20 or 40MB hard disk

Expansion Six built-in ports for peripherals
Internal slots for modem and RAM

Size and weight Height: 2.25 inches (5.7cm)
Width: 11.25 inches (28.6cm)
Depth: 9.3 inches (23.6cm)
Weight: 6.8 pounds (3.03 kg)

MACINTOSH POWERBOOK 170

The PowerBook 170 is the top-of-the-line Macintosh laptop. It has more memory, and a math coprocessor built in. It's also the most expensive.

It comes with a 10-inch diagonal backlit active-matrix liquid crystal display, 640 by 400 pixels. The battery is a NiCad, 2.5 ampere-hours, which provides 2 to 3 hours of usage before recharging is necessary. (Recharge time is 3 hours.) There is one built-in 1.4MB drive that uses high-density floppy disks and reads, writes, and formats Macintosh, MS-DOS, OS/2, and ProDOS disks. It has one internal 40MB hard disk. The keyboard is built in, with a standard Macintosh layout, two-level tilt adjustment, and a 30mm dual-button trackball. It has one Apple Desktop Bus port for keyboard, mouse, and other devices using a low-speed synchronous serial bus. Two RS-422 serial ports for LocalTalk networking, printers, modems, and other devices are provided. There is one HDI-30 SCSI port for hard disks, scanners, CD-ROM drives, and other devices. It has one sound output port for external audio amplifier, and one sound-in port. There is an internal 2400-baud modem with fax send at 9600 baud; and it includes fax send software. Apple Sound chip provides 8-bit sound capable of driving stereo headphones or other stereo equipment through the sound port. It has 8-bit sound, sampled at 11 or 22 KHz. The system software is System 7.0.1.

Features	25 MHz 68030 microprocessor 25 MHz 68882 math coprocessor 4MB of RAM, expandable to 8 One built-in 1.4MB drive One internal 40MB hard disk
Expansion	Six built-in ports for peripherals Internal slots for modem and RAM
Size and weight	Height: 2.25 in (5.7cm) Width: 11.25 in (28.6cm) Depth: 9.3 in (23.6cm) Weight: 6.8lbs (3.08 kg)

MACINTOSH QUADRA 700: THE NEW POWER MACS

The Quadra 700 is the highest-performance desktop system, with a Motorola 68040 microprocessor (32-bit architecture, 25 MHz clock speed), faster graphics architecture, and an enhanced NuBus and SCSI subsystems. These features make it possible for the computer to run applications up to twice as fast as the Macintosh IIfx. There is an integral paged memory management unit (PMMU), Floating Point Unit (FPU), and 8K cache architecture. It comes with 4MB of RAM on the logic board and 4 memory expansion slots. It expands to up to 20MB of RAM by installing 4MB SIMMs in the empty slots.

There is a built-in Apple SuperDrive 1.4MB floppy disk drive and an 80 or 160MB internal Apple SCSI hard disk drive. The video display supports all Apple monitors (from the 12-inch RGB and monochrome to the 21-inch Color Display). It also supports non-Apple monitors, including VGA, NTSC, and PAL. The Video RAM is 512K, upgradable to 2MB for display of more colors or shades of gray on a monitor. There are two Apple Desktop Bus ports, supporting a keyboard, mouse, and other devices daisy-chained through a synchronous serial bus. There are two serial (RS-232/RS-422) ports, a SCSI bus interface, video port, two internal NuBus expansion slots, one processor-direct slot (to provide access to the CPU bus for the highest possible performance), stereo sound output port—which can deliver sound to both channels of a stereo device, a sound input port for monaural sound input, and an AUI-15 Ethernet connector.

The Quadra 700 will support all Apple Desktop Bus keyboards and mice.

Features 25 MHz 68040 microprocessor
4MB RAM, expandable to 20
Built-in support for all Apple monitors
32 bits per pixel for true color

Expansion Nine built-in ports for peripherals
Two expansion slots

Size and weight Height: 11.9 inches (30.2cm)
Width: 5.5 inches (14.0cm)
Depth: 14.4 inches (36.5cm)
Weight: 13 lbs. 10 oz. (6.2kg) (more with internal hard disk)

MACINTOSH QUADRA 900

The Quadra 900 is the largest, most powerful, and expensive Macintosh on the market today. With the ultrafast Motorola 68040 microprocessor, faster graphics architecture, and improved SCSI and NuBus capabilities, the Quadra 900 runs applications up to twice as fast as the Macintosh IIfx. The Quadra 900 has a MC68040 (32-bit architecture, 25 MHz clock speed), integral paged memory management unit, floating point unit, and 8K cache architecture. It comes with 4MB of RAM standard and 12 memory expansion slots for SIMMs. It will expand to up to 64MB of RAM with the installation of 4MB SIMMs in the empty slots and the replacement of existing 1MB RAM SIMMs with 4MB RAM chips.

There is a built-in Apple SuperDrive 1.4MB floppy disk drive and support for up to three additional devices, such as a CD-ROM drive. The video display supports all Apple monochrome and color monitors and some other non-Apple monitors including VGA, NTSC, and PAL. There is 1MB, upgradable to 2MB for display of more colors or shades of gray on a monitor.

The interfaces include: one Apple Desktop Bus port to support a keyboard, mouse, and other devices daisy-chained through a synchronous serial bus; two serial (RS-232/RS-422) ports, 230.4 kilobits per second maximum (up to .0920 megabits per second if clocked externally); SCSI bus interface; video port to support RGB and monochrome monitors; five internal NuBus expansion slots; one processor-direct slot (to provide access directly to the CPU for the highest possible performance); stereo output to both channels of a stereo device; sound input for monaural sound; one stereo line input port; and a AUI-15 Ethernet connector. The Quadra 900 supports all Apple Desktop Bus keyboards and mice.

Features	25 MHz 6040 microprocessor 4MB RAM, expandable to 64
Expansion	Ten built-in ports for peripherals Up to four storage devices Five NuBus expansion slots
Size and weight	Height: 18.6 inches (47.3cm) Width: 8.9 inches (22.4cm) Depth: 20.6 inches (52.3cm) Weight: 36 lbs. 12 oz. (16.7 kg) (more with internal hard disk)

MACINTOSH CLONES

There have been numerous attempts to clone Macintoshes, with limited success. The companies which remain have clearly found "work-arounds" for the legal issue of infringement on Apple's patents and copyrights. Colby, Dynamac, and Outbound scrounge used Macintoshes (generally Macintosh 512, Plus, or SE varieties) to create their own systems. By cannibalizing the logic board from these systems, they do not violate any patents or copyrights. They get the crucial components to create their computers. This pursuit can be quite an expensive proposition. Outbound pays anywhere from $200 to $1,000 for an older Macintosh. They manufacture the hardware to house these components.

AKKORD

Akkord should be mentioned for its place in history. Its Macintosh clone, the "Jonathan," is no longer around. This Taiwan-based company attempted to create a Macintosh clone which did work. Apple alleged (even in a lawsuit) that the company copied the Macintosh ROMs and pirated System software. This suit was launched after Akkord had shut down its operation. It closed the company due to its inability to sell the Jonathan in both Europe and Asia.

COLBY

Colby makes two Macintosh clones, the Colby Classmate and the Colby SE-30. You can contact them at:

Colby Systems Corp.
2991 Alexis Drive
Palo Alto, CA 94304
415-941-9090

Colby Classmate

The Colby Classmate is a notebook-sized Macintosh. It is based on the Macintosh Classic's mother board. The system itself weighs five pounds. The Classmate is 2 by 10 by 13 inches. Its display is a backlit supertwist LED display. The resolution of the display is 640 by 480 pixels. The unit contains a built-in keyboard and a small trackball.

Storage on the Colby Classmate is either a 40, 80, or 105MB hard drive. It can support a 1.44MB floppy drive in addition to the hard disk.

The standard RAM configuration is 2MB, upgradable to 4MB, which uses standard D-RAM SIMMs.

The battery lasts 2 to 3 hours without a recharge. Either an ADB keyboard or mouse may be used with the system.

Colby SE-30

The Colby SE-30 is a 12-pound portable Macintosh clone which uses the 68030 chip. Its dimensions are 11 7/8 by 15 3/4 by 3 1/2 inches. An 800K floppy drive is standard on the system. A 1.44MB floppy drive is optional in lieu of the 800K drive. The system may also come with a 40MB hard drive.

The display used on the Colby SE-30 is the same as the Classmate: a backlit, supertwist black and white LCD.

The system can be upgraded to 8MB of RAM. Additionally, an optional dual-page high-resolution video board is available. This board can support the 19-inch video display which is sold by Colby.

DYNAMAC

Dynamac manufactures the Dynamac SE, SE/30, and Macintosh Portable. They use Macintosh logic boards to avoid any patent or trademark infringement. They can be reached at:

Dynamac Computer Products, Inc.
555 17th Street, Suite 1850
Denver, Colorado 80202
303-296-0606 or 800-234-2349

Dynamac SE

The Dynamac SE uses a Macintosh SE mother board with a Motorola MC68000 processor. It comes standard with 2.5MB of RAM, upgradable to 4MB. The system has a 1.44MB floppy disk drive. A 40MB hard disk is also a part of the system. It uses a fully light-emitting 640 by 400 video display. An internal 1200 baud modem is in every system.

The Dynamac SE has a video interface for 1024 by 808, 17-inch E-Machines monitors. The system, itself, is upgradable to the Dynamac SE/30.

Dynamac SE/30

The Dynamac SE/30 has a Macintosh SE/30 mother board with a 16 MHz Motorola MC68030 processor. To expedite mathematical calculations, it has a Motorola MC68882 math coprocessor. You buy the Dynamac SE/30 with 2MB of RAM, standard. This RAM can be upgraded to 8MB.

Like the Dynamac SE, it comes standard with 2.5MB of RAM, upgradable to 4MB. The system has a 1.44MB floppy disk drive. A 40MB hard disk is also a part of the system. It uses a fully light-emitting 640 by 400 video display.

The Dynamac SE/30 has an SE/30 Direct Slot for use as an expansion slot. The system comes with a 2400 baud internal data modem and a 4800 baud internal fax modem.

Dynamac Macintosh Portable

The Dynamac Macintosh Portable is driven by a 16 MHz Motorola 68000 processor. Standard features of the system are as follows:

- 2MB of RAM
- 1.44MB HD floppy disk drive
- 40MB hard drive
- 640 by 400 active matrix LCD display
- internal 2400 baud data modem
- 4800 baud internal fax modem
- internal surge protector
- AC/DC power

The Dynamac Macintosh Portable can support all available Apple monitors.

OUTBOUND

Outbound Systems has two Macintosh clones on the market, the Outbound Laptop System and the Outbound Notebook System. Both of these systems are made from cannibalized parts of older Macintosh systems. You can contact them at:

Outbound Systems, Inc.
4840 Pearl East Circle
Boulder, CO 80301
303-786-9200 or 800-444-4607

Outbound Laptop System

The Outbound Laptop System is a laptop computer. It runs with a 15 MHz processor taken from the Macintosh Plus computer. This laptop has the following features:

- up to 4MB of RAM
- 40MB hard disk
- external 1.44MB floppy disk drive
- carrying case

Two features are optional. They are a SCSI adapter and emulator and a 2.4 ounce portable modem called the Pocket Port.

Outbound Notebook System

The Outbound Notebook System is 8 1/2 by 11 by 2 inches in size. It weighs 5.7 pounds with only a floppy disk drive, and 6 pounds with a floppy and hard disk. You have a choice of two processors in the system: a Motorola MC68000, which runs at 16 MHz or a Motorola MC68030, which runs at 25 MHz. Memory can be configured up to 4MB on the system which runs the Motorola MC68000. On the Motorola MC68030-based system, memory can be configured up to 16MB.

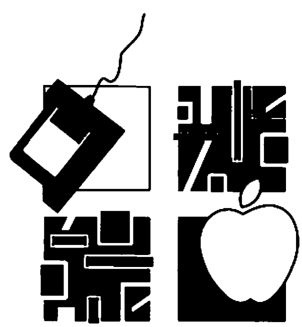
The display on this system is the Sharp Model P722 SlimFast display. The display is a backlit, antiglare, film compensated display. Its resolution is 640 by 480 pixels.

The Outbound Notebook System comes with a 1.44MB floppy disk drive and either a 20, 40, or 80MB removable hard drive. Its keyboard is an Outbound's Full PitchKeyboard designed for this system.

This Macintosh clone has six ports:

- two serial ports
- one Apple-SCSI (DB-25) port
- an Apple Desktop Bus port which supports a full-size keyboard, mouse, or trackball
- an external speaker/microphone port
- a power input port

The Notebook uses a 12 volt battery for its power source. It can also accept electricity from a universal power supply.



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A P P E N D I X

MAC ERROR MESSAGES

The following is a list of error messages which your Macintosh might display someday. The error log number is the first thing displayed followed by an obscure message. The number and message are translated here (the English-type stuff).

This table was created by Bill Steinberg. It's a freeware product called DisplayDA 2.1. It is available through many users groups and on bulletin boards. You load it as a Desk Accessory and it resides in the System folder so it is available under the Apple icon at any time. This list is maintained with MPW SysErr.a. The last change is Version 3.1 made on Wednesday, June 12, 1991.

Error Number	Error Message	Description
DS Table		
1	dsBusError	Bus error
2	dsAddressErr	Address error
3	dsIllInstErr	Illegal instruction error
4	dsZeroDivErr	Zero divide error
5	dsChkErr	Check trap error
6	dsOvflowErr	Overflow trap error
7	dsPrivErr	Privilege violation error

Error Number	Error Message	Description
8	dsTraceErr	Trace mode error
9	dsLineAErr	Line 1010 trap error
10	dsLineFErr	Line 1111 trap error
11	dsMiscErr	Miscellaneous hardware exception error
12	dsCoreErr	Unimplemented core routine error
13	dsIrqErr	Uninstalled interrupt error
14	dsIOCoreErr	I/O core error
15	dsLoadErr	Segment loader error
16	dsFPErr	Floating point error
17	dsNoPackErr	Package 0 not present [List Manager]
18	dsNoPk1	Package 1 not present [Reserved by Apple]
19	dsNoPk2	Package 2 not present [Disk Initialization]
20	dsNoPk3	Package 3 not present [Standard File]
21	dsNoPk4	Package 4 not present [Floating-Point Arithmetic]
22	dsNoPk5	Package 5 not present [Transcendental Functions]
23	dsNoPk6	Package 6 not present [International Utilities]
24	dsNoPk7	Package 7 not present [Binary/Decimal Conversion]
25	dsMemFullErr	Out of memory!
26	dsBadLaunch	Can't launch file
27	dsFSErr	File system map has been trashed
28	dsStknHeap	Stack has moved into application heap

Error Number	Error Message	Description
30	dsReinsert	Request user to reinsert offline volume
31	dsNotThe1	Not the disk I wanted (obsolete)
33	negZcbFreeErr	ZcbFree has gone negative
40	dsGreeting	Welcome to Macintosh greeting
41	dsFinderErr	Can't load the Finder error
42	dsBadStartupDisk	Unable to mount boot volume (obsolete)
43	dsSystemFileErr	Can't find System file to open (obsolete)
51	dsBadSlotInt	Unserviceable slot interrupt
81	dsBadSANEopcode	Bad opcode given to SANE Pack4
83	dsBadPatchHeader	SetTrapAddress saw the "come-from" header
84	menuPrgErr	Happens when a menu is purged
85	dsMBarNFnd	SysErr—cannot find MBDF
86	dsHMenuFindErr	SysErr—recursively defined HMenus
87	dsWDEFnFnd	Could not load WDEF
88	dsCDEFnFnd	Could not load CDEF
89	dsMDEFnFnd	Could not load MDEF
90	dsNoFPU	FPU instruction executed, but machine has no FPU
98	dsNoPatch	Can't patch for particular Model Mac
99	dsBadPatch	Can't load patch resource
101	dsParityErr	Memory parity error
102	dsOldSystem	System is too old for this ROM
103	ds32BitMode	Booting in 32-bit on a 24-bit sys

Error Number	Error Message	Description
104	dsNeedToWriteBootBlocks	Need to write new boot blocks
105	dsNotEnoughRAMToBoot	Need at least 1.5MB of RAM to boot 7.0
20000	dsShutDownOrRestart	User choice between ShutDown and Restart
20001	dsSwitchOffOrRestart	User choice between Switch off or Restart
20002	dsForcedQuit	Allow the user to ExitToShell, return if Cancel
32767	dsSysErr	General system error (catch-all used in DSAT)

General System (VBL Mgr, Queue, and so forth)

0	noErr	0 for success
-1	qErr	Queue element not found during deletion
-2	vTypErr	Invalid queue element
-3	corErr	Core routine number out of range
-4	unimpErr	Unimplemented core routine
-5	SlpTypeErr	Invalid queue element
-8	seNoDB	No debugger installed to handle debugger command

Color Manager

-9	iTabPurgErr	From Color2Index/ ITabMatch
-10	noColMatch	
-11	qAllocErr	From MakeITable
-12	tblAllocErr	
-13	overRun	
-14	noRoomErr	
-15	seOutOfRange	From SetEntry
-16	seProtErr	

Error Number	Error Message	Description
-17	i2CRangeErr	
-18	gdBadDev	
-19	reRangeErr	
-20	seInvRequest	
-21	seNoMemErr	

I/O System

Error Number	Error Message	Description
-17	controlErr	Driver can't respond to Control call
-18	statusErr	Driver can't respond to Status call
-19	readErr	Driver can't respond to Read call
-200	writErr	Driver can't respond to Write call
-21	badUnitErr	Driver ref num doesn't match unit table
-22	unitEmptyErr	Driver ref num specifies NIL handle in unit table
-23	openErr	Requested read/write permission doesn't match driver's open permission, or attempt to open RAM SerD failed
-24	closErr	Close failed
-25	dRemovErr	Tried to remove an open driver
-26	dInstErr	DrvrInstall couldn't find driver in resources
-27	abortErr	I/O call aborted by KillIO
-27	iIOAbortErr	I/O abort error (Printing Manager)
-28	notOpenErr	Couldn't rd/wr/ctl/sts because driver not opened

Error Number	Error Message	Description
-29	unitTblFullErr	Unit table has no more entries
-30	dceExtErr	dce extension error
File System		
-33	dirFulErr	Directory full
-34	dskFulErr	Disk full
-35	nsvErr	No such volume
-36	ioErr	I/O error (bummers)
-37	bdNamErr	There may be no bad names in the final system!
-38	fnOpnErr	File not open
-39	eofErr	End of file
-40	posErr	Tried to position to before start of file (r/w)
-41	mFulErr	Memory full (open) or file won't fit (load)
-42	tmfoErr	Too many files open
-43	fnfErr	File not found
-44	wPrErr	Diskette is write-protected
-45	fLckdErr	File is locked
-46	vLckdErr	Volume is locked
-47	fBsyErr	File is busy (delete)
-48	dupFNErr	Duplicate filename (rename)
-49	opWrErr	File already open with write permission
-50	paramErr	Error in user parameter list
-51	rfNumErr	refnum error
-52	gfpErr	Get file position error
-53	volOffLinErr	Volume not online error (was ejected)
-54	permErr	Permissions error (on file open)
-55	volOnLinErr	Drive volume already online at MountVol

Error Number	Error Message	Description
-56	nsDrvErr	No such drive (tried to mount a bad drive num)
-57	noMacDskErr	Not a mac diskette (sig bytes are wrong)
-58	extFSErr	Volume in question belongs to an external fs
-59	fsRnErr	File system internal error: during rename the old entry was deleted but could not be restored
-60	badMDBErr	Bad master directory block
-61	wrPermErr	Write permissions error
Font Manager		
-64	fontDecError	Error during font declaration
-65	fontNotDeclared	Font not declared
-66	fontSubErr	Font substitution occurred
Disk		
-64	lastDskErr	
-64	noDriveErr	Drive not installed
-65	offLinErr	R/W requested for an offline drive
-66	noNybErr	Couldn't find 5 nibbles in 200 tries
-67	noAdrMkErr	Couldn't find valid addr mark
-68	dataVerErr	Read verify compare failed
-69	badCksmErr	addr mark checksum didn't check
-70	badBtSlpErr	Bad addr mark bit slip nibbles
-71	noDtaMkErr	Couldn't find a data mark header
-72	badDCksum	Bad data mark checksum

Error Number	Error Message	Description
-73	badDBtSlp	Bad data mark bit slip nibbles
-74	wrUnderrun	Write underrun occurred
-75	cantStepErr	Step handshake failed
-76	tk0BadErr	Track 0 detect doesn't change
-77	initIWMErr	Unable to initialize IWM
-78	twoSideErr	Tried to read 2nd side on a 1-sided drive
-79	spdAdjErr	Unable to correctly adjust disk speed
-80	seekErr	Track number wrong on address mark
-81	sectNFErr	Sector number never found on a track
-82	fmt1Err	Can't find sector 0 after track format
-83	fmt2Err	Can't get enough sync
-84	verErr	Track failed to verify
-84	firstDskErr	
Serial Ports, PRAM/Clock		
-85	clkRdErr	Unable to read same clock value twice
-86	clkWrErr	Time written did not verify
-87	prWrErr	Parameter ram written didn't read-verify
-88	prInitErr	InitUtil found the parameter ram uninitialized
-89	rcvrErr	SCC receiver error (framing, parity, OR)
-90	breakRecd	Break received (SCC)
AppleTalk		
-91	ddpSktErr	Error in socket number

Error Number	Error Message	Description
-92	ddpLenErr	Data length too big
-93	noBridgeErr	No network bridge for non-local send
-94	lapProtErr	Error in attaching/ detaching protocol
-95	excessCollsns	Excessive collisions on write
-97	portInUse	Driver Open error code (port is in use)
-98	portNotCf	Driver Open error code (parameter RAM not configured for this connection)
Memory Manager		
- 99	memROZErr	Hard error in ROZ
- 99	memROZError	Hard error in ROZ
- 99	memROZWarn	Soft error in ROZ
Scrap Manager		
-100	noScrapErr	No scrap exists error
-102	noTypeErr	No object of that type in scrap
Memory Manager		
-108	memFullErr	Not enough room in heap zone
-109	nilHandleErr	Handle was NIL in HandleZone or other
-110	memAdrErr	Address was odd, or out of range
-111	memWZErr	WhichZone failed (applied to free block)
-112	memPurErr	Trying to purge a locked or non-purgeable block
-113	memAZErr	Address in zone check failed

Error Number	Error Message	Description
-114	memPCErr	Pointer Check failed
-115	memBCErr	Block Check failed
-116	memSCErr	Size Check failed
-117	memLockedErr	Trying to move a locked block (MoveHHi)

HFS

-120	dirNFErr	Directory not found
-121	tmwdoErr	No free WDCB available
-122	badMovErr	Move into offspring error
-123	wrgVolTypErr	Wrong volume type error: not supported for MFS
-124	volGoneErr	Server volume has been disconnected
-125	updPixMemErr	Insufficient memory to update a pixmap
-127	fsDSIntErr	Internal file system error

Menu Manager

-126	dsMBarNFnd	System error code for MBDF not found
-127	dsHMenuFindErr	Could not find HMenu's parent in MenuKey
-128	userCanceledErr	User canceled the operation status

HFS FileID

-130	fidNotFound	No file thread exists
-131	fidNotAFile	Directory specified
-132	fidExists	File id already exists

Color Quickdraw and Color Manager

-145	noMemForPictPlaybackErr	

Error Number	Error Message	Description
-147	rgnTooBigError	Region accumulation failed, rgn may be corrupt
-148	pixMapTooBigErr	Passed pixelmap is too large
-149	nsStackErr	Not enough stack space for the necessary buffers
-150	cMatchErr	Color2Index failed to find an index
-151	cTempMemErr	Failed to allocate memory for temporary structures
-152	cNoMemErr	Failed to allocate memory for structure
-153	cRangeErr	Range error on colorTable request
-154	cProtectErr	ColorTable entry protection violation
-155	cDevErr	Invalid type of graphics device
-156	cResErr	Invalid resolution for MakeITable
-157	cDepthErr	Invalid pixel depth
-158	cParmErr	Invalid parameter
Resource Manager		
-185	badExtResource	Extended resource has a bad format
-186	CantDecompress	Resource bent ("the bends") can't decompress a compressed resource
-192	resNotFound	Resource not found
-193	resFNotFound	Resource file not found
-194	addResFailed	AddResource failed
-195	addRefFailed	AddReference failed
-196	rmvResFailed	RmveResource failed
-197	rmvRefFailed	RmveReference failed

Error Number	Error Message	Description
-198	resAttrErr	Attribute inconsistent with operation
-199	mapReadErr	Map inconsistent with operation
Sound Manager		
-200	noHardware	No hardware support for the specified synthesizer
-201	notEnoughHardware	No more channels for the specified synthesizer
-203	queueFull	No more room in queue
-204	resProblem	Problem loading resource
-205	badChannel	Invalid channel queue length
-206	badFormat	Handle to 'snd ' resource was invalid
-207	notEnoughBufferSpace	Could not allocate enough memory
-208	badFileFormat	Was not type AIFF or was of bad format, corrupt
-209	channelBusy	The channel is being used for a PFD already
-210	buffersTooSmall	Cannot operate in the memory allowed
-211	channelNotBusy	
-212	noMoreRealTime	Not enough CPU cycles left to add another task
-220	siNoSoundInHardware	
-221	siBadSoundInDevice	Invalid index, SoundInGet-IndexedDevice
-222	siNoBufferSpecified	Nil buffer passed to synchronous SPBRecord
-223	siInvalidCompression	Invalid compression type
-224	siHardDriveTooSlow	Hard drive too slow to record to disk
-225	siInvalidSampleRate	Invalid sample rate

Error Number	Error Message	Description
-226	siInvalidSampleSize	Invalid sample size
-227	siDeviceBusyErr	Input device already in use
-228	siBadDeviceName	Input device could not be opened
-229	siBadRefNum	Invalid input device reference number
-230	siInputDeviceErr	Input device hardware failure
-231	siUnknownInfoType	Driver returned invalid info type selector
-232	siUnknownQuality	Invalid quality selector returned by driver

MIDI Manager

-250	midiNoClientErr	No client with that ID found
-251	midiNoPortErr	No port with that ID found
-252	midiTooManyPortsErr	Too many ports already installed in system
-253	midiTooManyConsErr	Too many connections made
-254	midiVConnectErr	Pending virtual connection created
-255	midiVConnectMade	Pending virtual connection resolved
-256	midiVConnectRmvd	Pending virtual connection removed
-257	midiNoConErr	No connection exists between specified ports
-258	midiWriteErr	Couldn't write to all connected ports
-259	midiNameLenErr	Name supplied is longer than 31 characters
-260	midiDupIDErr	Duplicate client ID
-261	midiInvalidCmdErr	Command not supported for port type

Error Number	Error Message	Description
Notification Manager		
-299	nmTypErr	Wrong queue type
Start Manager		
-290	smSDMInitErr	SDM could not be initialized
-291	smSRTInitErr	Slot resource table could not be initialized
-292	smPRAMInitErr	Slot resource table could not be initialized
-293	smPriInitErr	Cards could not be initialized
-300	smEmptySlot	No card in slot
-301	smCRCFail	CRC check failed for declaration data
-302	smFormatErr	FHeader Format is not Apple's
-303	smRevisionErr	Wrong revison level
-304	smNoDir	Directory offset is Nil
-305	smDisabledSlot	This slot is disabled
-306	smNosInfoArray	No sInfoArray. Memory Mgr error
-307	smResrvErr	Fatal reserved error. Reserved field <> 0
-308	smUnExBusErr	Unexpected BusError
-309	smBLFieldBad	ByteLanes field was bad
-310	smFHBlockRdErr	Error occurred during _sGetFHeader
-311	smFHBlkDispErr	Error occurred during _sDisposePtr (Dispose of FHeader block)
-312	smDisposePErr	_DisposePointer error
-313	smNoBoardsRsrc	No Board sResource

Error Number	Error Message	Description
-314	smGetPRErr	Error occurred during _sGetPRAMRec (See SIMStatus)
-315	smNoBoardId	No Board Id
-316	smIntStatVErr	The InitStatusV field was negative after primary or secondary init
-317	smIntTblVErr	An error occurred while trying to initialize the Slot Resource Table
-318	smNoJmpTbl	SDM jump table could not be created
-319	smBadBoardId	BoardId was wrong, re-init the PRAM record
-320	smBusErrTO	BusError time out
-330	smBadRefId	Reference Id not found in List
-331	smBadsList	Bad sList: Id1<Id2<Id3 _ format is not followed
-332	smReservedErr	Reserved field not zero
-333	smCodeRevErr	Code revision is wrong
-334	smCPUErr	Code revision is wrong
-335	smsPointerNil	LPointer is nil {From sOffsetData. If this error occurs, check sInfo rec for more information.}
-336	smNilsBlockErr	Nil sBlock error {Don't allocate and try to use a nil sBlock}
-337	smSlotOOBErr	Slot out of bounds error
-338	smSelOOBErr	Selector out of bounds error
-339	smNewPErr	_NewPtr error
-340	smBlkMoveErr	_BlockMove error
-341	smCkStatusErr	Status of slot = fail
-342	smGetDrvrNamErr	Error occurred during _sGetDrvrName

Error Number	Error Message	Description
-343	smDisDrvrNamErr	Error occurred during _sDisDrvrName
-344	smNoMoresRsrcs	No more sResources
-345	smsGetDrvrErr	Error occurred during _sGetDriver
-346	smBadsPtrErr	Bad pointer was passed to sCalcsPointer
-347	smByteLanesErr	NumByteLanes was determined to be zero
-348	smOffsetErr	Offset was too big (temporary, should be fixed)
-349	smNoGoodOpens	No opens were successful in the loop
-350	smSRTOvrFlErr	SRT overflow
-351	smRecNotFnd	Record not found in the SRT
Device Manager Slot Support		
-360	slotNumErr	Invalid slot # error
-400	gcrOnMFMErr	gcr format on high density media error
Edition Manager		
-450	editionMgrInitErr	Edition manager not inited by this app
-451	badSectionErr	Not a valid SectionRecord
-452	notRegisteredSectionErr	Not a registered Section-Record
-453	badEditionFileErr	Edition file is corrupt
-454	badSubPartErr	Cannot use sub parts in this release
-460	multiplePublisherWrn	Pub already registered for container
-461	containerNotFoundWrn	Couldn't find edition-Container now

Error Number	Error Message	Description
-462	containerAlreadyOpenWrn	Container is open by this section
-463	notThePublisherWrn	Different pub last wrote that container

SCSI Manager

-470	scsiBadPBErr	Invalid field(s) in the parameters block
-471	scsiOverrunErr	Attempted to transfer too many bytes
-472	scsiTransferErr	Write flag conflicts with data transfer phase
-473	scsiBusTOErr	Bus error during transfer
-474	scsiSelectTOErr	scsiSelTO exceeded (selection failed)
-475	scsiTimeOutErr	scsiReqTO exceeded
-476	scsiBusResetErr	The bus was reset, so your request was aborted
-477	scsiBadStatus	Non-zero (not "Good") status returned
-478	scsiNoStatusErr	Device did not go through a status phase
-479	scsiLinkFailErr	Linked command never executed
-489	scsiUnimpVctErr	Unimplemented routine was called SysErrs used instead of inline $A9FF & $ABFF
-490	userBreak	User debugger break
-491	strUserBreak	User debugger break display string on stack
-492	exUserBreak	User debugger break execute commands on stack

Error Number	Error Message	Description
QuickDraw		
-500	rgnTooBigErr	Region too big error
Text Edit		
-501	teScrapSizeErr	Scrap item too big for text edit record
O/S		
-502	hwParamrErr	Bad selector for _HWPriv
Process Manager		
-600	procNotFound	No eligible process with specified descriptor
-601	memFragErr	Not enough room to launch app w/spec requirements
-602	appModeErr	Memory mode is 32-bit, but app not 32-bit clean
-603	protocolErr	app made module calls in improper order
-604	hardwareConfigErr	Hardware configuration not correct for call
-605	appMemFullErr	Application SIZE not big enough for launch
-606	appIsDaemon	app is BG-only, and launch flags disallow this
Memory Dispatch		
-620	notEnoughMemoryErr	Insufficient physical memory
-621	notHeldErr	Specified range of memory is not held
-622	cannotMakeContiguousErr	Cannot make specified range contiguous

Error Number	Error Message	Description
-623	notLockedErr	Specified range of memory is not locked
-624	interruptsMaskedErr	Don't call with interrupts masked
-625	cannotDeferErr	Unable to defer additional functions

DatabaseAccess (Pack 13)

-800	rcDBNull	
-801	rcDBValue	
-802	rcDBError	
-803	rcDBBadType	
-804	rcDBBadCol	
-805	rcDBBreak	
-806	rcDBExec	
-807	rcDBBadSessID	
-808	rcDBBadSessNum	
-809	rcDBBadDDEV	
-810	rcDBCancel	
-811	rcDBAsyncNotSupp	
-812	rcDBBadAsyncPB	
-813	rcDBNoHandler	
-814	rcDBWrongVersion	
-815	rcDBPackNotInited	
-816	rcDBStatusCancel	

Help Manager

-850	hmHelpDisabled	Show Balloons mode off, call to routine ignored
-851	hmResNotFound	
-852	hmMemFullErr	
-853	hmBalloonAborted	Mouse was moving/wasn't in window port rect

Error Number	Error Message	Description
-854	hmBadHelpData	HMShowMenuBalloon menu & item same as last time
-855	hmHelpManagerNot-InitedHMGetHelpMenu-Handle	Help menu not setup
-856	hmBadSelector	
-857	hmSkippedBalloon	Helpmsg specified a skip balloon
-858	hmWrongVersion	Help mgr resource was the wrong version
-859	hmUnknownHelpType	Help msg record contained a bad type
-860	hmCouldNotLoadPackage	
-861	hmOperationUnsupported	Bad method passed to HMShowBalloon
-862	hmNoBalloonUp	No balloon visible when HMRemoveBalloon called
-863	hmCloseViewActive	CloseView active when HMRemoveBalloon called

PPC Toolbox

-900	notInitErr	PPCToolBox not initialized
-902	nameTypeErr	Invalid locationKindSelector in locationName
-903	noPortErr	Unable to open port or bad portRefNum
-904	noGlobalsErr	The system is hosed, better re-boot
-905	localOnlyErr	Network activity is currently disabled
-906	destPortErr	Port does not exist at destination
-907	sessTableErr	Out of session tables, try again later

Error Number	Error Message	Description
-908	noSessionErr	Invalid session reference number
-909	badReqErr	Bad parameter or invalid state for operation
-910	portNameExistsErr	Port is already open (perhaps another app)
-911	noUserNameErr	User name unknown on destination machine
-912	userRejectErr	Destination rejected the session request
-913	noMachineNameErr	User hasn't named his Macintosh
-914	noToolboxNameErr	A system resource is missing, not too likely
-915	noResponseErr	Unable to contact destination
-916	portClosedErr	Port was closed
-917	sessClosedErr	Session was closed
-919	badPortNameErr	PPCPortRec malformed
-922	noDefaultUserErr	User hasn't typed in owner's name
-923	notLoggedInErr	The default userRefNum does not yet exist
-924	noUserRefErr	Unable to create a new userRefNum
-925	networkErr	An error has occurred in the network, not too likely
-926	noInformErr	PPCStart failed: dest didn't have inform pending
-927	authFailErr	Unable to authenticate user at destination
-928	noUserRecErr	Invalid user reference number
-930	badServiceMethodErr	Illegal service type, or not supported
-931	badLocNameErr	Location name malformed

Error Number	Error Message	Description
-932	guestNotAllowedErr	Destination port requires authentication
AppleTalk NBP		
-1024	nbpBuffOvr	Buffer overflow in LookupName
-1025	nbpNoConfirm	Name not confirmed on
ConfirmName		
-1026	nbpConfDiff	Name confirmed at different socket
-1027	nbpDuplicate	Duplicate name exists already
-1028	nbpNotFound	Name not found on remove
-1029	nbpNISErr	Error trying to open the NIS
AppleTalk ASP (XPP driver)		
-1066	aspBadVersNum	Server cannot support this ASP version
-1067	aspBufTooSmall	Buffer too small
-1068	aspNoMoreSess	No more sessions on server
-1069	aspNoServers	No servers at that address
-1070	aspParamErr	Parameter error
-1071	aspServerBusy	Server cannot open another session
-1072	aspSessClosed	Session closed
-1073	aspSizeErr	Command block too big
-1074	aspTooMany	Too many clients (server error)
-1075	aspNoAck	No ack on attention request (server err)

Error Number	Error Message	Description
AppleTalk ATP		
-1096	reqFailed	SendRequest failed: retry count exceeded
-1097	tooManyReqs	Too many concurrent requests
-1098	tooManySkts	Too many concurrent responding-sockets
-1099	badATPSkt	Bad ATP-responding socket
-1100	badBuffNum	Bad response buffer number specified
-1101	noRelErr	No release received
-1102	cbNotFound	Control Block (TCB or RspCB) not found
-1103	noSendResp	AddResponse issued without SendResponse
-1104	noDataArea	No data area for request to MPP
-1105	reqAborted	SendRequest aborted by RelTCB
Data Stream Protocol DSP driver		
-1273	errOpenDenied	Open connection request was denied
-1274	errDSPQueueSize	Send or receive queue is too small
-1275	errFwdReset	Read terminated by forward reset
-1276	errAttention	Attention message too long
-1277	errOpening	Open connection request was denied
-1278	errState	Bad connection state for this operation
-1279	errAborted	Control call was aborted
-1280	errRefNum	Bad connection refNum

Error Number	Error Message	Description
HFS		
-1300	fidNotFound	No file thread exists
-1301	fidExists	File id already exists
-1302	notAFileErr	Directory specified
-1303	diffVolErr	Files on different volumes
-1304	catChangedErr	Catalog has been modified
-1305	desktopDamagedErr	Desktop database files are corrupted
-1306	sameFileErr	Can't exachange a file with itself
-1307	badFidErr	File id is dangling or doesn't match file number
-1308	notARemountErr	If _Mount allows only remounts & doesn't get 1
AppleTalk ATP		
-3101	buf2SmallErr	Buffer too small error
-3102	noMPPErr	No MPP error
-3103	ckSumErr	Checksum error
-3104	extractErr	Extraction error
-3105	readQErr	Read queue error
-3106	atpLenErr	ATP length error
-3107	atpBadRsp	ATP bad response error
-3108	recNotFnd	Record not found
-3109	sktClosedErr	Socket closed error
Print Manager w/LaserWriter		
-4096	???	No free Connect Control Blocks available
-4097	???	Bad connection reference number
-4098	???	Request already active
-4099	???	Write request too big

Error Number	Error Message	Description
-4100	???	Connection just closed
-4101	???	Printer not found, or closed

File Manager Extensions

-5000	accessDenied	Incorrect access for this file/folder
-5006	DenyConflict	Permission/Deny mode conflicts with the current mode in which this fork is already open
-5015	NoMoreLocks	Byte range locking failure from Server
-5020	RangeNotLocked	Attempt to unlock an already unlocked range
-5021	RangeOverlap	Attempt to lock some of an already locked range

AppleTalk AFP (XPP driver)

-5000	afpAccessDenied	AFP access denied
-5001	afpAuthContinue	AFP authorization continue
-5002	afpBadUAM	AFP bad UAM
-5003	afpBadVersNum	AFP bad version number
-5004	afpBitmapErr	AFP bitmap error
-5005	afpCantMove	AFP can't move error
-5006	afpDenyConflict	AFP deny conflict
-5007	afpDirNotEmpty	AFP dir not empty
-5008	afpDiskFull	AFP disk full
-5009	afpEofError	AFP End-of-File error
-5010	afpFileBusy	AFP file busy
-5011	afpFlatVo	AFP flat volume
-5012	afpItemNotFound	AFP item not found
-5013	afpLockErr	AFP lock error
-5014	afpMiscErr	AFP misc error
-5015	afpNoMoreLocks	AFP no more locks
-5016	afpNoServer	AFP no server

Error Number	Error Message	Description
-5017	afpObjectExists	AFP object already exists
-5018	afpObjectNotFound	AFP object not found
-5019	afpParmErr	AFP parm error
-5020	afpRangeNotLocked	AFP range not locked
-5021	afpRangeOverlap	AFP range overlap
-5022	afpSessClosed	AFP session closed
-5023	afpUserNotAuth	AFP user not authorized
-5024	afpCallNotSupported	AFP call not supported
-5025	afpObjectTypeErr	AFP object type error
-5026	afpTooManyFilesOpen	AFP too many files open
-5027	afpServerGoingDown	AFP server going down
-5028	afpCantRename	AFP can't rename
-5029	afpDirNotFound	AFP directory not found
-5030	afpIconTypeError	AFP icon type error
-5031	afpVolLocked	Volume is Read-Only
-5032	afpObjectLocked	Object is M/R/D/W inhibited
-5033	afpContainsSharedErr	Folder being shared has a shared folder
-5034	afpIDNotFound	
-5035	afpIDExists	
-5036	afpDiffVolErr	
-5037	afpCatalogChanged	
-5038	afpSameObjectErr	
-5039	afpBadIDErr	
-5040	afpPwdSameErr	Same password on a mandatory password change
-5041	afpPwdTooShortErr	Password being set is too short
-5042	afpPwdExpiredErr	Password being used is too old
-5043	afpInsideSharedErr	Folder being shared is in a shared folder
-5044	afpInsideTrashErr	Folder being shared is in the trash folder

Error Number	Error Message	Description
SysEnvirons		
-5500	envNotPresent	SysEnvirons trap not present returned by glue
-5501	envBadVers	Version non-positive
-5502	envVersTooBig	Version bigger than call can handle
Gestalt		
-5550	gestaltUnknownErr	Gestalt doesn't know the answer
-5551	gestaltUndefSelectorErr	Undefined code was passed to Gestalt
-5552	gestaltDupSelectorErr	Tried to add entry that already existed
-5553	gestaltLocationErr	Gestalt function ptr wasn't in sysheap
LaserWriter Driver		
-8132	????	Manual Feed time out
-8133	????	General PostScript Error
-8150	????	No LaserWriter chosen
-8151	????	Version mismatch between LaserPrep dictionaries
-8150	????	No LaserPrep dictionary installed
-8160	????	Zoom scale factor out of range
Picture Utilities		
-11000	pictInfoVersionErr	Wrong version of the PictInfo structure
-11001	pictInfoIDErr	Internal consistency check is wrong

Error Number	Error Message	Description
-11002	pictInfoVerbErr	The passed verb was invalid
-11003	cantLoadPickMethodErr	Unable to load the custom pick proc
-11004	colorsRequestedErr	The number of colors requested was illegal
-11005	pictureDataErr	The picture data was invalid
Power Manager		
-13000	pmBusyErr	Pmgr never ready to start handshake
-13001	pmReplyTOErr	Timed out waiting for reply
-13002	pmSendStartErr	During send, pmgr did not start hs
-13003	pmSendEndErr	During send, pmgr did not finish hs
-13004	pmRecvStartErr	During receive, pmgr did not start hs
-13005	pmRecvEndErr	During receive, pmgr did not finish hs
Mac TCP		
-23000	ipBadLapErr	Bad network configuration
-23001	ipBadCnfgErr	Bad IP configuration error
-23002	ipNoCnfgErr	Missing IP or LAP configuration error
-23003	ipLoadErr	Error in MacTCP load
-23004	ipBadAddr	Error in getting address
-23005	connectionClosing	Connection in closing
-23006	invalidLength	
-23007	connectionExists	Request conflicts with existing connection
-23008	connectionDoesntExist	Connection does not exist
-23009	insufficientResources	Insufficient rsrcs to perform request
-23010	invalidStreamPtr	

Error Number	Error Message	Description
-23011	streamAlreadyOpen	
-23012	connectionTerminated	
-23013	invalidBufPtr	
-23014	invalidRDS	
-23014	invalidWDS	
-23015	openFailed	
-23016	commandTimeout	
-23017	duplicateSocket	
-23030	ipOpenProtErr	Can't open new protocol, table full
-23031	ipCloseProtErr	Can't find protocol to close
-23032	ipDontFragErr	Packet too large to send w/o fragmenting
-23033	ipDestDeadErr	Destination not responding
-23034	ipBadWDSErr	Error in WDS format
-23035	icmpEchoTimeoutErr	ICMP echo timed-out
-23036	ipNoFragMemErr	No memory to send fragmented pkt
-23037	ipRouteErr	Can't route packet off-net
-23041	nameSyntaxErr	
-23042	cacheFault	
-23043	noResultProc	
-23044	noNameServer	
-23045	authNameErr	
-23046	noAnsErr	
-23047	dnrErr	
-23048	outOfMemory	

Font Manager

-32615	fontNotOutlineErr	Bitmap passed, routine does outlines only Primary or Secondary Init Code
-32768	svTempDisable	Temporarily disable card but run primary init

Error Number	Error Message	Description
-32640	svDisabled	Reserve -32640 to -32768 for Apple temp disables
Internal File System		
1	NoBuf	No free cache buffers (all in use)
2	chInUse	Requested block in use
3	chnotfound	Requested block not found
4	chNotInUse	Block being released was not in use
16	fxRangeErr	File position beyond mapped range
17	fxOvFlErr	Extents file overflow
32	btnotfound	Record not found
33	btexists	Record already exists
34	btnospace	No available space
35	btnoFit	Record doesn't fit in node
36	btbadNode	Bad node detected
37	btbadHdr	Bad BTree header record detected
48	cmnotfound	CNode not found
49	cmexists	CNode already exists
50	cmnotempty	Directory CNode not empty (valence = 0)
51	cmRootCN	Invalid reference to root CNode
52	cmbadnews	Detected bad catalog structure
53	cmFThdDirErr	Thread belongs to a directory not a file
54	cmFThdGone	File thread doesn't exist
64	dsBadRotate	Bad BTree rotate

Error Number	Error Message	Description
Slot Declaration ROM Manager		
1	siInitSDTblErr	Slot int dispatch table couldn't be initialized
2	siInitVBLQsErr	VBLqueues for all slots couldn't be initialized
3	siInitSPTblErr	Slot priority table could not be initialized
10	sdmJTInitErr	SDM Jump Table could not be initialized
11	sdmInitErr	SDM could not be initialized
12	sdmSRTInitErr	Slot Resource Table could not be initialized
13	sdmPRAMInitErr	Slot PRAM could not be initialized
14	sdmPriInitErr	Cards could not be initialized
HD20 Driver		
16	wrtHsLw	HSHK low before starting
17	wrtHSLwTO	Time out waiting for HSHK to go low
19	wrtHSHighTO	Time out waiting for HSHK to go high
32	rdHsHi	HSHK high before starting
33	rdSyncTO	Time out waiting for sync ($AA) bye
34	rdGroupTO	Time out waiting for group
36	rdHoffSyncTO	Time out waiting for sync after holdoff
37	rdHsHiTO	Time out waiting for HSHK high
38	rdChksumErr	Checksum error on response packet
48	invalidResp	First byte in response packet was wrong

Error Number	Error Message	Description
49	sqncNumErr	Sequence number in response packet was wrong
50	dNumberErr	Drive number in response packet was wrong
64	noResp	No response packet ever received

SCSI Manager

Error Number	Error Message	Description
2	scCommErr	Communications error (operations time out)
3	scArbNBErr	Arbitration failed during SCSIGet _ Bus busy
4	scBadparmsErr	Bad parameter or TIB opcode
5	scPhaseErr	SCSI bus not in correct phase for operation
6	scCompareErr	SCSI Manager busy with another operation when SCSIGet was called
7	scMgrBusyErr	SCSI Manager busy with another operation when SCSIGet was called
8	scSequenceErr	Attempted operation is out of sequence _ e.g., calling SCSISelect before doing SCSIGet
9	scBusTOErr	Bus timeout before data ready on SCSIRBlind and SCSIWBlind
10	scComplPhaseErr	SCSIComplete failed _ bus not in Status phase

Connection Manager

Error Number	Error Message	Description
0	cmNoErr	
1	cmRejected	

Error Number	Error Message	Description
2	cmFailed	
3	cmTimeOut	
4	cmNotOpen	
5	cmNotClosed	
6	cmNoRequestPending	
7	cmNotSupported	
8	cmNoTools	
9	cmUserCancel	
11	cmUnknownError	
-1	cmGenericError	

File Transfer Manager

0	ftNoErr	
1	ftRejected	
2	ftFailed	
3	ftTimeOut	
4	ftTooManyRetry	
5	ftNotEnoughDSpace	
6	ftRemoteCancel	
7	ftWrongFormat	
8	ftNoTools	
9	ftUserCancel	
10	ftNotSupported	
11	ftUnknownError	
-1	ftGenericError	

Terminal Manager

0	tmNoErr	
1	tmNotSent	
2	tmEnvironsChanged	
7	tmNotSupported	
8	tmNoTools	
11	tmUnknownError	
-1	tmGenericError	

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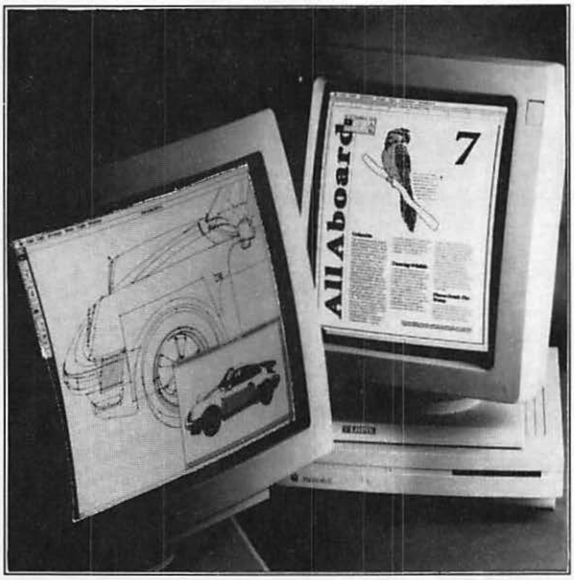

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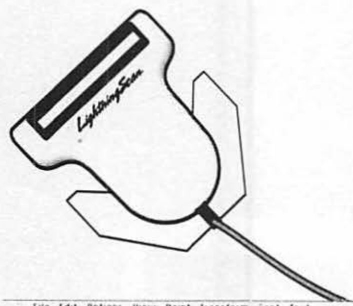

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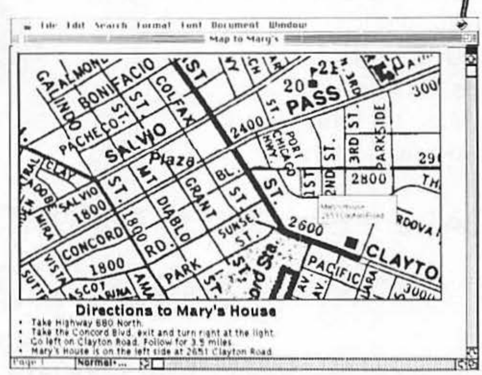

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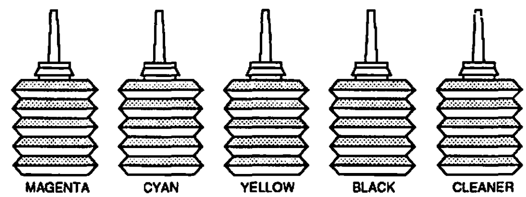

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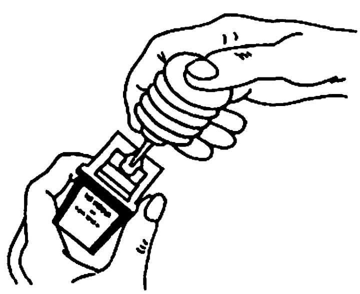

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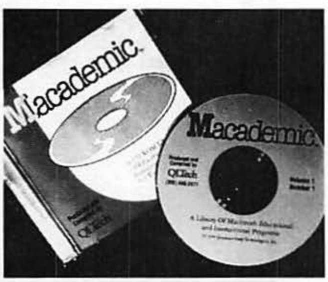

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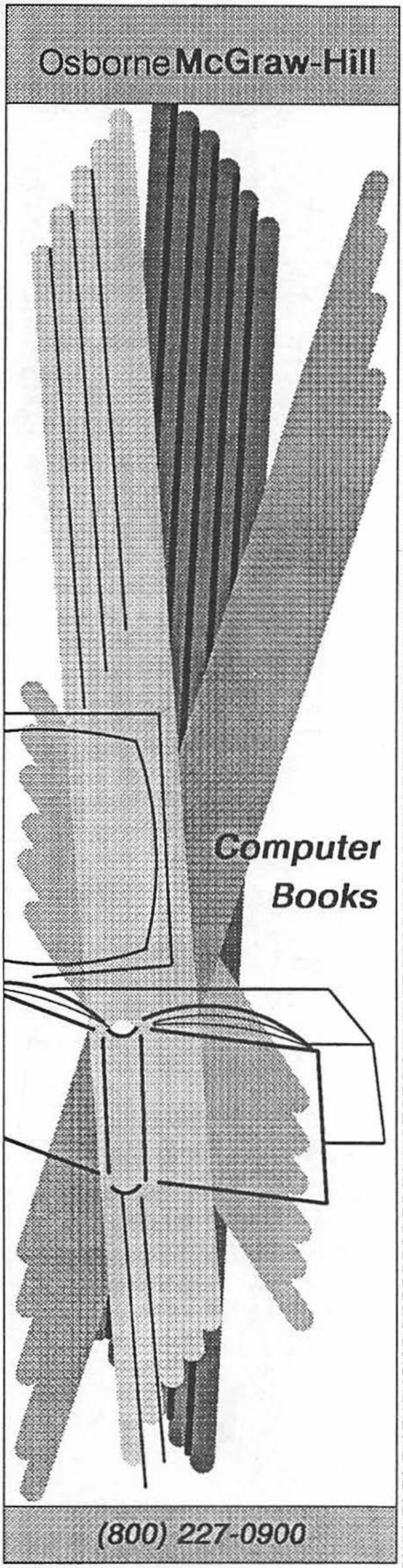

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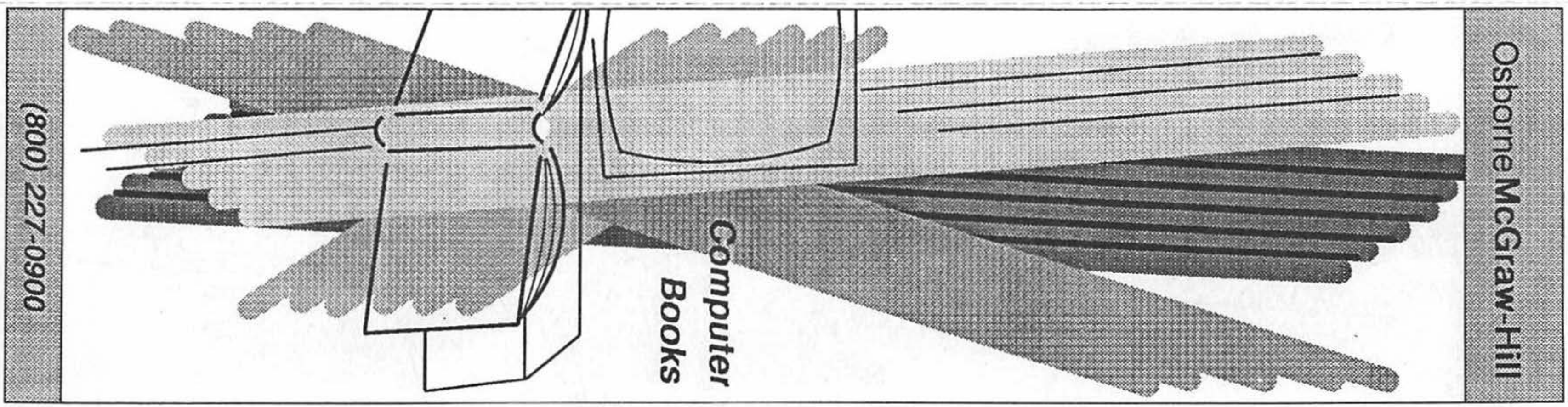

About the Authors

John C. Dvorak is the world's most widely read computer columnist and author. Among others, he has columns in **MacUser**, **MacWeek**, and he also writes the sought-after "Inside Track" column in **PC Magazine** noted for breaking cutting edge information in the computer marketplace.

Mimi Smith-Dvorak is an editor-writer living in the Berkeley area. She has contributed to many of the books in the Dvorak•Osborne/McGraw-Hill series as well as to authoring a book on computers for Dell Publishing. She is an avid Macintosh enthusiast and a mother of two children.

Bernard J. David is president of a computer connectivity firm and has developed Macintosh-based software. His articles have appeared in all the major computer magazines, and he is author of a best-selling book on how to make money with your computer.

John A. Murphy is a partner in a management consulting and technical communications firm. He is also a contributing editor to **Today's Office** and publisher of **The Wohl Report on End-User Computing**.

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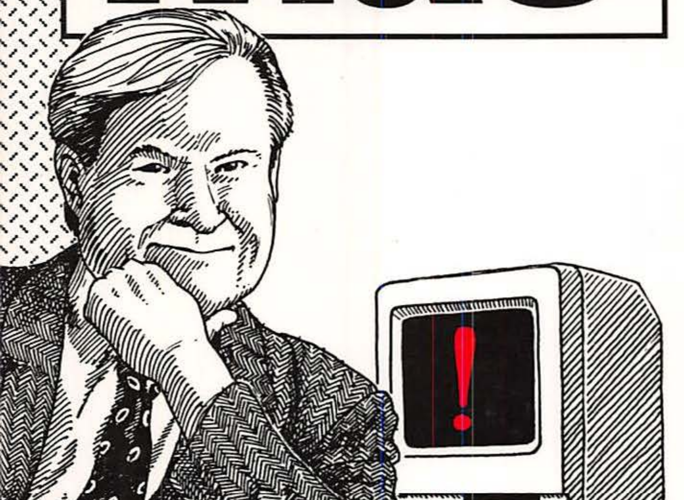

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